



INDIAN MARITIME UNIVERSITY

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

School of Nautical Studies

3 Year Bachelor of Science (B.Sc.) Nautical Science

Regulations and Syllabus
(6TH Revision) – 2024

(With effect from Academic year 2024-2025 onwards)



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REGULATIONS AND SYLLABUS

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The Curriculum for the Three Year “B.Sc. (Nautical Science)” include the requirement of STCW Convention (as amended), of IMO Model Course 7.03 and that of the Directorate General of Shipping, Government of India for competencies required for “Officer In-charge of a Navigational watch”.

Preface

The syllabus for 3 year B.Sc. (Nautical Science) Degree course has been tailored to suit the present need of the Industry.

The syllabus is drawn up keeping the objective of providing Maritime Education and Training, including competencies that one would require to progress in the career from a Deck Cadet to Master Mariner.

The syllabus contents have been drawn up keeping in mind the country's sound Education system at the 10 +2 level which is the entry level qualification for this programme.

Continuous interaction with the Industry experts have impressed upon us to revise on the present B.Sc. (Nautical Science) syllabus.

The computer language Python is included.

The traditional Chart work is reduced to give more space to Electronic Chart Display and Information System.

All the semester courses have been re-structured and well defined by writing Specific Course Learning Objectives.

The syllabus has been revised in such a way to keep the total hours equally in all semesters 525 hrs.

The pedagogy will be as per National Education Policy (NEP) and University Grants Commission (UGC) guideline, 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 as per NEP.

It is suggested that efforts should be made to take the students for ship visit,

A Nautical Science career in Non-academic areas, 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 extra-curricular activities (Parade, Swimming, Boat rowing, Sports, etc.) of an individual. This includes the necessary regimental training in uniform for disciplined education.

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

Sl. No	Broad Category of Course	Minimum Credit Requirement for 3-year UG (as per UGC)	Actual Credits allotted for each category in B.Sc. (Nautical Science)
1	Major or Core Course (CC)	60	72
2	Minor Stream (MS)	24	29
3	Multidisciplinary (MD)	9	19
4	Ability Enhancement Courses (AE)	8	13
5	Skill Enhancement Courses (SE)	9	11.5
6	Value Added Courses common for all UG (VA)	6 to 8	14
7	Summer Internship(SI)	2 to 4	9.5
	Total	120	168

Following Points considered in preparing this:

- Choice Base Credit system is fully introduced as per IMU orders and UGC guidelines
- The minimum credit requirements prescribed by UGC have been fulfilled in all the courses
- Swimming, Harbour/ Port visits, Industrial visits brought under the syllabus with 1 credit course each semester
- Terrestrial Navigation is Combined with Chart Work Theory
- Celestial Navigation topics have been trimmed to suit programme
- ECDIS is taught extensively in both Theory as well as in Chart Work practical.
- Familiarization with Bridge Equipment's on OOW simulator has been introduced.
- 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.,
- A *Book review session* is slated as a Separate Field Practice practical for all six semester
- 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.
- As far as possible unnecessary repetitions of topics avoided
- Odd Even spread of subjects such as Navigation, Ship Stability, Cargo and Naval Architecture, Bridge Equipment for the best use of faculty members and facilities in the colleges.
- 5th and 6th Semester completely covers Major portions of Mate's and Master's syllabus as per MMD exams and Commercial subjects', hence students are ready for PG programs such as MBA in shipping and logistics, MICS etc.,
- To make a cadet to get overall industry knowledge viz, Ports, Agents, Chartering, Piloting, Logistics
- Students will have overview knowledge of technological advancement in the Maritime industry
- Students Taught on Societal Human Values, Environmental responsibilities.
- Watch-Keeping practices made mandatory and included as Practical subject
- Project and Model making included in the syllabus

Syllabus Revision Committee 2024

B.Sc. (Nautical Science) Syllabus 2024 (6th Revision) has been revised in June 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 Tiruchirappalli)
7. Capt Sujit Kumar Pathak, Member (Associate Professor and HoD i/c IMU Kochi Campus)
8. Capt A K Majumder, Member (Associate Professor and 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)

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 Tiruchirappalli

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.

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Regulations for B.Sc. (Nautical Science) Programme (With effect from August 2024 -25 batch)

1. Scope

The following regulations apply to the programme **B.Sc. (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. SSTP means Structured Shipboard Training Programme
- vii. 2nd Mate (FG) means Second Mate's Foreign Going
- viii. OOW means Officer Of the Watch
- ix. COLREGS means Collision Regulations (The International Regulations for Preventing Collisions at Sea 1972)
- x. ECDIS means Electronic Chart Display and Information System
- xi. NAV means Navigation
- xii. 'School' means School of Nautical Studies of Indian Maritime University
- xiii. '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.
- xiv. 'Academic Programme' means an entire course of study comprising programme structure and evaluation schemes designed to be taught and evaluated by an B.Sc. (Nautical Science)
- xv. 'Course' means an individual subject component that contributes to the completion of an Academic Programme.
- xvi. '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 B.Sc. (Nautical Science) Programme. In general, one credit approximately equal to 15 hours of lecture/tutorial class or 30 hours of practical work/project work/Field Practices design class per semester.
- xvii. 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.
- xviii. 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.
- xix. 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.
- xx. 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.
- xxi. 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. **B.Sc. (Nautical Science) by School of Nautical Studies**

The Indian Maritime University offers B.Sc. (Nautical Science) programme. The duration of the B.Sc. (Nautical Science) programme is of three academic years, consisting of six semesters. The odd semester functions from August to December each year and the even semester from January to May. There shall be not less than 90 working days in each semester.

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

No	Graduate Attributes	PLOs	Program Learning Outcomes
1	Disciplinary knowledge	PLO1	Acquire fundamental knowledge about the vessel and its safe and secure Navigation and operations at sea and in port
2	Disciplinary technical skills	PLO2	Equip with technical skills for carrying various tasks on-board vessels in operational level
3	Disciplinary non-technical skills	PLO3	Equip with non-technical skills for a smooth and secured shipboard operations in operational level
4	Moral, ethic and Socio cultural competence	PLO4	Be a social responsible and well behaved maritime professional with global vision
5	Lifelong learner	PLO5	Acquire professional knowledge throughout life.

6. **Entry Requirements:**

Educational Qualification

Candidates must have completed 10+2 with Physics, Chemistry, and Mathematics (PCM) as mandatory subjects from a recognized board. Minimum Marks: a) 60% aggregate marks in PCM. b) 50% marks in English subject in 10th or +2 examination.

Marital Status

Unmarried

Relaxation

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

Age Limit

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.

Physical Fitness

Candidates must be medically fit and must meet the physical standards as prescribed in the Merchant Shipping (Medical Examination) Rules, 2000, as amended from time-to-time.

Medical Certificate

Physical Fitness

Candidates seeking admission to this Nautical Science 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. (Refer: <https://www.dgshipping.gov.in/Content/MaritimeHealthBranch.aspx>)

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>)

If any amendments take place to the above Ordinance 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/she 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 re-joining 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/behaviour in class, responses/attentiveness in class etc.	10
2	Lab work records (Includes record work and Model Exam)	40
	Total	50

The component-wise breakup of the 'Internal Assessment' for the Book Review / Field Practice, Placement training and Community engagement and services shall be as follows:

S No	Component	Marks
1	Teachers Assessment which may include parameters such assignments/behaviour 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. Records of seminar like topics, marks allotted to students shall be maintained by the Faculty / College.
- 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 |
- Remarks: Attendance is Common for all Subjects in a semester for each students
- 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 shall 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/industry visit (for field practice). The 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 (ESE) 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/ Placement Training /Community engagement and Service: Viva-voce by the external evaluated for maximum of 50 marks

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 totalling 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 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 valuation by a Panel of Examiners / Evaluators 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 as and when the same can be conducted by IMU (Please refer IMU Circular No.2403). In such cases, the internal marks obtained by the student will be carried over for computation of total marks

**16. Policy for Academic Progression of students during their stay at IMU
(As per IMU Circular 1917 dated 30-07-2019)**

If a student who has arrears in the first year (Semester I and II) of the programme, he/she cannot proceed to into the third year. Such students will have to clear the arrear papers as External candidate (cannot attend classes and will not be permitted to stay in hostel). Such candidates after clearing the arrears, can re-join the course at appropriate batch with regular students after paying the applicable semester fees.

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

17. Classification of Marks vs Grade

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	-

18. Consolidated Mark Statement

The consolidated marks statement indicating marks scored in all the subjects will be issued when the students pass all the subjects of the B.Sc. (Nautical Science) programme. The fee for consolidated marks statement is to be remitted along with the examination fee while registering for the VI semester examination fee.

19. Provisional Certificate

For those who are declared qualified for the B.Sc. (Nautical Science) programme, the Provisional Degree certificate will be issued in person or sent by post after publication of the results. All the students have to pay the fee for the provisional certificate along with sixth semester examination fee.

20. Award of Degree

Students who have successfully completed the programme within the stipulated period will be awarded the degree of Bachelor of Science (Nautical Science). For those who are declared qualified for the Bachelor of Science (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 12 form, along with the fee specified in the application form. The degree will be conferred in person or in absentia as requested.



Programme Structure

SEMESTER I								
S.No	Course Code	Course Title	Course Category	No. of Lecture /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credit
1	UG21T6101	Maritime English	SE	45	15	60	4	4
2	UG21T6102	Mathematics	MS	45	15	60	4	4
3	UG21T6103	Physics	MS	45	15	60	4	4
4	UG21T6104	Computer Science	MS	45	15	60	4	4
5	UG21T6105	Ship Construction	CC	60	15	75	5	5
6	UG21P6106	Computer Science Practical	PL <MS>	60	15	75	5	2.5
7	UG21P6107	Soft Skill Practical (Communication skill)	PL <MD>	60	15	75	5	2.5
8	UG21F6108	Field Practice - Swimming Training	FP <AE>	15	15	30	2	1
9	UG21F6109	Book Review (any good English book of student's choice, literature, fiction, Novel, Historic, Time travel Adventure etc.)	SA <SI>	15	15	30	2	1
Total Hours / Credits in Semester I				390	135	525	35	28
SEMESTER II								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credit
1	UG21T6201	Nautical Mathematics	MS	45	15	60	4	4
2	UG21T6202	Nautical Physics and Electronics	MS	45	15	60	4	4
3	UG21T6203	Environmental Science	VA	45	15	60	4	4
4	UG21T6204	Bridge Equipment and COLREGS	CC	45	15	60	4	4
5	UG21T6205	Terrestrial Navigation	CC	60	15	75	5	5
6	UG21P6206	Seamanship Practical	PL <CC>	60	15	75	5	2.5
7	UG21P6207	Nautical Physics and Electronics Practical	PL <MS>	60	15	75	5	2.5
8	UG21F6208	Field Practice - Industry Visits	FP <MD>	15	15	30	2	1
9	UG21F6209	Communication Skills on Case Studies	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester II				390	135	525	35	28

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SEMESTER III								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
1	UG21T6301	Marine Meteorology	AE	45	15	60	4	4
2	UG21T6302	Bridge Electronic Equipment and Watch Keeping	CC	45	15	60	4	4
3	UG21T6303	Ship Stability-I	CC	45	15	60	4	4
4	UG21T6304	Cargo Work I	CC	45	15	60	4	4
5	UG21T6305	Celestial Navigation	CC	60	15	75	5	5
6	UG21P6306	Nav Equipment OOW Simulator Practical	PL <CC>	60	15	75	5	2.5
7	UG21P6307	Project Work Practical (Making model ship structures / Cargo related / Case Studies)	PL<SI>	60	15	75	5	2.5
8	UG21F6308	Field Practice – Planetarium/ Light House visit	FP <MD>	15	15	30	2	1
9	UG21F6309	Technical Writing Skills on Navigational Subjects	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester III				390	135	525	35	28
SEMESTER IV								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
1	UG21T6401	Contingency preparedness	MD	45	15	60	4	4
2	UG21T6402	Marine Pollution Prevention	VA	45	15	60	4	4
3	UG21T6403	Artificial Intelligence and Autonomous Ships	AE	45	15	60	4	4
4	UG21T6404	Cargo Work-II	CC	45	15	60	4	4
5	UG21T6405	Ship Stability-II	CC	60	15	75	5	5
6	UG21P6406	Chart Work Plotting and ECDIS Simulator Practical	PL <CC>	60	15	75	5	2.5
7	UG21P6407	Advanced Seamanship Practical	PL <CC>	60	15	75	5	2.5
8	UG21F6408	Field Practice- Boat Rowing Exercises	FP <SE>	15	15	30	2	1
9	UG21F6409	Technical Writing skills on Environmental subjects	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester IV				390	135	525	35	28

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SEMESTER V								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
1	UG21T6501	Ship Manoeuvring and Piloting	SE	45	15	60	4	4
2	UG21T6502	Marine Engineering and Automation	MD	45	15	60	4	4
3	UG21T6503	Shipboard Operations	CC	45	15	60	4	4
4	UG21T6504	IMO and International Conventions	CC	45	15	60	4	4
5	UG21T6505	Naval architecture-I	CC	60	15	75	5	5
6	UG21P6506	Engine Room Machinery and Workshop Practical	PL<MD>	60	15	75	5	2.5
7	UG21P6507	Watch Keeping Practical - I	PL <SI>	60	15	75	5	2.5
8	UG21F6508	Field Practice - Placement Activities	FP <SI>	15	15	30	2	1
9	UG21F6509	On-board Record Keeping	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester V				390	135	525	35	28
SEMESTER VI								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
1	UG21T6601	HR Practices in Shipping	MS	45	15	60	4	4
2	UG21T6602	Logistics and Supply Chain Management	AE	45	15	60	4	4
3	UG21T6603	Blue Economy	MD	45	15	60	4	4
4	UG21T6604	Commercial Shipping Practices	CC	45	15	60	4	4
5	UG21T6605	Naval architecture-II	CC	60	15	75	5	5
6	UG21P6606	OOW Simulator Steering and BTM Practical	PL <SE>	60	15	75	5	2.5
7	UG21P6607	Watch Keeping Practical - II	PL <SI>	60	15	75	5	2.5
8	UG21F6608	Field Practice - Community Service	CS <VA>	15	15	30	2	1
9	UG21F6609	Maritime Upskilling	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester VI				390	135	525	35	28
Grand Total Hours / Credits							3150	168

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. CS - Community engagement and service
- VII. VA - Value Added Courses Common for All UG
- VIII. PL - Practical Lab
- IX. SI - Summer Internship
- X. FP - Field Practice
 - a. Field practice includes a comprehensive approach to swimming/aquatic skills and visits to lighthouses, meteorological labs, Community engagement and Service, Placement related activities etc.,
- XI. SA - Studio activities
- XII. FP <SI> – Nautical Science being specialized studies; the Field Practice shall be considered on par with summer internship.

Curriculum for B.Sc. (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 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	UG21T6101	Maritime English	SE	10	20	30	70	35/70	100	50/100
2	UG21T6102	Mathematics	MS	10	20	30	70	35/70	100	50/100
3	UG21T6103	Physics	MS	10	20	30	70	35/70	100	50/100
4	UG21T6104	Computer Science	MS	10	20	30	70	35/70	100	50/100
5	UG21T6105	Ship Construction	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
6	UG21P6106	Computer Science Practical	PL <MS>	10	40	50	50	25/50	100	50/100
7	UG21P6107	Soft Skill Practical (Communication skill)	PL <MD>	10	40	50	50	25/50	100	50/100
8	UG21F6108	<i>Field Practice - Swimming Training</i>	FP <AE>	10	40	50	50	25/50	100	50/100
9	UG21F6109	Book Review (any good book of student's choice, literature, fiction, non-fiction, historic, time travel etc)	SA <SI>	10	40	50	50	25/50	100	50/100
		Total		90	260	350	550		900	

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	UG21T6201	Nautical Mathematics	MS	10	20	30	70	35/70	100	50/100
2	UG21T6202	Nautical Physics and Electronics	MS	10	20	30	70	35/70	100	50/100
3	UG21T6203	Environmental Science	VA	10	20	30	70	35/70	100	50/100
4	UG21T6204	Bridge Equipment and COLREGS	CC	10	20	30	70	35/70	100	50/100
5	UG21T6205	Terrestrial Navigation	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
6	UG21P6206	Seamanship Practical	PL <CC>	10	40	50	50	25/50	100	50/100
7	UG21P6207	Nautical Physics and Electronics Practical	PL <MS>	10	40	50	50	25/50	100	50/100
8	UG21F6208	Field Practice - Industry Visits	FP<MD>	10	40	50	50	25/50	100	50/100
9	UG21F6209	Communication Skills on Case Studies	SA <VA>	10	40	50	50	25/50	100	50/100
		Total		90	260	350	550		900	

SEMESTER III										
S. No	Course code	Course Title	Course Category	Internal Assessment (IA) - 30 Marks			End Semester Examination (ESE) – 70 Marks		Total 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	UG21T6301	Marine Meteorology	AE	10	20	30	70	35/70	100	50/100
2	UG21T6302	Bridge Electronic Equipment and Watch Keeping	CC	10	20	30	70	35/70	100	50/100
3	UG21T6303	Ship Stability-I	CC	10	20	30	70	35/70	100	50/100
4	UG21T6304	Cargo Work I	CC	10	20	30	70	35/70	100	50/100
5	UG21T6305	Celestial Navigation	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
6	UG21P6306	Nav Equipment OOW Simulator Practical	PL <CC>	10	40	50	50	25/50	100	50/100
7	UG21P6307	Project Work Practical (Making model ship structures / Cargo related / Case Studies)	PL<SI >	10	40	50	50	25/50	100	50/100
8	UG21F6308	Field Practice – Planetarium/ Light House visit	FP<M D>	10	40	50	50	25/50	100	50/100
9	UG21F6309	Technical Writing Skills on Navigational Subjects	SA<V A>	10	40	50	50	25/50	100	50/100
		Total		90	260	350	550		900	

SEMESTER IV										
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	UG21T6401	Contingency preparedness	MD	10	20	30	70	35/70	100	50/100
2	UG21T6402	Marine Pollution Prevention	VA	10	20	30	70	35/70	100	50/100
3	UG21T6403	Artificial Intelligence and Autonomous Ships	AE	10	20	30	70	35/70	100	50/100
4	UG21T6404	Cargo Work-II	CC	10	20	30	70	35/70	100	50/100
5	UG21T6405	Ship Stability-II	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
6	UG21P6406	Chart Work Plotting and ECDIS Simulator Practical	PL <CC >	10	40	50	50	25/50	100	50/100
7	UG21P6407	Advanced Seamanship Practical	PL <CC >	10	40	50	50	25/50	100	50/100
8	UG21F6408	Field Practice-Boat Rowing Exercises	FP <SE >	10	40	50	50	25/50	100	50/100
9	UG21F6409	Technical Writing skills on Environmental subjects	SA <VA >	10	40	50	50	25/50	100	50/100
		Total		90	260	350	550		900	

SEMESTER V										
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	UG21T6501	Ship Manoeuvring and Piloting	SE	10	20	30	70	35/70	100	50/100
2	UG21T6502	Marine Engineering and Automation	MD	10	20	30	70	35/70	100	50/100
3	UG21T6503	Shipboard Operations	CC	10	20	30	70	35/70	100	50/100
4	UG21T6504	IMO and International Conventions	CC	10	20	30	70	35/70	100	50/100
5	UG21T6505	Naval architecture-I	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
6	UG21P6506	Engine Room Machinery and Workshop Practical	PL<MD>	10	40	50	50	25/50	100	50/100
7	UG21P6507	Watch Keeping Practical - I	PL<SI>	10	40	50	50	25/50	100	50/100
8	UG21F6508	Field Practice - Placement Activities	FP<SI>	10	40	50	50	25/50	100	50/100
9	UG21F6509	On-board Record Keeping	SA<VA>	10	40	50	50	25/50	100	50/100
		Total		90	260	350	550		900	

SEMESTER VI										
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	UG21T6601	HR Practices in Shipping	MS	10	20	30	70	35/70	100	50/100
2	UG21T6602	Logistics and Supply Chain Management	AE	10	20	30	70	35/70	100	50/100
3	UG21T6603	Blue Economy	MD	10	20	30	70	35/70	100	50/100
4	UG21T6604	Commercial Shipping Practices	CC	10	20	30	70	35/70	100	50/100
5	UG21T6605	Naval architecture-II	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
6	UG21P6606	OOW Simulator Steering and BTM Practical	PL <SE>	10	40	50	50	25/50	100	50/100
7	UG21P6607	Watch Keeping Practical - II	PL <SI>	10	40	50	50	25/50	100	50/100
8	UG21F6608	Field Practice - Community Service	CS <VA>	10	40	50	50	25/50	100	50/100
9	UG21F6609	Maritime Upskilling	SA <VA>	10	40	50	50	25/50	100	50/100
		Total		90	260	350	550		900	

Detailed Teaching Syllabus - Semester I

SEMESTER I								
S.No	Course Code	Course Title	Course Category	No. of Lecture /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credit
Theory Courses								
1	UG21T6101	Maritime English	SE	45	15	60	4	4
2	UG21T6102	Mathematics	MS	45	15	60	4	4
3	UG21T6103	Physics	MS	45	15	60	4	4
4	UG21T6104	Computer Science	MS	45	15	60	4	4
5	UG21T6105	Ship Construction	CC	60	15	75	5	5
Practical Courses								
6	UG21P6106	Computer Science Practical	PL <MS>	60	15	75	5	2.5
7	UG21P6107	Soft Skill Practical (Communication skill)	PL <MD>	60	15	75	5	2.5
8	UG21F6108	<i>Field Practice - Swimming Training</i>	FP <AE>	15	15	30	2	1
9	UG21F6109	Book Review - I (any good English book of student's choice, literature, fiction, Novel, Historic, Time travel Adventure etc.)	SA <SI>	15	15	30	2	1
Total Hours / Credits in Semester I				390	135	525	35	28

SKILL ENHANCEMENT COURSE (SE)	UG21T6101 - MARITIME ENGLISH		LECTURE	TUTORIAL	TOTAL
	CREDITS		3	1	4
	HOURS		45	15	60
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				
CLO4	Comprehend passages and appreciate rich Maritime heritage of India				
CLO5	Read and understand relevant maritime news from News papers				
Mapping with Programme Learning Outcomes (PLO)					
CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	M	M	-	H
CLO2	H	M	M	-	M
CLO3	H	M	M	-	H
CLO4	H	M	M	-	H
CLO5	H	M	M	-	M
H-High; M-Medium; L-Low					

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/ANN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Introduction to Communication in English		9	3
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	3
2.1	State the Objective of using Standard Maritime Communication Phrases for effective onboard communication onboard.	K		
2.2	Explain the use of SMCP vs General English in the backdrop of multinational crew	U		

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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 & Unberthing	K		
3	Writing Skill		9	3
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 Sensitisation		9	3
4.1	Understand gender sensitisation	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			
4.5	The Way Forward 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			
4.10	Female Ratings	U		
	Explain Education Among Seafarers			
	Current Scenario in the Seafaring Community			

	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 Nature of the job and demands of the careers in the merchant navy		9	3
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 & 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	Explain the functions of Deck Department, Engine Department, and Saloon Department.			

5.11	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 3. Swadeshi Steam: V.O. Chidambaram Pillai and the Battle against the British Maritime Empire by A.R. Venkatachalapathy-Published by Penguin on 22 December 2023 4. The Ocean of Churn: How the Indian Ocean Shaped Human History by Sanjeev Sanyal- Published by Penguin Random House India on 18 September 2017				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

MINOR STREAM (MS)	UG21T6102 - MATHEMATICS		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

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	PLO5
CLO1	M	H	L	-	L
CLO2	M	H	L	-	L
CLO3	M	H	L	-	M
CLO4	M	H	L	-	M
CLO5	M	H	L	-	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Trigonometry		9	3
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	3
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
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	3
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	3
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 1/3 rd rule	AP		
5.6	Calculate areas, volume based on Simpson's 3/8 th 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)	UG21T6103 - PHYSICS		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

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	PLO5
CLO1	H	H	L	-	L
CLO2	H	H	L	-	-
CLO3	H	H	L	L	M
CLO4	H	M	L	-	-
CLO5	H	M	L	-	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Mechanics and Hydromechanics		9	3
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 & Buoyancy.	K		
1.6	State Pascal's law and its applications (hydraulic lift, hydraulic Brake).	K		
2	Sound, Heat and Thermodynamics		9	3

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
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	3
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	3
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 1 published by S.Chand, Published on 10 June 2006.				
2) Principles of Electronics by V.K Mehta, Rohit Metha, edition 7, published by S.Chand on 3 Feb 2014.				
REFERENCE BOOKS				
1	Engineering Physics by R. K Gaur-Volume 1-Published by MC Graw-Hill Education (India) Pvt Limited,1998.			
2	Basic Electrical Engineering by B.L. Thereja & A. K Theraja, Volume 1-Published by S. Chand, Published on 10 th June 2006			
3	Principles of Electronics by V. K. Mehta, Rohit Mehta-Edition 7, published by S. Chand, Published on 3 Feb 2014.			
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

MINOR STREAM (MS)	UG21T6104 - COMPUTER SCIENCE	LECTURE	TUTORIAL	TOTAL	
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand the basics of Computer memory
CLO2	Understand the basics of ecommerce and internet
CLO3	Demonstrate proficiency in utilizing MS Word and MS PowerPoint
CLO4	Demonstrate proficiency in utilizing MS Excel
CLO5	Understand of computer programming using python

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	M	L	L	H
CLO2	M	M	L	L	H
CLO3	M	M	L	L	H
CLO4	M	M	L	L	H
CLO5	M	M	L	L	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Computer Memory and Software		9	3
1.1	Explain computer Memory	K		
1.2	Describe types of computer memory - Primary memory, Secondary Memory	U		
1.3	Describe Random Access Memory and its types	U		
1.4	Explain Read Only Memory and its types	U		
1.5	Explain Cache Memory and Virtual Memory	U		
1.6	Define software	K		
1.7	Explain types of software - System Software and application Software	U		
1.5	Explain Compiler, Assembler, and Interpreter.	U		
2	Explain utility programs	U		
2.1	Define Programming Languages Machine language, Assembly language, Low level and High level Languages	K		
2	E-commerce and Internet		9	3
2.1	Explain E-commerce and types of E-commerce Models	U		
2.2	Explain benefits and limitations of E-Commerce	U		

2.3	Explain EDI Electronic Data Interchange and its benefits	U		
2.4	Explain computer network, its types , topologies	U		
2.5	Explain advantages of computer networks	U		
2.6	Explain internet, intranet	U		
2.7	Explain applications of Internet and Intranet	U		
2.8	Differentiate Internet and Intranet	A		
3	MS Word and MS PowerPoint		9	3
3.1	MS word	K/U		
3.2	Demonstrate creating Documents, formatting text and paragraph and Borders & Shading to a Paragraph	AP		
3.3	Demonstrate Finding and Replacing Text	AP		
3.4	Explain and demonstrate Spelling and grammar	U		
3.5	Demonstrate Insert bullets and numbered lists, Insert SmartArt, symbols and pictures, Headers and Footers	AP		
3.6	Demonstrate Create tables and using formulas in it	AP		
3.7	Demonstrate Mail merge, Embedding Excel to WORD, MS PowerPoint	AP		
3.8	Explain and demonstrate Create a presentation: Create a slide, Add new slides	U		
3.9	Explain and demonstrate Insert pictures, Format text, Format pictures, and Preview a presentation.	U		
3.10	Explain in detail and demonstrate Insert tables and charts, Employ design templates, employ a master slide, and rearrange slides.	U		
3.11	Explain in detail and demonstrate Animate text, animate graphics, create slide transitions, Advance slides automatically, Preparing Live Presentations, Make presentation portable	U		
4	MS Excel		9	3
4.1	Explain in detail how Create workbooks, working with rows, columns, cells and Worksheets.	U		
4.2	Explain in detail how Insert pictures and graphics. Format cells.	U		
4.3	Explain in detail how Use conditional formatting on data in cells	U		
4.4	Demonstrate Advanced Calculations Create formulas employ the function wizard, add comments	AP		
4.5	Explain autofill and flash fill	U		
4.6	Explain the procedures in creating Charts and Overview of types of charts	U		
4.7	Explain Sort and filtering data	U		
5	Python		9	3
5.1	Define Python language	K		
5.2	Explain in detail Python operators	U		
5.3	Explain in detail datatypes	U		

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5.4	Explain in detail condition statements	U		
5.5	Explain in detail Loop control statement	U		
5.6	Explain in detail different types function or methods in python	U		
TEXT BOOKS				
Course notes by the faculty				
REFERENCE BOOKS				
1	Information Technology for management by Henry Lucas- 7 th Edition-Published by Tata Mc-Graw Hills on August 17, 1999			
2	The Complete E-Commerce Book: Design, Build, and Maintain a Successful Web-Based Business by Janice Reynolds- 2nd Edition-Published by 30 March 2004			
3	MS Office 2007 By Gary Shelly, Thomas Cashman, Misty.E. Vermaat-1 st Edition-Published by Cengage Learning on 1 January 2010			
4	Basics of Computer Science by Behrouz Forouzan, Firouz Maosharraf- Published by CENGAGE LEARNING (RS) on 1 January 2009.			
5	Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic-1 st Edition- O,,Reilly Publication on 21 November 2014.			
6	Beginning Python: From Novice to Professional by Magnus Lie Hetland- Published by Apress on 15 th Nov 2009			
7	Computer Concepts and Fundamentals of Programming by Ganesh Ingle-1 st Edition- Published by Notion Press on 1 January 2018			
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6105 – SHIP CONSTRUCTION	LECTURE	TUTORIAL	TOTAL	
		CREDITS	4	1	5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Familiarise 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	Understand various fittings on ships
CLO5	Learn various stresses action on the ships

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	M	L
CLO2	H	H	M	M	L
CLO3	H	H	M	M	L
CLO4	H	H	M	M	L
CLO5	H	H	M	M	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP /AN/C)	LECTURE HOURS	TUTORIAL HOURS
1	Principle parts of ship and Definitions:		60	15
			12	3
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.	A		

2	Load Line, Draft Marks and Hull Structures		12	3
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	Explain the difference between Plan View, Profile View and Elevation View and also sketch and label a plan and 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 1.1	AP		
2.5	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
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		
3.8	Explain Longitudinal, Transverse And Combined Systems of Framings	AP		
3.9	Illustrate Double-Bottom Structure For Longitudinal And Transverse Framing	AP		
3.10	Sketch a neat Mid-ship sections of Gen Cargo, Bulk Carrier, Oil Tanker Ships with different Framing system	AP		
4	Fittings on Forecastle deck, Fire main and Bilge piping system, Stern Frame and Rudder		12	3
4.1	Describe The Cleating Arrangements For The Hatch Covers	U		
4.2	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		
4.3	Describe The Bilge Piping System Of A Cargo Ship	U		
4.4	Describe That Each Section Is Fitted With A Screw-Down Non Return Suction Valve.	U		
4.5	Describe The Arrangement Of A Fire Main And List What Pumps May Be Used To Pressurize It	U		
4.6	Sketch And Label Air Pipes To Ballast Tanks / Fuel Oil Tanks	AP		
4.7	Describe The Use Of Save-All And Drip Trays.	U		
4.8	Sketch a neat diagram of Stern frame and label the parts	AP		
4.9	Sketch a neat diagram of Balance, Semi-balanced and Unbalanced Rudder	AP		
5	Ship Stresses and Loadicator		12	3
5.1	Define Terms Shear Force (SF) And Bending Moments (BM)	K		
5.2	Explain What Is Meant By ‘Hogging’ And By ‘Sagging’ And Distinguish between them (Static and Dynamic both)	U		
5.3	Describe The Loading Conditions and Sea condition Which Give Rise To Hogging And Sagging Stresses	AP		
5.4	Describe Liquid Pressure Loading On the Tank Structures. Stress due to Torsion on Hull girder	U		
5.5	Describe Qualitatively The Stresses Set Up By Liquid Sloshing In A Partly Filled Tank	U		
5.6	Describe Racking Stress And Its Causes	U		

5.7	Explain What Is Meant By 'Pounding' Or 'Slamming' And List Which Part Of The Ship Is Affected	U		
5.8	Explain What Is Meant By 'Panting' And List Which Parts Of The Ship Are Affected?	U		
5.9	Describe Stresses Caused By Localized Loading	U		
5.10	Describe The Input and Output Data from Stress Calculation Machine (Loadicator). Briefly state about class certificate of Loadicator, approved Loadicator manual and approved test conditions and testing requirements by ship staff & annual testing in presence of Class	U		

TEXT BOOKS

Course notes by the faculty

Ship Construction Notes for Ship Mates - by Edrich Fernandes-1999

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

REFERENCE BOOKS

Ship Construction Sketches & Notes - by Kemp & Young-2ND Edition-Published by Routledge on 8 October 2015

Ship & Naval Architecture - by R. Munro-Smith

Ship Constructions - by D.J. Eyres, George J Bruce 7th Edition- Published by Butterworth Heinemann Ltd on 22 May 2012

Ship Construction for Marine Engineer - by Stroke

Pedagogy

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

PRACTICAL MINOR STREAM (PL/MS)	UG21P6106 - COMPUTER SCIENCE PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Demonstrate proficiency in utilizing MS Word and MS PowerPoint
CLO2	Demonstrate proficiency in utilizing MS Excel and python

Mapping with Programme Learning Outcomes (PLO)

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

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	MS Word		15	3
1.1	Create and save a document using MSWORD	C		
	Deletion of Character, Word, line and block of text - Undo and redo process - Moving, Copying and renaming			
1.2	Format the Text document	AP		
	Character formatting - Paragraph formatting - Page formatting			
1.3	Spell check the document	AP		
	Finding and Replacing of text, Checking Spelling and Grammar			
1.4	Print the document Print Preview - Print Dialog box	AP		
1.5	Mail Merge	AP		
1.6	Create main document and data file for mail merging	AP		
1.7	Table creation	C		
	Create a table in the document - Add row, column to a table - Changing column width and row height - Merge, split cells of table - Use formulae in tables - Sorting data in a table - Formatting a table.			
2	MS Excel		15	4
2.1	Demonstrate Create workbooks, working with rows, columns, cells and Worksheets.	AP		
2.2	Demonstrate Insert pictures and graphics. Format cells.	AP		
2.3	Demonstrate flash fill, auto fill functionality	AP		

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2.4	Demonstrate Use conditional formatting on data in cells	AP		
2.5	Demonstrate Perform Basic Calculations	AP		
2.6	Demonstrate Advanced Calculations – Create formulas, employ the function wizard,	AP		
2.7	Demonstrate Add comments, Create charts	AP		
2.8	Demonstrate VLOOKUP and data sorting	AP		
2.9	Demonstrate use of macros	AP		
2.10	Demonstrate data analysis tool pack	AP		
2.11	Demonstrate conditional formatting	AP		
2.12	Demonstrate advance excel functions	AP		
2.13	Demonstrate excel as database	AP		
3	MS PowerPoint		15	3
3.1	Create and save a new presentation	C		
	a. layout of opening screen in PowerPoint			
	b. the tool bars in MS PowerPoint			
3.2	Choose Auto Layout for a new slide.	AP		
3.3	Insert text and pictures into a blank slide.	AP		
3.4	Insert new slides into the presentation.	AP		
3.5	Apply slide transition effects.	AP		
3.6	Slide show. Set animation to text and pictures in a slide - Set the sounds, order and timing for animation	AP		
4	Python		15	5
4.1	Demonstrate Program using Python operators, data types	AP		
4.2	Demonstrate Program using condition statements	AP		
4.3	Demonstrate Program using Loop control statement	AP		
4.4	Demonstrate Program using different types function or methods	AP		
TEXT BOOKS				
Course notes by the faculty				
REFERENCE BOOKS				
1	John Zelle, "Python Programming: An Introduction to Computer Science", Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410			
2	Michel Dawson, "Python Programming for Absolute Beginners", Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1435455009			
WEB RESOURCES : Web content from NDL / SWAYAM or open source web resources				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

PRACTICAL MULTI-DISCIPLINARY <PL/MD>	UG21P6107 – SOFT SKILL PRACTICAL (COMMUNICATION SKILL)		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Practice self-management in the hostel and academics
CLO2	Exercising role play in communication and team work
CLO3	Practice to learn emotional intelligence
CLO4	Learn work ethics through simulating various conditions
CLO5	Practice situational awareness and decision making

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	H	H	L	M
CLO2	L	H	H	L	M
CLO3	L	H	H	L	M
CLO4	L	H	H	L	M
CLO5	L	H	H	L	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Self-Management		12	3
1.1	Exercise health and hygiene management at the living quarters management Time Management	AP		
1.2	Set object for the daily routines, studies (any one) and practice to achieve the objectives	AP		
1.3	Make a personal time schedule and follow and report	AP		
1.4	Write a report on the Procrastination which has happened during this semester	AP		
1.5	Analyse how many times you have fallen sick and report the preventive measures	AN		
1.6	Analyse how many times you have late for the classes, mess and other similar activities and write the report.	AN		
1.7	Exercise officer like qualities and write the report that where you have lagged	AP		
1.8	Analyse what happens when the OOW going to the bridge watch late by 15 mins.	AN		
1.9	Study one accident report and analyse the cause in relation to time management	AN		
2	Communication and Team work		12	3

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2.1	Practice communication during crane operation by using hand signals	AP		
2.2	Analyse the advantage and disadvantage of body communication on board ships	AN		
2.3	Simulate mooring operation and practice communication and role play	AP		
2.4	Simulate bridge team and practice communication within the bridge team including pilot and role play	AP		
2.5	Practice mooring operation and report the importance of team work in mooring operation	AP		
2.6	Simulate enclosed space entry and practice team work and communication	AP		
2.7	Study one accident report and analyse the cause in relation to team work			
3	Emotional Intelligence		12	3
3.1	Simulate a on board sick condition for your colleague and enumerate the consequences and other situational management	AP		
3.2	Practice the Positive & Negative Emotional effects when your roommate is not getting along with you.	AP		
3.3	Analyse the effect when you are on board and you are urgently needed at home, but the nearest port is 10 days away.	AN		
3.4	Analyse the mental preparedness for transiting a piracy prone area	AN		
3.5	Practice away from home (regimental course) - write a report on the effect and consequences	AN		
4	Work ethics and problem solving		12	3
4.1	Illustrate importance of turnout			
4.2	Demonstrate table manners, personal hygiene	AP		
4.3	Demonstrate Interaction with authorities and Inspectors	AP		
4.4	Recognize emotional cues and express socially comfortable feelings	AN		
4.5	Recognize the power dynamics in a group or organization through role play	AN		
4.6	Develop and maintain good relationships among the cadets in the hostel	AP		
4.7	Inspire and influence others, work well in a team	AP		
4.8	Analyse the series of actions when a distress vessel is sighted in your watch and write down consequences when not reported to master	AN		
4.9	Analyse the consequences when a problem is not reported in the early stage - simulate few cases such as greasy surface, improper hand over watch in high traffic area, minor defects in equipment's etc.	AN		
5	Situational awareness and decision making		12	3
5.1	Practice look out reporting, constant monitoring and decision making on bridge duties	AP		

5.2	Exercise various decision making for different vessel scenario and report the consequences when there is a delay in decision making	AP		
5.3	Practice analysing the weather report and decide whether to work on deck or not	AP		
5.4	Practice analysing the condition of rolling and pitching and decide on work aloft duties	AP		
5.5	Analyse the weather condition and decide whether to start the ventilation or not.	AN		
5.6	Write the action when you see your team member fainted inside the tank	AP		
TEXT BOOKS				
Communication Skills: A Workbook. Oxford University Press, by Sanjay kumar and Pushp Lata, Edition 1, Published by Oxford University Press, Published on 1 Jun 2018.				
REFERENCE BOOKS				
Softskills – Dr K.Alex Effective Small Group and Team Communication by Judith D. Hoover (Wadsworth Publishing Co Inc) Tom Chatfield, Critical Thinking, Sage Publications India Pvt. Ltd., 2018. The Ace Of Soft Skills: Attitude, Communication And Etiquette For Success - Gopaldaswamy Ramesh Effective Communication and Soft Skills - Nitin Bhatnagar Mastering Interviews and Group Discussions - Dinesh Mathur				
Case studies related to maritime accidents				
Pedagogy				
Assignment, Seminar, Group Discussion, and Activity based Learning.				

FIELD PRACTICE - ABILITY ENHANCEMENT COURSES (FP/AE)	UG21F6108 - FIELD PRACTICE - SWIMMING TRAINING		PRACTICAL	TUTORIAL	TOTAL																		
		CREDITS	0.5	0.5	1																		
		HOURS	15	15	30																		
Course Learning Outcomes (CLO)																							
On the successful completion of the course, students will be able to																							
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CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5																		
CLO1	-	-	L	H	-																		
CLO2	-	-	L	H	-																		
H-High; M-Medium; L-Low																							

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
1	Swimming Training <ul style="list-style-type: none"> - learn free style swimming, - Regular swimming practices 	AP	5	5
2	<ul style="list-style-type: none"> - able to float freely for at least 10 minutes - Regular swimming practices 	AP	5	5
3	<ul style="list-style-type: none"> - displays Jumping from a height of 2 meters with life-vest on - Regular swimming practices - Student must pass the Swimming test 	AP	5	5

STUDIO ACTIVITIES – SUMMER INTERNSHIP (SA/SI)	UG21F6109 - BOOK REVIEW (ANY GOOD ENGLISH BOOK OF STUDENT'S CHOICE, LITERATURE, FICTION, NOVEL, HISTORIC, TIME TRAVEL ETC.,)		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

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	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
1	Introduction to Book Reviewing		3	3
	Explore the importance of book reviews in literary criticism Analysis of sample book reviews from various publications	AP AN		
2	Literary Elements		3	3
	Identifying and analysing key literary elements (plot, character, setting, theme, etc.)	AP		
3	Genre Exploration		3	3
	Explore different genres of literature (fiction, non-fiction, poetry, etc.) Study genre-specific conventions and expectations	AP AP		
4	Writing Style and Voice		3	3
	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: and iii. Conclusion	AP	3	3

Detailed Teaching Syllabus - Semester II

SEMESTER II								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credit
Theory Courses								
1	UG21T6201	Nautical Mathematics	MS	45	15	60	4	4
2	UG21T6202	Nautical Physics and Electronics	MS	45	15	60	4	4
3	UG21T6203	Environmental Science	VA	45	15	60	4	4
4	UG21T6204	Bridge Equipment and COLREGS	CC	45	15	60	4	4
5	UG21T6205	Terrestrial Navigation	CC	60	15	75	5	5
Practical Courses								
6	UG21P6206	Seamanship Practical	PL <CC>	60	15	75	5	2.5
7	UG21P6207	Nautical Physics and Electronics Practical	PL <MS>	60	15	75	5	2.5
8	UG21F6208	Field Practice - Industry Visits	FP <MD>	15	15	30	2	1
9	UG21F6209	Communication Skills on Case Studies	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester II				390	135	525	35	28

MINOR STREAM (MS)	UG21T6201 - NAUTICAL MATHEMATICS			LECTURE	TUTORIAL	TOTAL	
				CREDITS	3	1	4
				HOURS	45	15	60
Course Learning Outcomes (CLO)							
On the successful completion of the course, students will be able to							
CLOs	CLO STATEMENT						
CLO1	Solve problems in spherical triangle						
CLO2	Solve numerical in statistics						
CLO3	Solve numerical in sets and algebra						
CLO4	Exercise sums from matrix						
CLO5	Solve numerical related to research						
Mapping with Programme Learning Outcomes (PLO)							
CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5		
CLO1	H	H	-	-	M		
CLO2	M	H	-	-	M		
CLO3	M	H	-	-	M		
CLO4	M	H	-	-	M		
CLO5	M	H	-	-	M		
H-High; M-Medium; L-Low							

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Spherical Trigonometry		9	3
1.1	Solve Polar Triangle problems to find any angle or the side including ambiguous cases	AP		
1.2	Use 4 Part formula for solving spherical triangles	AP		
2	Statistics & Probability Distribution		9	3
2.1	Calculate Correlation and Rank Correlation for the sets of data	AP		
2.2	Calculate Regression lines & Regression Coefficient for the set of data	AP		
2.3	Understand Binomial Distribution, Normal Distribution, Poisson Distribution	U		
2.4	Calculate simple and compound interest	AP		
3	Understand Matrices, Determinants and Basic Vector Theory		9	3
3.1	Comprehend Properties of Determinants	U		
3.2	solve simultaneous equations using determinants	AP		
3.3	Study Different matrices, Rank of a matrix and their properties	AP		
3.4	Solve simultaneous equation using matrices	AP		
3.5	Explain Eigen Value theorem and Basic vector theory	U		
4	Discrete Mathematics		9	3

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4.1	Understand Set Theory, Set operations and Laws of set theory	U		
4.2	Solve numerical using set theory	AP		
4.3	Understand Algebra of Logic, Propositions & statements, Compound Statements and Contradictions, Equivalence and Tautology	U		
4.4	Solve numerical in algebra	AP		
4.5	Understand Boolean Algebra, Boolean function and identities.	U		
4.6	Understand Fuzzy Logic, Fuzzy sets, Fuzzy set operations, Truth values and properties of fuzzy sets	U		
4.7	Solve numerical in fuzzy sets	AP		
5	Operations Research		9	3
5.1	Understand Linear Programming	U		
5.2	Explain Formulation of problem	U		
5.3	Understand Graphical solution and transportation problems	U		
5.4	Solve assignments related to above topics	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				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning				

MINOR STREAM (MS)	UG21T6202 NAUTICAL PHYSICS AND ELECTRONICS		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Gain knowledge about positive & negative feedback in amplifiers
CLO2	Understand the concept of Generators & motors.
CLO3	Study in detail about the positive and negative feedback in amplifiers
CLO4	Comprehend electromagnetic induction
CLO5	Understand the basic principle of working of oscillators.

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	M	L	L	L
CLO2	M	M	L	L	L
CLO3	M	M	L	L	L
CLO4	M	M	L	L	L
CLO5	M	M	L	L	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Semiconductor devices		9	3
1.1	Define types of Semiconductors	K		
1.2	Explain construction and symbol of p-n junction diodes with their characteristics	U		
1.3	Explain construction and working of LDR and LED	U		
1.4	Explain Photo Electric Cell	U		
2	Generators and Motors		9	3
2.1	Describe the principle and working of AC generator, DC generator	U		
2.2	Describe the principle and working of AC motor/Induction motor.	U		
2.3	Explain the Series, Shunt type and compound type DC motor.	U		
2.4	Describe heating effect of current, heaters, fuses, thermoelectric effect.	U		
3	Electromagnetic Induction:		9	3
3.1	Describe relation between magnetism and electricity.	U		
3.2	Understand Production of electro-magnetic induction and current.	U		
3.3	Describe Faraday- Lenz's law, self and Mutual inductance and their coefficients, coupling coefficients.	U		

4	Amplifiers		9	3
4.1	Understand the working of CE amplifier	U		
4.2	explain D.C and A.C equivalent circuit of CE amplifier	U		
4.3	Explain Cascading stages of amplifier	U		
4.4	Explain Negative and positive feedback amplifiers	U		
4.5	Define classification of amplifiers, Class A, B and C	K		
4.6	Explain the working of RC coupled amplifiers	U		
4.7	Understand the working of Class-B push pull amplifier.	U		
5	Oscillators and Digital electronics		9	3
5.1	Understand basic principle of LC tank circuit.	U		
5.2	Define Barkhausen's criteria for oscillators.	K		
5.3	Explain the working of LC Oscillators namely Hartley and Colpitts Oscillator.	U		
5.4	Explain basic logic gates & its types.	U		
5.5	Explain working of NAND gates, NOR Gates and XOR Gates.	U		
5.6	Define Boolean algebra	K		
TEXT BOOKS				
1) Electrical Technology by B. L. Thereja & A.K Theraja, Volume 1 Published 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	Advanced level physics by Nelkon & Parker -7 th Edition-Published by CBS on January 1995			
2	Applied physics by J H Clough-Smith, R.A. Davies-2 nd Edition- Published by Brown, Son & Ferguson Ltd on 1 September 1994			
3	Text book of Engineering Mechanics by R.S. Khurmi -22 nd Edition- Published by S Chand on 1 January 2018			
4	Heat & Thermodynamics: Brijal & R. Subramaniam-Published by S Chand on 30 June 2008			
5	Principles of Physics: Fredrick. Bueche -6 th Edition-Published by McGraw-Hill Inc., US on 1 January 1995			
6	Communication electronics: ND Deshpande, DA Deshpande, PK Rangole, TMH.			
7	Electronic communication system: G Kennedy, MGH			
8	Electronic Devices and Circuit-PHI: Boylestead, Nashelsky			
9	Modern Digital Electronics: R P Jain, 4E-TMH.			
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

VALUE ADDED COURSE (VA)	UG21T6203 - ENVIRONMENTAL SCIENCE		LECTURE	TUTORIAL	TOTAL																																				
	CREDITS		3	1	4																																				
	HOURS		45	15	60																																				
Course Learning Outcomes (CLO)																																									
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UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Multidisciplinary nature of Environmental Studies and Natural Resources:		9	3
	The Multidisciplinary nature of Environmental Studies:			
1.1	Define the Scope and importance, Need for public awareness	K		
	Natural Resources:			
1.2	Describe renewable and non-renewable resources: Natural resources and associated problems.	U		
	a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.			
	b) Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.			
	c) Mineral resources: Use and exploitation, environmental effect of extracting and using mineral resources, case studies.			

	d) Food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source. Case studies.			
	f) Land resources: Land as a resources, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.			
2	Ecosystems, Biodiversity and its conservation:		9	3
	Ecosystems:			
2.1	Describe concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, Ecological succession, food chains, food webs and ecological pyramids.	U		
2.2	Understand the types, characteristic features, structure and function of the following ecosystem: forest ecosystem, grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lake, rivers, oceans, estuaries)	U		
	Biodiversity and its conservation:			
2.3	Define: genetic, species and ecosystem diversity, Bio-geographical classification of India,	K		
2.4	Understand Value of biodiversity:	U		
	consumptive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels,			
	India as a mega-diversity nation, hot-spots of biodiversity, threats of biodiversity:			
	habitat loss, poaching of wildlife, man vs wildlife conflicts,			
	Endangered and endemic species of India,			
2.5	Understand Conservation of biodiversity:	U		
	In-situ and Ex-situ conservation of biodiversity.			
3	Environmental Pollution:		9	3
3.1	Describe the causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards Solid waste.	U		
3.2	Understand the Management of Causes, effect and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Pollution case studies.	U		
3.3	Understand the Disaster management: floods, earthquake, cyclone and landslides.	U		
4	Social Issues and the Environment:		9	3
4.1	Understand From Unsustainable to sustainable development,			
	Urban problems related to energy, Water conservation,	U		
	rain water harvesting, watershed management,			
4.2	Describe Resettlement and rehabilitation of people: its problems and concerns.	K		
4.3	Case studies related to the above	A		

	Environmental ethics:			
4.4	Understand the Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion. Nuclear accidents and holocaust.	U		
4.5	Case studies related to above	A		
4.6	Understand Wasteland reclamation, Consumerism and waste products.	U		
4.7	Define Environment Protection Act.	K		
4.8	Define Air (Prevention and Control of Pollution) Act.	K		
4.9	Define Water (Prevention and Control of Pollution) Act.	K		
4.1	Define Wildlife Protection Act.	K		
4.11	Define Forest conservation Act.	K		
4.12	Understand Issues involved in enforcement of environmental	U		
	Legislation, Public awareness.			
5	Human Population and the Environment, Field Work:		9	3
5.1	Understand Human Population and the Environment:			
	Population growth, variation among nations, Population explosion – Family Welfare Programme, environmental and Human health, human rights, Value Education, HIV / AIDS, Women and child Welfare,	U		
	Describe Role of Information Technology in Environment and human health,	U		
	Case Studies.	A		
	Field Work (One Field Visit)			
5.2	Visit to a local area and	AP		
	a) Document Environmental assets-river/ Ocean /forest/ grassland/ hill/ mountain.			
	b) document pollution at Urban / Rural / Industrial / agriculture area			
	c) study of common plants, insects, birds,			
	study simple eco systems-pond, river, hill slopes, etc.	A		
TEXT BOOKS				
Textbook of Environmental Studies for UG Courses- by Erach Bharucha, Published by Orient Blackswan Pvt Ltd, Published on 8 Mar 2021				
REFERENCE BOOKS				
1	Agarwal, K.C.2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.			
2	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380013, India , Email: mapin@icenet.net(R)			
3	Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc.480p.			
4	Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopaedia, Jaico Publ, Mumbai, 1196p			
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6204 - BRIDGE EQUIPMENT AND COLREGS		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

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	PLO5
CLO1	H	H	M	-	-
CLO2	H	H	M	-	-
CLO3	H	H	M	M	L
CLO4	H	H	M	M	L
CLO5	H	H	M	M	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	LECTURE HOURS	TUTORIAL HOURS
			45	15
1	Lay out of Bridge (Wheel House) and Navigational equipment		9	3
1.1	Understand the general layout of the Bridge with its Navigational Equipment and 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		9	3
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		9	3
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		9	3
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) <ul style="list-style-type: none"> - 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		9	3

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 & 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 and 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- by Capt. H. Subramaniam, Published by Vijaya Publications, Published on 1 Jan 2017
2	Bridge equipment and watchkeeping by Capt.A.G Bhatia-2022 Edition
3	Rules of The Road, Bhandarkar Publications-2018
4	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis

REFERENCE BOOKS

1	Modern electronic Navigation Aids- Bhatia and Sinha
2	Bridge Procedure Guide - ICS

3	Bridge Team work - Nautical Institute
4	Mariners Handbook – HMSO Publication
Pedagogy Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning	

CORE COURSE (CC)	UG21T6205 - TERRESTRIAL NAVIGATION	LECTURE	TUTORIAL	TOTAL	
		CREDITS	4	1	5
		HOURS	60	15	75

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	PLO5
CLO1	H	H	M	M	H
CLO2	H	H	M	M	H
CLO3	H	H	M	M	M
CLO4	H	H	M	M	H
CLO5	H	H	M	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U /AP/AN/C)	LECTURE HOURS 60	TUTORIAL HOURS 15
1	Earth, Compasses, Parallel and Plane Sailing:		12	3
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	3
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, Great Circle and Composite (Great) Circle, Limited Latitude Sailing:		12	3
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		
3.8	Demonstrate the understanding of Composite circle sailing and limited latitude great circles sailing.	U		
3.9	Calculate composite great circles, vertex and position of intermediate points.	AP		
3.10	Calculate initial and final course and the distance of Composite (Great) Circle track and Limited Latitude sailing track.	AP		
4	Chart Work Theory:		12	3
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	3
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	<u>Appraisal</u> – 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	<u>Planning</u> – 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	<u>Execution</u> - 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	<u>Monitoring</u> – 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, Dual 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		
	<ul style="list-style-type: none"> 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. 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.				

PRACTICAL CORE COURSE (PL/CC)	UG21P6206 - SEAMANSHIP PRACTICAL	PRACTICAL	TUTORIAL	TOTAL	
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

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	PLO5
CLO1	H	H	M	L	M
CLO2	H	H	M	L	H
CLO3	H	H	M	L	M
CLO4	H	H	M	L	M
CLO5	H	H	M	L	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Deck Work		10	3
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	Stencilling	AP		

2	Access and lifting appliances		10	3
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		5	
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	10	3
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 and Gas Measurement		5	
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		10	3
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 A Sparay Machine	AP		
4.4	Demonstrate how wet & And Dry' Film Thickness Can Be Measured After Painting	AP		
5	Mooring Stations		10	3
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		
	<p>Text Book</p> <p>Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House Publisher: Routledge Taylor & Francis"</p>			

PRACTICAL MINOR STREAM (PL/MS)	UG21P6207 - NAUTICAL PHYSICS AND ELECTRONICS PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Experiment Hartley and Colpitts oscillator
CLO2	Determine wave length measurements by diffraction methods
CLO3	Experiment venture meter
CLO4	Determine moment of inertia of fly wheel
CLO5	Experiment LDR and LED and their characteristics
CLO6	Experiment the working of basic and universal gates

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	M	L	-	-
CLO2	L	M	L	-	-
CLO3	L	M	L	-	-
CLO4	L	M	L	-	-
CLO5	L	M	L	-	-
CLO6	L	M	L	-	-

H-High; M-Medium; L-Low

UNI T NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	PRACTICAL HOURS 60	TUTORIAL HOUR 15
1	Working of LED and LDR.		5	2
1.1	Connect the circuit as per the circuit diagram.	AP		
1.2	Performs the experiment as per procedure.	AP		
1.3	Note down the readings.	AP		
1.4	Do the calculations on LED and LDR	AP		
2	Moment of inertia of a flywheel and frictional torque.		5	2
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	Working of basic gates and universal gates		5	2
3.1	Connect the circuit as per the circuit diagram.	AP		
3.2	Performs the experiment as per procedure.	AP		

3.3	Note down the readings.	AP		
3.4	Do the calculations on basic gates and universal gates	AP		
4	Verification of KVL and KCL:		5	1
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	To study the characteristics of Zener diode and its use as voltage regulator		10	2
8.1	connect the circuit as per the circuit diagram of Zener diode	AP		
8.2	Perform the experiment and study its characteristics as per the procedure	AP		
8.3	Note down the readings and do the related calculations	AP		
6	Use of thermistor as temperature / heat sensor:		10	2
6.1	Comparison between thermistor and thermocouple type heat sensors	AN		
6.2	Performance of thermistor experiment to find the temperature of hot water.	AP		
6.3	Draw a graph between resistance Vs temperature change	AP		
6.4	Compare the characteristics curve of thermistor with RTD type temperature sensor	AN		
6.5	Application of thermistor in different fields	AP		
7	Study of Venturimeter:		10	2
7.1	Compare Venturimeter with other flow meters (like Orifice and Rotameter)	AN		
7.2	Perform the experiment on Venturimeter apparatus	AP		
7.3	Calculate the theoretical and practical value of discharge and discharge coefficient	AP		
7.4	Apply Venturimeter in different field	AP		
8	Hartley and Colpitts oscillator		10	2
8.1	connect the circuit as per the circuit diagram of Hartley oscillator.	AP		
8.2	Perform the experiment as per the procedure	AP		
8.3	Note down the readings and do the related calculations	AP		
8.4	Connect the circuit as per the circuit diagram of colpitts oscillator.	AP		
8.5	Performs the experiment as per procedure.	AP		
8.6	Note down the readings and do the relevant calculations	AP		

FIELD PRACTICE - MULTI DISCIPLINARY (FP/MD)	UG21F6208 - Field Practice - Industry Visits		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Experience the port/harbour structures and observe berthing and unberthing of ships
CLO2	Understand various structures onboard ship
CLO3	Experience the container Terminal and its functioning

Mapping with Programme Learning Outcomes (PLO)

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

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS	TUTORIAL HOURS
			15	15
	<i>Campuses / Colleges to have the flexibility to choose unit1 AND/OR unit2 AND/OR unit3 that are feasible based on availability / location. Atleast one industry related activity has to be done</i>		15	15
1	Industrial visit - (Port or Harbour or Terminal) <ul style="list-style-type: none"> - A visit to a port and or, ship yard, and or Harbour and a ship visit - To understand the port facility, jetty, Berth, Tug - Submit a write-up on the visit 	AP		
2	Ship Visit <ul style="list-style-type: none"> - 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 - To submit a write-up on the ship visit and experience 	AP		
3	Visit to a Container Terminal, Dry-Port or any allied Industry linked to Maritime Industry <ul style="list-style-type: none"> - Write a write-up on Industrial visit 	AP		

STUDIO ACTIVITIES – VALUE ADDED COURSE (SA/VA)	UG21F6209 – Communication Skills on Case Studies		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Practice reviewing of maritime related case studies

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	-	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
1	Learn about the concept of case study (ACCIDENTS RELATED BOOKS AND CASE STUDIES)	K	2	2
1.1	Learn the Significance of case studies			
2	Review international Regulations for preventing Collision at Sea	AP	10	10
	Write the review report of any 5 rules of ROR	AP		
3	Write review report after reviewing the case studies from the following book	AP	18	18
	Navigation Accidents and their Causes published by nautical institute (MARS)	AP		

Detailed Teaching Syllabus - Semester III

SEMESTER III								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
Theory Course								
1	UG21T6301	Marine Meteorology	AE	45	15	60	4	4
2	UG21T6302	Bridge Electronic Equipment and Watch Keeping	CC	45	15	60	4	4
3	UG21T6303	Ship Stability-I	CC	45	15	60	4	4
4	UG21T6304	Cargo Work I	CC	45	15	60	4	4
5	UG21T6305	Celestial Navigation	CC	60	15	75	5	5
Practical Courses								
6	UG21P6306	Nav Equipment OOW Simulator Practical	PL <CC>	60	15	75	5	2.5
7	UG21P6307	Project Work Practical (Making model ship structures / Cargo related / Case Studies)	PL<SI>	60	15	75	5	2.5
8	UG21F6308	Field Practice – Planetarium/ Light House visit	FP <MD>	15	15	30	2	1
9	UG21F6309	Technical Writing Skills on Navigational Subjects	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester III				390	135	525	35	28

ABILITY ENHANCEMENT COURSE (AE)	UG21T6301 – MARINE METEOROLOGY		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

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	PLO5
CLO1	H	H	L	M	H
CLO2	H	H	L	M	H
CLO3	H	H	L	M	H
CLO4	H	H	L	M	H
CLO5	H	H	L	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS	TUTORIAL HOURS
1	Earth's Atmosphere and atmospheric pressure		45	15
1.1	Describe the composition of the earth's atmosphere, mentioning dry air and its constituents, water vapour and aerosols.	U	9	3
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	U		

	temperature, Dry Adiabatic Lapse Rate (DALR) and Saturated Adiabatic Lapse Rate (SALR), Saturation; Evaporation, Condensation, Latent Heat, and Vapour Pressure.			
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 placed within it.	K		
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/m ² .	K		
1.13	State that 1 millibar = 1/1000 bar = 102 N/m ²	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	3
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
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 organisations for issuing ice warnings.	U		
4	Tropical Revolving Storms (TRS) and weather system		9	3
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 centres 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	3
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	Use the Ship's Code Book to code a ship's full report	AP		
5.16	Describe Indian monsoon, EL Nino, IOD, local atmospheric phenomena such as water spout, thunder storm, aurora and halo.	U		
5.17	Understand weather routing and its uses for safe and efficient vessel navigation	U		
TEXT BOOKS				
1	Marine Meteorology – Capt. H. Subramaniam			
2	Ships' Code and Decode Book- The Met. Office, Edition 10, Published by Stationary office books, Published on 1 May 1981.			
3	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis			
REFERENCE BOOKS				
1	Meteorology for Mariners- HMSO			
2	Meteorology for Seafarers- Frampton, R.M			
3	Meteorology Demystified: self-teaching guide- Gibilisco Stan			
4	Dynamical Meteorology: an introductory selection- Atkinson, B.W.			
5	Mariners Handbook (NP 100) - Admiralty			
6	Cloud Types for Observers- HMSO			
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6302- BRIDGE ELECTRONIC EQUIPMENT AND WATCH KEEPING		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

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	PLO5
CLO1	H	M	H	L	H
CLO2	H	H	H	L	H
CLO3	H	M	H	L	M
CLO4	H	M	H	L	M
CLO5					

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	RADAR and ARPA		9	3
	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		9	3
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		9	3
	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		9	3
	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 & limitations of BNWAS	U		
5	Bridge Procedures Guide Contents and Keeping a safe Navigational Watch:		9	3
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 signalling 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 Edition
2	Bridge equipment and watchkeeping by Capt.A.G.Bhatia 2022 Edition
3	Ship Borne Radar and ARPA Nutshell Series Book 3 by Capt H. Subramaniam
4	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis
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-7 th Edition- Published by Butterworth-Heinemann on 17 November 2011
3	Bridge Procedure Guide – ICS
4	Bridge Team work - Nautical Institute
5	Electronic Navigation Systems by L. Tetley & D. Calcutt-3 rd Edition - 20 March 2001
6	Ship Magnetic Compass- Capt T.K. Joseph & Capt. S S S Rewari- Published by Applied Research International on 1 January 2018
7	Bridge Equipment, Charts & Publication Nutshell Series Book 5- Capt. H. Subramaniam-1st Edition - Vijaya Publications on 1 January 2017
8	Modern electronic Navigation Aids-Bhatia & Sinha
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

CORE COURSE (CC)	UG21T6303 – SHIP STABILITY-I		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Apply stability formula in calculating basic vessel stability parameters
CLO2	Estimate the centre of gravity of the vessel during cargo operation
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	PLO5
CLO1	H	H	M	M	H
CLO2	H	H	M	M	H
CLO3	H	H	M	M	H
CLO4	H	H	M	M	H
CLO5	H	H	M	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Introduction to ship stability		9	3
1.1	Explain Archimedes Principle & Principle of flotation.	U		
1.2	Compute underwater volumes of regular geometrical shapes and solve numerical on flotation.	AP		
1.3	Define Centre of Buoyancy as the geometric centre of the underwater volume & the up thrust by the water is known as Buoyancy.	K		
1.4	Define Reserve buoyancy as the above water enclosed volume which provides buoyancy in case vessel becomes heavier.	K		
1.5	Define Load Displacement, Present displacement, Light displacement, Deadweight, Deadweight aboard & Deadweight available.	K		
1.6	Show mathematically Deadweight = Load displacement – Light displacement, Deadweight Available = Load displacement – Present displacement & Deadweight aboard = Present displacement – Light displacement.	AP		
1.7	Explain how the draft of a vessel changes due to change of density.	U		

	Stability Terminology:			
1.8	Sketch and define TPC. Show that $TPC = \text{density} \times A/100$	AP		
1.9	Define Fresh Water Allowance (FWA). Show that FWA in cm can be calculated using formula $W/40$ TPC.	K		
1.10	Define Dock Water Allowance (DWA).	K		
1.11	Calculate TPC, FWA & DWA in various densities.	AP		
1.12	Sketch & define Block co-efficient (C_b), Water-plane coefficient (C_w), Mid-ship Coefficient (C_m), Prismatic Coefficient (C_p).	AP		
1.13	Show the relationship between C_p , C_b & C_m .	AN		
1.14	Calculate TPC given maximum Length, breadth of water plane, density of water & C_w .	AP		
1.15	Calculate Displacement given maximum length, breadth, draft and density of water & C_b .	AP		
2	Centre of Gravity :		9	3
2.1	Define Centre of gravity of ship and factors affecting the same.	K		
2.2	State that COG on a ship can be pinpointed if the 3 references are known. Distance from Keel, Distance from Aft perpendicular (or midships) & distance from fore and aft centre line.	K		
2.3	Calculate movement of COG when only one operation is carried out using GG1 formula.	AP		
2.4	Calculate KG of a Ship when multiple operations are carried out using moments about the keel.	AP		
2.5	Determine the position of the longitudinal centre of gravity (LCG) of a ship for different conditions of load & ballast using moments about the Aft Perpendicular.	AP		
2.6	Explain the effect on the position of centre of gravity of a ship by adding, removing and/or shifting weights.	U		
	Centre of Buoyancy & Centre of Flotation			
2.7	Define Centre of buoyancy and factors affecting the same.	K		
2.8	State that COB on a ship can be pinpointed if the 3 references are known. Distance from Keel, Distance from Aft perpendicular (or midships) & distance from fore and aft centre line.	K		
2.9	Define Longitudinal Centre of Buoyancy (LCB) & factors affecting their positions.	K		

2.10	Calculate KB & LCB of a ship with regular geometrical shapes.	AP		
2.11	Define Centre of Floatation and factors affecting its position.	K		
	Density, Draft & Displacement:			
2.12	Construct Displacement, TPC & Deadweight curves to scale for a given data.	AP		
2.13	Use displacement and TPC curves to determine weights of cargo or ballast from draughts or freeboards.	U		
3	Transverse Statical Stability and Equilibrium of Ships:		9	3
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		9	3
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 centre 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 $\tan \Theta = GG1/GM$	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:		9	3
5.1	Demonstrate the use of Ship and Hydrostatic particulars of M.V. Hindship.	U		
5.2	Apply knowledge of above topics & calculate numerical from 1 to 25 from M.V. Hindship.	AP		
TEXT BOOKS				
<ol style="list-style-type: none"> 1. Ship Stability at the Operational Level- Capt. Subramaniam H Published by Vijaya Publications, Published on 1-Jan-2021 2. Stability, trim and cargo calculations on M.V. Hindship and Oil Tankers- Capt. Joseph & Capt. Rewari, Edition 3, Published by Applied Research International, Published on 2018. 3. Stability Table Trim & stability particulars of M.V. Hindship (Stability tables) -Bhandarkar Publication. 				
REFERENCE BOOKS				
<ol style="list-style-type: none"> 1. Ship Stability for Masters & / Mates - C.B. Barrass and D.R. Derrett-7th Edition-Published on Butterworth-Heinemann Ltd on 5 September 2012 2. Ship Stability for Mates & Masters - Martin A. Rhodes - Published by Seamanship International Ltd on 1st Dec 2003 				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6304 – CARGO WORK I	LECTURE	TUTORIAL	TOTAL	
		CREDITS	3	1	4
		HOURS	45	15	60

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	PLO5
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 LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Types of Cargo and Cargo Care		9	3
	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	Explain the need for the segregation of different cargoes with reference to:	U		
1.16	– dangerous goods			
1.17	– dry cargo			
1.18	– wet cargo			
1.19	– clean cargo			
1.20	– dirty cargo			
1.21	– delicate cargo			
1.22	– valuable cargo, e.g. bank notes, personal effects			
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		9	3
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 the 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 on-board 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		9	3
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: <ul style="list-style-type: none"> – 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 longitudinal 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 <ul style="list-style-type: none"> – Defines: – angle of repose – cargoes which may liquefy – flow moisture point – flow state – transportable moisture limit – Describe in detail the preparation of cargo holds prior to loading bulk cargoes 	U		
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: <ul style="list-style-type: none"> – 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		9	3
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		9	3
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		

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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 with mean of mean draft without trim corrections (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 Off-shore 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 on 1 Jan 1993
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REFERENCE BOOKS

1	Cargo Notes- Dhananjay Swadi-2 nd Edition- Published by Witherby Seamanship International Ltd on 31 July 2009
2	IMDG Code Vol I,II & Supplement - Published by International Maritime Organization on 21 Jan 21
3	IMO Grain Code ,CSC , IMSBC Code & BLU Code
4	Cargo Work for Maritime Operation- D.J. House- 7 th Edition.

Pedagogy

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

CORE COURSE (CC)	UG21T6305 – CELESTIAL NAVIGATION		LECTURE	TUTORIAL	TOTAL
		CREDITS	4	1	5
		HOURS	60	15	75
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 and altitude of celestial body				
CLO4	Apply formula for finding position line by long by Chron and Intercept method				
CLO5	Calculate position line by intercept method				
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
CLO4	H	H	L	-	H
CLO5	H	H	L	-	H
H-High; M-Medium; L-Low					

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP/AN/C)	LECTURE HOURS 60	TUTORIAL HOURS 15
1	Celestial Sphere and Equinoctial System of Coordinates:		12	3
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 earth's 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	3
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		
2.9	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), and Lat by Mer Alt (Sun):		12	3

3.1	Calculate the Azimuth of a Heavenly body (Sun, Star and Planets only) at any given time (GMT/UTC). Find the Gyro and Mag Compass Error, calculate the Deviation if Variation given visa-versa.	AP		
3.2	Calculate Sun Rise, Sun Set time.	AP		
3.3	Calculate Amplitude (Sun).	AP		
3.4	Find the Gyro and Mag Compass Error, calculate the Deviation if Variation given.	AP		
3.5	Latitude by Meridian Altitude (Sun):	AP		
3.6	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		
3.7	Describe the direction of the position line through the observer when taking a meridian altitude.	U		
3.8	Time of the meridian passage of Sun.	U		
3.9	Calculate latitude by meridian altitude of Sun.	AP		
3.10	Find the Direction of the position line and the position through which it passes.	AP		
4	Long by Chron (Sun) and Intercept (Sun) (Marcq St. Hilaire method):		12	3
4.1	Calculate the Observed Longitude using Long by Chron method with heavenly body sun only.	AP		
4.2	Find the Direction of the position line and the position through which it passes.	AP		
4.3	Calculate the Intercept using Marc St. Hillarie Method (Intercept method) with heavenly body sun only.	AP		
4.4	Find the Direction of the position line, and Position through which it passes.	AP		
5	Twilight, Circumpolar bodies and Star Identifier		12	3
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. S Rewari & Capt. T.K. Joseph, Edition 2, Published by Applied Research International, Published on 1 January 2018
2	Practical Navigation by Capt.H.Subramaniam 2010 Edition
3	Nautical Almanac
REFERENCE BOOKS	
1	The Admiralty Manual of Navigation: Principles of Navigation:Vol. 1-Nautical Institute
2	The Admiralty Manual of Navigation: Astro Navigation Vol.2- Nautical Institute
3	Norrie's Nautical Tables
4	Star Identifier set
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

PRACTICAL – CORE COURSE (PL/CC)	UG21P6306 - NAV EQUIPMENT OOW SIMULATOR PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

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/auto pilot

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	-	M	-	-
CLO2	M	M	M	-	-
CLO3	H	M	H	-	L
CLO4	H	H	M	-	M
CLO5	H	M	M	M	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Determining Errors on Sextant Altitude and Azimuth instruments:		15	3
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	4
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	4
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
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		
	Reference book			
1	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis			

PRACTICAL – SUMMER INTERNSHIP (PL/SI)	UG21P6307 - PROJECT WORK PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Make model of various parts of the ships
CLO2	Role model of onboard officers
CLO3	Analyse maritime case studies

Mapping with Programme Learning Outcomes (PLO)

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

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Model making		15	4
1.1	Make a scaled working model of any ship board equipment or machinery, demonstrating one of the maritime concepts. (This can be done in a group consists of maximum of 8 cadets making a model)	AP		
2	Human Element in Shipping		15	3
2.1	Demonstrate various facets of Human Element	AP		
2.2	Devise few methodologies for promoting safety culture onboard	AP		
2.3	Enact the above in a mode of your choice - skit, drama, song or any other practical way - for the others to understand.	AP		
3	Analyse Case Study Reports –	AN	15	4
3.1	Download one of the detailed Final Report published by Maritime administration – eg :			
	a. Fire Onboard Xpress Pearl - 2021			
	b. Grounding of MV Evergiven – 2021			
	c. Grounding of MV Wakashio – 2020			
	d. Fire onboard Maersk Homnam – 2018			
	Or any other similar final report of Maritime accidents.			
	1. Understand the sequence of Investigation reports			
	2. Read the index page to understand how factual evidences are collected.			
	3. Read through the analysis section to understand how evidences are linked together to reach towards conclusion of Root Cause of accidents			

	4. Read through the Recommendations section to understand how similar accidents can be avoided.			
4	Maritime Case Studies – Learning from Others mistakes	AN	15	4
4.1	Links for Maritime case studies given in References below.			
	The below exercise to be done by a group consists of maximum of 8 cadets			
	1. Explore various Maritime accident case studies and chose one case study			
	2. Do a detailed analysis of the accident / incident and determine its root cause.			
	3. If the above were to happen in your ship, how will you implement methodologies to avoid its recurrence			
	4. Enact the above in a mode of your choice - skit, drama, song or any other practical way - for the others to understand the mistakes made and avoid it recurrences.			
REFERENCE BOOKS				
1	a. Japanese P&I Club - Understanding Case Studies https://www.piclub.or.jp/wp-content/uploads/2018/04/Loss-Prevention-Bulletin-Vol.40-Full.pdf			
2	b. The Human Element - A Guide to Human Behaviour in the Shipping Industry - UK MCA http://www.nautinst.org/static/uploaded/e22106a2-337b-46a9-9449aa6fc2c439f5.pdf			
3	a. Fire onboard Xpress Pearl - 2021 https://www.mot.gov.sg/docs/default-source/default-document-library/final-report---tib-mai-cas-110---fire-onboard-x-press-pearl-colombo-anchorage-20-may-2021.pdf			
4	b. Grounding of MV Evergiven 2021 https://maritimecyprus.com/wp-content/uploads/2023/08/Final-Investigation-Report-Ever-Given-23-March-2021.pdf			
5	c. Grounding of MV Wakashio 2020 https://www.mlit.go.jp/jtsb/eng-mar_report/2023/2020tk0010e.pdf			
6	d. Fire onboard Maersk Honnam - 2018 https://www.mot.gov.sg/docs/default-source/default-document-library/final-report_mib-mai-cas-035---fire-on-board-srs-maersk-honam-on-6-march-2018.pdf			
7	Swedish Club - Collection of Case Studies https://www.swedishclub.com/loss-prevention/cases/case-studies/			
8	Confidential Human Factors Incident Reporting Programme - Maritime			
9	Chirp Reports : https://chirp.co.uk/maritime/reports/			
10	DGS Casualty Circular No. 01 of 2024 https://www.dgshipping.gov.in/writereaddata/ShippingNotices/202402230510448735170casualtyc-iruclarno01of2024.pdf			
11	DGS Report of Shipping Casualty 2014 to 2016 https://www.dgshipping.gov.in/writereaddata/ShippingNotices/201907180516294513521CASULATY_REPORT_2014-16_NT.pdf			
Pedagogy				
Group Discussion, and Activity based Learning and case study analysis				

FIELD PRACTICE - MULTI DISCIPLINARY (FP/MD)	UG21F6308 Field Practice – Planetarium/ Light House visit		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	See the operations of light house
CLO2	Experience the celestial objects useful for navigation

Mapping with Programme Learning Outcomes (PLO)

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

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP /AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
	<i>Campuses / Colleges to have the flexibility to choose unit1 AND/OR unit2 AND/OR unit3 that are feasible based on availability / location. Atleast one industry related activity has to be done</i>			
1	Light House visit <ul style="list-style-type: none"> - A visit to a Light House and Light house museum - write a report on the experience and knowledge gained by the visit 	AP	5	5
2	Meteorological Observatory visit <ul style="list-style-type: none"> - A visit to a Meteorological Observatory and - write a report on the experience and knowledge gained by the visit 	AP	5	5
3	Planetarium and Maritime Museum visit <ul style="list-style-type: none"> - A visit to a Planetarium and/ or Maritime Museum - Write an experience on observing the celestial objects - write an essay on the experience in the Maritime Museum visit 	AP	5	5

STUDIO ACTIVITIES VALUE ADDED (SA /VA)	UG21F6309 Technical Writing Skills on Navigational Subjects		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Practice reviewing maritime related books

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	-	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
1	Practice Technical report writing in Navigation related subjects		15	15
1.1	Write review report after reviewing Ocean passage for the world	AP		
1.2	Write a review report from Mariner's handbook any one topic	AP		
1.3	Write review report after reviewing Sailing Directions	AP		
1.4	Write review report after reviewing Admiralty List if lights and fog signals	AP		
1.5	Write review report after reviewing Admiralty List of Radio signals	AP		

Detailed Teaching Syllabus - Semester IV

SEMESTER IV								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
Theory Courses								
1	UG21T6401	Contingency preparedness	MD	45	15	60	4	4
2	UG21T6402	Marine Pollution Prevention	VA	45	15	60	4	4
3	UG21T6403	Artificial Intelligence and Autonomous Ships	AE	45	15	60	4	4
4	UG21T6404	Cargo Work-II	CC	45	15	60	4	4
5	UG21T6405	Ship Stability-II	CC	60	15	75	5	5
Practical Courses								
6	UG21P6406	Chart Work Plotting and ECDIS Simulator Practical	PL <CC>	60	15	75	5	2.5
7	UG21P6407	Advanced Seamanship Practical	PL <CC>	60	15	75	5	2.5
8	UG21F6408	Field Practice- Boat Rowing Exercises	FP <SE>	15	15	30	2	1
9	UG21F6409	Technical Writing skills on Environmental subjects	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester IV				390	135	525	35	28

MULTI DISCIPLINARY (MD)	UG21T6401 - CONTINGENCY PREPAREDNESS	LECTURE	TUTORIAL	TOTAL	
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand Risk assessment
CLO2	Practice risk assessment
CLO3	Understand Various Emergency situations on board Ships & how to prepare to face the emergencies
CLO4	Understand how to respond to emergencies onboard
CLO5	Understand respond to emergencies at sea

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	H	L	-	M
CLO2	M	H	L	-	M
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)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Hazard Identification and Reporting		9	3
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	3
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
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			
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	3
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, Scharnov 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.			
2	ISM Code.			
3	M & MS Notices for Case Studies.			
4	Theory and Practice of Seamanship - Danton G.			
5	Seamanship Notes - Kemp & Young			
6	Code of Safe Working Practices.			
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

VALUE ADDED COURSE (VA)	UG21T6402 – MARINE POLLUTION PREVENTION	LECTURE	TUTORIAL	TOTAL	
		CREDITS	3	1	4
		HOURS	45	15	60

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	Demonstrate Marine pollution prevention equipments
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	PLO5
CLO1	M	H	H	H	M
CLO2	M	H	H	H	M
CLO3	H	M	L	M	M
CLO4	L	H	M	H	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	MARPOL 73/78 Convention General -	U	9	3
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, centre 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 73/78.	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	K		

	and above, no ballast water should normally be carried in any oil fuel tank.			
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	3
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
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		

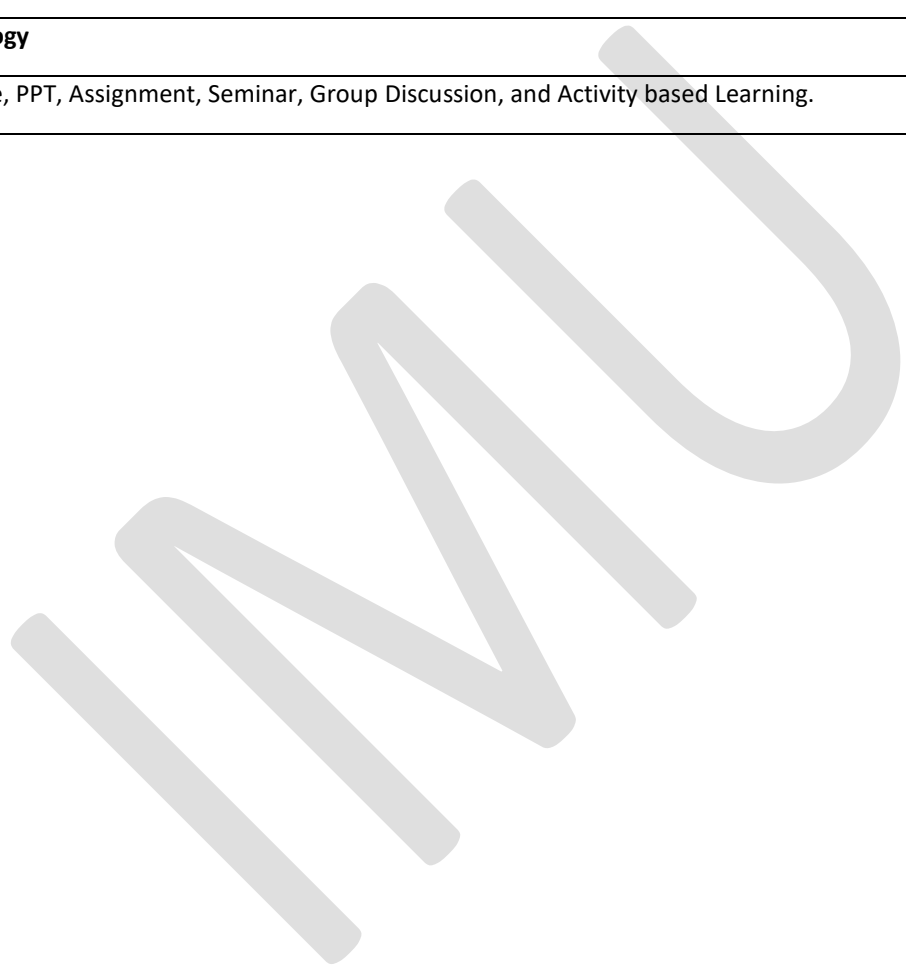
3.5	State that the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; or is discharging 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	State the regulations concerning the disposal of other garbage	K		
3.9	List the special areas for the purposes of Annex V	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	3
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	3
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 (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 by Capt. Subroto Khan- Second edition

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.



ABILITY ENHANCEMENT COURSES (AE)	UG21T6403 - ARTIFICIAL INTELLIGENCE AND AUTONOMOUS SHIPS		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand artificial intelligence and machine learning in marine industry
CLO2	Understand the importance of Cyber Security
CLO3	Understand IoT and Block chain Technology
CLO4	Understand Big data and Cloud database
CLO5	Understand Autonomous ships and its future

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	L	-	-	L
CLO2	M	L	-	-	L
CLO3	M	L	-	-	L
CLO4	M	L	-	-	L
CLO5	M	L	--	-	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Fundamentals of Artificial Intelligence and Machine Learning:		9	3
1.1	Define Intelligence, Types of Intelligence, Human and Machine Intelligence,	K		
1.2	Define Artificial Intelligence	K		
1.3	Explain History of AI, Turing test	U		
1.4	Explain Characteristics of AI (Understands, Reasons, Learns, Interacts)	U		
1.5	Explain Types of (AI) – types based on Capabilities and based on functionality	U		
1.6	Define Narrow AI (ANI), General AI (AGI) Super AI (ASI)	K		
1.7	Define Reactive machines, Limited memory, Theory of mind, Self-aware	K		
1.8	Define Machine learning	K		
1.9	Explain types of Machine Learning: Supervised learning, Unsupervised learning, Reinforcement learning	U		

1.10	Explain AI Ethics	U		
1.11	Explain Applications of Artificial Intelligence in autonomous ships	U		
1.12	Explain in details Challenges of Artificial Intelligence in autonomous ships	U		
2	Cyber Security		9	3
2.1	Explain Cyber Security and its importance	U		
2.2	Explain cyber security terminologies	U		
2.3	Explain classification of cybercrime	U		
2.4	Explain types of cyber-attacks	U		
2.5	Explain types of hackers	U		
2.6	Explain CIA triad (Confidentiality, Integrity, Availability)	U		
2.7	Explain AAA Security framework. Define Zero-Trust Security	U		
2.8	Explain cyber security in maritime industry CIA vs. CAIC (Control Availability Integrity Confidentiality)	U		
2.9	Explain cyber security challenges in maritime industry	U		
2.10	Explain Threats and Vulnerabilities	U		
2.11	Explain Risk Identification, Risk Assessment, mitigating the risk and Risk Control Strategies	U		
2.12	Define Cyberspace List Cyber security best practices and do's and don'ts	K		
2.13	Explain Cyber security on board ship	U		
3	Internet of things (IoT) and Block chain Technology:		9	3
3.1	Define IoT	K		
3.2	Define M2M	K		
3.3	Explain Characteristics of IoT	U		
3.4	Explain IoT in everyday life, Internet of Everything Describe and explain IoT and Individual Privacy.	U		
3.5	Explain different IoT application in shipping industries	U		
3.6	Define Blockchain technology	K		
3.7	State the Features of Blockchain Technology	K		
3.8	Explain Types of block chain	U		
3.9	Explain the Limitations, Opportunities and Challenges of Blockchain in marine industry.			
4	Big data:		9	3
4.1	Define Bigdata	K		
4.2	Explain its importance Explain the types of Big Data: structured, semi-structured, unstructured	U		
4.3	Explain characteristics of big data	U		
4.4	Explain challenges in big data, Big Data and AI	U		
4.5	Explain the applications of big data in maritime industry	U		
4.6	Define cloud databases	K		
4.7	State types of cloud database	K		

4.8	Explain Cloud services -- SaaS, PaaS, IaaS	U		
4.9	Explain the applications of cloud database in maritime industry	U		
5	Autonomous ships and future developments:		9	3
5.1	Define Maritime Autonomous Surface Ship (MASS)	K		
5.2	Understand Degrees of automation	U		
	Degree 1: Ship with automated processes and decision support			
	Degree 2: Remotely controlled ship with seafarers on board:			
	Degree 3: Remotely controlled ship without seafarers on board:			
	Degree 4: Fully autonomous ship			
5.3	Explain the advantages autonomous ships	U		
5.4	Explain the challenges in implementing autonomous ships	U		
5.5	Define Remote Operations Centre (ROC)	K		
5.6	Define MASS code	K		
5.7	State Regulatory Framework for MASS	K		
5.8	State Safety Legal implication of MASS	K		
TEXT BOOKS				
Course notes by the faculty				
REFERENCE BOOKS				
1. Artificial Intelligence and Machine Learning by Chandra S.S.V- 1 st Edition-Published by PHI Learning on 6th March 2014.				
2. Cybersecurity Attack and Defence Strategies: Infrastructure Security with Red Team and Blue Team Tactics by Erdal Ozkaya and Yuri Diogenes-1st Edition- Published by Packt Publishing on 9 February 2018				
3. Internet of Things and its Applications by Prof. Satish Jain, Shashi Singh-1st Edition- Published by BPB Publications on 1 June 2020				
4. Blockchain: Blueprint for a new economy by Melanie Swan-1st Edition-Published by O'Reilly Media on 23 January 2015				
REFERENCE LINKS/ONLINE REFERENCES				
The Guidelines on Cyber Security Onboard Ships Version 4 - https://www.ics-shipping.org/wp-content/uploads/2021/02/2021-Cyber-Security-Guidelines.pdf				
https://www.missionsecure.com/maritime-security-perspectives-for-a-comprehensive-approach				
https://www.lawyersclubindia.com/articles/classification-of-cybercrimes--1484.asp				
https://dl.icdst.org/pdfs/files3/053e44f660b0c2f405e42ac1f8f1a408.pdf				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6404 – CARGO WORK II		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

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	PLO5
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 LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Oil tankers		9	3
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 Educators	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 (O ₂ meters, H ₂ S 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)		9	3
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 cargo lines	K		
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		9	3
3.1	Explain IMO ST 1, ST 2 and ST 3 tankers as per IBC Ch 17	U		
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:		9	3
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 re-liquefaction plant.	K		
5	Cargo calculations(oil tanker) and cargo watch		9	3
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 on 1 Jan 1993			
REFERENCE BOOKS				

B.Sc. Nautical Science – 6th Revision

1	Cargo Work – Kemp and Young -5 th Edition-Published by Sheridan House Inc on 1 st June 1991
2	Cargo Works – Taylor -12 th Edition-Published by Brown, Son & Ferguson Ltd on 1 st Jan 1992
3	Cargo Notes- Dhananjay Swadi-2nd Edition- Published by Witherby Seamanship International Ltd on 31 st July 2009
4	Cargo Work for Maritime Operation- D.J. House-7th Edition-Published by A Butterworth-Heinemann Title on 1 st April 2005
5	ISGOTT, IGC Code, IBC Code
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

CORE COURSE(CC)	UG21T6405 – SHIP STABILITY-II		LECTURE	TUTORIAL	TOTAL
		CREDITS	4	1	5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Calculate trim of the vessel during cargo operation and at sea with different densities
CLO2	Draw curve of statical stability and cross curves
CLO3	Estimate righting moment and analyse angle of loll
CLO4	Calculate the stability of the vessel loading grain
CLO5	Apply stability related knowledge in Hindship calculations

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	M	H
CLO2	H	H	M	M	H
CLO3	H	H	M	M	H
CLO4	H	H	M	M	H
CLO5	H	H	M	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP/AN/C)	LECTURE HOURS 60	TUTORIAL HOURS 15
1	Trim :		12	3
1.1	Explain the theory of Trim, Changes in the position of COG & COB, Role of COF in change of trim, Trimming Moment & MCTC.	U		
1.2	Calculate Changes of drafts & Trim due to Loading, discharging & shifting weights and find final drafts F & A.	A		
1.3	Calculate amount to be loaded, discharged or shifted to achieve desired drafts.	A		
1.4	Calculate amount loaded, discharged or shifted to keep aft draft constant.	A		
1.5	Calculate final F & A drafts using Trim Tables.	A		
	Effect of change of density on Trim:			
1.6	Understand the theory behind Change of underwater volume, Bodily sinkage or rise due to change in density.	U		
1.7	Calculate location of COG, COB & COF, Change of Trimming Moment, Change of trim due to change of density for a box shaped vessel while going from SW to FW and vice versa.	A		
1.8	Calculate F & A drafts due to change of density for box shaped vessel and for a vessel for which hydrostatic particulars are provided.	A		
2	Curve of Statical Stability and Cross curves		12	3
2.1	Understand how to use cross curves of stability and compute value of GZ for given displacement & KG.	U		
2.2	Understand KN Cross curves of stability or tables & obtain GZ using formula $GZ = KN - KG \sin \theta$	U		
2.3	State that the KG used in formula for finding GZ using KN values is the corrected KG after application of FSC.	K		
2.4	Construct GZ curve using GZ values as obtained from cross curves.	A		
2.5	Obtain Max GZ & the angle at which occurs, Range of Stability, Angle of vanishing stability, Angle at which deck edge immersion takes place & Initial GM BY Using the GZ curve.	A		

2.6	Understand the GZ curve for a listed vessel and a vessel at her angle of loll.	U		
	Effect of Increased Beam and Freeboard			
2.7	Describe the effect of increasing the beam on ship's stability with the help of GZ curve	K		
2.8	Describe the effect of increasing the freeboard on ship's stability with the help of GZ curve.	K		
3	Righting Moment and angle of loll:		12	3
3.1	Use Wall sided formula to obtain GZ value at moderate and large angles of heel.	A		
3.2	Use Atwood's formula to obtain GZ value at moderate and large angles of heel.	A		
3.3	Use KN values to obtain GZ at moderate and large values of heel.	A		
3.4	Calculate Righting Moment after obtaining GZ values by any of the aforesaid methods by multiplying the GZ with displacement of the vessel.	A		
	Angle of Loll:			
3.5	Define "Angle of Loll"	K		
3.6	Explain in detail with diagrams, how a vessel takes to angle of loll.	U		
3.7	Explain the danger to a ship at the angle of loll.	U		
3.8	Explain the Remedial Actions for Angle of Loll giving reasons for the ballasting sequence to rectify same.	U		
3.9	Calculate the value of angle of loll using the formula: Tan $\theta = \frac{V}{2GM/BM}$	A		
4	Stability of Ships loading Grain		12	3
4.1	Define Grain, Angle of Repose, and Volumetric heeling moment.	K		
4.2	Explain the Hazards associated with respect to ship stability during carriage of grain in bulk.	U		
4.3	Describe Document of Authorization.	U		
4.4	Sketch and describe the stability criteria for grain cargo as per part B of chapter VI of SOLAS 74.	A		
4.5	Construct the GZ curve for grain laden vessel using KN values for various angles of heel.	A		
4.6	Construct the heeling arm curve by obtaining value of λ_0 & λ_{40}	A		
4.7	Obtain the angle of heel due to assumed shift of grain by the point of intersection of the GZ curve and heeling arm curve.	A		
4.8	Determine by Stability calculations whether the ship satisfies the requirements of Stability criteria as specified in chapter VI of SOLAS 74.	A		
5	Hydrostatic Curves and Tables of M.V. HINDSHIP:		12	3
5.1	Apply knowledge of above topics and solve numerical 26 to 67 from Text book- "Stability, Trim and cargo calculations on M.V. Hindship and Oil Tankers."	A		
TEXT BOOKS				
1) Ship Stability at the Operational Level by Capt. Subramaniam -Published by Vijaya Publications on 1 January 2021				
2) Ship Stability at the Management Level- Capt. H. Subramaniam -Published by Vijaya Publications on 1 January 2020				
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				
REFERENCE BOOKS				
1) Ship Stability for Mates & Masters, Martin A. Rhodes, Seamanship International Ltd 1 December 2003				
Pedagogy Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

PRACTICAL CORE COURSE (PL/CC)	UG21P6406 - CHART WORK PLOTTING AND ECDIS PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

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 LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	<p>Chart work exercises: (English Channel Chart) Determine the Ship's position, Course, Distance, Set & Drift:</p> <ul style="list-style-type: none"> 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	5
2	<p>Chart work exercises: (English Channel Chart) Determine the Course to Steer, CMG, SMG, Distance, Set & Rate of Current, Drift, Leeway and ETA to a given point:</p> <ul style="list-style-type: none"> 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 	AP	20	5

	v. Exercise on Planning a Passage from Point A to B			
3	<p>Demonstrate the use of ECDIS on Simulator: ECDIS Simulator Set up the ECDIS display as per following list -</p> <ul style="list-style-type: none"> - 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 <p>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</p> <ul style="list-style-type: none"> - 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	5
<p>TEXT BOOKS Chart Work for Mariner-Capt. S.K. Puri-6th Edition-Published on 1 Jan 2016 English Channel Chart (Photocopy) Parallel Ruler, Divider, Compass, 2B pencil and Eraser</p>				
<p>REFERENCE BOOKS ECDIS simulator manual</p>				
<p>Pedagogy Group Discussion, and Activity based Learning.</p>				

PRACTICAL – CORE COURSE (PL/CC)	UG21P6507 - ADVANCED SEAMANSHIP PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Demonstrate the use of life saving appliances
CLO2	Exercise mooring station activities
CLO3	Demonstrate the flag hoisting and communication procedures by using flags
CLO4	Carry out deck opening maintenance

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	L	-	-
CLO2	H	H	L	--	-
CLO3	H	H	L	-	-
CLO4	H	H	L	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Life Saving Appliances		15	4
1.1	Demonstrate the correct method of connecting Life raft painter, hydrostatic release unit (HRU) and weak link.	AP		
1.2	Identify Life boat equipment and explain their uses.	AP		
1.3	Identify parts of Life boat davit.	AP		
1.4	Demonstrate the use, care and maintenance of Line Throwing Apparatus, Immersion suit, TPA and Life jacket.	AP		
1.5	Identify different types of life buoy, their uses and maintenance.	AP		
1.6	Analyse why changing of lifeboat falls end to end is needed.	AN		
1.7	Demonstrate Abandon ship drill.	AP		
1.8	Demonstrate lifeboat launching and retrieval operation and explain On Load and off load Release mechanism	AP		
2	Mooring Stations		15	4

2.1	Demonstrate Making fast tug boat, bunker barge, stores boat	AP		
2.2	Demonstrate Procedure of Rigging Fire wire in a tanker	AP		
2.3	Analyse the need for Emergency towing apparatus – Forward system & Aft System	AN		
2.4	Study the Mooring Arrangement plans of various ships, including line up of ropes and wires, direction of rope leads etc.	AP		
3	Flag works and Communication		15	4
3.1	Identify Nation flag of all countries using Interco, Recognition of House flag.	AP		
3.2	Identify flag denoting numbers and substitute flags,	AP		
3.3	Practice usage of “International Code of Signals”.	AP		
3.4	Practice Use of Heliograph	AP		
3.5	Demonstrate the Use of Aldis Lamp / Torch for transmitting Morse codes	AP		
3.6	Hoist the flag in the respective mast	AP		
3.7	Demonstrate the use of single letter flag and numerical flags	AP		
3.8	Demonstrate the hoisting of Call sign flag of the ship in the flag mast	AP		
4	Deck Openings maintenance		15	3
4.1	Demonstrate the use of Scupper plugs	AP		
4.2	Analyse the Water Tight doors for	AN		
	.1 its construction			
	.2 Securing the door			
	.3 Care of rubber packing			
4.3	Study Booby Hatch and Manholes for	AP		
	.1 Right methods of Opening Booby Hatches and manholes			
	.2 Securing			
	.3 Care of Rubber packing			
4.4	Demonstrate the methods of air pipe maintenance	AP		
4.5	Demonstrate the correct methods of closing the sounding pipes, man holes, booby hatch, port holes	AP		
1	Text Book Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis			

FIELD PRACTICE SKILL ENHANCEMENT COURSE (FP/SE)	UG21F6408 - Field Practice- Boat Rowing Exercises		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Exercise survival techniques using life raft
CLO2	Demonstrate rowing boat in the sheltered waters

Mapping with Programme Learning Outcomes (PLO)

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

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIV ELEVEL (K/U/AP/ AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
	<i>Campuses / Colleges to have the flexibility to choose unit1 AND/OR unit2 AND/OR unit3 that are feasible based on availability / location. Atleast one industry related activity has to be done</i>			
1	Life Boat Launching and Recovery Davit Operation <ul style="list-style-type: none"> - Lifeboat Davit Operation - Lowering of Boat - Picking-up (Recovery of Life Boat exercise 	AP	5	5
2	Life Raft Exercises <ul style="list-style-type: none"> - 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	5	5
3	Boat Rowing Exercises <ul style="list-style-type: none"> - Boat Rowing exercises with oars - Understand the steering and Manoeuvring of Boat - Understand the Davit arrangement - Understand the Boat lowering and stowing arrangement. 	AP	5	5

STUDIO ACTIVITIES VALUE ADDED COURSE (SA/VA)	UG21F6409 – Technical Writing skills on Environmental subjects		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Practice reviewing maritime related books

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	-	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVELEVEL (K/U/AP/AN/C)	PRACTICAL HOURS	TUTORIAL HOURS
			15	15
1	Practice report writing in Environment related subjects		15	15
1.1	Write review report after reviewing International Maritime Dangerous Good Code (IMDG Code)	AP		
1.2	Write a review report after reviewing IGC Code	AP		
1.3	Write a review report after reviewing IBC code	AP		
1.4	Write a review report of any one annex after reviewing MARPOL	AP		
1.5	Write a review report after analysing the case study Deep-water Horizon oil rig accident	AP		

Detailed Teaching Syllabus - Semester V

SEMESTER V								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
Theory Courses								
1	UG21T6501	Ship Manoeuvring and Piloting	SE	45	15	60	4	4
2	UG21T6502	Marine Engineering and Automation	MD	45	15	60	4	4
3	UG21T6503	Shipboard Operations	CC	45	15	60	4	4
4	UG21T6504	IMO and International Conventions	CC	45	15	60	4	4
5	UG21T6505	Naval architecture-I	CC	60	15	75	5	5
Practical Courses								
6	UG21P6506	Engine Room Machinery and Workshop Practical	PL<MD>	60	15	75	5	2.5
7	UG21P6507	Watch Keeping Practical - I	PL <SI>	60	15	75	5	2.5
8	UG21F6508	Field Practice - Placement Activities	FP <SI>	15	15	30	2	1
9	UG21F6509	On-board Record Keeping	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester V				390	135	525	35	28

SKILL ENHANCEMENT COURSE (SE)	UG21T6501 SHIP MANOEUVRING AND PILOTING	LECTURE	TUTORIAL	TOTAL	
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand ship manoeuvring techniques
CLO2	Explain mooring operations
CLO3	Comprehend anchoring operations
CLO4	Understand pilotage operation and role of OOW
CLO5	Explain ship manoeuvring in restricted visibility and ice navigation

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	L	-	L
CLO2	H	H	L	-	L
CLO3	H	H	L	-	L
CLO4	H	H	L	-	L
CLO5	H	H	L	-	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP/AN/C)	LECTURE HOURS	TUTORIAL HOURS
			45	15
1	Ship Manoeuvring		9	3
1.1	Define Manoeuvring Data of Ship: Advance, transfer, drift angle, tactical diameter, track reach, head reach, side reach, turning circles of a ship in loaded and ballast condition and at different speeds	K		
1.2	Understand the effects of various dead weights, draughts, trim, speed and under keel clearance on turning circles and stopping distances	U		
1.3	Define directional stability, pivoting point, location of pivoting point when moving ahead, stopped, and going astern	K		
1.4	Define constant radial turn technique and understand determining wheel over position and turning radius.	K		

1.5	Define windage area and understand the effect of wind and current on ship handling and effect of wind and current on a given ship while moving and when making large turns.	K		
1.6	State that the force of the wind on the ship will vary with the heading relative to the wind	K		
1.7	Describe the Manoeuvres for the rescue of a man overboard: Immediate action, delayed action, single turn, Williamson turn and Scharnow turn, sequence of actions when a person is seen to fall overboard.	U		
1.8	Define Shallow-water effects, squat and bank effects.	K		
1.9	Understand the reduction in under keel clearance due to rolling and pitching.	U		
1.10	Define Interaction between passing ships and between own ship and nearby banks (canal effect)	K		
1.11	Describe different types of ship Propellers, Fixed Pitch propeller, controllable Pitch Propeller, Single screw propeller, double screw propeller etc State different types of bow/stern thrusters eg azimuth thrusters, tunnel thrusters, retractable thrusters etc	U		
1.12	Understand the Effectiveness of bow thrusters and stern thrusters. Explain that thrusters can enhance the manoeuvrability of vessels, particularly at low speeds	U		
2	Mooring Operations		9	3
2.1	Explain Safe practices during mooring operations and snap back zone	U		
2.2	Describe the Mooring plan of a ship, optimum mooring pattern and rope leads	U		
2.3	Understand the load on mooring lines due to wind, current, waves, surging at berth	U		

2.4	Explain Joining of two mooring ropes, slip wire, Synthetic fibre tails, explain joining shackles eg. Mandal and Tonsberg shackles	U		
2.5	Explain the dangers of mixed mooring systems	U		
2.6	State the uses of making fast of tugs, using fenders during berthing/unberthing	K		
2.7	Understand Brake Testing of Mooring Winches	U		
2.8	Define BHC - Brake Holding Capacity, BRC - Brake Rendering Capacity, Correct layers of lines on split drums, and correct reeling of lines on drum of mooring winch. Self-tensioning winches	K		
2.9	Understand the danger of belaying rope on a single bollard.	U		
2.10	Define SPM/SBM and CBM mooring	K		
2.11	Describe STS (Ship to Ship) mooring including fendering of vessels prior to ship to ship operations and tandem mooring system	U		
3	Anchoring		9	3
3.1	State the different types of anchors used onboard ships, various parts of the anchor, windlass, hawse pipe, spurling pipe, cable, link, swivel, joining shackle, shackle as a term of length, bitter end, the markings on anchor cable and the use of bow stopper	K		
3.2	Define the terms Anchor ready for letting go, Anchor aweigh, clear hawse, foul hawse, clear or foul anchor, anchor dragging, long stay, short stay, up and down, to veer cable, weighing anchor, yawing, brought up to three in water / four on deck, devil's claw	K		

3.3	State that anchoring plan must be prepared by the Master taking into consideration various factors eg. Limitation of anchoring equipment Available depth and holding ground, Under keel clearance, Location of anchorage, Tide, direction and strength of current, Weather including visibility and sea condition, Safety Swinging circle, Proximity of navigation hazards, Alternative anchorage, Anchor to be used	K		
3.4	Explain the term securing anchor for sea, covering spurling pipe.	U		
3.5	Define standing moor, running moor.	K		
3.6	Understand the Procedures for anchoring in deep water and in shallow water.	U		
3.7	Describe anchor dragging and anchoring in heavy weather	U		
3.8	Describe the Load on anchor due to wind, current, waves, Yawing, factors involved in determining the length of cable to be used.	U		
3.9	Define the terms anchor holding power, dragging anchor, clearing fouled anchor, hanging off anchor, slipping cable.	K		
3.10	State the use of correct terminology for communication between bridge and anchor station crew.	K		
3.11	Explain the use of anchor buoys and causes for loss of anchor.	U		
4	Piloting and usage of Tugs		9	3
4.1	State that Pilots are mariners with local knowledge and they come onboard to guide ships into or out of port safely Pilotage is compulsory in most parts of the world	K		
4.2	State that the pilot directs the navigation of the ship, but the master still retains overall command and control of the ship.	K		

4.3	Describe the Procedures for embarkation and disembarkation of pilot.	U		
4.4	Understand Master Pilot relationship including Master Pilot Information Exchange	U		
4.5	Understand action and precautions on Navigating Bridge during Pilot Embarkation and Disembarkation.	U		
4.6	Understand the importance of compliance with safe procedures for embarking and disembarking of Pilots and Pilot transfer arrangements, as per SOLAS & its upkeep.	U		
4.7	Understand the navigational duties with Pilot embarked	U		
4.8	Define bridge Manning levels during pilotage	K		
4.9	State different types of tugs used for Berthing and Unberthing i.e Conventional tugs, Tractor tugs, Azimuth Stern Drive tugs etc	K		
4.10	Define bollard pull of tugs. State that bollard pull of a tug is the force produced by the tug in tonnes when pulling against a static bollard	K		
4.11	Explain different electronic aids used during pilotage e.g. Electronic Range finders, Berthing aid systems to monitor distance, speed, wind speed and direction etc	U		
4.12	Define VTS - Vessel Traffic Services and VTMS - Vessel Traffic Management System, Role of VTS while arriving/ departing port and during pilotage.	K		
4.13	State that vessel traffic services (VTS) contribute to safety of life at sea, safety and efficiency of navigation and protection of the marine environment	K		
4.14	State that IALA produces standards, guidelines and courses related to establishment and operation of VTS	K		

4.15	State that the VTS uses advanced technological equipment to monitor and manage the traffic eg automatic processing and fusion of data from various sensors, such as radars, AIS (including virtual AIS), CCTV, RDF, GMDSS, weather stations to provide the VTS operator with dynamic information about the VTS area.	K		
5	Navigation in restricted visibility and Ice Navigation		9	3
5.1	State different Navigational Equipment and Techniques used for safe navigation in restricted visibility (blind navigation techniques)	K		
5.2	Describe the sound signals sounded by vessels when navigating in or near an area of restricted visibility	U		
5.3	Define Polar code	K		
5.4	State that Polar code is mandatory under SOLAS and MARPOL	K		
5.5	List the contents of Polar Code.	K		
5.6	Understand the Basic ship handling in ice	U		
5.7	Understand sighting and reporting of ice, working through ice, navigation in ice.	U		
5.8	Understand the effects of ice accretion on stability of the vessel	U		
Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis				
REFERENCE BOOKS Bridge Procedures Guide, Standard Club – A Master’s guide to berthing, OCIMF – Mooring Equipment Guidelines, SOLAS Chapter V, Regulation 23 “Pilot Transfer Arrangements”, SOLAS, Polar Code Seamanship for marine operations by DJ House 5 th edition				
Pedagogy Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

MULTI-DISCIPLINARY	UG21T6502 - MARINE ENGINEERING AND AUTOMATION		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand the general layout of engine room and terminology used in engine rooms
CLO2	Understand the functioning of Main engine and oilers
CLO3	Explain the need of various machineries in the engine room of ship
CLO4	Understand the uses of auxiliary machinery and hydraulic systems on the ships
CLO5	Comprehend the uses of PLCs and SCADA onboard ship machineries

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	M	M
CLO2	H	H	M	M	M
CLO3	H	H	M	M	M
CLO4	H	H	M	M	M
CLO5	H	H	M	M	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Basic Terms & General Layout of ship Board Engine Room		9	3
1.1	Define SI Units under in Marine Engineering	K		
1.2	Define Basic Engineering Terms and Laws	K		
	- Mass, Force, Force of Gravity, Work, Power & Energy			
	- Pressure, Gauge Pressure and Absolute Pressure			
	- Volume, Specific Volume, Temperature, Absolute Temperature, Heat, Specific Heat & Latent Heat			
	- Stress & Strain			
	- Properties of Gases & Gas Laws			
	- Indicated Power, Mechanical Efficiency, Brake Power, Shaft Power			
	- Propeller Pitch & Slip			
1.3	Understand general layout of Engine room - floors, platforms, location of various machinery, access way, etc. from General Arrangement plans of various ships.	U		
2	Marine Diesel Engine and Boilers		9	3
2.1	Understand the Cycle of operation of 4 Stroke Diesel Engine	U		
2.2	Understand the Cycle of operation of 2 Strike Diesel Engine	U		
2.3	Describe Various fuels used in Marine Engine, including Alternate fuels for decarbonisation and reducing Marine Pollution.	U		
2.4	Explain Dual Fuel used ships in Marine Engines, eg Wartsilla - RT Flex, MAN B&W - MEGI, MEGA, MELGI, WinGDX-DF.	U		

2.5	describe Conventional engine driven by Cam Shafts and Cam-less Electronic Engine	U		
2.6	Marine Boilers			
2.7	state the Types - Water Tube, Fuel Tube & Other Type	K		
2.8	Describe Boiler Mountings	U		
2.9	Understand the importance of Maintaining Boiler Feed Water	U		
3	Other Engine room machineries		9	3
	Distillation & Production of Water			
3.1	Understand Distillation of Water in Evaporators – Submerged type & Boiling process type incl Fresh water Generator	U		
3.2	Understand Reverse Osmosis fresh water generator	U		
3.3	Describe the Treatment of Fresh water meant for Drinking purposes	U		
	Refrigeration			
3.4	Define Basic principles of Refrigeration	K		
3.5	Understand Commonly used Refrigerants and their potential of damage environmental	U		
	Air Conditioning			
3.6	state the Requirement of Air Conditioning in Ships	K		
3.7	Describe Single Duct Air conditioning system	U		
	Ventilation			
3.8	Understand Process of ventilation in ships	U		
	Oily Water Separator			
3.9	Understand Basic Principle and functioning of OWS	U		
3.10	Understand Oil Content monitoring system	U		
	Sewage Treatment Plant			
3.11	Describe the functioning of Chemical Sewage Treatment	U		
3.12	Describe the functioning of Biological Sewage Treatment	U		
	Waste Oil Incinerator			
3.13	Understand the Construction of Waste Oil Incinerator and its functioning	U		
4	Auxiliary engine and Hydraulic machineries		9	3
4.1	Understand Basics of Hydraulics and types of Hydraulic oils used	U		
4.2	Describe Advantages, Disadvantages & Applications on board	U		
4.3	Explain Hydraulic Power packs	U		
4.4	Explain Hydraulic Accumulators	U		
4.5	State the needs of Hydraulic Coolers and Heat Exchangers	K		
4.6	Describe the General precautions to be followed in maintaining Hydraulic systems	U		
	Steering Gears			
4.7	Understand the functioning of Electro Hydraulic Ram Steering Gear	U		

4.8	Explain Rotary Vane Steering Gear and Electric Steering gear	U		
4.9	Describe Single Failure Criteria – Safematic Design of Steering Gear system	U		
4.10	Electrical Power Generators			
4.11	Define Power Generation – AC Generator (Alternator) & DC Generator	K		
4.12	Understand Power Distribution System – AC & DC Supply	U		
4.13	Understand Power Utilization devices – AC Motors and DC Motors	U		
4.14	state the uses of Circuit Breakers and Fuses	K		
	Marine Electrical Propulsion System			
4.15	Understand the Basics of Marine Electrical Propulsion system	U		
4.16	Compare the Conventional Propulsion and Electrical Propulsion system with the help of a block diagram	AN		
4.17	state the Advantages of Electrical Propulsion system	K		
4.18	Give Examples of ships using Electrical propulsion system	K		
5	Programmable Logic Controller		9	3
5.1	Define PLC and its functioning	K		
5.2	Understand the uses of Microprocessor, Micro Computers and Controllers	U		
5.3	Explain the role of Programmable Logic Controller in ships	U		
5.4	Explain PLC Hardware	U		
5.5	Describe the Marine application of PLC	U		
	Supervisory Control And Data Acquisition			
5.6	Define SCADA	K		
5.7	Define the construction of SCADA	K		
5.8	Describe the Communications process of SCADA	U		
5.9	Explain the Functional Overview of SCADA	U		
5.10	Explain the Marine Application of SCADA	U		
TEXT BOOKS				
1	Basic Marine Engineering by J.K. Dhar-12 th Edition			
REFERENCE BOOKS				
1	PLC :IGNOU – Mechatronics – Block 4 / Unit 11 – PLC Structures and Languages – selected topics			
2	https://egyankosh.ac.in/handle/123456789/26579			
3	SCADA : IGNOU – Smart Technologies / Unit 12 – Concept Of SCADA – selected topics			
4	http://egyankosh.ac.in//handle/123456789/91594			
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6503 - SHIPBOARD OPERATIONS		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand basic seamanship
CLO2	Comprehend on rope and anchor work
CLO3	Explain about Life saving and Firefighting equipments
CLO4	Comprehend on the safe working practices
CLO5	Understand Planned maintenance system

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	-	-	-
CLO2	H	H	-	-	-
CLO3	H	H	L	L	M
CLO4	H	H	L	L	M
CLO5	H	H	L	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	BASIC SEAMANSHIP and FLAGS:-		9	3
1.1	Describe Names and timings of watches.	U		
1.2	Describe Watch keeping: General duties – Duties of the officer of the watch (OOW) – Duties of the lookout – Duties of the helmsman – Duties of the standby man	U		
1.3	State Daily routines checks on vessels, sounding of fresh water, fuel and ballast tanks, weather checks, reporting position daily etc.	K		
1.4	List Personal Protective Equipment (PPE) – Boiler suits, Face Masks, Safety Harness, Ear Mufflers, Chemical Suits, Hand Gloves, Safety goggles, Safety helmet, Safety Shoes.	K		
1.5	Define meaning of Bunting.	K		
1.6	Explain how to dress the ship	U		
1.7	Explain Halyard at the dip, Close up, Half mast, Hoist, Fly, Tackline.	U		
1.8	Explain Courtesy flag, Quarantine Flag, Pilot flag, Blue Peter, Jack Flag.	K		
1.9	Define Flags A-Z with Meaning and Numeral and pendants.	K		

1.1	State the location of Jack Staff, Ensign staff and What flags are hoisted from these part of Ship and When.	K		
1.11	State type of Ensigns and State that there can be penalty for not using or wrongly using an Ensign.	K		
1.12	Marine Phonetics and Morse code for Alphabets A - Z and Numerals 0-9	K		
1.13	Brief on International code of signal.	U		
1.14	Define Morse code procedure: signalling by flashlight – Morse code.	K		
1.15	Describe the Concept Of GMDSS: MSI, Equipment required, Sea Areas, NavAreas/MetAreas	U		
1.16	Explain Types of messages Distress, Urgency, Safety; Format of Emergency Messages	U		
2	Rope Work and Anchor Work:	U	9	3
2.1	State types of material used in construction of Ropes – Natural fibres, Synthetic fibres, HMP Ropes.	K		
2.2	Explain different lays of rope.	U		
2.3	Describe different types of fibre ropes and compare the strength and elasticity of the ropes.	U		
2.4	Describe Care and maintenance of fibre Ropes.	U		
2.5	State the damage caused by surging.	K		
2.6	Explain marline, Twine, spun, lead lines. Knots, Bends, Hitches & Whippings.	U		
2.7	Explain different types of Mooring ropes and advantages/disadvantages.	U		
2.8	Explain the grades of steel used for making Wire ropes, construction of wire ropes, advantage of a fibre heart and factors determining flexibility,	U		
2.9	State meaning of 6/12, 6/24, 6/37 types of wire ropes, Non-rotating wire rope, Plastic covered wire rope.	K		
2.1	Explain, Care and maintenance of wire ropes,	U		
2.11	Describe the method of measuring size of ropes, wires and chains.	U		
2.12	Explain use of Chain/rope stoppers.	U		
	Anchor Work (Fundamentals):-			
2.13	Define the term anchors, Tests on anchors, Marks on anchors, Anchor certificate, Chain cable tests and Notes on cable	K		
2.14	Define Kenter lugless joining shackle – ‘D’ lugged joining shackle	K		
2.15	Describe Securing and stowage of anchors	U		
2.16	Describe Securing anchor and cable	U		
2.17	Explain Preparing anchor for ‘letting go’	U		
2.18	Define Disc brake systems for anchor handling windlass	K		
2.19	Define Cable holders	K		
2.2	Describe the Procedure for coming to anchor	U		
2.21	Describe Clearing away anchors	U		
2.22	Define Chain cable/stud link	K		
3	Life Saving Appliances and Fire Prevention:		9	3

3.1	Define lifesaving appliance	K		
3.2	Describe lifesaving appliances Life buoy, Life buoy self-igniting light and buoyant line, Life jacket, Life jacket light and whistle, Immersion suit, Anti exposure suit, Thermal protective aids, Life vest and pyro technics.	U		
3.3	Define Life boats - Parts of the lifeboat – Totally enclosed survival craft – Partially enclosed boats – Free fall lifeboats – Life rafts - The inflatable life raft – rigid life raft,	K		
3.4	outline knowledge of SOLAS requirements of life saving appliances	K		
3.5	Understand Survival Craft and Practice:	U		
	Boat rigging –			
	Launching procedure – Taking boat away from ship’s side – Boat recovery in heavy weather – Beaching a lifeboat, Boat handling and safe procedures			
	Launching inflatable life raft – Boarding raft –Righting capsized life raft – Beaching a life raft			
	Boat drills and musters.			
	Drill Planner			
	Muster List			
	Emergency Muster Station			
	Emergency Alarms			
	Fire Prevention and Fire Fighting Equipments:			
3.6	Define Causes of fire and The fire triangle.	K		
3.7	Understand the Principles of fire-fighting.	U		
3.8	Define Types of fire and methods of extinguishing each type.	K		
3.9	Understand various methods of detection and fighting of fire.	U		
3.1	Outline knowledge of SOLAS requirements on FFA.	K		
3.11	Define Fire-fighting equipments – Fire extinguishers, Foam extinguishers, DCP and CO2 extinguishers.	K		
3.12	State Equipment for on board firefighting –Small fires	K		
	Accommodation fires at sea			
	Gallery fires at sea			
	Machinery space fires at sea			
	Paint room fires			
	Fixed fire-fighting installations			
	International shore connection –			
	Self-contained breathing apparatus (CABA) EEBD			
	Contents of fireman’s outfits.			
	Fire Plan			
4	Code of Safe Working Practices and Permit to work system:	U	9	3
4.1	Explain the outline of “Code of safe working practices for merchant seamen”.	U		
4.2	List the precautions while entering confined / enclosed space	K		
4.3	Describe procedure for Rescue from enclosed spaces	U		

4.4	Explain procedure of manual lifting and carrying of weights	U		
4.5	List the precautions while working aloft and over side	K		
4.6	List the safety precautions while painting, during the use of personnel basket and while on mooring stations.	K		
4.7	List the precautions while painting funnel, main mast	K		
4.8	List precautions while repairing radar.	K		
4.9	List precautions while operating hatch covers, using portable ladder.	K		
4.1	Explain method of guarding of openings on deck.	U		
4.11	List precautions while using hand tools.	K		
4.12	Describe Marking of obstructions on the passage way on deck.	U		
4.13	List the safety precautions whilst walking/working on deck.	K		
4.14	Explain standard crane signals.	U		
4.15	List safety precautions while anchoring.	K		
4.16	List the safety precautions while entering battery room and paint room.	K		
4.17	List precaution while using Bosun's chair and stages, rigging gangway and pilot ladder.	K		
4.18	List the precautions while using electric, pneumatic and hydraulic (power) tools and appliances.	K		
4.19	List the precautions while working with compressed air, chipping machines, spray painting machine.	K		
4.2	List precautions while cleaning holds using high pressure (water jet) machines.	K		
4.21	Describe safe bunkering practices.	U		
4.22	Understand Procedure to carry out risk assessment.	U		
4.23	Understand the Importance of various Check list.	U		
4.24	Explain Permit to Work system and different types of permits – Hot work permit, Cold work Permit, Entry into enclosed space permit, working aloft permit, and Working overside permit, Electrical isolation permit, lockout and tagout.	U		
4.25	Explain Conduct of Safety Committee meetings.	U		
4.26	State Role of Safety committee and Safety Officer in maintaining safety standards on board.	K		
4.27	Explain importance of personnel health and hygiene on board ship.	U		
5	General / Planned Ship Maintenance:		9	3
5.1	List the equipment / tools used for surface preparation.	K		
5.2	Classify the various Swedish Standards of steel preparation such as St-2, St-3, Sa-2, Sa- 2.5, Sa- 3	K		
5.3	Understand the corrosion reaction i.e. principle of Galvanic cell	U		
5.4	Understand the purpose of Sacrificial Anode & Impressed Current System.	U		
5.5	Introduction of Laser application for removing rust on steel surfaces.	K		

5.6	Describe the required standard of preparation of steelwork depending upon the type of paint to be applied.	U		
5.7	State that paints consist mainly of a Binder, a pigment and a solvent, and explains the purpose of each.	K		
5.8	Understand the concept of MSDS for particular paint system.	U		
5.9	Describe the action of Anodic Primers and Resistance type primers	U		
5.1	List the common types of paints and their area of application along with their advantages and disadvantages for Alkyd paints, CRP paints, Vinyl paints, Bituminous paints, Epoxy paints, Polyurethane paints	K		
5.11	Describe the action of Antifouling Paint and use of Self Polishing Antifouling Paint	U		
5.12	Explain typical paint schemes for dry dock, underwater areas, boot topping, weather decks, superstructures & tank interiors	U		
5.13	Describe the various Painting Defects, their Causes and Prevention	U		
5.14	State the methods of measuring wet paint thickness and dry paint thickness	K		
5.15	Describe procedures for cleaning and polishing of brass and copper.	U		
5.16	Describe the maintenance of mooring winches/windlass and Inspection of chain lockers, anchor cables and anchors.	U		
5.17	Describe maintenance of crane, lifeboat davits as per PMS.	U		
5.18	List the different types of Lubricants.	K		
5.19	Explain the purpose & method of Lubrication.	U		
5.2	State the dangers of excess lubrication	K		
	Planned Maintenance System: -			
5.21	State that Routine Maintenance is to be carried out as per PMS	K		
5.22	List out the advantages of planned maintenance over breakdown maintenance.	K		
5.23	Examples of maintenance as per PMS: - Hatches / Cranes / Gangway.	K		
5.24	State that hatch cover wheels, gears, racks and pinions and other moving parts, side cleats should be kept lubricated.	K		
5.25	Explain that hydraulic systems for cargo holds should be checked for leakage, especially in tween decks where it may cause cargo damage. Explain that the weather tightness of hatch covers is checked by hose testing, Ultrasonic testing.	U		
5.26	Describe Maintenance of Gantry cranes/Deck crane/ - wires, sheaves & blocks.	U		

5.27	Describe maintenance of Gangway & Accommodation ladders.	U		
TEXT BOOKS				
1	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis			
REFERENCE BOOKS				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				



CORE COURSE (CC)	UG21T6504 - IMO AND INTERNATIONAL CONVENTIONS	LECTURE	TUTORIAL	TOTAL	
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand International organisation and IMO
CLO2	Understand Merchant Shipping Act 1958
CLO3	Explain the contents of UNCLOS for mariners
CLO4	Describe the contents of MLC 2006
CLO5	Comprehend on ISPS Code

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
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 LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN /C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	International Organizations and IMO:		9	3
1.1	State that maritime law is based partly on generally accepted customary rules developed over many years and partly on statute law enacted by States.	K		
1.2	State that matter of safety, protection of the marine environment and conditions of employment are covered by statute law.	K		
1.3	State that the main sources of maritime law are international conventions.	K		
1.4	State that the adoption of international conventions and agreements is intended to provide uniform practice internationally.	K		
1.5	State that a convention is a treaty between the States which have agreed to be bound by it to apply the principles contained in the convention within their sphere of jurisdiction.	K		
1.6	State that, to implement a convention or other international agreement, a State must enact national legislation giving effect to and enforcing its provisions.	K		

1.7	State that recommendations which are not internationally binding may be implemented by a State for ships flying its flag	K		
1.8	Explain that the main originators of international conventions concerned with maritime law are:	K		
	a) International Maritime Organization(IMO)			
	b) International Labour Organization(ILO)			
	c) Comite Maritime International(CMI)			
	d) United Nations			
1.9	Describe:	U		
	a) flag State jurisdiction			
	b) coastal State jurisdiction			
	c) port State jurisdiction			
1.10	Describe main elements of SOLAS, MARPOL, STCW and ILO.	U		
1.11	–Explain the significance of the ‘ no more favourable treatment’ clause in the SOLAS, MARPOL, STCW and ILO Minimum Standards in Merchant Ships Conventions	U		
1.12	Distinguish between private and public international law	U		
1.13	Explain that public maritime law is enforced through:	U		
	–surveys, inspection and certification			
	–penal sanctions (fines, imprisonment)			
	–administrative procedures (inspection of certificates and records, detention)			
1.14	State that the operation of a ship is governed by the national laws and regulations of the flag State, including those laws and regulations giving effect to international conventions	K		
1.15	State that differences of detail usually exist in the national laws of different states implementing the same convention	K		
1.16	State that, when serving in a ship flying a foreign flag, it is essential that the master and chiefmate familiarize themselves with the laws and regulations of the flag State	K		
1.17	State that, when in port,a ship must also comply with the appropriate laws and regulations of the port State	K		
1.18	Describe the importance of keeping up to date with developments in new and amended legislation.	U		
1.19	Define the work of Organizations with maritime functions; UNO, WHO, ITF, UNCITRAL, UNCTAD, WTO (Outline of work relevant to maritime sector)	K		
1.20	Define IMO Instruments: Conventions, Protocols, Codes, Recommendations, and Guidelines. (purpose and examples of each)	K		
1.21	Define IMO Conventions: List of IMO conventions. Development, adoption, conditions for coming into force, implementation, enforcement and amendments of conventions.	K		
2	Indian Merchant Shipping Act,1958:		9	3
2.1	Define Indian Merchant Shipping Act 1958	K		
2.2	Understand Registration of Indian ships;	U		
2.3	Describe the regulations for Seamen and Apprentices. Section 88 to 218 in MSA	U		

2.4	Understand Investigation and inquiries. Section357to389	U		
2.5	Understand in overall about the chapters in MSA	U		
3	International Law of the Sea:		9	3
3.1	Understand Historical Background; UNCLOS1982;	U		
3.2	Define Baselines; Internal Waters and Territorial Sea; Contiguous Zone; Hot Pursuit, Continental Shelf; Exclusive Economic Zone; The High Seas,	K		
3.3	Understand Legal jurisdictions and Freedoms in various zones; Nationality of Ships,	U		
3.4	Explain the Duties of Flag states and Flag State Control.	U		
3.5	Understand the Responsibilities of coastal states,	U		
3.6	Describe Settlement of Disputes; Law of the Sea Tribunal.	U		
3.7	Define UNCLOS definition of marine pollution and duties of states towards environmental protection.	K		
3.8	Define UNCLOS definition of piracy. IMO's definition of "armed robbery" Duties of states to suppress piracy.	K		
4	Maritime Labour Convention and Maritime Safety:		9	3
4.1	Understand International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW)	U		
4.2	Explain the general obligations under the Convention	U		
4.3	Define, for the purpose of the Convention:	K		
	Certificate of Competency			
	Certificate of Proficiency			
	sea going ship			
4.4	Explain that the regulations contain:	U		
	Mandatory minimum requirements for the certificate of Competency and certificate of Proficiency.			
	International Convention for the Safety of Life at Sea,1974 as amended (Brief contents of all chapters) (SOLAS)			
	International Convention on Load Lines,1966(LL1966), as amended			
4.5	State that no ship to which the Convention applies may proceed to sea on an international voyage unless it has been surveyed, marked and provided with an International Load Line Certificate(1966)or an International Load Line Exemption Certificate, if appropriate	K		
4.6	Describe the duration of validity of an International Load Line Certificate (1966)	U		
4.7	Explain the circumstances in which an International Load Line Certificate (1966) would be cancelled by the Administration	U		
4.8	State the control to which ships holding an International Load Line Certificate(1966) are subject when in the ports of other Contracting Governments	K		
4.9	state that the International Load Line Certificate (1966) will not be delivered to a ship until the surveyor has certified that the marks are correctly and permanently indicated on the ship's sides	K		
4.10	State International Safety Management (ISM)Code	K		
	Objectives and Functions of the code.			

4.11	Outline of the content so fall chapters. State that a Safety Management System in compliance with the ISM Code must be in place on board all passenger ships, tankers and bulk carriers of 500gt and upwards.	K		
4.12	State that a Safety Management System in compliance with the ISM Code must be in place on board all vessels of 500gt and up wards from1 July2002	K		
4.13	State that the details of the ship’s system may be found in the ship’s Safety Management Manual, Certification, audits. Impact and practice of Risk management.	K		
4.14	Describe ILO’s Convention–MLC2006–	U		
	Engagement, Discharge, Welfare of Seamen and Repatriation; Discipline; Abandonment of Seafarers.			
	Ship Owner Responsibility for Injury and Death Claims; Ship Safety;			
	Port State Control (authority, inspections, detentions, common deficiencies, MOUs and their benefits)			
5	ISPS Code		9	3
5.1	Understand International Ship and Port Facility Security Code (ISPS Code) -ISPS Code: Security threats, SSO, CSO, PFSO, SSP, ISSC, Security duties, Security Levels, Restricted areas, Security equipment, Declaration of security, Contingency plans to deal with security incidents.	U		
TEXT BOOKS				
1	Merchant Shipping Act-1958			
RECOMMENDED BOOKS FOR REFERENCE:				
1	SOLAS 1974 as amended			
2	MARPOL as amended			
3	ISM Code			
4	ISPS Code			
5	MLC 2006			
6	STCW as amended			
7	UNCLOS			
	Maritime Legislation and Shipboard Management for deck officers by Capt. M.V. Naik& Capt.			
8	C.L.Dubey			
9	Website for reference: www.imo.org			

CORE COURSE (CC)	UG21T6505 – NAVAL ARCHITECTURE-I	LECTURE	TUTORIAL	TOTAL	
		CREDITS	4	1	5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Apply Simpson's rule for calculating area, volume, centroid and moment of inertia
CLO2	Calculate centre of pressure by using Simpson's rule
CLO3	Analyse the effect of bilging on the vessel's stability
CLO4	Understand the ship yard practices
CLO5	Understand the welding used in ship construction

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	M	H
CLO2	H	H	M	M	H
CLO3	H	H	M	M	H
CLO4	H	H	M	M	H
CLO5	H	H	M	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/A/P/AN/C)	LECTURE HOURS	TUTORIAL HOURS
1	Simpson's Rule:		12	3
1.1	State Simpson's First Rule, Second Rule & Third Rule.	K		
1.2	Calculate areas, volumes, TPC, load displacement, centroids for areas & volumes using Simpson's Rule.	AP		
1.3	Calculate areas, volumes, centroids using combination of Simpson's Rules when number of ordinates cannot be used singularly by any of the Rules.	AP		
1.4	Obtain Dynamical Stability by computing area under the GZ curve up to given angle using Simpson's rules.	AP		
2	Moment of Inertia and Centre of Pressure:		12	3
2.1	Define Second moment of area (Moment of Inertia).	K		
2.2	Sketch and describe second moment of a rectangle about axis passing through centroid and about one of its sides.	AP		
2.3	Sketch and describe Theorem of Parallel axes.	AP		
2.4	State marine applications of Simpson's Rules.	K		
2.5	Compute second moments of area about transverse axis passing through centre of flotation and about center line using Simpson's Rules.	AP		
2.6	Define Centre of pressure and its importance.	K		
2.7	Compute Centre of pressure for regular shapes.	AP		
2.8	Compute Centre of pressure for combination of regular shapes.	AP		
3	Bilging:		12	3
3.1	Sketch, define and describe bilging of a box shaped vessel.	K		

3.2	Explain effects of bilging of a compartment with / without permeability.	U		
3.3	Calculation on bilging and flooding of a midship compartment for a box shaped vessel.	AP		
3.4	Explain actions to be taken in the event of partial loss of intact buoyancy by closing openings and using cross flooding arrangements.	U		
4	Shipyard Plans and Practices		12	3
4.1	Describe four stages of design as Concept, Preliminary, Contract and Detail design.	U		
4.2	Describe Plans and Specifications developed during ship design.	U		
4.3	Explain sequence of events in ship construction.	U		
4.4	Describe various ship building practices- Prefabrication, Preparation of Lines Plan, Sheer Plan, half-breadth Plan, Body Plan, Lofting and Fairing, methods of marking, Transfer of Plan to plate, use of computers, numerical control.	U		
4.5	Explain progress of a plate from stockyard to ship.	U		
4.6	Explain various shipyard processes - Plate straightening, blasting and painting, edge preparation, Cutting, drilling, bending, shaping, Subassembly, assembly, Testing.	U		
4.7	Explain Launching of a ship and Sea Trials.	U		
5	Welding in ship construction		12	3
5.1	Define strength and properties of materials	K		
5.2	Define different types of steel used in ship construction	K		
5.3	Explain role of aluminium in ship construction	U		
5.4	Define gas welding and submerged arc welding	K		
5.5	Explain the function of flux, filler metal and electrodes	U		
5.6	Understand the importance of surface preparations at the joints	U		
5.7	Explain joint preparation for welding such as butt weld, fillet weld, lap joints, plug and slot welds	U		
5.8	Explain the faults in welding	U		
5.9	understand the testing of welds	U		
TEXT BOOKS				
1 Ship Stability for Masters & / Mates - C.B. Barrass and D.R. Derrett, 7 th Edition (2012)				
2 Ship construction by Capt. Errol Fernandes				
REFERENCE BOOKS				
1 Ship construction - Pursey				
2 Ship construction –D.J. Eyres				
3 Ship Stability at the Management Level- Subramaniam H				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

PRACTICAL - MULTI DISCIPLINARY (PL/MD)	UG21P6506 ENGINE ROOM MACHINERY AND WORKSHOP PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

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	PLO5
CLO1	M	H	L	L	L
CLO2	M	H	L	L	L
CLO3	M	H	L	L	L
CLO4	M	H	L	L	L
CLO5	M	H	L	L	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIV ELEVEL (K/U/AP/AN/C)	PRACTI CAL HOURS 60	TUTORI AL HOURS 15
1	Fitting and Carpentry work Shop		12	3
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		12	3
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		12	3
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		12	3
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	Welding Workshop		12	3
5.1	Demonstrate The Safety Precautions to Be Observed While Welding Including Earthing. (Instructor Demonstration for A Group Of 20 Cadets).	AP		
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-12 th Edition			

PRACTICAL SUMMER INTERNSHIP (PL/SI)	UG21F6507 WATCH KEEPING PRACTICAL 1		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Practice watch keeping activities
CLO2	Practice log book writing practices

Mapping with Programme Learning Outcomes (PLO)

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

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVELEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Watch keeping activities		60	15
1.1	Keep watch from sun set to sun rise (preferably after the evening routines) 2 hours per day on rotational basis.	AP		
	The procedures shall be as below			
	2 cadets to be kept at one location and different locations shall be identified by the individual college / institute for this purpose.			
	Watch keeping schedule shall be prepared by the college / institute and cadets shall be put on rotational duty as per the watch keeping schedule.			
	The watch keepers shall be provided with necessary equipment like torches, whistle or any other equipment as needed for the particular watch keeping location.			
	Watch keeping instructions shall be prepared by the college / institute and the watch keeper shall be briefed prior starting watch keeping.			
	Reporting procedures shall be established for any incident occurs during the watch keeping hours.			
1.2	Maintain watch keeping log for each location. A log book shall be used for this purpose which resembles ships deck log book.	AP		
	The log book shall be signed by the watch keepers at the end of the watch.			

FIELD PRACTICE SUMMER INTERNSHIP (FP/SI)	UG21F6508 - Field Practice - Placement Activities		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30
Course Learning Outcomes (CLO)					
On the successful completion of the course, students will be able to					
CLOs	CLO STATEMENT				
CLO1	Effectively write a CV and ready for facing company interviews				
CLO2	Create a professional placement brochure and actively participate in group discussions				
Mapping with Programme Learning Outcomes (PLO)					
CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	H	-	-	
CLO2	L	H	-	-	
H-High; M-Medium; L-Low					

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIV ELEVEL (K/U/AP/ AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
1	Placement Related Activities Training: - CV writing - Company Interview facing	AP	5	5
2	- Placement Brochure making - Group discussion	AP	5	5
3	- Interacting with Shipping and Maritime Industry Personal - Visiting various shipping companies in the locality	AP	5	5

STUDIO ACTIVITIES VALUE ADDED COURSE (SA/VA)	UG21F6509 – On-board Record Keeping		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	0.5	0.5	1
		HOURS	15	15	30

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Practice using checklists and Permits to Work systems and practice writing various log books

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	M	-	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
1	Practice using of Checklists and permits and record keeping		15	15
1.1	Review “Code of Safe Working Practices” and write a report on various checklists and permit to work systems.	U		
1.2	Practice use of checklists during watch keeping and workshop practice	AN		
1.3	Practice use of “permit to work” during practical work in workshops, campuses, swimming pool etc.	U		
1.4	Practice writing log books after watch keeping activities and report writing after workshop and other practical activities	AN		

Detailed Teaching Syllabus - Semester VI

SEMESTER VI								
S.No	Course Code	Course Title	Course Category	No. of Teaching /Practical hours	No. of Tutorial hours	Total Hours per semester	Total Hours per week	Total Credits
Theory Courses								
1	UG21T6601	HR Practices in Shipping	MS	45	15	60	4	4
2	UG21T6602	Logistics and Supply Chain Management	AE	45	15	60	4	4
3	UG21T6603	Blue Economy	MD	45	15	60	4	4
4	UG21T6604	Commercial Shipping Practices	CC	45	15	60	4	4
5	UG21T6605	Naval architecture-II	CC	60	15	75	5	5
Practical Courses								
6	UG21P6606	OOW Simulator Steering and BTM Practical	PL <SE>	60	15	75	5	2.5
7	UG21P6607	Watch Keeping Practical - II	PL <SI>	60	15	75	5	2.5
8	UG21F6608	Field Practice - Community Service	CS <VA>	15	15	30	2	1
9	UG21F6609	Maritime Upskilling	SA <VA>	15	15	30	2	1
Total Hours / Credits in Semester VI				390	135	525	35	28

MINOR STREAM (MS)	UG21T6601 – HR PRACTICES IN SHIPPING		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand the basic structure of shipping
CLO2	Describe ship chartering
CLO3	Manage human resource onboard ships
CLO4	Understand personnel management on the shipping
CLO5	Comprehend non-technical skills

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	L	L	-	-
CLO2	H	L	L	-	-
CLO3	M	-	H	-	M
CLO4	M	-	H	-	M
CLO5	M	-	H	-	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	Basic Structure and organization of Shipping		9	3
1.1	State the types of Shipping Services - Liner and Tramp	K		
1.2	State the types of ships and cargoes in Liner and Tramp shipping.	K		
1.3	State the Freight brokers, Clearing and Forwarding Agents, Bunker and Stores suppliers, shipping Agencies.	K		
1.4	Explain the Role of Shipping Companies.	U		
1.5	List the types of Shipping Companies.	K		
1.6	State the various departments in shipping company's office and their functions.	K		
1.7	Describe Role of superintendents and Designated Person Ashore.	U		
1.8	Sketch Company's Organizational Chart.	AP		
1.9	Describe Shipboard organizational structure.	U		

1.10	Describe functions and responsibilities of shipboard staff.	U		
1.11	List cadet's duties on board.	K		
2	Human Resource Management: General		9	3
2.1	State the Function, Requirement & Selection of Personnel.	K		
2.2	Explain the Performance Appraisal and Reward System.	U		
2.3	State the Working Conditions as per MLC.	K		
2.4	State the Employer's Liabilities for Health and Safety.	K		
2.5	State the relation with Trade Union & Workers Participation in Management.	K		
2.6	Explain Cross cultural, multi-racial and multi-lingual environment.	U		
3	Human values		9	3
3.1	State the Indian insight on managing self, human relationships, managing stress, decision making and resolving ethical dilemma; enhancing life satisfaction.	K		
3.2	State personal traits that will assist in effective functioning onboard, physical fitness, health and personal hygiene, travel arrangements.	K		
3.3	List human factors and their importance.	K		
3.4	Explain the Importance of Interpersonal relationship.	U		
3.5	State that Building positive attitude and behavior by developing a professional and organizational culture.	K		
3.6	Explain mental gymnastics & creative problem solving techniques	U		
	Manage anger/violence prevention/aggression control & conflict			
	Manage stress, distress situations, accidents proneness, depression / fear / fatigue / revenge v/s forgiveness			
	Cope with anxiety of being away from home, use of drugs & alcohol and sexual health			
4	Personnel Management: Shipping		9	3
	MS Act 1958			
4.1	Section 95 (registration of recruitment and placement agencies)	K		
4.2	Part VII (Employment of seafarers on Indian flag vessel)	K		
	Recruitment and placement rules 2005			
4.3	Explain & define significance of the RPS, Rules, 2005	U		
4.4	State the purpose of the rule, benefit to seafarers under the rule, responsibilities of employer, rights and responsibilities of the seafarer.	K		

4.5	Access information regarding registered recruitment and placement agencies. Article of Agreement (Indian Ships)	AP		
4.6	State general content of agreement	K		
4.7	State Responsibilities of employer & seafarer	K		
	Collective Bargaining Agreement (foreign flagship)			
4.8	State general content of agreement	K		
4.9	State the needs of foreign shipping companies to comply with RPSL rules	K		
4.10	State the responsibilities of foreign employer & seafarer	K		
4.11	Explain the Nature of the job at sea, demands of the career – technical, practical, physical, emotional and psychological.	U		
4.12	State onboard human relations role of human error in accidents.	K		
5	Non-technical skills		9	3
	Communication and Negotiation			
5.1	State the importance of communication; interpersonal communication.	K		
5.2	State the barriers to effective interpersonal communication, communication in organizations.	K		
5.3	State how to use communication skills for negotiating and managing conflicts.	K		
5.4	Explain importance of effective communication, time management & planning.	U		
	Leadership, Teamwork, Motivation and Positive Attitude			
5.5	State the Importance of teamwork, team spirit.	K		
5.6	State the Necessity of positive attitudes, work ethics, allocation, assignment, and prioritization of resources.	K		
5.7	Explain assertiveness and motivation and decision making.	U		
5.8	Explain Motivational Theory	U		
	i) McGregor's Theory X and Theory Y (ii).			
5.9	Maslow's Hierarchy of Needs Theory	U		
	(iii). Herzberg's Motivation-Hygiene Theory.			
5.1	Explain Trait's approaches to leadership, Fiedler's contingency approach to leadership	U		
5.11	Explain the Managerial Grid	U		
5.12	State knowledge, skills, attitude	K		
5.13	Explain Age, Fatigue, Control of human errors, Situational awareness.	U		
5.14	State the Need for familiarisation with work environment and procedures.	K		
TEXT BOOKS:				

1	Future of Human Resource Management – Raman Preet- 2019 Edition
RECOMMENDED BOOKS FOR REFERENCE:	
1	General Management - Processes & Action- David A. Garvin
2	Maritime Logistics: A Complete Guide to Effective Shipping and Port Management by DongWook Song and Photis M. Panayides (May 28, 2012)
3	Maritime Economics (3/E) Martin Stopford
4	The Business of Shipping James, Jr. Buckley
5	Reeds Sea Transport: Operation and Economics (Reed's Professional) by Patrick M. Alderton
6	Management (6/E) Stoner & Freeman
7	Elements of Shipping Alan Edward Branch
8	Institute of Chartered Ship Brokers.
9	Strategic Leadership Models & Theories – Som Sekhar Bhattacharya
10	Principles of Management by Openstax.
11	Human Resource Management by Gary Dessler and Biju Varkkey
12	Human Resource Development by David McGuire
13	Human Resource Development - Experiences, Interventions, Strategies by T V Rao.

AE (ABILITY ENHANCEMENT COURSE)	UG21T6602 - LOGISTICS AND SUPPLY CHAIN MANAGEMENT		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)
On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand the distribution of resource around the world
CLO2	Understand the equipments used in the logistics
CLO3	Comprehend the trade routes around the world
CLO4	Understand supply chain management

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	M	L	L	L
CLO2	M	M	L	L	L
CLO3	M	M	L	L	L
CLO4	M	M	L	L	L
CLO5	M	M	L	L	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	INTERNATIONAL DISTRIBUTION:		9	3
1.1	Understand the importance of distribution in international trade and how basic distribution structures meet international and national needs.	U		
1.2	Understand the use of the word 'logistics' when applied to commercial distribution and understand the role of logistics in the provision of distribution services.	U		
1.3	State that the evolution of the global economy in the last quarter of the 20th century arising from unitisation and intermodal transport development. Thoroughly understand the supply-chain concept and how the different transport modes may be combined.	K		
1.4	Understand the importance of modal interfaces and the basic function of ports, airports, inland depots, railheads etc.	U		

1.5	Understand the basic intermodal systems: road/rail/sea; sea/air; road/air; road/rail. Understand the importance of inventory control in operating systems.	U		
2	PHYSICAL OPERATION:		9	3
2.1	Understand the characteristics of the main types of primary vehicles and equipment used: ships, trucks, trains and aircraft.	U		
2.2	Understand the main variant types of special equipment and facilities used to enhance through transport including swap bodies, double stacks, trailer types, container types.	U		
2.3	Understand the structural needs and layout of modal interfaces and terminals: depots, warehouses and cargo-handling equipment	U		
3	TRADE ROUTES:		9	3
3.1	Understand the relative importance of main trade routes including the main container shipping routes, railway routes and land bridges.	U		
3.2	Understand the relationship between commodities, value and transit time and transport mode.	U		
3.3	Understand the economic, political and environmental factors arising in respect of road/rail/barge competition and the role of short sea shipping.	U		
3.4	Understand the role of airfreight and its advantages and limitations. Understand the role of road haulage and the difference between international, domestic trunk and local delivery.	U		
3.5	Understand the way in which both the transport and logistics of the distribution of many specialist businesses are closely tailored to their needs. Be aware of, and be able to give examples of, the arrangements made in some representative businesses, for example, hanging garments, bonded goods, perishables, cars, directories.	U		
4	Introduction to Supply Chain Management (SCM):		9	3
	Supply Chain Management:			
4.1	Understand the Concept, Features, Evolution, Importance, Process and Barriers of Supply Chain Management.	U		
	Principles and Strategies:			
4.2	Understand Principles, Supply Chain Strategies – Organizations, Coordination, Innovation and Forecasting.	U		
	Participants in SCM:			
4.3	Understand Supply chain intermediaries- Concept and Types, Channels of Distribution for Industrial Goods and Consumer Goods, Channel of Distribution at Services Level, Factors for selection of suitable channels	U		
5	Perspectives of Supply Chain Management:		9	3
5.1	Global perspectives: Understand Measuring and analysing the value and efficiency of global Supply Chain Networks, Global market forces, Types of global supply chain.	U		

5.2	Indian Perspectives: Analyse the value and efficiency of domestic Supply Chain Networks, Economic effects of supply chains.	AN		
5.2	Customer Perspectives: Understand Customer values, Role of customers and Ways of improving customer services in SCM.	U		
TEXT BOOKS				
Course notes by the faculty				
REFERENCE BOOKS				
Chopra, S., & Meindl, P. (2007). Supply chain management. Strategy, planning & operation				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

MULTI DISCIPLINARY (MD)	UG21T6603 - BLUE ECONOMY		LECTURE	TUTORIAL	TOTAL
		CREDITS	3	1	4
		HOURS	45	15	60

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Understand offshore oil, gas and construction activities
CLO2	Comprehend on the new developments at sea in way of renewal energy activities
CLO3	Understand the marine fishing activities and their hazards for maritime navigation
CLO4	State the blue economic activities at sea
CLO5	Describe the safe navigation procedures in and around the offshore and blue economic activities areas

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	H	H
CLO2	H	H	M	H	H
CLO3	H	H	M	H	H
CLO4	H	H	M	H	H
CLO5	H	H	M	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP/AN/C)	LECTURE HOURS	TUTORIAL HOURS
1	Offshore Oil and Gas activities		45	15
			9	3
1.1	Define offshore oil and gas activities and how oil and gas is extracted from deep under ground	K		
1.2	State the different vessels involved in offshore oil and gas activities	K		
1.3	Define different mobile offshore drilling units, offshore oil platform, jack up platforms, drilling barges, drilling ship, semi-submersible rigs, fixed platforms, tension leg platforms and spar platforms	K		
1.4	Define the role of offshore oil structures such as jackets, oil rigs, oil platforms and flare booms	K		
1.5	Understand the role of offshore platform supply vessels, anchor handling vessel, well stimulation vessel, drilling vessels, drilling rigs, crew boats, seismic vessels, FSO, FPSOs, FLNG and SPM / SBM in oil and gas activities	U		
1.6	Describe how shallow water and deep water offshore oil activities differs.	U		
1.7	Understand the measures for safe navigation in and around the and gas activities areas	U		
2	Offshore construction activities		9	3
2.1	Define offshore construction activities, platform construction, pipe lay, cable lay vessels	K		
2.2	State the role of different type of vessels involved in offshore construction activities such as heavy lift construction vessels, barges, dump barge, towing vessels,	K		

	anchor handling tug, ocean towing vessels and supply vessels			
2.3	Explain different types of mooring systems in offshore construction activities including barge mooring system	U		
2.4	Explain the deep water construction activities and mode of construction in deep waters	U		
2.5	Explain S and J lay pipe lay system	U		
2.6	Explain safe navigation of other vessels in and around the construction activities and over the submarine cable and pipe lines.	U		
2.7	Describe offshore navigational buoy deployment systems and action to be taken in case vessel collided with them	U		
3	Offshore renewable energy activities		9	3
3.1	Define renewable energy in offshore - solar energy, wind energy, geothermal energy and ocean energy	K		
3.2	Define different offshore renewable energy activities such as wind mill, tidal energy, wave energy, Ocean thermal energy conversion systems etc.	K		
3.3	Explain different types of offshore wind mill installation methods such as pile, jacket, semi-submersible and spar type	U		
3.4	State the working principles of wind, wave, tidal and ocean thermal energy conversion system works	K		
3.5	Describe the impact on safe navigation of merchant vessels in and around the renewable energy installations	U		
4	Offshore fishing activities		9	3
4.1	Explain different types of fishing vessels such as long line, gillnet, trawling, trolling line, hand-lining, potting, jigging, purse seiner, fish factory vessels and their movements at sea	U		
4.2	Explain the lines and hooks, gill nets, fishing net markers and trawl nets used by the fishing vessels and their potential to cause harm to other vessel's navigation	U		
4.3	Explain the identification of nets, lines, fish aggregating (or aggregation) device (FAD) and different types of trawl nets at sea.	U		
4.4	Understand the mariculture activities in the coastal waters and how they protected from dangers of navigation.	U		
4.5	Describe the safe navigation in and around mariculture areas and dense fishing vessel areas	U		
5	Other offshore and blue economic activities		9	3
5.1	Define Blue economy and sustainable development.	K		
5.2	Define the activities coming under blue economy as maritime transportation, tourism, fishing and aquaculture and traditional uses	K		
5.3	Define Deep sea mining activities, Dredging activities in coastal water, Marine research activities, Oceanographic research activities and metrological activities at sea.	K		
5.4	Understand the role of different floating devices used at sea including meteorological buoy, oceanographical buoy, Tsunami buoys,	U		
5.5	Understanding the functioning of Dynamic positioning vessel and the role in blue economy	U		
5.6	Describe the safe navigation in and around areas of blue economic activities, safe zones around the structures and laws related to safety zones.	U		

5.7	Define mines at sea, former mined area and state the role of mine clearance vessels,	K		
5.8	Explain the governing mechanism in blue economic activities	U		
5.9	Define dragons, its uses and navigational signals shown by the dragons.	K		
5.10	Describe firing practice area and submarine exercise areas and methods employed to disseminate the information to the merchant vessels	U		
5.11	Explain the uses of helicopter at sea - offshore personnel transfer and rescue operations. State the procedures followed when conducting helicopter operations	U		
TEXT BOOKS				
Modern Fishing Gear Technology by M. R. Boopendranath, M. Shahul Hameed				
REFERENCE BOOKS				
Mariner's hand book latest edition				
Marine and offshore engineering by T.V. Ramakrishnan				
Websites				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6604 – COMMERCIAL SHIPPING PRACTICES	LECTURE	TUTORIAL	TOTAL	
		CREDITS	3	1	4
		HOURS	45	15	60
Course Learning Outcomes (CLO)					
On the successful completion of the course, students will be able to					
CLOs	CLO STATEMENT				
CLO1	Understand the commercial geography of the earth				
CLO2	Comprehend on the major trade routes on the earth				
CLO3	Understand the laws pertaining to carriage of cargoes				
CLO4	Understand chartering of vessel				
CLO5	Define various shipping organisations				
Mapping with Programme Learning Outcomes (PLO)					
CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	M	-	L	L
CLO2	M	M	-	L	L
CLO3	M	M	-	L	L
CLO4	M	M	-	L	L
CLO5	M	M	-	L	L
H-High; M-Medium; L-Low					

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45	TUTORIAL HOURS 15
1	COMMERCIAL GEOGRAPHY:		9	3
1.1	Define Continents; geographical regions, for example the Far East, Mediterranean, south-east Asia; location of major countries and ports.	K		
1.2	Describe All the continents, the major centres of which they are comprised and the manner in which they are grouped in geographical regions.	U		
1.3	Narrate The location of major ports, canals and waterways. Oceans of the world and the seas of which they are comprised.	U		
1.4	Describe The effects of tides, currents, climate and weather.	U		
1.5	Types of Ports:			
1.6	Define Types Of Ports(Natural, Manmade, Major, Minor, River, Tidal, Inland, Outer, Free port, Anchorage Ports)	K		
	GEOGRAPHY OF TRADE:			
1.7	Understand the major trade routes and the types of ships used for transportation of the five primary raw materials, namely, coal, ores, grains, fertilisers and oil, as well as general cargo (manufactured goods), with names and locations of the principal ports involved.	U		
1.8	Understand any particular characteristics and/or hazards involved in the transport of these commodities.	U		

1.9	Understand the factors that influence the choice of the most favoured transport modes for these commodities, for example, palletisation, unitisation, containerisation, refrigeration, multimodal transport and be aware of the shore side facilities and infrastructure needed.	U		
1.10	Understand the location and seasons of major natural phenomena affecting sea transportation, particularly storms, Ice, <i>El Nino</i> and La Nina.	U		
1.11	Understand the rationale behind loadline zones and how knowledge of these can affect voyage planning and estimating.			
2	CARGOES AND TRADE ROUTES:		9	3
2.1	Understand the different roles of liners and tramps. In liners, understand the main unitised systems and break-bulk operations. Be aware of major liner routes.	U		
2.2	Understand the major dry bulk trades and the origins and distribution of principal cargoes. The oil and other liquid trades; understand the origin and distribution of principal cargoes, distinguishing between crude oil and products. Be aware of the categorization of cargoes into clean, dirty, chemicals, gas, vegetable oils and juices.	U		
	INTERNATIONAL TRADE:			
2.3	Understand the role of different markets that comprise the global market. Be aware of the difference between absolute and comparative advantage. Understand the role of shipping as arising from derived demand.	U		
	SHIPPING PERSONAL and TYPES OF TRADES:-			
2.4	Understand the following personalities involved in the Shipping trade and their role,	U		
2.5	Define Ship-Owner, Charterer, Shipper, Consignee, Agent, Stevedore, and Broker.	K		
2.6	Describe the types of Shipping Trades- Liner and Tramp trades	U		
3	CONTRACTS OF CARRIAGE:		9	3
3.1	Understand the basic contracts; charter parties for tramp and tankers; bills of lading for liners. Be aware of the role of the bill of lading under a charter party. Understand the difference between voyage and time charter parties and the basic elements of each.	U		
3.2	Understand the three functions of the bill of lading and its role in international trade. Understand the main specialist abbreviations, terms and expressions used in charter parties and bills of lading.	U		
	LAW OF CARRIAGE:			
3.3	Understand the duty of care and the nature of tortious acts outside contracts.	U		
3.4	Be aware of the way in which international conventions are established and the major conventions relative to shipping.			
3.5	Understand the basic application of Hague/Hague-Visby, Hamburg and Rotterdam Rules, their requirement for seaworthiness and the limitation of carrier liability. Be aware of the differences between these rules.			

3.6	Understand the legal effect of the bill of lading as a document of title and the implication of its role in the delivery of goods.			
3.7	Understand the role of marine insurance and P&I Clubs associations.			
4	DRY CARGO and TANKER CHARTERING:		9	3
	Dry Cargo Chartering:			
4.1	Understand the relative positions of charterers and ship-owners as well as the relationship between these principals and the broker(s) involved.	U		
4.2	Understand how each principal may have its own broker, how these may be 'exclusive' appointments or 'competitive'. The position of intermediate brokers.	U		
4.3	Understand the way in which the international chartering market operates, the various prime centres including London, New York, Hong Kong, Tokyo.	U		
	Tanker Chartering:			
4.4	Tanker Chartering Thoroughly understand the similarities and differences between dry cargo and Tanker Chartering, especially the restricted number of players in this specialised field.	U		
4.5	Understand the meaning of such expressions as 'Oil majors' and 'Traders'.	U		
4.6	Understand the manner in which the market is further compartmentalised depending on the commodities including crude, petroleum products, chemicals, gases, vegetable oils, etc and the way each commodity needs a different type of ship.	U		
4.7	Understand the way World scale operates in some sectors of the tanker trade and the reasons for its use.	U		
4.8	State the term AFRA Max is based on the Average Freight Rate Assessment (AFRA)	K		
4.9	Understand those elements in tanker charter parties that are different from dry cargo forms.	U		
5	SHIPPING ORGANISATIONS:		9	3
	Ship owners' organisations:			
5.1	Define Intercargo (dry cargo ship-owners); Intertanko (tanker owners); Baltic and International Maritime Council (BIMCO) (all owners and brokers); - International Chamber of shipping. National liner ship-owner organisations.	K		
	Broker and Agent Organisations:			
5.2	State Institute of Chartered Shipbrokers (ICS)	K		
5.3	State The Baltic Exchange, FONASBA (International association of national broker/agent associations); International Federation of Freight Forwarders Associations (FIATA) (international association of national forwarding associations).	K		
	United Nations agencies:-			
5.4	Define IMO, ILO, WHO, UNCTAD.	K		
	Chambers of Commerce:-			

5.5	Define International Chamber of Commerce (ICC) (international association of national chambers of commerce); International Maritime Bureau (IMB) (branch of ICC devoted to prevention of maritime fraud and piracy)	K		
	Insurance:-			
5.6	Define corporation of Lloyd's (Historic London Based insurance market on which underwriters and brokers trade)	K		
	Classification Societies and IACS.			
5.7	Define Labour Organisations International Transport Workers' Federation (ITF) (international federation of national trades unions involved in transport);	K		
	Define International Shipping Federation (ISF) (international association of national seafarer employers' associations)	K		
TEXT BOOKS				
Course Notes by the Faculty				
REFERENCE BOOKS				
Institute of Chartered Ship Brokers Publications World Maritime atlas				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

CORE COURSE (CC)	UG21T6605 – NAVAL ARCHITECTURE-II		LECTURE	TUTORIAL	TOTAL
		CREDITS	4	1	5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Analyse the capabilities of vessels for dry-docking
CLO2	Assess the longitudinal stresses action on the vessel
CLO3	Understanding the functioning of loading computers
CLO4	Comprehend on load line regulations
CLO5	Comprehend on the class surveys

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	M	M	H
CLO2	H	H	M	M	H
CLO3	H	H	M	M	H
CLO4	H	H	M	M	H
CLO5	H	H	M	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/AP /AN/C)	LECTURE HOURS 60	TUTORIAL HOURS 15
1	Dry – Docking and inclining experiment		12	3
1.1	Explain critical period, critical instant, and loss of metacentric height during dry-docking.	U		
1.2	Explain importance of trim during dry-docking.	U		
1.3	Calculations based on dry-docking of the vessel	A		
1.4	State the objective of inclining experiment	K		
1.5	Describe the procedure of inclining experiment	U		
1.6	State precautions to be observed	K		
1.7	Compute light ship KG.	A		
2	Shear Force and Bending Moments:		12	3
2.1	Explain shearing force & bending moments of a box shaped vessel	U		
2.2	Calculate & graphically represent SF/BM of a box shaped vessel in even keel condition under various condition of loads.	A		
2.3	State the hazards on exceeding SF / BM	K		
3	Stress calculating Instrument (Loadicator):		12	3
3.1	States that each ship above a specified length is required to carry a loading manual, in which are set out acceptable loading patterns to keep shear forces and bending moments within acceptable limits	K		
3.2	Explain documents for Loading Instrument, Class Certificate, Class approved Loading Manual, Class approved test conditions.	U		
3.3	Describe the input parameters and output results.	K		

3.4	Describe the testing procedure and importance of maintaining record.	K		
3.5	Explain likelihood of overstressing hull structure when loading certain bulk cargoes	U		
3.6	Demonstrate calculations of intact stability using stress calculating equipment (Loadicator)	U		
4	Load line Regulations		12	3
4.1	Sketch and Define load lines for normal ships and timber load lines	A		
4.2	Explain computation of freeboard	U		
4.3	Explain the conditions of assignment for freeboard, doors, ventilators, hatch ways, machinery space opening, other openings in freeboard deck, air pipes, cargo ports, scuppers, Inlets, discharges, side scuttles, freeing ports and protection to crew	U		
4.4	Understand computation of freeboard,	U		
4.5	Explain Type A, B and B60 ships	U		
5	Class Surveys		12	3
5.1	Explain the role and functions of Classification Societies	U		
5.2	State Various classification societies and IACS Members,	K		
5.3	Describe surveys for assignments & retention of class.	K		
5.4	Explain Harmonized System of Survey and Certification and its benefits	U		
5.5	Describe Enhanced Programme of Inspections during Surveys of Bulk Carriers and Oil Tankers	K		
5.6	Define – overall survey, close-up survey, substantial corrosion, corrosion prevention system	K		
5.7	Sketch and describe critical structure areas	A		
5.8	Describe the preparation for enhanced survey.	K		
TEXT BOOKS				
Ship Stability for Masters & / Mates - C.B. Barrass and D.R. Derrett-6 th Edition ,7 th Edition 2012				
Ship construction by Capt. Errol Fernandes-2006 Edition				
REFERENCE BOOKS				
Ship construction - Pursey				
Ship construction –D.J. Eyres				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

PRACTICAL SKILL ENHANCEMENT COURSE (PL/SE)	UG21P6606 - OOW SIMULATOR STEERING AND BTM PRACTICAL		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Demonstrate look out duties
CLO2	Execute steering operation of a vessel
CLO3	Operate RADAR for safe navigation of vessel
CLO4	Calculate CPA and TCPA by using ARPA
CLO5	Apply soft skill in executing bridge resources

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	L	L	M
CLO2	H	H	L	L	M
CLO3	H	H	L	L	M
CLO4	H	H	L	L	M
CLO5	H	H	H	L	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Lookout Duties	AN	12	3
1.1	Demonstrate lookout duty and perform ROR rule 5,6,7,8,19,34,35;			
1.2	Demonstrate case studies on marine accidents			
2	Steering duties	AP	12	3
2.1	Demonstrate steering etiquettes and steering duty, steering orders, modes of steering, setting course on autopilot, steer a steady course on OOW simulator			
3	Operation of RADAR	AP	12	3
3.1	Demonstrate precautions when putting on radar, know the controls of radar; interpret radar display; identify RACON&SART; understand shadow areas, blind sectors, spoking, starring; use and importance of performance monitor; radar log			
4	Operation of ARPA	AP	12	3
4.1	Recognise target data on ARPA; compare with manual radar plotting;			
4.2	Demonstrate use of guard zone, trail of target, past posn of target; trial manoeuvre to attain desired CPA/TCPA with time delay;			
4.3	Demonstrate use of parallel index technique; radar plotting alteration of course and speed			

5	Bridge resource management	AN	12	3
5.1	Apply effective communication skills; prevent errors and accidents by using "error chain analysis";			
5.2	enhance the working relationship of bridge team including interaction with the pilot;			
5.3	recognize loss of situational awareness and apply appropriate corrective techniques;			
5.4	Use effective leadership, bridge organization, and teamwork techniques.			
TEXT BOOKS				
1. Ship Borne Radar and ARPA Nutshell Series Book 3 by Capt H. Subramaniam-Edition 5 – Published on 1 Jan 2020				
2. RULE OF THE ROAD –15 th edition- BHANDARKSR PUBLICATION-on 1 Jan 2018				
3. College Simulator Manual				
REFERENCE BOOKS				
1. BRIDGE PROCEDURE GUIDE – ICS				
2. BRIDGE TEAM MANAGEMENT – NAUTICAL INSTITUTE				
3. BRIDGE RESOURCE MANAGEMENT – NAUTICAL INSTITUTE				
Pedagogy				
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.				

PRACTICAL – SUMMER INTERSHIP (PL/SI)	UG21P6607 - WATCH KEEPING PRACTICAL II		PRACTICAL	TUTORIAL	TOTAL
		CREDITS	2	0.5	2.5
		HOURS	60	15	75

Course Learning Outcomes (CLO)

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

CLOs	CLO STATEMENT
CLO1	Practice watch keeping activities
CLO2	Practice log book writing practices

Mapping with Programme Learning Outcomes (PLO)

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

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60	TUTORIAL HOURS 15
1	Watch keeping activities			
1.1	Keep watch from sun set to sun rise (preferably after the evening routines) 2 hours per day on rotational basis.	AP	20	5
	The procedures shall be as below			
	2 cadets to be kept at one location and different locations shall be identified by the individual college / institute for this purpose.			
	Watch keeping schedule shall be prepared by the college / institute and cadets shall be put on rotational duty as per the watch keeping schedule.			
	The watch keepers shall be provided with necessary equipment like torches, whistle or any other equipment as needed for the particular watch keeping location.			
	Watch keeping instructions shall be prepared by the college / institute and the watch keeper shall be briefed prior starting watch keeping.			
	Reporting procedures shall be established for any incident occurs during the watch keeping hours.			
1.2	Maintain watch keeping log for each location. A log book shall be used for this purpose which resembles ships deck log book.	AP	20	5
	The log book shall be signed by the watch keepers at the end of the watch.			

1.3	Write weather conditions in the log book as per weather booklet. The weather condition must include clouds, air temp., wet and dry bulb temp. Humidity, wind direction, wind speed, moon face percentage (if available), prominent stars observed or any other observation as required by the college / institute.	AP	20	5
1	Text Book Bridge equipment and watchkeeping by Capt.A.G Bhatia 2022 Edition			
2	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis			

COMMUNITY ENGAGEMENT AND SERVICE VALUE ADDED COURSE (CS/VA)	UG21F6608 Field Practice - Community Service		PRACTICAL	TUTORIAL	TOTAL																		
		CREDITS	0.5	0.5	1																		
		HOURS	15	15	30																		
Course Learning Outcomes (CLO)																							
On the successful completion of the course, students will be able to																							
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CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5																		
CLO1	-	-	-	L	-																		
CLO2	-	-	-	H	-																		
H-High; M-Medium; L-Low																							

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIV ELEVEL (K/U/AP/ AN/C)	PRACTICAL HOURS	TUTORIAL HOURS
			15	15
	<i>Community Engagement and Services – Campuses / Colleges to have the flexibility to choose unit1 AND/OR unit2 AND/OR unit3 that are feasible based on availability / location. Atleast one industry related activity has to be done</i>			
1	Beach and Coastal Cleaning Activity - To engage in cleaning of Coastal and Beaches as a group	AP	5	5
2	Park and Garden Maintenance - To develop or Maintain a already existing Garden or Park	AP	5	5
3	Any Social Service Activities - To engage in social service activity such as visiting a orphanages / service in the old age homes etc	AP	5	5

STUDIO ACTIVITIES VALUE ADDED COURSE (SA/VA)	UG21F6609 – Maritime Upskilling		PRACTICAL	TUTORIAL	TOTAL
			CREDITS	0.5	0.5
	HOURS	15	15	30	

Course Learning Outcomes (CLO)
On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand practicalities of various International Conventions and Treatises

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	-	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVELEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 15	TUTORIAL HOURS 15
1	Practice using Mock Sessions of IMO Conventions			
1.1	Write a review of Hong Kong international convention for the safe and environmentally sound recycling of ships, 2009	AP	3	3
1.2	Understand the working of IMO by participating in mock sessions using “role playing” methodology	AP	3	3
1.3	Write a review report on Ship Yard related Technical papers and Studies. Study on Indian Ship Yards.	AP	3	3
1.4	Write a review report on SOLAS Chapter II-1 - Construction - Structure, subdivision and stability, machinery and electrical installations. SOLAS Chapter II-2 - Construction - Fire protection, fire detection and fire extinction	AP	3	3
1.5	Write and report on Maritime Anti-Corruption Network (Denmark) MACN			
1.6	Write a review report on International code on the enhanced programme of inspections during surveys of bulk carriers and oil tankers, 2011 (2011 ESP Code)	AP	3	3

Question Paper Template for Core courses

**INDIAN MARITIME UNIVERSITY
(A Central University Government of India)**

B. Sc (Nautical Science)

Semester I/II/III/IV/V/VI

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)**

B.Sc (Nautical Science)

Semester I/II/III/IV/V/VI

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 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 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	* Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis 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) 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	Computer Science	Course notes by the faculty or any one Book of Institute Choice
5	Ship Construction	1) Ship Construction Notes for Ship Mates - by Edrich Fernandes. 1999 2) *Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis 3) And additionally, course notes by the faculty
6	Computer Science Practical	Course notes by the faculty
7	Soft Skill Practical (communication skill)	1) Communication Skills: A Workbook. Oxford University Press, by Sanjay kumar and Pushp Lata, Edition 1, Published by Oxford University Press, Published on 1 Jun 2018.
8	Field Practice Swimming Training	Guidance by Instructor
9	Book Review (any good book of student's choice, literature, fiction, non-fiction, historic, time travel etc)	eBooks from website

Semester II		
1	Nautical Mathematics	<ol style="list-style-type: none"> 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
2	Nautical Physics and Electronics	<ol style="list-style-type: none"> 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.
3	Environmental Science	Textbook of Environmental Studies for UG Courses- by Erach Bharucha, Published by Orient Blackswan Pvt Ltd,Published on 8 Mar 2021.
4	Bridge Equipment and COLREGS	<ol style="list-style-type: none"> 1) Bridge Equipment, Charts & Publication Nutshell Series Book 5- by Capt. H. Subramaniam, Published by Vijaya Publications,Published on 1 Jan 2017. 2) Bridge equipment and watching keeping by Edrich Fernandes-1999 3) *Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis" 3) Rules of The Road Bhandarkar Publications-2018
5	Terrestrial Navigation	<ol style="list-style-type: none"> 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)
6	Seamanship Practical	1) *Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis
7	Nautical Physics and Electronics Practical	Course notes by the faculty
8	Field Practice - Industry Visits	Guidance by Faculty
9	Communication Skills on Case Studies	eBooks case studies from website

Semester III		
1	Marine Meteorology	<ol style="list-style-type: none"> 1) Marine Meteorology – Capt. H. Subramaniam Ships' Code and Decode Book- The Met. Office, Edition 10, Published by Stationary office books, Published on 1 May 1981. 2) * Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis
2	Bridge Electronic Equipment and Watch Keeping	<ol style="list-style-type: none"> 1) Basic of electronic aids for surface navigation by Dr. Veera Senthil Kumar and Capt. Mihir Chandra-2023 Edition 2) Bridge equipment and watchkeeping by Capt.A.G Bhatia 2022 Edition 3) Ship Borne Radar and ARPA Nutshell Series Book 3 by Capt H. Subramaniam 4) *Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis
3	Ship Stability-I	<ol style="list-style-type: none"> 1) Ship Stability at the Operational Level- Capt. Subramaniam H Published by Vijaya Publications, Published on 1-Jan-2021 2) Stability, trim and cargo calculations on M.V. Hindship and Oil Tankers- Capt. Joseph & Capt. Rewari, Edition 3, Published by Applied Research International, Published on 2018. 3) Stability Table Trim & stability particulars of M.V. Hindship (Stability tables) -Bhandarkar Publication
4	Cargo Work I	<ol style="list-style-type: none"> 1. Cargo Work for Ship officer – Capt Errol Fernandes Published by Marinez Enterprises Published on 1 Jan 1993 2. Addl Notes by Teacher
5	Celestial Navigation	<ol style="list-style-type: none"> 1) Principles of Navigation by Capt.S.S.S. S Rewari & Capt. T.K. Joseph, Edition 2, Published by Applied Research International, Published on 1 January 2018 2) Practical Navigation by Capt. Subramaniam 2010 Edition Nautical Almanac
6	Nav Equipment OOW Simulator Practical	Simulator Manual
7	Project Work Practical (Making model ship structures / Cargo related / Case Studies)	Guidance by Faculty
8	Field Practice – Planetarium/ Light House visit	Guidance by Faculty
9	Technical Writing Skills on Navigational Subjects	eBooks from website

Semester IV		
1	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
2	Marine Pollution Prevention	1) Introduction to Marine Environment Protection by Capt. Subroto Khan- Second edition 2) Course notes by the faculty
3	Artificial Intelligence and Autonomous Ships	Course notes by the faculty
4	Cargo Work-II	1) Cargo Work for Ship officer by Capt Errol Fernandes- Published by Marinez Enterprises on 1 January 1993 2) Course notes by the faculty
5	Ship Stability-II	1) Ship Stability at the Operational Level by Capt. Subramaniam -Published by Vijaya Publications on 1 January 2021 2) Ship Stability at the Management Level- Capt. H. Subramaniam -Published by Vijaya Publications on 1 January 2020 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
6	Chart Work Plotting and ECDIS Simulator Practical	1) Chart Work for Mariner by Capt. S.K. Puri-6 th Edition- Published on-1 January 2016 2) Other Materials to be issued English Channel Chart (Shall be Photocopy) Parallel Ruler, Divider, Compass, 2B pencil and Eraser
7	Advanced Seamanship Practical	* Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis
8	Field Practice- Boat Rowing Exercises	Guidance by Instructor
9	Technical Writing skills on Environmental subjects	eBooks and case studies from website

Semester V		
1	Ship Manoeuvring and Piloting	*Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis"
2	Marine Engineering and Automation	Basic Marine Engineering by J.K. Dhar-12 th Edition
3	Shipboard Operations	*Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis"
4	IMO and International Conventions	Merchant Shipping Act-1958
5	Naval architecture-I	1) Ship Stability for Masters & / Mates - C.B. Barrass and D.R. Derrett -6 th Edition, 7 th Edition (2012) 2) Ship construction by Capt. Errol Fernandes
6	Engine Room Machinery and Workshop Practical	Basic Marine Engineering by J.K. Dhar-12 th Edition
7	Watch Keeping Practical - I	1) Bridge equipment and watchkeeping by Capt.A.G Bhatia 2022 Edition 2) *Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis"
8	Field Practice - Placement Activities	Guidance by Faculty
9	On-board Record Keeping	eBooks and case studies from website

Semester VI		
1	HR Practices in Shipping	Future of Human Resource Management – Raman Preet- Edition 2019
2	Logistics and Supply Chain Management	Course notes by the faculty or any one Book of Institute Choice
3	Blue Economy	Course notes by the faculty
4	Commercial Shipping Practices	Course notes by the faculty
5	Naval architecture-II	1) Ship Stability for Masters & / Mates by C.B. Barrass and D.R. Derrett-6th Edition, 7th Edition 2012 2) Ship construction by Capt. Errol Fernandes-2006 Edition
6	OOW Simulator Steering and BTM Practical	1) Ship Borne Radar and ARPA Nutshell Series Book 3 by Capt H. Subramaniam-Edition 5 – Published on 1 st January 2020 2) Rule of the Road – fifteenth edition- Bhandarkar Publication -on 1 January 2018 3) College Simulator Manual
7	Watch Keeping Practical - II	1) Bridge equipment and watchkeeping by Capt.A.G Bhatia 2022 Edition 2) *Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) - By: D. J. House Publisher: Routledge Taylor & Francis"
8	Field Practice - Community Service	Guidance by Faculty
9	Maritime Upskilling	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

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