ALAGAPPA UNIVERSITY

(Accredited with A+ Grade by NAAC (CGPA: 3.64) in the Third Cycle,
Graded as Category-I University and granted autonomy by MHRD-UGC)

DIRECTORATE OF COLLABORATIVE PROGRAMMES

B. Sc Nautical Science

Regulations and Syllabus

[For those who join the Course in July 2023 and after]

CHOICE BASED CREDIT SYSTEM

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 or "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 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 English syllabus has been revised to the demand of time and industry. An attempt has been made to have soft skills learning in initial four semesters by including all aspects of soft skills in 80 hours.

In line with the National Education Policy for training in the developing technology which is going tobe the need of the hour, Three micro credit courses, Cyber Security and Artificial Intelligence, Machine Learning and Internet of Things and Block chain Technology have been added.

The old computer language C++has been replaced by the Python language which is in current use.

The Navigating officers are required to critically think in complex situations and make intelligent and quick decisions, and to address this a Critical Thinking and Leadership course has been introduced..

Maritime Risk Assessment is an integral part of seafarers' life and to address this a microcredit course" Maritime Risk Assessment" has been included.

All the semester courses have been re-structured and well defined by writing Specific Learning Objectives. The syllabus has been revised in such away to keep the total hours in semester between 520 and 540.

The pedagogy will be as per NEP 2020, 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, alternatively use of **"Ship in Campus" can be made.**

A Nautical Science career in Non-academic areas, demands a very high level of discipline and over all 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.

Board of Studies – Alagappa University, Karaikudi

(Syllabus Revision Committee 2023)

B.Sc. (Nautical Science) Syllabus 2015 (3rd Revision) has been revised in 2015.
Syllabus Revision Committee 2023 has been constituted with the following members:

1) Dr. A. Veera Ravi, Professor / Director, Collaborative Programmes, Alagappa University,Karaikudi – Chairperson/Convener.

2) Dr. V. Sivakumar, Director, Curriculum Design and Development Cell, Alagappa University,Karaikudi – Ex-Officio Member.

3) Dr. N.M. Prabhu, Deputy Director, Curriculum Design and Development Cell, AlagappaUniversity, Karaikudi – Ex-Officio Member.

4) Shri. S. Shyamsundar, Regional Director, Coimbatore Marine College, - Subject & Industry Expert.

5) Capt. Sasidharan Manikkath, Principal, Coimbatore Marine College, - Subject Expert

6) Shri. Muthuswamy Nadar, Nautical Faculty, Coimbatore Marine College, - Subject Expert

7) Shri. Arun Natarajan, Coimbatore Marine College, - Subject Expert.

8) Dr. Senthil Kumar, Director – Management Studies, Coimbatore Marine College, - Subject Expert.

9) Capt. Murali Somasundaram, Principal, Jeyanthinather Academy of Marine Studies, ThoothukudiDistrict, - Subject Expert

10) Capt.Viswanathan, Dean, College of Fisheries Nautical Department, Thoothukudi District, -Subject Expert

11) Dr. C. Brintha Malar, Faculty, TDMNS College, Kallikulam, - Subject Expert.

12) Ch.Eng. M. Lazar Donald, STCW Course Incharge, Jeyanthinather Academy of MarineStudies, Thoothukudi District, - Subject Expert

PROGRAMME REGULATIONS

1. B.Sc. (Nautical Science) by Nautical Studies

The 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 **July to November** each year and the even semester from **January to May.** There shall be not less than 90 working days in each semester.

2. Entry Requirements:

For entry into B.Sc. (Nautical Science) programme, the eligibility criteria are as follows:

i) Minimum 60 % marks in Physics, Chemistry & Mathematics at 10+2 /Equivalent Examination.

ii) Minimum50% marks in English at 10+ 2 Exam.

iii) Minimum Age17.5 years & maximum Age 25 years

3. Attendance:

(As per DG Shipping Norms)

All students must put in a minimum of 90% of attendance in order to appear in the end-semester examinations (Theory and Practical) of the DG Shipping norms.

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

4. Procedure for awarding Internal Assessment (IA) Marks:

1. There will be minimum 50% pass mark for Internal Assessment for all programmes.
   a. The maximum marks for each theory paper will be 100 marks, out of which 25 marks will be for Internal Assessment and 75 marks for University Examination.

   b. The maximum marks for each practical paper will be100 marks, out of which 25 marks will be for Internal Assessment and 75 marks for University Examination.

2. The above break-up will not apply to Project Work, Dissertation, Summer Internship.

3. The component-wise break-up of the 'Internal Assessment' for the Theory papers is given:

Sl. No	Component	Marks
1	Internal (1& 2) and model examination	15
2	Viva & Behaviour response and attentiveness	10
	Total	25

4. The component-wise break-up of the 'Internal Assessment' for the Practical papers of UG and PG Programmes shall be as follows:

UG Programmes

Sl.No	Component	Marks
1	Viva & Behaviour response and attentiveness	10
2	Lab work records	15
	Total	25

(a) Teacher Assessment - Teachers Assessment which may include parameters such assignments/ behaviorin class, responses/attentiveness in class etc.

(b) Internal Test: Two Tests of 1 hour 30 minutes' duration, for a maximum of 40 marks each, shall be conducted. 1st Internal Test in the 7th week and 2nd Internal Test in the 12th week of the semester. Average marks of the two tests shall be taken as the Internal Test marks.

(c) Practical (Lab Work / Record Keeping): Every completed Practical (Lab Work / Record Keeping) shall be evaluated for a maximum of 25 marks. Average mark of all the prescribed experiments / exercises done during the entire semester shall be taken as Practical (Lab Work/Record Keeping) marks.

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

8. Procedure for awarding End Semester University Exam (UE) Marks:

a) **Theory Papers**: Examination of 3 hours' duration shall be conducted and evaluated for a maximum of 75 marks.

b) **Practical Papers:** Examination of 3 hours' duration shall be conducted and evaluated maximum of 75 marks.

c) There shall be a common minimum pass mark 40% in the Internal / External (Theory and Practical) Examinations.

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

9. Classification of Marks

Successful candidates passing the examination for all papers except English and securing the marks 60% and above in the aggregate of the marks prescribed for the course shall be declared to have passed the Examination in the FIRST Class.

All other successful candidates shall be declared to have passed the examination in the SECOND Class.

10. Consolidated Mark Statement

The consolidated marks statement indicating marks scored in all the subjects will be issued when thestudentspassallthesubjectsoftheB.Sc.(NauticalScience)programme.Thefeeforconsolidatedmarksstatement is to be remitted along with the examination fee while registering for the First semester examination.

11. Provisional Certificate

For those who are declared qualified for the B.Sc. (Nautical Science) program, 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 First semester examination fee.

12. Award of Degree

Students who have successfully completed the program 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 fee for Degree Certificate is to be remitted along with the examination fee while registering for the First semester examination.

Syllabus Index

Sem.	Part	CourseCode		Title of the Paper	T/P	Cr.	Hrs./ Week**	Max. Marks		
								Int.	Ext.	Total
Semester - I										
I	I	T/OL	11611T/H/F/M/TU/A/S	Tamil - I / Hindi - I	T	3	4	25	75	100
	II	E	11612	General English – I	T	3	4	25	75	100
	III	CC	11613	Basic Ship Knowledge	T	4	5	25	75	100
		CC	11614	Navigation – I	T	4	5	25	75	100
		Allied	11615	Nautical Mathematics – I	T	3	5	25	75	100
		Allied	11616	Nautical Physics and Electronics – I	T	3	5	25	75	100
		Allied	11617	Nautical Physics and Electronics – I	P	2	5	25	75	100
		SEC - I	11618	Value Education	T	2	3	25	75	100
				Total		**24**	**36**	**200**	**600**	**800**
Semester - II										
II	I	T/OL	11621T/H/F/M/TU/A/S/	Tamil – II / Hindi - II	T	3	3	25	75	100
	II	E	11622	General English – II	T	3	3	25	75	100
	III	CC	11623	Ship Construction	T	4	5	25	75	100
		CC	11624	Ship Operation Technology	T	4	5	25	75	100
		Allied	11625	Nautical Mathematics – II	T	3	3	25	75	100
		Allied	11626	Nautical Physics & Electricity – I	T	3	4	25	75	100
	IV	Allied	11627	Nautical Physics & Electricity – I	P	2	3	25	75	100
		SEC - II	11628	Fundamentals of Computer Science	T	3	4	25	75	100
		SEC - III	11629	Meteorology & Environmental Studies	T	2	4	25	75	100
		SEC - IV	11210	English Communication Lab	P	1	2	25	75	100
				Total		**28**	**36**	**250**	**750**	**1000**
Semester - III										
III	I	T/OL	11631T/H/F/M/TU/A/S	Tamil – III / Hindi - III	T	3	3	25	75	100
	II	E	11632	General English – III	T	3	3	25	75	100
	III	CC	11633	Navigation – II	T	3	4	25	75	100
		CC	11634	Ship Stability – I	T	3	4	25	75	100
		CC	11635	Voyage Planning and Collision Prevention (BA Chart.813)	T	3	3	25	75	100
		CC	11636	Cargo Operation – I	T	3	3	25	75	100
		CC	11637	Navigation Watch Keeping & Bridge Equipment – I	T	2	3	25	75	100
	IV	CC	11638	Seamanship Lab – I	P	2	3	25	75	100
		Allied	11639	Marine Engineering, Automation & Control Systems – I	T	2	3	25	75	100
		Allied	116310	Marine Engineering, Automation & Control Systems – I	P	2	3	25	75	100
		Allied	116311	Artificial Intelligence & Machine Learning	T	2	2	25	75	100
		NME - I	116312A	1.Adipadai Tamil	P	2	2	25	75	100
			116312B	2.Advance Tamil	T					
			116312C	3.IT Skills for Employment	T					
				4.MOOC'S	T					
				Total		**30**	**36**	**300**	**900**	**1200**
Semester- IV										
	I	T/OL	11641T/H/F/M/TU/A/S	Tamil – IV / Hindi - IV	T	3	3	25	75	100
	II	E	11642	General English – IV	T	3	3	25	75	100

IV	III	CC	11643	Navigation – III	T	3	5	25	75	100
		CC	11644	Ship Stability – II	T	3	4	25	75	100
		CC	11645	Cargo Operation – II	T	3	4	25	75	100
		CC	11646	Seamanship Lab - II	P	2	3	25	75	100
		Allied	11647	Marine Engineering, Automation & Control Systems – II	T	3	4	25	75	100
		Allied	11648	Meteorology	T	3	4	25	75	100
		SEC - V	11649	Cyber Security, Internet of Things	T	1	1	25	75	100
		SEC - VI	116410	Block Chain Technology	T	1	1	25	75	100
		NME - II	116411A 116411B 116411C	1.Adipadai Tamil	P	2	2	25	75	100
				2.Advance Tamil	T					
				3. Small Business Management	T					
				4MOOC'S	T					
		116412		Project Work	PR	6	--	25	75	100
				Total		**33**	**36**	**300**	**900**	**1200**
Semester – V										
V	III	CC	11651	Navigation & Collision Prevention Regulations (BA Chart 5049/5047/5048/2675)	T	3	4	25	75	100
		CC	11652	Naval Architecture – I	T	3	4	25	75	100
		CC	11653	Ship SafetyEquipment	T	3	4	25	75	100
		CC	11654	Navigation Watchkeeping and Bridge Equipment – II	T	3	4	25	75	100
		CC	11655	Ship Operation Technology Lab	P	2	4	25	75	100
		CC	11656	Navigation Lab – 1	P	2	4	25	75	100
		DSE - I	11657	Specialized Cargo Operation	T	3	4	25	75	100
		DSE - II	11658	Marine Environmental Protection	T	3	4	25	75	100
				Total		**22**	**36**	**225**	**675**	**900**
Semester - VI										
VI	III									
		CC	11661	Voyage Planning & ECDIS (BA Chart 5049/ 5047/5048/2675)	T	3	4	25	75	100
		CC	11662	Naval Architecture – II	T	3	4	25	75	100
		CC	11663	Ship Maintenance & Emergencies	T	3	4	25	75	100
		CC	11664	Ship Handling & Collision Prevention Regulations	T	3	4	25	75	100
		CC	11665	IMO & International Conventions	T	3	4	25	75	100
		CC	11666	Navigation Lab - II	P	3	4	25	75	100
		DSE - III	11667	Human Resource Development and Shipping Management	T	2	4	25	75	100
		DSE - IV	11668	Maritime Risk Management	T	3	4	25	75	100
				Total		**23**	**32**	**200**	**600**	**800**
				Grand Total		**160**	**-**	**-**	**-**	**5900**

Curriculum Matrix

Semester - I

Serial No.	Subject Code	Subject Name	Internal Assessment				End Semester Exam		Total marks	Pass marks	Hours/week
			Viva & teacher assessment	Internal test & Model Exam	Practical(Labwork/ recordkeeping)	Total Marks	Max Marks	Pass Marks			
1	UG23T11611	Tamil –I / Hindi - I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
2	UG23T11612	General English – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
3	UG23T11613	Basic Ship knowledge	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**5**
4	UG23T11614	Navigation – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**5**
5	UG23T11615	Nautical Mathematics – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**5**
6	UG23T11616	Nautical Physics and Electronics – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**5**
7	UG23P11617	Nautical Physics and Electronics – I (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**5**
8	UG23T11618	Valued Education (Theory)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**3**

Semester - II

Serial No.	Subject Code	Subject Name	Internal Assessment				End Semester Exam		Total marks	Pass marks	Hours/week
			Viva & teacher assessment	Internal test & Model Exam	Practical(Labwork/ recordkeeping)	Total Marks	Max Marks	Pass Marks			
1	UG23T11621	Tamil – II / Hindi - II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
2	UG23T11622	General English - II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
3	UG23T11623	Ships Constructions	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**5**
4	UG23T11624	Ship Operation Technology	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**5**
5	UG23T11525	Nautical Mathematics – II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
6	UG23T11626	Nautical Physics & Electricity – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
7	UG23P11627	Nautical Physics & Electricity – I (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**3**
8	UG23TP11628	Fundamentals of Computer Science (Theory & Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**4**
9	UG23T11629	Meteorology & Environmental Studies	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
10	UG23P11630	English Communication Lab (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**2**

Semester - III

Sl. No.	Subject Code	Subject Name	Internal Assessment				End Semester Exam		Total marks	Pass marks	Hours/week
			Viva & teacher assessment	Internal test & Model Exam	Practical(Labwork/ recordkeeping)	Total Marks	MaxMarks	Pass Marks			
1	UG23T11631	Tamil – III / Hindi - III	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
2	UG23T11632	General English - III	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
3	UG23T11633	Navigation – II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
4	UG23T11634	Ship Stability – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
5	UG23T11635	Voyage planning and collision prevention (BA Chart.813)	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
6	UG23T11636	Cargo Operation - I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
7	UG23T11637	Navigation Watch Keeping & Bridge Equipment – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
8	UG23P11638	Seamanship Lab – I (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**3**
9	UG23P11639	Marine Engineering, Automation & Control Systems – I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
10	UG23T116310	Marine Engineering, Automation & Control Systems - I (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**3**
11	UG23TP116311	Artificial Intelligence & Machine Learning (Theory & Practical)	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**2**
12	UG23T116312	NME- I 1.Adipadai Tamil 2.Advance Tamil 3.IT Skills for Employment/ 4. MOOC'S	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**2**

Semester - IV

Serial No.	Subject Code	Subject Name	Internal Assessment				End Semester Exam		Total marks	Pass marks	Hours/week
			Viva & teacher assessment	Internal test & Model	Practical(Labwork/ recordkeeping)	Total Marks	Max Marks	Pass Marks			
1	UG23T11641	Tamil – IV / Hindi - IV	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
2	UG23T11642	General English - IV	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**3**
3	UG23T11643	Navigation – III	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**5**
4	UG23T11644	Ships Stability - II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
5	UG23T11645	Cargo Operation – II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
6	UG23P11646	Seamanship Lab – II (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**3**
7	UG23TP11647	Marine Engineering, Automation &Control Systems – II (Theory & Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**4**
8	UG23T11648	Meteorology	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
9	UG23TP11649	Cyber Security, Internet of Things (Theory & Practical)	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**1**
10	UG23T116410	Block Chain Technology	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**1**
11	UG23P116411	NME- II 1.Adipadai Tamil 2.Advance Tamil 3. Small Business Management / MOOC'S	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**3**
		Project Work							**100**	**40**	

Semester - V

Serial No.	Subject Code	Subject Name	Internal Assessment				End Semester Exam		Total marks	Pass marks	Hours/week
			Viva & teacher assessment	Internal test & Model	Practical(Labwork/ recordkeeping)	Total Marks	Max Marks	Pass Marks			
1	UG23T11651	Navigation & Collision Prevention Regulations (BA Chart 5049/5047/5048/ 2675)	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
2	UG23T11652	Naval Architecture - I	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
3	UG23T11653	Ships Safety Equipment	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
4	UG23T11654	Navigation Watchkeeping and Bridge Equipment – II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
5	UG23P11655	Ship Operation Technology Lab (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**4**
6	UG23P11656	Navigation Lab – I (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**4**
7	UG23T11657	Specialized Cargo Operations	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
8	UG23T11658	Marine Environmental Protection	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**

Semester - VI

Serial No.	Subject Code	Subject Name	Internal Assessment				End Semester Exam		Total marks	Pass marks	Hours/week
			Viva & teacher assessment	Internal test & Model	Practical(Labwork/ recordkeeping)	Total Marks	Max Marks	Pass Marks			
1	UG23T11661	Voyage Planning & ECDIS (BA Chart 5049/ 5047/5048/2675)	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
2	UG23T11662	Naval Architecture – II	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
3	UG23T11663	Ships Maintenance & Emergencies	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
4	UG23T11664	Ships Handling & Collision prevention regulations	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
5	UG23T11665	IMO & International Conventions	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
6	UG23P11666	Navigation Lab - II (Practical)	**10**	**-**	**15**	**25**	**75**	**30/75**	**100**	**40**	**4**
7	UG23T11667	Human Resource Development and Shipping Management	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**
9	UG23T11668	Maritime Risk Management	**10**	**15**	**-**	**25**	**75**	**30/75**	**100**	**40**	**4**

Credit System

1. Credit Score Criteria–

One Credit is given for approximate 15 hrs theory and 30 hrs practical training.

Credit Score	Lecture	Practical Hours
1	Upto15	Upto 30
2	16-30	31-60
3	31-45	
4	46-60	
5	61-75	

2. All Micro Credit Courses are of One Credit Score.

3. Semester wise Credits summary-

Sr.No	Semester	Hours/Week	Credit Score
1	I	36	24
2	II	36	28
3	III	36	30
4	IV	36	33
5	V	36	22
6	VI	32	23
Total			160

Training outcomes

The syllabus adequately covers the knowledge and skill competencies required for an operational level officer.

After completion of this B.Sc. Nautical Science Degree Course the students will be able to demonstrate a knowledge and understanding of:

1. Thorough knowledge of the Collision Regulations,
2. Principles in keeping a navigational watch,
3. Bridge Resource Management,
4. Use of Routeing
5. Use of information from Navigational equipment for maintaining a safe Navigational watch,
6. Knowledge of blind pilotage techniques
7. Use of reporting in accordance with the general principles for ship reporting systems and with VTS procedures,
8. Knowledge of the fundamentals of RADAR and ARPA,
9. Precautions for protection and safety of people on board in emergency
10. Initial actions following a collision or grounding,
11. Rescuing persons from the sea
12. Assisting a ship in distress
13. English reading, writing, listening and speaking,
14. Use of Standard Marine Communication Phrases
15. Use the International Code of Signals,
16. The effect of cargo, including heavy lifts on the seaworthiness and stability of the ship,
17. Safe handling, stowage and securing of cargoes including dangerous, hazardous and harmful cargoes and effect on the safety of life and of the ship,
18. Precautions to be taken to prevent pollution of marine environment,
19. Anti-pollutions procedures and associated equipment,
20. Proactive measures to protect the marine environment,
21. Stability, trim and stress table,
22. The principal structural members of a ship,
23. The surveys carried out to maintain the ship,
24. Basic knowledge of Physics and Electricity uses on board
25. Basic knowledge of Electronics' applications onboard
26. Fire prevention,
27. Organizing fire drills,
28. Chemistry of fire,
29. Fire fighting systems,
30. The action to be taken in the event of fire,
31. Organizing abandon ship drill, use of various Life Saving Appliances,
32. Survival at Sea techniques,
33. Ship board personnel management &training,

Training outcomes (Contd..)

34. National Maritime legislations & International Conventions and regulations,
35. Effective Resource Management,
36. Decision making techniques,
37. Knowledge of Personal Safety and Social Responsibility,
38. Knowledge of Piracy at Sea and counter measures,
39. Basics of MS Word, Excel,
40. Introduction to Digital Twins
41. Introduction to Autonomous and Semi-Autonomous Ships,
42. Basics of Cyber Security,
43. Basics of Artificial Intelligence,
44. Basics of Machine Learning,
45. Basics of Internet of Things,
46. Basics of Block chain Technology,
47. Leadership qualities, and
48. Good Officer Like Qualities.

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - I					
Core	**Course Code 11613**	**Basic Ship Knowledge**	**T**	**Credit:4**	**Weekly:5**
Pre-requisite	**Basic Knowledge of Ship**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To familiarize types of ships and their cargoes & stowage arrangements. 2. To learn basic definitions and meanings of marine terms 3. To educate on how to read drafts and familiarize various load lines. 4. To learn the principal parts of the ship 5. To analyze and understand general layout, midship section & profile view
	Specific Learning Objectives
Unit - I	**Introduction:** Explain in brief Development of ocean-going Merchant Ships and Modern merchant ships Explain existence of old Harbours and need of modern ports. Discuss development of modern ports. **Types of Ships:** Describe ships in general. Explain in brief different types of cargoes and typical stowage requirements. Exp lain basic features and purpose of various types of ships- Passenger ship, Ferries, General Cargo ship, Bulk Carrier, Container, Car Carrier, Ro-Ro, Crude Oil Tanker, Product Tanker, LPG, LNG, Passenger Ship and Cattle Carrier, Offshore ships, specialized vessels like seismic vessels, Hydrographic vessels, Oceanographic vessels, and Polar vessels.
Unit – II	**Definitions and Meanings:** Define and e xp lain marine terms - Length Over All, Length Between Perpendiculars, Breadth Extre me, Breadth Moulded, Depth of vessel, Draft, Freeboard, Camber of Deck, Sheer of Deck, Rake of Stem, Rise of floor, Air Draft, Flare of Bows, Parallel Middle Body, Entrance, Run, Forward Perpendicular, After Perpendicular, Amidships, Abeam, Right ahead, Right astern, Base Line, Bilge Radius, Bow, Stern and Trim. **Load lines and Draught Markings:** Sketch and e xpla in Deck Line, Plimsoll line and various other load line markings- T, S, W, TF, F & WNA. Describe and explain Timber Loadline marks. Explain and demonstrate Reading draft.
Unit – III	**Principal parts of the ship:** Describe and locate parts of a ship on a diagram of Model - Bow, Stern, Shell plating, Double Bottom Tanks, Cargo Holds, Tween Decks, Deep tanks, Fore-peak and After Peak store rooms and tanks, Duct Keels. Forecastle deck, Poop deck, Main/Weather decks, Hatch covers, Cargo Gear, anchoring and mooring equipment, Mast House,Deck house, Bulbous Bow, Bow thrusters, Funnel and Boat deck. **Machinery spaces:** Describe Layout of Engine Room. Exp lain purpose and location of Engine Casing, sub-division ofEngine Room, Steering Gear, Pump rooms, Workshops etc. **Superstructure:** Describe layout of Superstructure. Explain purpose and location of Wheel House, accommodation spaces, cabins, galley, pantry, dining saloons, recreation rooms, various stores and lockers, cold storage spaces etc. **General Layout, Midship section & Profile view:** Exp lain layout, midship section and profile views of General Cargo Ship, Bulk Carrier, Oil Tanker, Container Ship,
Unit – IV	**Shell and Deck Plating:** Exp lain purpose of framing, frame spacing, shell plating. Exp lain numbering system of frames, hull and deck plating. Describe Shell expansion plan and its use. Demonstrate identification of plates with details. **Bilge keels, Double bottom Tank, Peak tanks, Wing tanks and Bilges:** Sketch & describe purpose of Bilge Keel, Double Bottom Tank,Peak tanks, Wing tanks and Bilges. **Sounding pipes, Air Pipes and Ventilators:** Sketch & explain purpose of Sounding pipes, Air pipes, Ventilators Sketch & explain various types of air pipes and ventilators
Unit – V	**Geographical Features affecting Shipping:** Describe Climate, t ides, wind, current, areas of bad weather, Time zone, International Dateline, Sea water

	density, Load line zones. Explain impact of Climate, tides, wind, current, areas of bad weather, Time zone, International Dateline, Sea water density, Load line zones on ships and shipping.

TEXT BOOKS

1. Ship Construction sketches & notes – Kemp &Young

RECOMMENDED BOOKS FOR REFERENCE:

1. Reed's Ship Construction for Marine students-by E.A.Stokoe
2. Merchant Ship Construction– H.J.Pursey
3. Ship Construction-D J. Eyres
4. Merchant Ship Construction- Dr D.A.Taylor.

Related online content (Marine Insight. Marinegyaan. Oways online)

Course Outcomes		**Knowledge level**
CO-1	Understanding natural harbours, modern ports and shipping.	K2
CO-2	Understanding types of ships purpose and different cargo carried by them.	K2
CO-3	Marine terms and meanings, Ability to read drafts and distinguish different types of loadlines	K1
CO-4	Ability to identify principle parts of the ship. Understanding the Engine room layout and Location of Equipment in engine room. Understanding the purpose and Various location of superstructure onboard.	K4
CO-5	Understanding Geographical Features affecting Shipping	K1

ALAGAPPA UNIVERSITY

B.Sc. NAUTICAL SCIENCE

Semester - I					
Core	**Course Code** 11614	**Navigation - I**	**T**	**Credit:4**	**Weekly:5**
Pre-requisite	**Basic Knowledge and Calculation of Ship's Navigation**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To familiarize fundamentals of ship navigation with geographically aspects. 2. To educate theoretically and mathematically about navigation. 3. To educate basic instrumental and equipment's of navigation. 4. To understand and analysis the types of navigation. 5. To educate about calculation and observation of celestial body.
	Specific Learning Objectives
Unit - I	**The Earth:** Define Great circle, Small circle, Spherical angle, Spherical triangle, poles of a great circle. Define Earth poles, Equator and Meridians. Describe the approximate polar and equatorial circumferences of the earth. Define latitude and Parallel of latitude, Prime meridian and longitude. Define difference of Latitude and difference of Longitude. Describe the earth as an ellipsoid. Define compression and states its value. Define international nautical mile, cable and Knot. DefineGeographical mile; Statute mile, comparison of nautical mile with kilometer
Unit – II	**Compass Corrections:** Describe the direction on the earth surface. Describe the direction of the ships head on gyro compass(gyro course). Describe thedirection of the ships head on the magnetic compass (compass course). Define true magnetic and compass north. Find deviation and variation 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, Calculate true course from compass course. Calculate compass course from true courseMeasure 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 andcharts. Calculate compass error and gyro error, from transit bearing and bearing from any distant fixed objects. Boxing of Compass
Unit – III	**Parallel and Plane Sailing:** Define departure and states the relationship to the difference longitude. Define t rue course and Rhumb line. Derive the plane sailing formulae. Explain the relationship between departure and difference of longitude in cases involving a change of latitude by using mean latitude. use the plane sailing formula Cosine of latitude = Departure / Diff. of Longitude 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 lat itude. 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. Calculate the course and distance between two positions, using the plane sailing formula. Derive thej information required in parallel and plane sailing problem, using a traverse table or calculator.
Unit – IV	**Mercator Sailing:** Demonstrate the basic knowledge of chart projection. Define natural scale of a chart. Define meridional parts. Describe the requirements of chart appropriate for marine navigation Understand the principles of construction of Mercator chart. Describe the properties of the chart and the degree to which it meets the Navigational requirements and also its limitations Latitude and longitudinal scales and conversion of one to the other. Relationship between D'long and DMP. Explain how to measure the distance between two positions on a Mercator chart based on the latitude of the two positions. Use the Mercator formula to calculate course and distance between two positions. Use Mercator formula to calculate the final position, given the initial position, course and distance. **Day's work:** Calculate DR position or an estimated position by using the Planesailing formula, given compass course and compass error, distance bylog , estimated speed, tidal and current information and leeway.

Unit – V	**Great Circle and Composite G.C. Sailing:** Demonstrate the understanding of great circle sailing including composite and limited lat itude great circles. Calculate in itial and final course and the distance of great circle track. Calculate composite great circles, vertex and position of intermediate points. Principles of Gno monic projection. Describe the use of gnomonic chart for plotting the great circles between two points Explain the procedure to transfer a great circle from a Gnomonic chart to a Mercator chart. **Maritime Geography:** Locate ocean, continents, seas, canals, straits, navigable rivers, major ports of the world and major ocean routes.

TEXT BOOKS

1. Principles of Navigation by Capt. S.S.S Rewari& Capt. T.K.Joseph 2.Practical Navigation by Capt. H Subramaniam

RECOMMENDED BOOKS FOR REFERENCE:

1. Principal of Navigation by Capt. P.M. Sarma
2. The Admiralty Manual of Navigation: Principles of Navigation: Vol. 1- Nautical Institute
3. NAV Basics: The Earth, the sailings, Tides & Passage Planning Vol.1- WitherbySeamanship International Ltd.
4. Nicholls's Concise Guide to the Navigation Examinations Vol. 2- Edward J Coolen
5. Oxford School Atlas

Related online content (Marine Insight. Marine Gyaan. Oways online)

Course Outcomes		**Knowledge level**
CO-1	Understanding the Terrestrial References	K2
CO-2	Understanding and applying Directional References	K2/K3
CO-3	Ability to find course and distance and also arrived position in parallel/plane sailing	K2/K3
CO-4	Ability to find course and distance and also arrived position in mercator sailing	K2/K3
CO-5	Understand and analyze the importance of great circle sailing in navigation. Ability to identify and locate Maritime Geographical locations.	K3

ALAGAPPA UNIVERSITY
B.Sc. Nautical Science

Semester - I					
Allied	**Course Code** 11615	**Nautical Mathematics - 1**	**T**	**Credit:3**	**Weekly:5**
Pre-requisite	**Basic Knowledge of Nautical Mathematics**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. Understand about the Spherical Trigonometry which is used in Navigation and Astronomy 2. Understand the Haversine Formula and Solution 3. Understand the mathematical techniques and constructs based on calculus, real and vector functions with applications 4. Understand Multivariable Calculus apply in problems 5. Understand Linear Algebra applications and solve technical situations, Matrices and their applications.
	Specific Learning Objectives
Unit – I	**Spherical Trigonometry:** Define: Great circle, small circle, pole, spherical angle, spherical, triangle, right angled, quadrantal, oblique and symmetrical spherical, t riangle. State: Properties of Spherical Triangle and oblique spherical triangle. Explain: The Sine & Cosine formulae and the possible ambiguities due to their use. Solve the exa mples by using Sine/ Cosine rule. Define: General problem in Spherical Triangle, Haversine function, Oblique spherical triangle with problem type – AAA and SAS, State: The advantage of Hav function..
Unit - II	**Haversine Formula and Solution:** Exp lain: The Haversine formula I and II. Understand the solution procedure for Oblique spherical triangles of both types by using Haversine formulas: I and II. Solve the e xa mples by using Haversine rule. Explains: Rules for Right-angled Spherical Triangle and Quadrantal Spherical Triangle. Understand: Napier's Rule for circular parts. Understand: Napier's Rule for circular parts. Understand the Solution Procedure: Right angled spherical triangle and Quadrantal Spherical Triangle using Napier's Rules. Solve the examples by Napier's rule. Define: Polar Triangle. Understand: Supplemental theorem. Solution Procedure: polar triangle. Identities of moderate difficulty Solve the examples by polar triangle. Define: Ambiguous cases. Solution Procedure: Cot four-part Formula. Solve the examples by cot four-part formula.
Unit – III	**Differential calculus:** Define Successive differentiation and notation. Find the nth order derivatives of standard functions. Find the nth order derivatives using trigonometric identities. Find the nth order derivatives using partial fractions. State Leibnitz' Theorem. Use Leibnitz' Theorem in problem solving. Define functions of several variables. Define partial derivatives and geometrical interpretation of it. Find the first and higher order partial derivatives of given function. Define Homogeneous function. State Euler's theorem on homogeneous functions with two and three independent variables. Use Euler's theorem to solve problems. Define scalar point functions and fields. Define gradient of a scalar point function. Find the gradient of a given scalar point function. Find the directional derivative of a given scalar point function. Define vector point functions and fields. Define divergence and curl of a vector point function. Find the divergence and curl of a vector point function. Check whether the given vector field is a solenoidal vectorfield. Check whether the given vector field is an irrotational vector field.
Unit – IV	**Integral Calculus:** Define Beta and Gamma functions. State and prove the following Properties a) 1 ‖ 1 b) 0 ‖ ‖ 1 c) 2 $n!$ if n is integer n 1 ‖ $n\,n$ if n is noninteger d) e) m, n n, m f) $\int^{\pi/2} \sin^p\theta \cdot \cos^q\theta d\theta = \frac{1}{2}\beta(\frac{p+1}{2}, \frac{q+1}{2})$ 0 2 2 2 g) Relation between Beta and Gamma

	$\beta(m,n) = \frac{\Gamma m\,\Gamma n}{\Gamma(m+n)}$ Evaluate the given integral by using Beta function. Evaluate the given integral by using Gamma function. Define double Integral and its region of integration. Evaluate the given double integrals with given limits. Evaluate the given double integrals with given region of integration. Change the order of the integration and evaluate the given double integration.
Unit – V	**Linear Algebra:** Define rank of matrix. Define row echelon form of a matrix. Obtain the rank of given matrix by reducing it to the row echelon form. Solve the examples on systems of non homogeneous equations. Solve the examples on systems of homogeneous equations. Define Eigen values and Eigen vectors. Find the Eigen values and Eigen vectors of given matrix of order two. Find the Eigen values and Eigen vectors of given matrix of order three. Define Linearly independent and depend entvectors. Check whether the given set of vectors are linearly dependentor independent.

TEXT BOOKS

1. Spherical Trigonometry - Capt. H.Subramaniam
2. Higher Engineering Mathematics - Dr. Grewal,B.S

RECOMMENDED BOOKS FOR REFERENCE:

1. An introduction to Spherical Trignometry - Clough-SmithJ.H
2. A Text book of applied mathematics Vol.I - Wartikar, P.N.&Wartikar,J.N
3. Further Engineering Mathematics –K.A.Stroud
4. Advanced Engineering Mathematics – Dr. A.B. Mathur&Prof. V.P.Jaggi
5. K Hoffman and R Kunze, Linear Algebra, Pearson Education, 2nd Edition, 2005.
   Erwin Kreyszig, Advanced Engineering Mathematics

Related online content (MOOC, Swayam, NPTEL, Websiteetc.)		
https://mathworld.wolfram.com/SphericalTrigonometry.html		
https://tutorial.math.lamar.edu/classes/calciii/DoubleIntegrals.aspx		
https://www.geeksforgeeks.org/eigen-values/		
Course Outcomes		**Knowledge level**
CO-1	Understand the fundamental concepts of Spherical Trigonometry	K1
CO-2	Calculation of Haversine Formula and Solution	K3
CO-3	Discuss application of Differential Calculus.	K2
CO-4	Acquire knowledge of Integral Calculus and their applications.	K4
CO-5	Analyze the usage of Matrices in different field	

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - I					
Allied	**Course Code** 11616	**Nautical Physics & Electronics - I**	**T**	**Credit:3**	**Weekly:5**
Pre-requisite	**Basic Knowledge of Nautical Physics & Electronics**		**Syllabus Revised**		**2023 - 24**

Nautical Physics

Course Objectives	1. To familiarize basic information about the magnetism and concepts of thermodynamics. 2. To provide technical knowledge in the concepts of light and sound 3. To familiarize basic concepts about hydromechanics and properties of matter. 4. To learn about the basic information about analog electronics & Digital electronics. 5. To learn the recent techniques in Satellite communication. To familiarize basic information about Microprocessor and its architecture
	Specific Learning Objectives
Unit - I	**Earth's Magnetism:** Explain how Earth is a magnet. Explain the magnetic elements of Earth. Explain angle of declination and angle of dip. Explain hard and soft magnetic materials. Define terms such as Magnetic field, magnetic intensity, magneticdipole, Permeability etc. [Application of above in Ships: *Magnetic compass*]. **Heat and Thermodynamics:** Explain the Heat Transfer Mechanism - Conduction, Convection and Radiation. Explain Expansion of solids, liquids and gases, Gas Laws [Application of above in Ships: *Coolers & condensers, application to liquid cargoes, Cargo tank vapour pressure & relief systems*]. Explain and Define Heat capacity, specific heat capacity, Sensible heat, Latent heat. [Application in Ships:*Volume correction factor to measurement of liquid cargoes, cargo heating, Meteorology*]. Explain and Define Vapour Pressures [Applications in Ships: *Volatile liquid cargo and fuel behaviour*]. **Light& Electromagnetic Waves:** Explain the laws of reflection. Discuss the reflection taking place in plane and spherical mirror. [Applications in Ship:*Searchlight base, Wheelhouse windows are required to be inclined*] Explain the laws of refraction. Discuss the refraction taking place in Lenses. [Applications in Ships:*Visible Sunrise when sun is below horizon, Refraction of light rays in Atmosphere*] Explain the Chromaticity of light. [Applications in Ships:*Ref Anx 1 of Colreg*] Explain Electromagnetic Spectrum and describe its various parts in short. [Applications in Ships: E*ffect of atmosphere on Radio wave propagation*]. Explain the bending of EM waves by Ionosphere. [Applications in Ships:*Transmission of MW & SW waves*] **Sound:** Differentiate between Longitudinal and Transverse Waves with exa mples. Discuss the factors which affect velocity of sound in seawater and in air. [Application in Ships:*Principle of Echo sounder, Fog signal propagation*]. Explain the characteristics of sound. Explain the Doppler effect and discuss the eight cases related to Doppler effect. [Applications in Ship : *Doppler speed Log, GPS*]
Unit – II	**Mechanics and Hydromechanics:** Explain Pascal law and its applications [Applications in Ship: *Liquid cargo systems, hydraulic motors*]. Explain Total pressure / Thrust on immersed surfaces [Applications in Ship: *Stability Calculations*]. State Law of Floatation, Archimedes principle and buoyancy [Applications in Ship: *How does Ship Float? WRF of Tanker Cals]*. Explain Bernoulli's theorem and its applications [Applications on Ships: V*enturi-meter, Differential pressure transmitter, Eductor*]. Explain Streamline and turbulence flow, Flow in pipe lines [Applications in Ships: *Ship structure, Propeller Wake*] **Properties of Matter:** Explain Atmospheric Pressure, Barometer, Explain Elasticity, Modulus of elasticity, Hooke's Law [Applications in Ship: *Hull crack, Wire parting, Lifting gears over stressed*] Metallurgy – Explain Physical Property of Alloys, hard vs Brittle, Cast Iron v/s Mild steel vs High tensile steel, abrasiveness, annealing, welding. Explain Cantilever, Bending of Beams, Shearing force, Rigidity [Applications in Ship: *Ship Constructions, stress in a ship*] Explain Air bubbles in liquid [Applications in Ships: *Pneumatic Level gauge, Cappuccino effect in*

	bunkers]. Exp lain Viscosity and viscous flow, CST, Reynolds number, Density & change due to temperature [Applications in Ships: *Viscous cargo and fuel – relationship to temp, Oil & Gas Cargo*]. Exp lain Angle of Repose of Granula r objects, Effect of ships roll on cargo with high angle of repose and low angle of repos [Application in Ships : *Bulk cargo Angle of Repose, shifting of cargo*]. **Semiconductors and Diodes:** Define types of Semiconductors. Exp lain construction and symbol of p-n junction diodes with their characteristics. Exp lain Half-wave and full wave bridge rectifiers. Exp lain construction and symbol of Zener Diode. Explain Zener diode as a voltage regulator Explain Photo Electric Cell.
Unit – III	**Transistors:** Exp lain Bipolar-junction transistor. Draw and e xp lain its characteristics. Exp lain transistor configurations. Define Transistor biasing. Define Current gain α and β of a transistor & relationship of α and β. Explain working of transistor as a switch. **Oscillators :** Derive Barkhausen's criteria for oscillations. Study of different types of LC, RC and Crystal Oscillators. Explain working of phase shift oscillator. Explain transistor Wein bridge oscillator **Digital Electronics:** Basic logic gates & its Types. Explain working of NAND gates, NOR gates and XOR logic gates. Development of logic circuits. Understand working of universal logic gate. Derive Boolean algebra. Derive De-Morgan's theorem. Simplification of logic equation using Boolean theorems. Exp lain working of Half adder, Full adder, Multiplexer and de multiple xe r circuits. Introduction of flip flop. Explain RS flip flop and JK flip flop.
Unit – IV	**Modulation and Demodulation:** Exp lain need of modulation. Working and derivation of Amplitude modulation and modulation inde x. Working and derivation of Frequency modulation and modulation index Derive side bands in F.M. Explain demodulation of A.M. Wave and Diode detector circuit
Unit - V	**Radio Receivers and Satellite communication:** Concept and working of super heterodyne receivers. Explain AM receivers - communication receivers. Exp lain elements of RADAR system - Radar range, limitation of Radar, Radar altimeters and beacons. Working ofRadio detection finding (RDF). Explain in short satellite links, Orbits and inclination, Communication frequencies, domestic satellites, telemetry. **Micro Processor & Programming:** Introduction to microprocessor and 8085 microprocessor. Draw and expla in Architecture of 8085. Exp lain Address and data bus, Control and status signal. Study microprocessor instructions. Exp lain Interfacing devices. Explain applications of microprocessors.

Nautical Physics

TEXT BOOKS

1. Engineering Physics by R. K Gaur

RECOMMENDED BOOKS FOR REFERENCE:

1. Advanced level physics: Nelkon & Parker
2. Applied physics: J H Clough-Smith
3. University physics: Young, Sears & Zemnasky
4. Text book of Engineering Mechanics: R.S.Khurmi
5. Heat & Thermodynamics: Brijal & R.Subramaniam
6. Principles of Physics: Fredrick .J.Bueche
7. Advanced Practical Physics – Worsnop and Flint

Nautical Electronics

TEXT BOOKS

1) Fundamental Of Electrical Engineering & Electronics by B. L. Thereja
2) Principles of Electronics by V. K. Mehta

RECOMMENDED BOOKS FOR REFERENCE:

1. Communication electronics: ND Deshpande, DA Deshpande, PK Rangole,TMH.
2. Electronic communication system: G Kennedy,MGH
3. Electronic Principles-5thEd:Malvino
4. Electronic Devices and Circuit-PHI: Boylstead,Nashelsky
5. Operational amplifier and linear integrated circuits:R.A.Gaikwad
6. Electronic devices and circuits: A.Mottershead
7. Modern Digital Electronics: R P Jain,4E-TMH.
8. Microprocessor architecture, programming and application with 8085, PI publication, By Ramesh Gaonkar.
9. Introductory Electronic Devices and Circuits 7th- Edition by Robert T. Paynter
10. Electronic Devices "Electron Flow Version" by Thomas L. Floyd
11. Fundamentals of Logic Design by Charles H. Roth, Jr. and Larry L. Kinney
12. Introduction to RADAR Systems by Merrill I. Skolnikp

Relatedonlinecontent(MOOC,S wayam, NPTEL,Websiteetc.)		
www.courseera.org		
www.udemy.com		
CourseOutcomes		**Knowledge level**
CO-1	Tofamiliarizebasicinformationaboutthe magnetism and concepts of thermodynamics.	K2
CO-2	Toprovidetechnicalknowledgeinthe concepts of light and sound.	K4
CO-3	Tofamiliarizebasicconcepts abouthydromechanics and properties of matter.	K4
CO-4	Acquireknowledgeabout analog electronics & digital electronics.	K2
CO-5	Discuss the satellite communication and its technology. Evaluatetherecenttrendsinmicroprocessor	K5

ALAGAPPA UNIVERSITY

SEMESTER - I

Semester - I					
Allied	**Course Code** 11617	**Nautical Physics & Electronics – I**	**P**	**Credit:2**	**Weekly:5**
Pre-requisite	**Basic and Practical Knowledge of Nautical Physics & Electronics**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To familiarize basic information about the magnetism and concepts of thermodynamics . 2. To provide technical knowledge in the concepts of light and sound 3. To familiarize basic concepts about hydromechanics and properties of matter. 4. To learn about the basic information about analog electronics & Digital electronics . 5. To learn the recent techniques in Satellite communication. To familiarize basic information about Microprocessor and its architecture
	Specific Learning Objective
Unit - I	**Determining Relative Humidity and effect of temperature on RH:** Define and Explain Relative Humidity Explain the effect of temperature on Relative humidity Explain the procedure to determine the Relative humidity Assessment **Determination of wavelength of laser by diffraction method:** Define wavelength, Explain Diffraction and Diffraction grating, Explain the procedure to determine the wavelength of laser by diffraction method, Perform the experiment and write the observation table Assessment
Unit – II	**Moment of inertia of a flywheel and frictional torque:** Define moment of inertia and frictional torque Explain the procedure to calculate moment of inertia and frictional torque of flywheel, Perform the experiment and write down the observation table, Calculate the moment of inertia and frictional torque by using formula, Assessment **Determination of mechanical advantage, velocity ratio and efficiency of a Weston differential pulley:** Define the terms mechanical advantage, velocity ratio and efficiency as applied to lifting machines. Study the relation between the MA, VR and Efficiency. Verify the formula to calculate the velocity ratio of Weston differential pulley. Explain the procedure to calculate MA,VR, Efficiency. Perform the practical and write down the observation table. Assessment
Unit – III	**Determination of Y : Single Cantilever loaded at one end:** Explain Elasticity and Modulus of elasticity. Define Cantilever beam. Explain the procedure to find the Y of Single Cantilever loaded at one end. Perform the practical and write down the observation table Assessment
Unit – IV	**Determination of angle of repose of grains and friction:** Define Friction and angle of repose Explain the procedure to find the angle of repose. Perform the practical and write the observation table Assessment
Unit – V	**Project Work based on any of the concept as above**

Relatedonlinecontent(MOOC,S wayam, NPTEL,Websiteetc.)		
www.courseera.org		
www.udemy.com		
CourseOutcomes		**Knowledge level**
CO-1	Tofamiliarizebasicinformationaboutthe magnetism and concepts of thermodynamics.	K2
CO-2	Toprovidetechnicalknowledgeinthe concepts of light and sound.	K4
CO-3	Tofamiliarizebasicconcepts abouthydromechanics and properties of matter.	K4
CO-4	Acquireknowledgeabout analog electronics & digital electronics.	K2
CO-5	Discuss the satellite communication and its technology	K5

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - II					
Core	**Course Code 11623**	**Ship Construction**	**T**	**Credit:4**	**Weekly Hours:5**
Pre-requisite	**Basic Knowledge of Ship Construction**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To understand with sketch of the structure of the ship, Frames, Beams and Beam knees, Water tight doors. 2. To understand with the sketch of Bilge keels, Ballast tanks, bilges and Deck openings 3. To understand and familiar with the Anchor, Anchor Chain and Mooring Arrangements. 4. To understand the Sounding Pipes, Air Pipes and Ventilators in Tanks and Holds. 5. To familiar and identifiy the Rudder Arrangement & Stern Frame, Propellers & Propeller Shaft. To Describe Welding process and its predominant use in ship construction.
	Specific Learning Objectives
Unit - I	**Frames, Beams and Beam knees** : Sketch & describe Frames, Beams and Beam knees. Exp lain Longitudinal & t ransverse framing, Exp lain importance of Beams and Beam knees. Sketch Beams and Beam knees Explain Combined systemof framing on transverse sections of the ship. **Water Tight Bulkheads:** Exp lain functions, construction and stiffening of water t ight bulkheads including collision bulkheads, Corrugated bulkhead.
Unit – II	**Bilge keels, Ballast tanks, bilges:** Describe and sketch Bilge Keels. Describe and sketch Double Bottom Tanks. Describe and sketch Fore Peak and After Peak Tanks. Describe and sketch Wing tanks and Bilges. **Deck Opening:** Exp lain Construction, stiffening & closing arrangement of openings on deck & Superstructures, Exp lain weather-tightness of Hatches, 3 Explain openings in RORO ships,Oil, Chemical & Gas tankers.
Unit – III	**Anchor, Chain and Mooring Arrangements:** Describe Chain lockers and attachment of Cables, Sketch and describe the Construction of Hawse pipes, Spurling Pipes & their securing arrangements. Explain Typical mooring / anchoring arrangeJment in forecastle showing the Leads of mooring. Describe Roller, multi angle, pedestal and panama fair lead. Exp lain Mooring bitts showing their attachment to the decks. Explain Cable stopper
Unit – IV	**Sounding Pipes, Air Pipes and Ventilators:** Sketch and describe the construction of Sounding pipes, Sketch and describe the construction of Air Pipes, Sketch and describe the construction of Ventilators. Pump & Piping Arrangement: Exp lain Genera l Pumping arrangements, Exp lain Genera l Pumping arrangements, Describe Bilge & Ballast line system, Explain Pumping arrangement on tankers, Explain Hold drainage systems and related structure Bilge piping, system, strum box, and Non-return valves. Special Doors on Cargo Vessels: Exp lain Methods adopted to maintain integrity of divisions & openings in the hull including STERN DOOR, SIDE DOOR & BOW DOORS, Describe Ro-Ro ship problems.
Unit – V	**Rudder Arrangement & Stern Frame:** Describe types of rudder, Sketch and e xpla in Balanced & Semi balanced Rudders, Describe the Construction & Support Arrangement of rudders, Sketch and describe Stern Frame. Describe Transom stern showing connections to the stern frame. Explain the purpose of rudder carrier, pintles and rudder trunking. Exp lain Arrangement of watertight gland around the rudder stock. **Propellers & Propeller Shaft:** Draw Simple sketch of Propeller & Propeller shaft, Stern Tube & adjacent structures. Expla in terms Boss, Rake, Skew, Face, Back, Tip, Radius, Pitch. 3 Explain Controllable pitch propeller **Welding:** Describe Welding process and its predominant use in ship construction. Discuss Advantages of welding over riveting in ship construction. Exp lain Genera l ideas of Electric Arc welding equipment, coated electrodes, and

	methods used. Exp lain methods used for Gas welding, and Gas cutting. Explain Precaution while welding. Describe Testing and inspection of welds, Explain Stresses set up due to welding and defects in welding.

TEXT BOOKS

1. Ship construction - D J Eyres

RECOMMENDED BOOKS FOR REFERENCE:

1. Ship Construction sketch's & notes by Kemp&Young - Kemp & Young
2. Merchant Ship Construction by H.J.Pursey
3. Reed's ship construction for marine students by E.A.Stokoe
4. Merchant Ship Construction – Dr. D.A.Taylor

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding with sketch of the structure of the ship, Frames, Beams and Beam knees, Water tight doors.	K2
CO-2	Understanding with the sketch of Bilge keels, Ballast tanks, bilges and Deck openings	K2
CO-3	Understanding and familiar with the Anchor, Anchor Chain and Mooring Arrangements.	K1
CO-4	Ability to understand the Sounding Pipes, Air Pipes and Ventilators in Tanks and Holds.	K4
CO-5	Ability to familiar and identify the Rudder Arrangement & Stern Frame, with the sketch of Bilge keels, Ballast tanks, bilges and Deck openings, Propellers & Propeller Shaft Describe Welding process and its predominant use in ship construction.	K5

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - II					
Core	**Course Code: 11624**	**Ship Operation Technology**	**T**	**Credit:4**	**Weekly Hours:5**
Pre-Requisite	**Basic Knowledge of Ship Operation**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To understand the General Parts of ship, watches, PPE and List names of various parts of ship. 2. Practical work with various types of ropes and materials to construct ropes. 3. To identify the various Flags and the terms of hoisting flags. 4. To State the contents of code of safe working practices for merchant seamen and Safe Working Practices. 5. State Role of Safety committee and Safety Officer in maintaining safety standards on board.
	Specific Learning Objectives
Unit - I	**General: Parts of ship, watches, PPE:** List names of various parts of ship. State names and timing of watches. List Personal Protective Equipment (PPE) – Boiler suits, Face Masks, Safety Harness, Ear Mufflers, Chemical Suits, Hand Gloves, Safety goggle, Safety helmet, Safety Shoes.
Unit – II	**Rope Work:** State types of material used in construction of Ropes – Natural fibres, Synthetic fibres, HMP Ropes. Explain different lays of rope. Describe different types of fibre ropes and compare the strength and elasticity of the ropes. Care and maintenance of fibre Ropes. State the damage caused by surging. Exp lain marline, Twine, spun, lead lines. Knots, Bends, Hitches & Whippings. Exp lain different types of Mooring ropes and their advantages/disadvantages. Exp lain the grades of steel used for making Wire ropes, construction of wire ropes, advantage of a fibre heart and Factors determining flexibility, State meaning of 6/12, 6/24, 6/37 types of wire ropes, Non- rotating wire rope, Plastic covered wire rope. Explain, Care and maintenance of wire ropes, Method of measuring size of ropes, wires and chains. Exp lain use of Chain/rope stoppers.
Unit – III	**Flags and Halyards:** Define meaning of Bunting. Exp lain how to dress the ship. Exp lain Halyard at the dip, Close up, Half mast, Hoist, Fly, Tackline. Explain Courtesy flag, Flags A-Z and Numeral pendants, Jack flag, Quarantine flag, Pilot flag, Blue Peter. State the location of Jack Staff, Ensign staff. What flags are hoisted from these part of ship and When. State type of Ensigns. State that there can be penalty for not using or wrongly using an Ensign.
Unit – IV	**Code of Safe Working Practices:** State the contents of code of safe working practices for merchant seamen. List the precautions while entering confined / enclosed space. Describe procedure for Rescue from enclosed spaces. Exp lain procedure of manual lifting and carrying of weights. List the precautions while working aloft and over side. List the safety precautions while painting, during the use of personnel basket and while on mooring stations. List the precautions while painting funnel, main mast. List precautions while repairing radar. List precautions while operating hatch covers, using portable ladder. Explain method of guarding of openings on deck. List precautions while using hand tools. Marking of obstructions on the passage way on deck. List the safety precautions whilst walking/working on deck. Exp lain standard crane signals. List safety precautions while anchoring. List the safety precautions while entering battery room and paint room. List precaution while using bosun's chair and stages, rigging gangway and pilot ladder. List the precautions while using electric, pneumatic and hydraulic (power) tools and appliances. List the precautions while working with compressed air, chipping machines, spray painting machine. List precautions while cleaning holds using high pressure (water jet) machines. Describe safe bunkering practices. Procedure to carry out risk assessment.
Unit - V	**Safety Committee Meeting:** Exp lain Conduct of Safety Committee meetings. State Role of Safety committee and Safety Officer in maintaining safety standards on board. Exp lain importance of personnel health and hygiene on board ship. Exp lain 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 tag out.

TEXT BOOKS

1. Seamanship Technique-D.J.House

RECOMMENDED BOOKS FOR REFERENCE:

1. Theory and Practice of Seamanship - Danton G.
2. Seamanship Notes - Kemp & Young
3. Seamanship & Nautical Knowledge- Nicholls
4. International code of signals
5. Code of Safe Working Practices for Merchant Seamen
6. Seamanship-Capt V.K.Bhandarkar

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the General Parts of ship, watches, PPE and List names of various parts of ship.	K1
CO-2	Understanding Practical work with various types of ropes and materials to construct ropes.	K3
CO-3	Identify the various Flags and the terms of hoisting flags.	K5
CO-4	State the contents of code of safe working practices for merchant seamen and Safe Working Practices.	K4
CO-5	States Role of Safety committee and Safety Officer in maintaining safety standards on board.	K2

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B.Sc. Nautical Science

Semester – II					
Allied	**Course Code: 11625**	**Nautical Mathematics - II**	**T**	**Credit:3**	**Weekly Hours:3**
Pre-Requisite	**Basic Knowledge of Nautical Mathematics**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the Fourier Series and Find the Fourier Series expansion. 2. To define Laplace Transform and apply the definition of LT to transforms of elementary functions. 3. To understand the Statistical Methods and Find the mean using direct method for grouped data and mean, median, and mode of given data mean, median, and mode of given data 4. To Find a root of given equation by using Bisection method by Numerical Methods. 5. To understand and ability to Construct the table of differences for the given data.
	Specific Learning Objective
Unit - I	**Fourier series:** Define Inner product, Periodic function, Orthogonal function. State Dirichlet's conditions for Fourier Series expansion. State Euler's formulae. State Fourier Series in different interval **($\alpha < x < \alpha+2\pi$).** Find the Fourier Series for the function in the interval $0 < x < 2\pi$**.** Define Even and Odd functions, Expansion of even and odd function. Find F.S for given even/odd function. Define Sine series and Cosine series. Express the function as a half-range sine /cosine series.
Unit – II	**Laplace Transform:** Define Laplace Transform. Apply the definition of LT to transforms of elementary functions. Solve problems by using Laplace transform of standard functions. State different properties (linearity, shifting, transforms of derivatives and integrals, multiplication by the division by t) of Laplace Transforms. Find the LT of given function using different properties. Find the Inverse Laplace transform of given function using different properties. State Convolution theorem. Apply convolution theorem to evaluate the Inverse function.
Unit – III	**Statistical Methods:** Find the mean using direct method for grouped data. Find mean, median, and mode of given data. Define Range, quartile deviation, mean deviation, standard deviation. Calculate mean and standard deviation for the given data. Find lines of regression of y on x and x on y using least square methods. Find the correlation coefficient from the following data. Find the rank correlation coefficient from the following data.
Unit - IV	**Numerical Methods:** Find a root of given equation by using Bisection method. Find the real root of the given equation by using Method of False Position. Find by Newton's method, the real root of the given equation. Define Forward differences, Backward differences, Central differences, Divided differences. Define Other difference operators: Taylor's operator – D, shift operator E, averaging operator, Evaluate the forward difference of given function.
Unit - V	**Construct the table:** Construct the table of differences for the given data. Evaluate the backward difference of given function. Find the missing term from the table. State Newton's forward and backward difference interpolation formulas and calculate the given value. Evaluate using Lagrange's interpolation formula Evaluate the given definite integral by using Trapezoidal rule. Evaluate the given definite integral by using Simpson's rules.

TEXT BOOKS

1. Higher Engineering Mathematics - Dr. Grewal,B.S .

RECOMMENDED BOOKS FOR REFERENCE:

2. A Text book of applied mathematics Vol.I - Wartikar, P.N.&Wartikar,J.N
3. Further Engineering Mathematics –K.A.Stroud
4. Advanced Engineering Mathematics – Dr. A.B. Mathur&Prof. V.P.Jaggi
5. K Hoffman and R Kunze, Linear Algebra, Pearson Education, 2nd Edition, 2005
6. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, 9thEdition, 2011

Related online content (MOOC, Swayam, NPTEL, Websiteetc.)
https://mathworld.wolfram.com/SphericalTrigonometry.html
https://tutorial.math.lamar.edu/classes/calciii/DoubleIntegrals.aspx
https://www.geeksforgeeks.org/eigen-values/

Related online content (MOOC, Swayam, NPTEL, Websiteetc.)

Course Outcomes		**Knowledge level**
CO-1	Understanding the Fourier Series and Find the Fourier Series expansion .	K2
CO-2	Define and Understanding Laplace Transform and apply the definition of LT to transforms of elementary functions	K2
CO-3	Understanding the Statistical Methods and Find the mean using direct method for grouped data and mean, median, and mode of given data mean, median, and mode of given data.	K3
CO-4	Ability to find a root of given equation by using Bisection method by Numerical Methods.	K3/K4
CO-5	Ability to Construct the table of differences for the given data.	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – II					
Allied	**Course Code: 11626**	**Nautical Physics & Electricity-I**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Nautical Physics & Electricity**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the Electromagnetic Induction and Productionof Electro-magnetic induction and current. 2. Describe and understand about the AC Circuits and DC voltage, Resistances and capacitors in seriesand parallel, Impedance, static electricity precaution and earthling insulators. 3. Describe and understand about the Bridge circuits, Wheatstone Bridge, 4. To understand the Network Theorems and its application 5. Describe and understand the principle and working of AC generator, AC motor, induction motor, DC generator, DC motor. Describe and understand the Calibration, Accuracy, Precision, Methods of measurement of temperature, pressure etc.
	Specific Learning Objective
Unit - I	**Electromagnetic Induction:** Describe relation between magnetism and electricity, Production of Electro-magnetic induction and current. Describe Faraday-Lenz's Law, Self and Mutual inductance and their coefficients, coupling coefficients.
Unit – II	**A.C. Circuits:** Describe AC and DC voltage, Resistances and capacitors in series and parallel, Impedance, static electricity precaution and earthling insulators, [Shipboard Application: Electrostatic charge by petroleum and precaution]. Describe A.C. Fundamentals, Series and Parallel RLC circuits, Resonance frequency, Power, Power factor, Q factor and Applied Numerical.
Unit – III	**Electrical Bridge Circuits:** Describe Bridge circuits, Wheatstone Bridge, [Application of Wheatstone Bridge in Gas Measuring Instruments]. Explain definition of Q of coil. Applied Problems.
Unit – IV	**Network Theorems and its applications:** Describe Kirchoff's Law, Classification of Network elements,Constant Voltage and Current Source.
Unit - V	**Generators and Motors:** Describe principle and working of AC generator, AC motor, induction motor, DC generator, DC motor, R.M.S. value, series and shunt type DCmotor. Describe heating effect of current, heaters, fuses, thermoelectric effect. **Instrumentation:** Describe Calibration, Accuracy, Precision, Methods of measurement of temperature, pressure, Fluid flow, venture tube, sound levelmeter, Thermister and its application as heat sensors, transducers. [Shipboard application of above]

TEXT BOOKS

1) Basic Electrical Engineering- B.L.Thereja

RECOMMENDED BOOKS FOR REFERENCE:

1. Electricity and magnetism: Brijlal & Subramaniam
2. Fundamentals of physics: Nelkon
3. Applied physics: JH Clough-Smith
4. Instrumentation: measurement and Analysis – Nakra andChaudhary.
5. Instrumentation: Devices and system – Rangan, Mani,Sharma
6. Fundamental Of Electrical Engineering & Electronics- B.L.Thereja

Relatedonlinecontent(MOOC,S wayam, NPTEL,Websiteetc.)
www.courseera.org
www.udemy.com

Relatedonlinecontent(MOOC,S wayam,NPTEL,We bsiteetc.)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the Electromagnetic Induction and Productionof Electro-magnetic induction and current.	K2
CO-2	Describe and understand about the AC Circuits and DC voltage, Resistances and capacitors in seriesand parallel, Impedance, static electricity precaution and earthling insulators.	K3
CO-3	Describe and understand about the Bridge circuits, Wheatstone Bridge	K5
CO-4	Understanding the Network Theorems and its application	K4
CO-5	Describe and understand the principle and working of AC generator, AC motor, induction motor, DC generator, DC motor. Describe and understand the Calibration, Accuracy, Precision, Methods of measurement of temperature, pressure etc.	K5/K3

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B.Sc. Nautical Science

Semester - II					
Allied	**Course Code: 11627**	**Nautical Physics & Electricity – I**	**P**	**Credit:2**	**Weekly Hours:3**
Pre-Requisite	**Basic and Practical Knowledge of Nautical Physics & Electricity**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To understand and explain the KCL Verification of KVL and KCL Law theoretically and practically. 2. To find the ratio of inductance value of a coil having air core and iron core 3. To Study of R-L-C series resonance circuit and Study of R-L-C parallel resonance circuit. To understand Wheatstone Bridge and Derive the formula for the bridge circuit. 4. To understand the Heating Effect of Current, Use of Fuses. To understand the Fluid Flow Method – Determine Viscosity and Determine the viscosity of fluid by using formula. 5. To Define Venturimeter and Perform the experiment on Venturimeter apparatus. To determine the Performance of thermister experiment to find the temperature of hot water.
	Specific Learning Objective
Unit - I	**Verification of KVL &KCL:** Introduction to basics of electrical circuits. Define terms related to electrical circuits (like Node, Branch, Loop, Mesh etc.). State and explain the KVL. State and explain the KCL Verification of KVL and KCL Law theoretically and practically. Assessment **To find the ratio of inductance value of a coil having air core and iron core:** Define the parameters of choke coil. Explain the basic action of choke coil. Explain the active and reactive power of circuit. Explain the construction of choke coil for Air and Iron core Performance of choke coil experiments on practical setup. Assessment
Unit – II	**Study of R-L-C series resonance circuit:** Define the R, L and C parameters of circuit. Explain the combinations of RL, RC and RLC type series circuits. Derive the formulae for the RLC series circuit. Calculate the different parameters of series circuit (R, X_L, X_C, pf, power etc.). Verify the RLC series resonance condition and find out resonance frequency, Application of RLC Series circuit. Assessment **Study of R-L-C parallel resonance circuit:** Exp lain the combinations of RL, RC and RLC type parallel circuits. Derive the formulae for the RLC parallel circuit. Calculate the different parameters of parallel circuit (R, XL, XC, pf, power etc.). Verify the RLC parallel resonance condition and find out resonance frequency Application of RLC parallel circuit. Assessment
Unit – III	**Wheatstone Bridge:** Define the resistance and classified it. Explain the Wheatstone bridge arrangement Derive the formula for the bridge circuit. Performance of experiment to find the unknown resistance of different wires, Applications of Wheatstone bridge circuit. Assessment **Heating Effect of Current, Use of Fuses:** Define Fuse and its types. Construction of different types of fuse. Working of fuse in LV and HV circuits. Applications of fuse in different appliances. Assessment
Unit – IV	**Fluid Flow Method – Determine Viscosity:** Define fluid flow. Explain the different types of fluids. Type of fluid flow. Explain the properties of fluid. Determine the viscosity of fluid by using formula. Application to determine the Viscosity of fluid. Assessment
Unit – V	**Study of Venturimeter:** Define importance of flow measurement. Define Venturimeter. Explain the working principle of Venturimeter. Explain the construction of Venturimeter. Perform the experiment on Venturimeter apparatus. Application of Venturimeter in different field. Assessment **Use of thermister as temperature / heatsensor:** Define the temperature sensors. Explain the types of thermistors according to resistance change (like NTC & PTC). Performance of thermister experiment to find the temperature of hot water. Draw a graph between resistance Vs temperature change. Application of thermister in different fields. Assessment

Related online content (MOOC, Swayam, NPTEL, Websiteetc.)		
Course Outcomes		**Knowledge level**
CO-1	Understanding and explain the KCL Verification of KVL and KCL Law theoretically and practically	K2
CO-2	Understanding and to find the ratio of inductance value of a coil having air core and iron core	K2
CO-3	Study of R-L-C series resonance circuit and Study of R-L-C parallel resonance circuit	K3
CO-4	Ability understand Wheatstone Bridge and Derive the formula for the bridge circuit.	K4
CO-5	Ability to understand the Heating Effect of Current, Use of Fuses. Understanding the Fluid Flow Method – Determine Viscosity and Determine the viscosity of fluid by using formula	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – II					
SEC -II	**Course Code: 11628**	**Fundamentals of Computer Science**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge and Practicals of Computer Science**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1.To Understand the Computer binary, hexadecimal, BCD number system 2.To Learn Computer types of memory 3. To understand E commerce, internet and Intranet for E-business 4. To Learn MS office, Ms Excel, MS PowerPoint 5. To Learn Phython data types, Loop Statement, demonstrate file handling using python
	Specific Learning Objective
Unit - I	**Computer Arithmetic:** Understand Binary, octal, decimal & hexadecimal number Systems & mutual conversion. Solve Addition, Subtraction, Multiplication, Division, 1's & 2's complement method of subtraction in binary only. Solve Binary codes: BCD numbers, Excess – 3 code, ASCII code, EBCDIC code Gray code.
Unit – II	**Computer Memory:** Explain in details Main Memory, Secondary Memory, Backup Memory, Cache Memory, Real and Virtual Memory. Explain in details System Software and Programming Techniques: Machine language, Assembly language, Low level and High level Languages, Compiler, Assembler, and Interpreter.
Unit – III	**E- Commerce:** Explain in detail IT and business, E-commerce: Concepts Electronic Communication, Internet and intranets. Explain in detail howEDI to E-commerce. Concerns for E- commerce Growth. Explain in detail how Cyber Cash, Dig cash.
Unit – IV	**MS Word MS Excel and MS PowerPoint:** Explain in detail how Create workbooks, working with rows, columns, cells and Worksheets. Explain in detail how Insert pictures and graphics. Format cells. Explain in detail how Use conditional formatting on data in cells, Demonstrate Advanced Calculations Create formulas, employ the function wizard,add comments, Create charts. Demonstrate Use spelling and grammar checks in the document. Demonstrate Use "Headers and Footers". Demonstrate Insert symbols and pictures. Demonstrate Create tables in MS-Word. Explain in details Use formulas in MS –WORD Mail merge, Embedding Excel to WORD. Demonstrate Create a presentation: Create a slide, Add new slides. Demonstrate Insert pictures, Format text, Format pictures, and Preview a presentation. Animate text , animate graphics, create slide transitions, Advance slidesautomatically, Preparing Live Presentations, Make presentationportable. Demonstrate Insert tables and charts, Employ design templates, employ a master slide, and rearrange slides.
Unit - V	**Python:** Explain in details Python operators, datatypes. Explain in details condition statements. Explain in details Loop control statement. Explain in details different types function or methods in python Explain , demonstrate file handling using python.

TEXT BOOKS

RECOMMENDED BOOKS FOR REFERENCE:

2. Information Technology for management: Henry Lucas, Tata Mc-Graw Hills
3. The Complete E-Commerce Book: Design, Build, and Maintain a Successful Web-Based Business: JaniceReynolds
4. MS Office 2007 By Gary Shelly, Thomas Cashman
5. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh.

6. Basics of Computer Science- Behrouz Forouzan, Firouz Maosharraf.
7. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O„Reilly Publication
8. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress
9. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries, et al., Pragmatic Bookshelf, 2/E 2014
10. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python", Green Tea Press, 2002.
11. Computer Concepts and Fundamentals of Programming By Ganesh Ingle.

Related online content

Course Outcomes		**Knowledge level**
CO-1	Understanding the Computer binary, hexadecimal, BCD number system	K2
CO-2	Understanding and Learning Computer types of memory	K2
CO-3	Understanding E commerce, internet and Intranet for E-business	K1
CO-4	Ability to Learn MS office, Ms Excel, MS PowerPoint	K4
CO-5	Ability to Learn Phython data types, Loop Statement, demonstrate file handling using python	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - II					
SEC - III	**Course Code:** 11629	**Meteorology & Environmental Studies**	**T**	**Credit:2**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Meteorology and Environmental Studies**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To understand the Multidisciplinary nature of Environmental Studies . 2. To understand and Describe the Natural Resources, renewable and non-renewable resources. 3. To understand and the Describe concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem. Introduction to Biodiversity and its conservation, Bio-geographical classification of India 4.To understand and Describe the composition of the earth's atmosphere, mentioning dry air and its constituents. To understand and Define 'wind' and its effect, Describe the Beaufort scale of wind force. 5. To understand the Cloud and Precipitation**,** State that clouds form when air containing water vapour rises, cools adiabatically and becomes saturated.
	Specific Learning Objectives
Unit - I	**The Multidisciplinary nature of Environmental Studies:** Definition, Scope and importance, Need for public awareness **Natural Resources:** Describe renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. b) Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. c)Mineral resources: Use and exploitation, environmental 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. 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 life styles.
Unit – II	**Ecosystems :** 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. Introduction, types, characteristic features, structure and function of the following ecosystem: forest ecosystem, grassland ecosystem, Desert ecosystem, Aquatic ecosystems(ponds, streams, lake, rivers, oceans, estuaries) **Biodiversity and its conservation :** Introduction- Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Va lue of biodiversity: 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, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Unit – III	**Environmental Pollution:** Definition: causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effect and control measures of urban and industrial wastes. Role of

	an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides. **Social Issues and the Environment:** From Unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion. Nuclear accidents and holocaust. Case studies. Wasteland reclamation, Consumeris m and waste products, Environment Protection Act, air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, wildlife Protection Act, Forest conservation Act, Issues involved in enforcement of environmental legislation, Public awareness. **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, Role of Information Technology in Environment and human health, CaseStudies.
Unit - IV	**Earth's Atmosphere:** Describe the composition of the earth's atmosphere, mentioning dry air and its constituents, water vapour and aerosols. 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. 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. Exp lain the Greenhouse effect and global warming. Exp lain heat e xchange process (conduction, convection and radiation). Exp lain radiation budget of the earth/atmosphere system. Explain environmental lapse rate and inversion. Expla in Diurnal, seasonal and geographical variation of temperature, Dry Adiabatic Lapse. Rate (DALR) and Saturated Adiabatic Lapse Rate (SALR), Saturation; Evaporation, Condensation, Latent Heat, and Vapour Pressure. Explain Ozone depletion and air pollution. **Atmospheric Pressure:** State that pressure equals force per unit area. State that the atmosphere e xerts a pressure on any surface placed within it. State that the atmospheric pressure on a unit area of a surface is equal to the weight of the "air column" e xtending from that surface to the outer fringes of the atmosphere. State that atmospheric pressure decreases with height above sea level. State that atmospheric pressure acts in all directions. State that the basic unit of pressure is N/ m2. State that 1 millibar = 1/ 1000 bar = 102 N/ m2. State that the atmospheric pressure at sea level normally varies between about 940 mbar and 1050 mbar. State that the average pressure at sea level is 1013.2 mbar. State that the surface pressure rises if air is added to the 'column' above the surface, and vice versa. Define 'isobar, Diurnal variation of pressure, Barometric tendency, Pressure Gradient.
Unit – V	**Wind:** Define 'wind' Describe the Beaufort scale of wind force. Exp lain qualitatively the pressure gradient force. Exp lain qualitatively the Coriolis (geostrophic) force and cyclostrophic winds. Exp lain the surface wind circulation around high- and low-pressure centres. Exp lain Buys-Ballot's Law. Explain the method of estimating the strength of the wind from the appearance of the sea surface, using the Beaufort wind scale. List the factors, other than the wind speed, which affect the appearance of the sea surface. Exp lain the differences between apparent and true wind. Determine the true wind velocity by using a vector diagram, given the apparent wind and the ship's course and speed. Describe the method of estimating the wind direction from the appearance of the sea surface. Explain interpretation of wind rose. **Cloud and Precipitation:** State that clouds form when air containing water vapour rises, cools adiabatically and becomes saturated. Describe the need for and define condensation nuclei. State that a cloud can consist of ice crystals, supercooled water droplets, water droplets or any combination of these. List and describes the ten basic cloud types. Describe the probable base heights of the ten principal cloud types. Define 'precipitation', 'rain', 'drizzle', 'hail', 'snow' and 'sleet', Dew.

TEXT BOOKS

1. Marine Meteorology- Capt. H. Subramaniam
2. Textbook of Environmental Studies for UG Courses-Erach Bharucha

RECOMMENDED BOOKS FOR REFERENCE:

1. Meteorology for Mariners – HMSO
2. Meteorology for seafarers – Frampton, R. M.
3. Meteorology Demystified :self-teaching guide – Gibilisco Stan
4. Meteorology for Sea –Sanderson Ray
5. Mariners Handbook (NP 100) – Admiralty
6. Cloud types for Observers – HMSO
7. Agarwal, K.C.2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
8. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380013, India , Email: mapin@icenet.net(R)
9. Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc.480p.
10. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
11. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001,Environmental Encyclopedia, JaicoPubl, Mumbai, 1196p.
12. De A. K., Environmental Chemistry, Wiley Eastern Ltd.
13. Down to Earth, Centre for Science and Environment (R)
14. Gleick, H. P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security.Stockholm Env.Institute.Oxford Univ. Press 473p.
15. Hawkins R.E, Encyclopedia of Indian Natural History, Bombay Natural History Society,Bombay (R)
16. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment.Cambridge Univ. Press 1140p. 18. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws.Himalaya Pub. House, Delhi 284p. 60
17. Mckinney, M.L. & School R.M. 1996. Environmental Science system & Solutions, Webenhanced edition. 6396p.
18. Mhaskar A.K, Matter Hazardous, Techno-Science Publications (TB)
19. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
20. Odum, E.P.1971. Fundamental of Ecology.W.B.Saunders Co. USA 574p.
21. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd.345p.
22. Sharma B.K., 2001. Environmental Chemistry.Goel Publ. House, Meerut
23. Survey of the Environment, The Hindu (M)
24. Townsend C., Harper J. and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
25. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
26. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB)
27. Wagner K.D. ,1998. Environmental Management.W.B. Saunders Co. Philadelphia, USA 499p.

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the Multidisciplinary nature of Environmental Studies. Understanding and Describe the Natural Resources, renewable and non-renewable resources.	K2
CO-2	Understanding and the Describe concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem	K2
CO-3	Introduction to Biodiversity and its conservation, Bio-geographical classification of India	K1
CO-4	Understanding and Describe the composition of the earth's atmosphere, mentioning dry air and its constituents.	K2
CO-5	Understanding and Define 'wind' and its effect, Describe the Beaufort scale of wind force. Understanding the Cloud and Precipitation, State that clouds form when air containing water vapour rises, cools adiabatically and becomes saturated.	K2

ALAGAPPA UNIVERSITY
B.Sc. Nautical Science

Semester - II					
SEC - IV	**Course Code: 116210**	**English Communication Lab**	**P**	**Credit:1**	**Weekly Hours:2**
Pre-Requisite	**Basic Practical Knowledge of English Communication**		**Syllabus Revised**		**2023 - 24**

Course Objectives	1. To understand Vowels and Consonants, and Describe the term 'phonology' and its application in communication. 2. To understand Maritime English and Introduction to SMCP and English Language among Multilingual Crew. 3. To Develop vocabulary, One-word Substitutes, Prefixes, Suffixes, Idioms, Phrases. 4. Developing Listening Skills, Listening training, speeches of people of different backgrounds and region 5. Developing Speaking Skills, Speaking activities in various contexts.
	Specific Learning Objectives
Unit – I	**Introduction to English Phonology:** **Speech Sounds- Vowels and Consonants** Describe the term 'phonology' and its application in communication. List the speech sounds with one example of each. Classify the speech sounds of English. Differentiate between a consonant sound and a vowel sound. Describe the following terms with examples: Consonant, Monophthong, and Diphthong. Match the sounds with words. Identify English sounds. **Consonant Clusters,** Word Stress, Intonation, Sentence Stress. Describe the following terms with examples: Syllable, Consonant clusters, Word stress, Intonation, and Sentence Stress. Transcribe the phonetics into words and vice versa.
Unit – II	**Introduction to SMCP and English Language among Multilingual Crew:** **Maritime English** Define Maritime English and e xp lain its features. Compare Genera l English and Maritime English. Define the terms related to maritime English. Match the terms (Maritime industry-specific vocabulary) with their meaning. **Standard Marine Communication Phrases (SMCP):** Exp lain the importance of SMCP in maritime practice. Describe the position of SMCP in Maritime Education and Training. List the spelling of letters, Message Markers, Distress, Urgency and Safety Signals. Illustrate the application of Corrections, Readiness, Repetition, Numbers, Positions, Bearings, Courses, Distances, Speed, Time, and Geographical Names List and describe the Ambiguous words in SMCP.
Unit – III	**Developing voc abulary:** **One-word Substitutes**, Prefixes, Suffixes, Idioms, Phrases. Find the error(s) in the sentence/paragraph. Underline the error(s) in the sentence/paragraph and rewrite. Select the correct option. Select the wrong pair from the given pairs. Fill the gap(s) in the sentence/paragraph. (Cloze test). Match Part-A with Part-B.
Unit – IV	**Developing Listening Skills:** **Listening training:** speeches of people of different backgrounds and regions,preferably native speakers of

	English. Listen to a speech and analyse it. (Tone, diction, and pronunciation) ompare the speeches made by the speakers of different backgrounds and regions. **Listening exercises:** listening for general content, listening to fill up information, Intensive listening, listening for specific information. Listen to an audio clip and answer the questions. Listen to an audio clip for different purposes (for general content, for filling up information, for intensive listening, for specific information, etc.).
Unit – V	**Developing Speaking Skills:** **Speaking acti vities in vari ous contexts:** Describing objects/situations/people, Making. Requests and Seeking Permissions, Giving Directions and Gu idelines, Agreeing and Disagreeing, Exte mpore Speeches, Welcome Speech, and Vote of thanks. Describe and discuss an object, a situation, a person. Compose and make a conversation on a given situation/topic.Make a speech on a given topic. Prepare a welcome note/vote of thanks for an event. **Making a Presentation:** individual and group presentation, Content Structuring, Preparation & Planning. Define the importance of body language in a presentation. Plan and make a group presentation on a given topic. Exp lain communicating ideas/views to seniors/peer group/subordinates. Explain Norms and etiquettes of public speaking. **Preparation of CV**, Facing Interview. Prepare CV. Explain the process for an interview. Answering frequently asked questions in a job interview. Organise and participate in a mock interview. **Group Communication:** Group Discussion (GD), Role Play. State purpose of Group Discussion and its objectives. List and name types of Group Discussion- Issue-based, Abstract, Role Play, and Case Study. Compare Group Discussion and debate. Participate in role-play activities. **Book Review**

TEXT BOOKS

1. Kumar, Sanjay, and Pushp Lata. *Communication Skills: A Workbook* . Oxford University Press,2018.
2. Managing Softskills for Personality development by B.N.Ghosh

RECOMMENDED BOOKS FOR REFERENCE:

1. Softskills –Dr K.Alex
2. Balasubramanian, T. *English Phonetics for Indian Students*. Laxmi Publications, 2018.
3. Hancock, Mark. *English Pronunciation in Use: Intermediate*. Cambridge University Press,2009.
4. Hewings, Martin. *English Pronunciation In Use: Advanced* . Cambridge University Press,2007.
5. Jones, Daniel. *Cambridge English Pronouncing Dictionary*. Cambridge University Press,2012.
6. Koneru, Aruna. *Professional Speaking Skills*. Oxford University Press, 2015.
7. Lowndes, Leil. *How to Talk to Anyone*. Harperelement, 2014.
8. Phillips, Sam. *3000 Idioms and Phrases*. Goodwill Publishing House, 2020.
9. Tanka, Judith, and Lida R. Baker. *Interactions 2: Listening/Speaking*. Tata Mcgraw Hill Education Pvt. Ltd. 2011.

Related online content		
Course Outcomes		**Knowledge level**
CO-1	Understanding Vowels and Consonants, and Describe the term 'phonology' and its application in communication.	K2
CO-2	Understanding Maritime English and Introduction to SMCP and English Language among Multilingual Crew.	K2
CO-3	Developing vocabulary, One-word Substitutes, Prefixes, Suffixes, Idioms, Phrases.	K6
CO-4	Ability to Develop Listening Skills, Listening training, speeches of people of different backgrounds and region	K4
CO-5	Ability to Develop Speaking Skills, Speaking activities in various contexts.	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – III					
Core	**Course Code: 11633**	**Navigation – II**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Navigation and Calculations**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand Celestial Sphere and Equinoctial System of Coordinates. 2. To understand the Solar System, the composition and dimensions of the Solar System. 3. To understand and Describe the concept of earths axial rotation causing change in hours angle of the body Define Greenwich hour angle (GHA), Local hour angle (LHA), sidereal hour angle, declination, longitude and expla in their relationship. To understand the Define sextant altitude, Apply Altitude Corrections to find True Altitude. To understand the Daily Motion of the Celestial Bodies and Horizontal System of Coordinates. 4. To understand Latitude by Meridian Altitude**,** Calculation of latitude by meridian altitude of Sun. 5. To understand and read the Nautical Almanac**,** Describe the information contained in general in the Nautical Almanac and in detail the daily pages.
	Specific Learning Objectives
Unit – I	**Celestial Sphere and Equinoctial System of Coordinates:** Describe the celestial sphere. Exp lain the apparent annual motion of sun and the concept of ecliptic. Define celestial poles, celestial meridian, equinoctial, Vertical circles, Prime vertical and obliquity of ecliptic. State the equinoctial as fixed reference plane and the direction of first point of Aries as reference direction (ignoring the effect of precession) Describe the equinoctial systemof coordinates. Calculation based on the above. **Solar System:** State the composition and dimensions of the Solar System. Explain Kepler's laws of planetary motion. Name inferior and superior planet. Describe the Earths elliptical orbit and state approximate aphelion and perihelion distance and date. Explain the eccentricity of earth's orbit. 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. State the date of solstice and equinoxes. Explain the concept of earths axial rotation giving day and night. Explain the varying length of daylight throughout the year. Explain the daylight and darkness condition in various latitudes at the solstice and equinoxes. Describe the significance of tropic of Cancer and Capricorn and of Arctic and Antarctic circles. Earth and Moon system; Phases of moon; Solar and lunar eclipses; Condition necessary for occurrence of solar or lunar eclipse; Umbra and Penumbra.
Unit – II	**Hour Angle and Time:** Describe the concept of earths axial rotation causing change in hours angle of the body . Define Greenwich hour angle (GHA), Local hour angle (LHA), sidereal hour angle, declination, longitude and exp lain their relationship. Define Time and hour angle, Greenwich time, Zone time, Standard time, GM T, LMT, relationship between longitude and time. Describe the rate of change of GHA of sun and Aries, Polar distance and Right Ascension (RA). Position of heavenly body on celestial sphere by its declination and GHA or by its altitude and azimuth. Identify the tabulation of SHA, GHA and declination (d and v corrections) in Nautical almanac for all celestial bodies. Determine the geographical position of a body for any given GMT. Calculation based on above.
Unit – III	**Altitude Corrections:** Define sextant altitude. Demonstrate how to retrieve and return the sextant into the storage box. Demonstrate how to read a se xtant. Show how to correct a se xtant into which has been introduced one or more of errors of perpendicularity, side error or index error. Demonstrate how to find the index error of the sextant by the horizon. Describe how to find index error of the sextant by the sun. Demonstrate use of sextant for taking horizontal and vertical angles.

	Describe the purpose of altitude correction. Define visible, sensible and rational horizons. Define observed altitude and true altitude. Define dip, refraction, semi-diameter and parallax and e xpla ins their causes. Illustrates the effect of terrestrial refraction on dip and the distance of the sea horizon. Demonstrate the use of alt itude and low altitude correction tables in nautical almanac. Obtain the true zenith distance from the true altitude of the body. Calculation based on above. **Daily Motion and Horizontal System of Coordinates:** Define Rational horizon, Zenith and Nadir, elevated pole and depressed pole. Define the observers upper and lower celestial meridian. Exp lain the true and apparent motion of bodies. Exp lain the relationship between azimuth and quadrantal bearings and 360 degrees' notation bearing. 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.
Unit – IV	**Latitude by Meridian Altitude:** 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 lat itude have same name and different name. Describe the relationship between altitudes of elevated pole and the latitude of the observer. Find the value of polar distance of the body, using its declination. 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. Define a position line/position circle. Describe the direction of the position line through the observer when taking a meridian altitude. Time of the meridian passage of Sun. Calculation of latitude by meridian altitude of Sun.
Unit - V	**Nautical Almanac:** Describe the information contained in general in the Nautical Almanac and in detail the daily pages. Use the table of correction and incremental correction in Nautical Almanac. Find the LHA of the body, given the date, GMT and longitude of the observer. Find the LHA of Aries, given the date, GMT and longitude of the observer. Exp lain what is meant by sidereal hour angle of a star and obtains it from the Nautical Almanac. Derive LHA of a star from the LHA of Aries and SHA of the star. Demonstrate the uses of the information in Nautical Almanac to obtain the LMT of meridian passage of the body to the nearest minute and interpolates for the observer's longitude when necessary.

TEXT BOOKS

1. Principles of Navigation by Capt. S.S.S Rewari& Capt. T.K.Joseph
2. Practical Navigation by Capt. H.Subramanium
3. Nautical Almanac

RECOMMENDED BOOKS FOR REFERENCE:

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. Navigation Guide Vol. 2: Celestial Navigation- Alexander Simpson
4. Practical Navigation for Officers of the Watch- Frost, A
5. NAV Basics: Ocean Offshore and Celestial Navigation Vol.2- Witherby SeamanshipInternational Ltd.
6. Nories Nautical Tables

Related online content (Marine Insight. Marinegyaan. Oways online)

Course Outcomes		Knowledge level
CO-1	Understanding Celestial Sphere and Equinoctial System of Coordinates.	K2
CO-2	Understanding the Solar System, the composition and dimensions of the Solar System.	K2
CO-3	Understanding and Describe the concept of earths axial rotation causing change in hours angle of the body . Define Greenwich hour angle (GHA), Local hour angle (LHA), sidereal hour angle, declination, longitude and explain their relationship.	K1/K6
CO-4	Understand and Define sextant altitude, Apply Altitude Corrections to find True Altitude. Ability to identify the Daily Motion of the Celestial Bodies and Horizontal System of Coordinates.	K4
CO-5	Understanding Latitude by Meridian Altitude**,** Calculation of latitude by meridian altitude of Sun. Understanding and read the Nautical Almanac**,** Describe the information contained in general in the Nautical Almanac and in detail the daily pages.	K4

ALAGAPPA UNIVERSITY

SEMESTER – III

Semester – III					
Core	**Course Code: 11634**	**Ship Stability – I**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Ship Stability**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the Laws of flotation and Explain Archimedes Principle & Principle of flotation. 2. To understand Stability Terminology and Calculate Displacement given maximum length, breadth, draft anddensity of water & Cb. To understand Centre of Gravity of ship and factors affecting the same. 3. To understand Centre of Buoyancy & Centre of Flotation and Density, Draft & Displacement. To understand Transverse Statical Stability and Equilibrium of Ships. 4. To understand Free Surface effect **and** Sketch the midship transverse section of a heeled ship & e xp lain Free Surface Effect. Define List as the transverse inclination caused when the COG of the ship is off the centre line. 5. To Demonstrate the use of Ship and Hydrostatic particulars of M.V. Hindship.
	Specific Learning Objectives
Unit - I	**Laws of flotation:** Exp lain Archimedes Principle & Principle of flotation. Compute underwater volumes of regular geometrical shapes and solve numerical on flotation. Define Centre of Buoyancy as the geometric centre of the underwater volume & the upthrust by the water is known as Buoyancy. Define Reserve buoyancy as the above water enclosed volume which provides buoyancy in case vessel becomes heavier. Define Load Displacement, Present displacement, Light displacement, Deadweight, Deadweight aboard & Deadweight available. Show mathematically Deadweight = Load displacement – Light displacement, Deadweight Available = Load displacement – Present. displacement & Deadweight aboard = Present displacement – Light displacement. Explain how the draft of a vessel changes due to change of density. **Stability Terminology:** Sketch and define TPC. Show that TPC = density x A/100. Define Fresh Water Allowance (FWA). Show that FWA in cm can be calculated using formula W/40 TPC. Define Dock Water Allowance (DWA). Calculate TPC, FWA & DWA in various densities. Sketch & define Block co-efficient (Cb), Water-plane coefficient (Cw), Mid-ship Coefficient (Cm), Pris matic Coefficient (Cp). Show the relationship between Cp, Cb & Cm. Calculate TPC given maximum Length, breadth of water plane, density of water & Cw. Calculate Displacement given maximu m length, breadth, draft and density of water & Cb.
Unit – II	**Centre of Gravity :** Define Centre of gravity of ship and factors affecting the same. 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. Calculate movement of COG when only one operation is carried out using GG1 formula. Calculate KG of a Ship when multiple operations are carried out using moments about the keel. 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. Exp lain the effect on the position of centre of gravity of a ship byadding, removing and/or shifting weights. **Centre of Buoyancy & Centre of Flotation:** Define Centre of buoyancy and factors affecting the same. 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. Define Longitudinal Centre of Buoyancy (LCB) & factors affecting their positions. Calculate KB & LCB of a ship with regular geometrical shapes. Define Centre of Floatation and factors affecting its position.

	Density, Draft & Displacement: Construct Displacement, TPC & Deadweight curves to scale for a given data. Use displacement and TPC curves to determine weights of cargo or ballast from draughts or freeboards.
Unit – III	**Transverse Statical Stability:** Draw the midship diagram for a box shaped vessel & show Keel, COB, COG, Metacentre, Metacentric height, righting lever. Explain Righting Moment can be calculated as a product of displacement & Righting Lever. State the Wall sided Formula for calculating Righting lever for large angles of heel. Calculate Moment of Statical Stability for s mall as well as large angles of heel. Define Stiff and Tender ships. Compare and contrast the variouscharacteristics of stiff and tender ships. **Equilibrium of Ships:** Define Stable, unstable and neutral equilibrium. Sketch the midship transverse section of a box shaped vessel to show Stable equilibrium. Sketch the midship transverse section of a box shaped vessel to show Unstable equilibrium. Sketch the midship transverse section of a box shaped vessel to show neutral equilibrium.
Unit – IV	**Free Surface effect:** Sketch the midship transverse section of a heeled ship & explain Free Surface Effect. State formula for calculating Free Surface correction (FSC) due to single slack tank. State formula for calculating Free Surface correction (FSC) due to multiple slack tanks. State formula for calculating Free Surface Correction (FSC) when tanks are subdivided into identical compartments. Calculate FSC due to slack tanks and compute GM (fluid). **List:** Define List as the transverse inclination caused when the COG of the ship is off the centre line. State the difference between and list & heel. Sketch the midship transverse section of a listed ship and show Tan Θ = GG1/GM State that the GM considered for calculating List will always be GM(Fluid). Calculate List while Loading, Discharging and/or shifting weights. Exp lain procedure to correct List by loading, discharging or shifting weights. Solve numerical for correction of List.
Unit – V	**M.V. HINDSHIP:** Demonstrate the use of Ship and Hydrostatic particulars of M.V. Hindship. Apply knowledge of above topics & calculate numerical from 1to 43 from M.V.Hindship.

TEXT BOOKS

1. Ship Stability at the Operational Level- Capt. Subramaniam H
2. Stability, trim and cargo calculations on M.V. Hindship and Oil Tankers- Capt. Joseph & Capt. Rewari
3. Stability Table Trim & stability particulars of M.V. Hindship (Stability tables)-Bhandarkar Publication.

RECOMMENDED BOOKS FOR REFERENCE:

1. Ship Stability for Masters & / Mates – C.B.Barrass and D.R.Derrett
2. Ship Stability for Mates & Masters – Martin A. Rhodes

Related online content (Marine Insight. Marinegyaan. Oways online)

Course Outcomes		Knowledge level
CO-1	Understanding Laws of flotation and Explain Archimedes Principle & Principle of flotation.	K2
CO-2	Understanding Stability Terminology and Calculate Displacement given maximum length, breadth, draft and density of water & Cb.Understanding Centre of Gravity of ship and factors affecting the same.	K2
CO-3	Ability to understand Centre of Buoyancy & Centre of Flotation and Density, Draft & Displacement. Ability to understand Transverse Statical Stability and Equilibrium of Ships.	K1
CO-4	Understanding Free Surface effect **and** Sketch the midship transverse section of a heeled ship & explain Free Surface Effect. Understanding and Define List as the transverse inclination caused when the COG of the ship is off the centre line.	K4
CO-5	Understanding and Demonstrate the use of Ship and Hydrostatic particulars of M.V. Hindship.	K4

ALAGAPPA UNIVERSITY

SEMESTER – III

Semester – III					
Core	**Course Code: 11635**	**Voyage Planning & Collision Prevention (BA Chart.813)**	**T**	**Credit:3**	**Weekly Hours:3**
Pre-Requisite	**Basic Knowledge of Voyage Planning and Chart Work**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. Introduction and Familiarization with Charts and Chart Catalogue. 2. To Obtain Information from Charts, Chart Datum, Lights, understanding the basic ideology of Traffic Separation Schemes. 3. To Demonstrate the procedure of Chart correction as per Admiralty Publication NP 294 including:Use of Tracings, Carrying out correction of Blocks. 4. Exercises in Chart Work, Determines the latitude and longitude of any point on the chart by use of: Parallel rulers, Set Squares and Dividers. 5. To understand and familiar with Conduct of vessels in any condition of Visibility, In sight of one another andin Restricted Visibility (Rule 1-19)
	Specific Learning Objectives
Unit - I	**Familiarization with Charts and Chart Catalogue** **Recognizes** the following on the chart – Chart Title, Chart Number, Scale of Chart, Date of Publication, Edition Number / Date, Details of Publisher / Hydrographic Office, Source Data **Lists out** the different types of Charts (Navigational& Thematic) – Small Scale – Ocean Charts, Large Scale – Coastal and Harbour Charts, Routeing Chatrts, Routeing Guides, Plan Charts.Describes Mercator and Gnomonic Chart Projections and states the uses and advantages of both Recognizes a Chart catalogue (Indian / Admiralty) and defines a Chart Folio. Determines the Charts required for a voyage using the Chart Catalogue
Unit – II	**Obtain Information from Charts: Chart Datum –** Exp lains the importance of Chart datum, Recalls the reference points and the units for heights and depths marked on the chart. Describes Depth and height contours. Identifies the nature of the sea bottom and discusses the importance ofthis information. **Lights (All) –** Describes the characteristics of the light, Describe Geographica l range of a Light. Exp lain Nominal Range of a Light. Recall the difference between when a " light is first sighted" and a"light is first raised". Calculate the sighting of a light using the Luminous Range Diagram. **Lights (Select) –** Identifies Leading Lights, States the use of Leading lights. Identifies Sector lights. States the advantages of Sector lights. Demonstrates the use of Clearing Bearings. **Traffic Separation Schemes –** Identifies the established direction of Traffic Flow, Identifies the Traffic lanes, Identifies the Traffic Separation Zones, Identifies the Inshore Traffic Zone, Identifies points on land, Identifies Radar Responsive (conspicuous) Targets. Compass Rose & Distance Scale. Identifies the Compass Rose on the Chart, Calculates the variation at the place, Measures the Distance between 2 points on the chart, Discuss why the adjacent latitude scale should be used for measuring distances. Identifies the Chart Symbols as given in INT 5011 limited to the symbols for the following: Rock, wreck, obstructions, depths and nature of sea bed, tidal stream, current, offshore installation, platform, mooring, submarine cable, submarine pipeline, t ide and current, depths, tracks, routes, areas and limits, traffic lanes and separation zones
Unit – III	**Chart Correction & Updates:** Describes the contents and expla in the use of:Annual Summary of Notices to Mariners, Cumulative Notices to Mariners, Weekly Notices to Mariners. Demonstrates the procedure of Chart correction as per Admiralty Publication NP 294 including:Use of Tracings, Carrying out correction of Blocks, Correction of T&P notices, Recording the updates in NP 133 A. Describes the process of checking newly received charts for the last correctiondone including finding the date the chart was last brought up to date

Unit – IV	**Chart Work Exercises:** Determines the latitude and longitude of any point on the chart by use of: Parallel rulers, Set Squares and Dividers. Demonstrates plotting position on the chart by means of: Latitude & Longitude, Bearing & Distance off from a Navigational mark, Compass bearings of two or more shore objects. Calculates the Compass Errors including:Defines True, Magnetic and Compass North, Defines Va riat ion and Deviation, Computes Variat ion from the Chart, Computes Deviation from the Deviation table, Gy ro Error, Applying the compass error to ship's head and compass bearing to convert to true. Uses Transit bearings to determine compass error. Identifies vessel's position and Compass error using: Two Horizontal Se xtant Angles, One Range and One Horizontal Sextant Angle, One Bearing and One Horizontal Sextant Angle. Determines vessels position from Raising and dipping of lights. Determines the Compass Course and distance between any two points on the chart. Plots a course to pass a lighthouse at a given distance and bow angle including beam bearing and special angles
Unit - V	**Conduct of vessels in any condition of Visibility, In sight of one another and in Restricted Visibility (Rule 1-19)** Collision Prevention Regulations – Rule 1 to 19 Exp lains that the OOW is responsible for navigating safely, with particular regard to avoiding collision and stranding and with reference to STCW Chapter VIII. Explains that the IRPCS(COLREGS) is a convention and must be mandatorily applied. States & Exp lains all the general definitions, which apply throughout the Rules. Distinguishes between 'Underway" and "Making way". Exp lains the importance of maintaining a proper lookout. States the factors to be taken into account in determining Safe Speed. Describes how the use of Radar affects determination of Safe Speed. Explains what is meant by "Risk of Collision". Describes how the Radar Equipment is used to determine whether Risk of Collision e xists. Exp lains the dangers of making assumptions on the basis of scanty information, cit ing e xa mples from clear weather as well as use of radar. States the benefit of long range scanning and systematic planning Exp lains how failure to plot the target ship may lead to a lack of appreciation of a developing situation. Exp lains the following actions to avoid collision referred to in Rule 8. Positive action, In ample time, Large enough to be readily apparent, Alteration of course alone, Passing at a safe distance, Checking the effectiveness of the action taken, Reduction of speed, Taking all way off, Finally past and clear. Describes how 'proper and effective action' and 'within a distance appropriate to the prevailing circumstances and conditions' may be interpreted. Defines the terms 'Narrow Channel' and 'Fairway'. Describes how to proceed along a narrow channel or fairway List out the restrictions on crossing a narrow channel or fairway. Describes the procedure for overtaking in a narrow channel. Describes the actions to be taken while nearing a bend in a narrow channel. Defines 'Traffic lane', 'Separation Line', 'Separation Zone' and 'InshoreTraffic Zone'. Demonstrates how to Navigate in a TSS with reference to: Entering and Leaving the TSS, Entering and Leaving the Traffic Lanes, Crossing Lanes, The use of Inshore Traffic Zones, Crossing separation lines or entering separation zones other than when crossing, joining or leaving a lane, Lists the requirements for vessels while in or near a TSS, Navigating in areas near the termination, Anchoring, Engaged in Fishing, Not using the TSS. States that a vessel of less than 20 m or a sailing vessel must not impede the safe passage of a power driven vessel when following a traffic lane. Explains how to decide when a vessel is an overtaking vessel Exp lains the application of Rules 14 & 15. Exp lains how to decide when to take avoiding actions as Stand-on Vessel. Explains the action which may / must be taken by Stand-on Vessel Describes Rule 18 – responsibility between vessels and its application. Describes Rule 19 in his own words. States that under rule 19 there is no 'Give-way' and no 'Stand-on' vessel. States that this rule applies not only 'IN' but also 'NEAR AN AREA' of Restricted Visibility. States the actions to be taken upon detection of vessel forward of the beam in restricted visibility. States the actions to be taken upon detection of vessel abeam or abaft thebeam in restricted visibility Exp lains the following terms with reference to rule 19:A vessel that detect by radar alone the presence of another vessel. Reduce speed to minimum at which she can be kept on her course Take all way off, Navigate with extreme caution until the danger of collision is over.

TEXT BOOKS

1. Chart Work for Mariners- Puri, S.K.
2. IMO Rules of the Road – Bhandarkar Publications

RECOMMENDED BOOKS FOR REFERENCE:

1. Chart Work: Basic Concepts & Miscellaneous Calculations- Chaudhari S.S
2. Modern Chart work- Squair, W.H
3. Navigation Guide Vol. 1: Near Coastal Navigation- Alexander Simpson
4. Admiralty publication NP 294 (How to keep charts up to date)
5. International Lights, Shapes and Sound Signals – D. A.Moore
6. A guide to the Collision Avoidance Rules – Cockcroft and Lameijer
7. International Code of Signals - HMSO
8. Collisions and their causes- Cahill, Richard
9. International Regulations for Preventing Collisions at sea- Nautical Press
10. Mariner's Guide to preventing collision- Capt. Yashwant Chhabra

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Introduction and Familiarization with Charts and Chart Catalogue.	K1
CO-2	Obtain Information from Charts, Chart Datum, Lights, understanding the basic ideology of Traffic Separation Schemes.	K3
CO-3	Demonstrate the procedure of Chart correction as per Admiralty Publication NP 294 including:Use of Tracings, Carrying out correction of Blocks.	K4
CO-4	Exercises in Chart Work, Determines the latitude and longitude of any point on the chart by use of: Parallel rulers, Set Squares and Dividers.	K6
CO-5	Understand and familiar with Conduct of vessels in any condition of Visibility, In sight of one another andin Restricted Visibility (Rule 1-19	K2

ALAGAPPA UNIVERSITY

SEMESTER - III

Semester – III					
Core	**Course Code: 11636**	**Cargo Operation - I**	**T**	**Credit:3**	**Weekly Hours:3**
Pre-Requisite	**Basic Knowledge of Cargo Operation**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. Introduction in brief to types of ships and cargo/ General Introductionto Dry Cargo ships. To understand the Basic Aspects of Cargo Operations. To understand about the Cargo Gear, Cargo gear Inspection, their use, Care and maintenance of Sling, Blocks and Tackles. To understand the Segregation, Separation and Securing of Cargoes 2. To understand about the Ventilation and Control of Sweat. To understand the working of Cranes, various safety limits and markings. 3. Calculations in Cargo work, Safe working load (SWL); Breaking strength; Proof Load; Factor of Safety. To understand Handling and Maintenance of different types of Hatch-covers. 4. To identify the Cargo-handling Safety and Precautions, Inspection of cargo gear prior work. Precautions during cargo operations while using cargo gear. 5. Planning, stowage and drawing up of stowage plans of general cargo taking into account stowage factor in General Cargo Ship - Stowage Plan.
	Specific Learning Objectives
Unit - I	**Introduction in brief to types of ships and cargo/ General Introduction to Dry Cargo ships:** General cargo ship, 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. **Basic Aspects of Cargo Operations** Importance of cargo care to economical operation of ships and care of cargo on board ships. The hazard of fire and its prevention, control and extinction in cargo. operations. Interaction between cargoes and the resultant contamination and tainting. Stowage and handling to prevent breaking, chafing, crushing. Sea water damage, importance of structural integrity and Hatch cover water tightness. Bale and Grain Capacity; Stowage factor, Broken stowage; Load density; Cargo density; Ullage and soundings; Deadweight and displacement. Ballasting and deballasting operations Duties of the Officer on Cargo. Watch; Checks prior ballasting and deballasting. Log Book Entries.
Unit – II	**Cargo Gear, Cargo gear Inspection, their use, Care and Maintenance:** Exp lain that Cargo gear should be visually inspected before the start of cargo. Ropes, wires & chains: Natural and synthetic ropes-manila, polypropylene,Terylene nylon. Breaking stress of ropes, wires and chains as given in the Chain Register. Calculation of SWL using Factor of Safety given Exp lain why the load on cargo gear should never exceed its safe working load. Care of ropes and wire used for cargo gear.Maintenance of wire ropes. When to condemn a wire rope. **Slings:** Types of slings used for lift ing cargo of different types. Use of snotters,canvas slings, vehicle slings, trays, pallets, nets, hooks and slings. **Blocks:** Parts of a block, Types of block, snatch blocks. Exte rnal and internal binding. Markings on a block. Size of a block and sheave, size of rope/wire to be used in a block. Relationship between diameter of sheave and diameter of rope/wire. Care and maintenance of blocks. Overhauling blocks. **Tackles:** Parts of a tackle, using a tackle to advantage or disadvantage. Mechanical advantage. Velocity ratio or power gained, efficiency of a tackle; relationship between effort and load. Types of purchases used on ships. Reeving a three-fold purchase. Cargo hooks & Shackles: Swivels, shackles, hooks and marking.
Unit – III	**Segregation, Separation and Securing of Cargoes** Segregation of different cargoes with reference to dangerous goods, dry, wet, delicate, dirty, valuable cargo. Separation between parcels of cargo for different ports. Separation of cargoes by natural bulkheads or artificial divisions. Dunnage and its uses to increase friction, prevent damage from sweat and in separating cargoes. Shifting boards. Shifting of cargo, toppling, and methods of securing to prevent the same viz. blocking, chocking and lashing. Methods of blocking, lashing, shoring and trimming cargo. Method of securing heavy

	loads, vehicles, containers. List Contents of Lashing Code and Cargo Securing Manual. Purpose of Lashing Code and Cargo Securing Manual. **Ventilation and Control of Sweat** Need for ventilation of cargo spaces. Ship sweat and cargo sweat, and differentiate between them. Factors affecting sweat. Control of sweat by ventilation, Operation of ventilation system. Cargoes requiring special ventilation due to emission of gases, absorption of oxygen, dust, release of moisture. Temperature variations leading to sweat damage, ship and cargo sweat. Monitoring of dew-point temperature and ventilation to prevent sweat. **Ventilation and Control of Sweat** Need for ventilation of cargo spaces. Ship sweat and cargo sweat, and differentiate between them. Factors affecting sweat. Control of sweat by ventilation, Operation of ventilation system. Cargoes requiring special ventilation due to emission of gases, absorption of oxygen, dust, release of moisture. Temperature variations leading to sweat damage, ship and cargo sweat. Monitoring of dew-point temperature and ventilation to prevent sweat. **Cranes** The working of Cranes, various safety limits and markings. Testing of cranes – static, dynamic test. Hoisting, lowering and securing a crane as per manual. Operational checks to be done on ship's cargo gear before handing over to stevedores including checks on limit cutouts. Entries to be made in Chain Register. Familiarisation with Crane operation Signals.
Unit – IV	**Cargo work Calculations** Safe working load (SWL); Breaking strength; Proof Load; Factor of Safety. Calculating 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. Finding mechanical advantage and efficiency of a systemusing a combination of two purchases to advantage/disadvantage. Calculation of cargo quantities given height, area or volume of hold, stowage factor, broken stowage, load density, bale or grain capacity. Effect of Load lines on cargo loadables. **Handling and Maintenance of Hatch-covers** Types of hatches. Hatch coaming uses. Opening and closing of chain- pull and hydraulic hatch covers. Closing arrangements. Battening down a hatch. Maintenance of hatch covers: Precautions to be taken whilst operating hatch covers. Importance of compression bars and sealing gaskets for maintaining weather tightness. Need to check hydraulic system for leakages. Maintenance and use of side cleats and cross-joint wedge mechanis m. Importance of clear drainage channels and drain holes. Importance and Methods of testing weather tightness of hatch covers. Procedure for securing hatches in open position to guard against accidental movement. State that ships are responsible for closing hatches when notice of completion of work for the day is given by the stevedores.
Unit – V	**Cargo-handling Safety and Precautions** Inspection of cargo gear prior work. Precautions during cargo operations while using cargo gear. Effective communication during loading and discharging. Precautions to be taken when using forklifts, bulldozers, grabs and other heavy gear on board in the tween decks or holds. Dock labour regulations pertaining to cargo handling covering dust, personalprotection and awareness of moving parts of machinery. **General Cargo Ship - Stowage Plan** Planning, stowage and drawing up of stowage plans of general cargo taking into account stowage factor, port rotation, hazardous nature, special stowage requirement relating to cargoes not covered by special codes. Broken stowage must be taken into account when estimating the number of packages of given size which can be loaded into a space. (Practical. Exercise to be conducted)

TEXT BOOKS

1. Cargo Work for Ship officer – Capt Errol Fernandes
2. Cargo Work for Maritime Operation- D.J. House

RECOMMENDED BOOKS FOR REFERENCE:

1. Cargo Work – Kemp and Young
2. Cargo Works – Taylor
3. Cargo Notes- DhananjaySwadi

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Introduction in brief to types of ships and cargo/ General Introduction to Dry Cargo ships. Understanding the Basic Aspects of Cargo Operations.	K1
CO-2	Understanding about the Cargo Gear, Cargo gear Inspection, their use, Care and maintenance of Sling, Blocks and Tackles. Ability to understand the Segregation, Separation and Securing of Cargoes. Ability understand about the Ventilation and Control of Sweat	K2
CO-3	Understanding the working of Cranes, various safety limits and markings. Calculations in Cargo work, Safe working load (SWL); Breaking strength; Proof Load; Factor of Safety.	K2
CO-4	Understanding Handling and Maintenance of different types of Hatch-covers. Understanding to identify the Cargo-handling Safety and Precautions, Inspection of cargo gear prior work. Precautions during cargo operations while using cargo gear.	K4
CO-5	Understand the Planning, stowage and drawing up of stowage plans of general cargo taking into account stowage factor in General Cargo Ship - Stowage Plan.	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – III					
Core	**Course Code: 11637**	**Navigation Watch keeping & Bridge Equipment – I**	**T**	**Credit:2**	**Weekly Hours:3**
Pre-Requisite	**Basic Knowledge of Watch-keeping and Bridge Equipment**		**Syllabus Revised**		**2023 – 24**

Course Objectives	**Watch Keeping:** 1. Familiar with a safe navigational watch, Watch-keeping Arrangements in accordance with the situations. 2. To Describe the procedure for handing over and taking over Bridge Watches and to Expla in the circumstances in which the Officer On Watch (OOW) should call the Master. To Describe the principles to be observed while keeping a safe navigational watch & lookout. To understand to make Record keeping and Entries in logbook, Explain the importance of recording all relevant information in Logbooks. To state importance of Keeping an effective anchor watch and Pilot embarking & disembarking. State the importance of beam bearings, use of Global Position Fixing System (GPS) and Radar during anchor watch. **Bridge Equipment:** 3. To enumerate the Navigation Equipment with Layout of Bridge and Integrated Bridge. To understand and Practical Knowledge of the Sextant and Magnetic Compass with sketch and Principles of Sextant. 4. To Familiar and practical knowledge on Tele-motor, Helm Orders and Internal Communication. To understand and identify the function and principles of Echo Sounder with the sketch. To understand and familiar with the Principles and Functions of Steering Control System. 5. Describe the use & care of other Equipment like Electric Telegraph, the Day Light Signalling Lamp and explain the reasons for considering it an emergency source of power.
	Specific Learning Objectives
	Watch-keeping
Unit - I	**Keeping a safe navigate onal watch :** Watch-keeping Arrangements in accordance with the situations any Keeping a safe navigational watch :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, States that the officer of the watch is responsible for navigating safely, with particular regard to avoiding collision and stranding. Describes the principles to be observed in keeping a navigational watch as set out in section A-VIII of the STCW Code regarding: **N**avigation**, N**avigational 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, Genera l principles for ship reporting systems and with VTs procedures. Describes 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: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 coastalwaters, 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 watchkeeping personnel, Describes the duties of the officer of the watch while at anchor, Lists the entries which should be made in the logbook. **Handing over and taking over watch:** Describe the procedure for handing over and taking over Bridge Watches. **Bridge manning levels:** Exp lain the circumstances in which the Officer On Watch (OOW) should call the Master. The responsibilities of OOW when in-charge of navigational watch andExtra lookout requirement Navigation duties with Pilot embarked. **Keeping a safe navig ational watch as per Section A-VIII/2 and B-VIII/2 of International Standards**

	of Training, Certification & Watch-keeping for Seafarers, 1978 as amended (STCW Convention): Describe the principles to be observed while keeping a safe navigationalwatch & lookout.
Unit - II	**Record keeping and Entries in logbook:** Exp lain the importance of recording all relevant information in Logbooks, Monitoring of navigational instruments, recording their performance and other relevant details,Recording all movements & activities related to the navigation of the ship & voyage records, Record keeping of different kinds of logs during ocean passages, coastal navigation & in port as per the company's ISM/SMS & IMO. Gu idelines for recording of events related to Navigation Res A. 916 (22) **Keeping an effective anchor watch:** State the importance of beam bearings, use of Global Position Fixing System (GPS) and Radar during anchor watch. Exp lain a Turning Circle in relation to length of vessel and length of cable used and the swinging of vessel anchored to tide/wind. State the indications of anchor dragging and the use of shapes, lights andsound signals as per IRPCS 1972. **Pilot embarking & disembarking:** Exp lain the importance of compliance with safe procedures for embarking and disembarking of Pilots and Pilot transfer arrangements, as per SOLAS, & its upkeep.
	Bridge Equipment
Unit – III	**Lay out of Bridge and Integrated Bridge:** Sketch the layout of the Bridge with its Navigational EquipmentIntroduction to various Navigational Equipment Introduction to Integrated Bridge Systems. **Sextant:** Sketch and explain the principle of Sextant. Explain the parts of a sextant **Magnetic Compass:** Exp lain the magnetis m of the earth and magnetic poles. Describe the marking of lubber line and its purpose. Describe the binnacle and arrangement of correcting devices provided. List the Compass points and exp lain True and Magnetic north. Magnetic variation and changes in its annual value, Isogonals, Magnetic compass error & naming convention. Variation & Deviation, Course & Bearing, Describe the conversion of compass course to true course and vice versa using deviation card. State the importance of comparing of compasses, checking of compass error regularly & on major changes of heading, precautions to be observed while taking compass bearings. Describe the use and care of magnetic compasses and their practical limitations.
Unit – IV	**Tele-motor, Helm Orders and Internal Communications:** Demonstrate clear, concise communication and acknowledgement at all times in a seaman like manner with due regards to Standard Marine Communication Phrases. Describe the various methods to call the Master to the bridge. Explain the inter-switching of Follow-up & Non Follow-up and Emergency Steering system. **Speed Log:** State the difference between ground reference speed and water reference speed. Exp lain : Principle, Errors & Limitations of Electro-Magnetic log and Doppler speed log. Sketch & exp lain with the help of a Block Diagram how is a ship's speed transmitted to remote displays and how an indication of distance run is derived from a speed log. **Steering control systems** Explain the principle of an automatic pilot system. Explain the functions of the manual settings Describe the procedures for changeover from automatic to manual steering and vice versa Explain what is meant by an adaptive automatic pilot and briefly explain how it functions Describe the course monitor and the off-course alarm. Describe the operation of the course recorder log. State that the automatic pilot should be included in the steering gear testing prior to the ship's departure. Exp lain the regulation regarding the use of the automatic pilot. Exp lain in the recommendation on performance, standards for automatic Pilots. Exp lain the need for regular checking of the automatic pilot to ensure that it is steering the correct course. State that the automatic pilot should be tested manually at least once per watch. Describe the factors to take into account regarding the changeover to manual control of steering in order to deal with a potentially hazardous situation. Exp lain Wheel House posters and the use of Rate of Turn Indicator (ROTI)
Unit – V	**Echo Sounder:** Describe the basic principles of marine echo- sounding equipment. Identifies the main components on a simple block diagram of an echo-sounder, and states the function of each

	Describe the accepted value of the velocity of sound in seawater and the limits within which the true va lue may lie. Describe the physical factors which affect the velocity sound in seawater Differentiates between range and phase, and explains the dangers of usingthe wrong phase. **Other Equipment in the Wheel House** Describe the Electric telegraph and e xp lain its operation. Describe the use & care of the Day Light Signalling Lamp and explain the reasons for considering it an emergency source of power. Describe Sound Signalling Equipment as in Part-D of IRPCS 197. Describe the use, care and precautions while operating wipers & Clean View Screen (CVS)

TEXT BOOKS

1. Bridge Equipment, Charts & Publication Nutshell Series Book 5- Capt. H. Subramaniam
2. Modern electronic Navigation Aids- Bhatia and Sinha
3. Nautical watch Keeping – Capt. H. Subramaniam

RECOMMENDED BOOKS FOR REFERENCE:

1. Bridge Procedure Guide - ICS
2. Bridge Team work - Nautical Institute
3. Shipborne Radar and ARPA-- Capt. H. Subramaniam
4. Electronic Navigational Aid-- Sonnenberg
5. Mariners Handbook – HMSO Publication
6. A Seaman's Guide to the RULES OF THE ROAD- Morgans Technical Books Ltd

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes **Bridge Equipment**		**Knowledge level**
CO-1	Understanding and enumerate the Navigation Equipment with Layout of Bridge and Integrated Bridge. Understanding and Practical Knowledge of the Sextant and Magnetic Compass with sketch and Principles of Sextant.	K2
CO-2		K2
Watch Keeping		
CO-3	Understanding and Familiar with a safe navigational watch, Watch-keeping Arrangements in accordance with the situations.	K2
CO-4	Understanding and Describe the procedure for handing over and taking over Bridge Watches and to Exp lain the circumstances in which the Officer On Watch (OOW) should call the Master.	K2
CO-5	Understanding and enumerate the Navigation Equipment with Layout of Bridge and Integrated Bridge. Understanding and Practical Knowledge of the Sextant and Magnetic Compass with sketch and Principles of Sextant.	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – III					
Core	**Course Code: 11638**	**Seamanship Lab – I**	**P**	**Credit:2**	**Weekly Hours:3**
Pre-Requisite	**Basic and Practical Knowledge of Seamanship**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To Understand the basic Knowledge of Seamanship in daily ship activities, 2. To understand and Practical works on making Stage, Bosun's Chair, Pilot Ladder and Mast Work, Safety procedure involved in working aloft on stage and a Bosun's chair, Demonstrate how to climb up a 'Pilot Ladder' after taking all due safety. 3. To Understand the types of Ropes. 4. To understand the Mooring and Mooring Ropes 5. Identify various parts of ship using ships Plans, Demonstrate enclosed space entry procedure, Demonstrate use of permits.
	Specific Learning Objectives
Unit - I	**Seamanship:** Demonstrate taking soundings and ullage to find quantity of liquid in a tank using Calibration Table. Demonstrate taking hold temperature. Demonstrate measurement of dock water density and temperature. Demonstrate and conduct practice on the use of various types of cordage, fibre and wire ropes used on the ship.
Unit – II	**Types of Ropes:** Natural fibre rope, synthetic fibre rope, wire rope – construction, care and lay, measuring the size of rope. Identify between right hand lay and left hand lay ropes. Demonstrate and conduct practice on various types of whippings. Demonstrate and conduct practice on various typesof knots, bends and hitches. Practical usage of knots and understanding where each knot is used. Opening a new coil & coiling of ropes. Demonstrate Fibre Rope eye splice, short splice, back splice. Demonstrate the method of connecting a heaving line / messenger line to a hawser. Demonstrate the method of belaying and racking a wire rope. Demonstrate the method of securing oil drums and other loose gear. Demonstrate the use of bulldog grips and bottle screws / turnbuckles in joining wires.
Unit - III	**Rope Works**: Conduct practical e xe rcises on throwing heaving lines, use of rope and chain stoppers, mooring shackle and safe handling of mooring ropes. Use of slip- ropes. Use of fenders, messenger line. Demonstrate the method of joining two mooring hawsers. To transfer rope from mooring winch to bollards and making fast. Demonstrate the method of belaying rope to cleats and Stag horn. Conduct Practical e xe rcises in reading draft marks. Demonstrate the use of various power tools such as pneumatic/ electrical chipping and de-scaling tools and precautions needed. Demonstrate hazards associated with the use of portable ladders onboard. Demonstrate understanding of different manual lifting techniques for heavy weights.
Unit - IV	**Stage, Bosun's Chair, Pilot Ladder and Mast Work:** Safety procedure involved in working aloft on stage and a Bosun's chair. Demonstrate the ability to climb a ship's mast. Demonstrate ability to climb downstairs in accommodation and ladders. Learn and Demonstrate how a 'Pilot Ladder' can be rigged up according to the relevant rule requirements. Demonstrate how to climb up a 'Pilot Ladder' after taking all due safety.
Unit - V	**Practical Lab Work:** Identify various parts of ship using ships Plans Demonstrate enclosed space entry procedure Demonstrate use of permits Interpretation of MSDS to identify hazards of chemicals/paints Identify various parts of ship using ships Plans Demonstrate enclosed space entry procedure

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the basic Knowledge of Seamanship in daily ship activities.	K2
CO-2	Understanding and Practical work on making Stage, Bosun's Chair, Pilot Ladder and Mast Work, Safety procedure involved in working aloft on stage and a Bosun's chair, Demonstrate how to climb up a 'Pilot Ladder' after taking all due safety.	K2
CO-3	To understand various types of ropes	K4
CO-4	To understand ship moorings and mooring ropes	K2
CO-5	Identify various parts of ship using ships Plans, Demonstrate enclosed space entry procedure, Demonstrate use of permits.	K4

ALAGAPPA UNIVERSITY

SEMESTER – III

Semester – III					
Allied	**Course Code: 11639**	**Marine Engineering, Automation & Control Systems –I**	**T**	**Credit:2**	**Weekly Hours:3**
Pre-Requisite	**Basic Knowledge of Marine Engineering, Automation & Control Systems**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the Strength of Materials and Material Science. 2. To understand the Electrical Engineering Science. Describe the maintenance procedure of batteries. 3. To understand and Explain the Layout of the Engine Room with sketch. 4. To understand the principles and procedure to take Fresh water from sea water. Describe the methods of making water potable. Describe a domestic fresh water and sanitary water hydrophore system 5. To understand and Explain the use of compressed air on board. Types of Bilors To understand and Refrigeration & Air conditioning. Describe principles and a basic refrigeration compression cycle.
	Specific Learning Objectives
Unit - I	**Strength of Materials:** Exp lain Hook's Law. Explain stress and strain. Define and e xpla in Tensile, Compressive and Shear forces. Exp lain Failure of materials under Tension, compression, shear & fatigue. Relate the Strength of Materials with marine engineeringexamples. **Materials Science:** Explain the following terms Hardness, Ductility, Malleability, Melting Point etc., Name common engineering materials. Various metals & alloys.Properties & uses. Explain ceramics & What are the uses of ceramics? Explain elementary metallurgy of steels. Explain Steel production- smelting & refining. What are the different types of steel & their uses? Explain the heat treatment of steels.
Unit – II	**Electrical Engineering Science:** Describe the maintenance procedure of batteries. Understand the purpose & operation of purifier drive. Exp lain the Navigation light circuit with indicators / alarms & alternative power supply. Name the services supplied from emergency generator. With diagram, e xp lain procedure for starting emergency generator manually. Exp lain the Parallel running of Gens and procedure & importanceof load sharing. Differentiate the prime movers e.g. Diesel engine and steam turbines. Exp lain the working principle of Step up/down Transformers. Understand transformer efficiency and describe the maintenance & care of transformer. Understand the purposes and use of Main switch boards & power distribution boards. Name the various Circuit breakers and understand it's applications. Understand the following: - operation of measuring instruments.Overload trip, short circuit trip, fuses and other protections.
Unit – III	**Layout of Engine Room:** Exp lain the classification of ship as per propulsion plant. Exp lain the position of main propulsion plant in various type ofships. List the function of various machineries/equipment in the Engine Room. **Fresh water from sea water:** Exp lain the requirements of production of FW on board. Describe the methods for making fresh water-steam, flash andreverse osmosis type plant. Describe the methods of making water potable. Describe a domestic fresh water and sanitary water hydrophore system
Unit – IV	**Compressed Air:** Exp lain the use of compressed air on board. Describe a compressed air plant as found on a ship. Describe the air bottle and mountings. Safety precautions while working with compressed air. **Types of Marine Boiler:** Describe the construction of a Smoke tube and water tube boiler. List and explain the function of different mountings on the boilers. Explain the use of boiler on board. Describe the purpose of feed water system and the chemical treatment carried out on a ship. Describe a waste heat recovery boiler and circulating system. Explain the safety features on and around the boiler.
Unit - V	**Refrigeration & Air conditioning:** Explain the principles of refrigeration. Describe a basic refrigeration compression cycle. Describe the components of a ref plant and their operation **Pumps & Pumping Systems:** Exp lain the working principle of different pumps. Explain the suitability of different pumps for specific purposes. Describe a submersible pump and a hydraulic aggregate pump (Framo pump). Describe a fire

	mains and requirement of main and emergency fire pump. Describe a typical bilge and ballast system for a ship. **Steering:** Describe types of steering gear. Describe Ram type & Rotary vane steering gear. Explain the SOLAS requirements pertaining to steering gear. Explain the mechanics of a ship turning by use of rudder. Describe telemotor and hunting gear. Telemotor –hyd & electric type. Describe electric steering gear. Requirements of emergency steering. **Hydraulic systems:** Exp lain a simple circuit diagram for linear & rotary motion. Explain ram & rotary vane actuators. Expla in the maintenances required for the system. Explain the necessity of cooling/heating of hydraulic oil.

TEXT BOOKS

2023 Basic Marine Engineering-T.K.Grover

RECOMMENDED BOOKS FOR REFERENCE:

2. Strength of Materials – Ryder
3. General Engineering Knowledge for Engineer – Reeds Vol.-8
4. Marine and offshore pumping and piping systems – Crawford
5. Engineering Drawing – Reeds
6. General Engineering Knowledge for Engineer – Reeds Vol.-12
7. Basic Electro Technology – Reeds Vol.-6
8. Marine Electrical Equipment & Practice – McGeorge
9. Materials for Marine Machinery – Fredrick & Capper
10. Basic Marine Engineering- J.K. Dhar

Related online content		
Course Outcomes		**Knowledge level**
CO-1	Understanding the Strength of Materials and Material Science.	K2
CO-2	Understanding the Electrical Engineering Science. Describe the maintenance procedure of batteries. Understand and Explain the Layout of the Engine Room with sketch.	K2
CO-3	Ability to understand the principles and procedure to take Fresh water from sea water. Describe the methods of making water potable. Describe a domestic fresh water and sanitary water hydrophore system	K2/K3
CO-4	Ability to identify principle and Explain the use of compressed air on board. Types of Bilors	K4
CO-5	Understanding the Refrigeration & Air conditioning. Describe principles and a basic refrigeration compression cycle. Understanding and Describe types of steering gear, Describe Ram type & Rotary vane steering gear.	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – III					
Allied	**Course Code: 116310**	**Marine Engineering, Automation & Control Systems - I**	**P**	**Credit:2**	**Weekly Hours:3**
Pre-Requisite	**Practical Knowledge of Marine Engineering Workshop**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the Practical work of the basic Marine Industry. Practice Cutting, Filing, and preparation of level surfaces on metals. Drilling, tapping, reamer operations. 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). Demonstrate the safety precautions to be observed while weldingincluding earthing. 3. Identify electrical insulated hand tools. Demonstrate the ability to identify electrical conductors (Wires andCables). Identify plumbing hand tools such as pipe wrench, dies, pipe benders, hacksaw, pipe vice, spanners, etc. (ship specific). 4. Identify carpentry hand tools such as chisel, jack plane, augur, mortise gauge, etc. Identify various wood for specific purposes treatment materials. 5. Identify various fasteners such as nut and bolts, allen screws, studs and demonstrates its use.
	Specific Learning Objective
Unit - I	**Basic Marine Workshop:** 1 Practice Cutting, Filing, and preparation of level surfaces on metals. Drilling, tapping, reamer operations. Shaping, drilling, grinding operations. Edge preparation on steel objects for welding. Welding of simple jo ints. Removal and fittings of ball bearing. Overhaul of valves, practice fitt ings on pipelines. Competency – Cuttings &planning, Dove tail joints. **Fitting Workshop:** 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). Demonstrate the use of feeler gauge, thread gauge, screw gauge, Vernier calliper, on the above said job. Identify various spanners, nuts and bolts, Allen screws, studs and their use. Demonstrate the use of grinding machine including portable grindersand drilling machine on the above said job.
Unit – II	**Welding Shop:** Demonstrate the safety precautions to be observed while weldingincluding earthing. Identify the arc and gas welding tools and welding kits. Identify ferrous and non-ferrous metals. Demonstrate the ability to carry out oxyacetylene gas cutting. (group activity of 4-5 cadets). Connect the arc welding kit and select the current /electrode to carry out arc welding. (group activity of 4-5 cadets). Demonstrate the ability to carry out arc bead welding. (group activity of4-5 cadets). **Electrical Shop:** Identify electrical insulated hand tools. Demonstrate the ability to identify electrical conductors (Wires andCables). Identify the electrical accessories such as fuse, circuit breakers, choke, starters, etc. and demonstrates the use of it in electrical circuits. Assemble a tube light fitting by using tube fittings and test it. 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). Identify safety precautions to take to avoid shock and to rescue a person from electricalshock location.(Instructor demonstration for a group of 5 cadets). Demonstrate the use of relay in electrical/ electronic circuits.
Unit – III	**Plumbing Shop:** Identify plumbing hand tools such as pipe wrench, dies, pipe benders, hacksaw, pipe vice, spanners, etc. (ship specific). Identify leak stopping material such as Teflon, sealant, jubilee clips, ermeto couplings and demonstrate their use. Demonstrate the procedures to cut threads on pipes by selecting appropriate die. (Group activity of 2-3 cadets). Demonstrate the ability to identify different pipes, pipe material and methods to join the pipes. Identify various taps, cocks and valves used in sanitary System, demonstrate ability to repair them (ship specific). Identify various plumbing accessories such as 'T' joint, socket, reducer, adapter, etc. used in pipe fitting and demonstrate its use. Cut the gasket as per sketch by selecting appropriate material and tools.

	Demonstrate the ability to clear choked pipes in accommodation plumbing system by using appropriate tool / choke clearing material.
Unit – IV	**Carpentry Shop:** Identify carpentry hand tools such as chisel, jack plane, augur, mortise gauge, etc. Identify various wood for specific purposes treatment materials. Identify various wood jointing material using adhesive, nails, screwsetc. Demonstrate the ability to e xecute wood jo inting (group activity of 2-3 cadets). Demonstrate the ability to make a cement box; wooden box as perdrawing by using appropriate tools, wood jointing method and wood jointing material / adhesives (group activity of 4-5 cadets). Use clamps/ cement box to arrest a leak. (Instructor demonstration for group of 20 cadets). Use of fibreglass repair kits. (Instructor demonstration for group of 20cadets)
Unit – V	**Machinery Maintenance:** Identify various fasteners such as nut and bolts, allen screws, studs and demonstrates its use. Identify valves and cocks used onboard. Overhaul a globe valve and butterfly valve by using appropriate tools and gaskets (group activity of 2-3 cadets). Demonstrate the procedure to carry out greasing and Oiling pumps and Motor by using grease gun, oilcans and pneumatic grease gun.

Related online content

Course Outcomes		**Knowledge level**
CO-1	Understanding the Practical work of the basic Marine Industry. Practice Cutting, Filing, and preparation of level surfaces on metals. Drilling, tapping, reamer operations.	K2
CO-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).	K3
CO-3	Demonstrate the safety precautions to be observed while welding including earthing. Ability to identify electrical insulated hand tools. Demonstrate the ability to identify electrical conductors (Wires andCables).	K3
CO-4	Identify carpentry hand tools such as chisel, jack plane, augur, mortise gauge, etc. Identify various wood for specific purposes treatment materials.	K4
CO-5	Ability to identify plumbing hand tools such as pipe wrench, dies, pipe benders, hacksaw, pipe vice, spanners, etc. (ship specific). Understanding to identify various fasteners such as nut and bolts, allen screws, studs and demonstrates its use.	K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – III					
Allied	**Course Code: 116311**	**Artificial Intelligence & Machine Learning**	**T**	**Credit:2**	**Weekly Hours:2**
Pre-Requisite	**Basic Knowledge of Artificial Intelligence and Machine Learning**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand and learn about the Fundamentals of Artificial Intelligence. 2. To understand the Artificial Intelligence and Marine industry and Explain Applications of Expert System in marine field. 3. To understand and learn about the Fundamentals of Machine learning. 4. To understand the Machine Learning and Marine industry 5. To explain Applications of Neural Networks.
	Specific Learning Objectives
Unit – I	**Fundamentals of Artificial Intelligence:** Define and describe Artificial Intelligence, Explain and Describe Philosophy of AI. Goals of AI. Describe Contributes to AI. AI Technique. Expla in Applications of AI. History of AI. What is Intelligence? Exp lain Types of Intelligence. Define Human and Machine Intelligence. Exp lain and understand research areas of AI. AI vs ML vs DL,
Unit - II	**Artificial Intelligence and Marine industry:** Understand Capabilities of Expert Systems. Explain Components of Expert Systems. Exp lain and analyze User Interface. Expert Systems Limitations. Exp lain Applications of Expert System in marine field. Explain in details Challenges of Artificial Intelligence inautonomous ships.
	Specific Learning Objectives
Unit – III	**Fundamentals of Machine learning (ML):** What is machine learning and is applications. Exp lain and understand research areas of AI. Distinguish between AI vs ML vs DL. Explain in detail neural networks
Unit – IV	**Machine Learning and Marine industry:** Analyse and expla in Learning by e xperience, Supervised Learning, Unsupervised learning, Competitive learning, Explain various rules of learning Exa mples on Neural network learning. Explain and analyse types of Artificial Neural Networks.Working of ANNs.
Unit - V	**Neural Networks:** Explain Applications of Neural Networks. AI training. Explain in detail Machine learning architecture in autonomousships and overview of its working. Explain in details Challenges of Machine learning in autonomous ships

Artificial Intelligence

TEXT BOOKS

1. Artificial Intelligence and Machine Learning by Chandra S.S.V

RECOMMENDED BOOKS FOR REFERENCE:

1. Machine Learning, Tom Mitchell, McGraw , 1997, 0-07-042807-7
2. Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill
3. Stuart Russell & Peter Norvig: "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition.
4. Jacek M. Zurada, “Introduction to Artificial neural System”, JAICO publishing house,2002
5. Ivan Bratko : "Prolog Programming For Artificial Intelligence" , 2nd Edition Addison Wesley,1990.
6. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley

7. Patterson: “Introduction to AI and Expert Systems”, PHI
8. Nilsson : “Principles of Artificial Intelligence”, Morgan Kaufmann.
9. Carl Townsend, “Introduction to turbo Prolog”, Paperback, 1987
10. Carl Townsend, “Introduction to turbo Prolog”, Paperback, 1987

Machine Learning

TEXT BOOKS

1.Artificial Intelligence and Machine Learning by Chandra S.S.V

RECOMMENDED BOOKS FOR REFERENCE:

1. Tom Mitchell , Machine Learning, , McGraw , 1997, 0-07-042807-7
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT press, 2004.
3. Jacek M. Zurada, “Introduction to Artificial neural System, JAICO publishing house,2002
4. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, Oreilly publication
5. Oliver Theobald, Machine Learning For Absolute Beginners: A Plain English Introduction ,Second Edition
6. Oliver Theobald, Machine Learning For Absolute Beginners: A Plain English Introduction ,Second Edition

Related online content		
Course Outcomes		**Knowledge level**
CO-1	Understanding and learning about the Fundamentals of Artificial Intelligence.	K2
CO-2	Understanding the Artificial Intelligence and Marine industry and Explain Applications of Expert System in marine field.	K2
CO-3	Understand and learning about the Fundamentals of Machine learning.	K1
CO-4	Ability to understand the Machine Learning and Marine industry	K4
CO-5	To explain Applications of Neural Networks.	K5

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – IV					
Core	**Course Code: 11643**	**Navigation - III**	**T**	**Credit:3**	**Weekly Hours:5**
Pre-Requisite	**Basic Knowledge of Position Fixing and Calculations**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To Recognize of important stars with reference to stellar constellations and stellarmagnitudes 2. To Calculate Sunrise and Sunset time using Nautical Almanac. Determine the observed altitude of the sun when the true altitude is zero. 3. Identify Polaris. Identify certain major constellations and navigational stars' movement relative to Polaris and the movement of Polaris with the change of latitude. 4. Position fixing, Position fixing by long by Chron, Intercept, EX-Meridian(Sun) methods of sight calculation. 5. To Define Twilights- civil, nautical and astronomical and Calculate twilight timings.
	Specific Learning Objectives
Unit - I	**Star Identification:** Recognition of important stars with reference to stellar constellations and stellarmagnitudes. **Hour Angle and Time:** Describe the apparent solar day and state the relationship between LHA (sun) and LAT, Solar t ime, Solar day, apparent sun, mean sun, and Sidereal time. Define sidereal day and state that it is a fixed time interval. Explain the reasons for the suns irregular rate of change of SHA and hence the necessity to adopt the astronomical sun for t ime keeping purpose. Describe the equation of time (ET) and its component. Determine the ET from the almanac and its sign of application. Define Zone Time, Standard Time and International Date Line. Explain how to alter the ships time during a passage with increasing or decreasing longitude. Demonstrate the use of time signal. Calculation based on above.
Unit – II	**Amplitude and Azimuth:** Calculate Sunrise and Sunset time using Nautical Almanac. Determine the observed altitude of the sun when the true altitude is zero. Derive formula "Sin amp= Sin decl. sec lat. Obtain from tables or by calculation, using observers DR position and information from Nautical Almanac, True bearing of the heavenly body on rising and setting i.e solves an amplitude problem. Obtain the azimuth of the body from tables, or by formula or calculation using GMT of observation, information from the Nautical Almanac, LHA of the body and observers DR position. Obtain the error of magnetic compass or gyrocompass by comparing the compass bearing of the body with the true azimuth of the body obtained at the time of observation.
Unit – III	**Pole Star Observations:** Identify Polaris. Identify certain major constellations and navigational stars' movement relative to Polaris and the movement of Polaris with the change of latitude. Describe the relationship between the altitude of the Polaris and the observer's latitude. Obtain the corrections 1˚,+a0,+a 1,+a2 from polestar tables in Nautical Almanac and apply them to the altitude of Polaris to find the latitude of the observer. Find the true azimuth of the Polaris from tables and the direction of the Position line. Calculation based on the above.
Unit – IV	**Position Fixing:** Define Geographica1 Position and Circle of Position. Determine the direction of position line through an observer and a position through which it passes. True Azimuth of a body and relationship with position line. Define and evaluates co-latitude, polar distance and zenith distance and uses them as sides of PZX

	triangle. Solve the PZX triangle to find the calculated zenith distance of the body when it is out of meridian. Position fixing by long by Chron, Intercept, EX-Meridian(Sun) methods of sight calculation. Position finding by simultaneous & staggered observations.
Unit - V	**Twilights:** Define Twilights- civil, nautical and astronomical; Explain conditions necessary for twilight all night; Calculate twilight timings; Define a circumpolar body, what conditions are necessary for a body to be circumpolar. Calculations based on above

TEXT BOOKS

1. Principles of Navigation by Capt. S.S.S Rewari& Capt. T.K.Joseph
2. Practical Navigation by Capt. H. Subramanium
3. Nautical Almanac

RECOMMENDED BOOKS FOR REFERENCE:

1. Principles of Navigation by Capt. P.M. Sarma
2. Nories Nautical Tables
3. The Admiralty Manual of Navigation: Principles of Navigation: Vol. 1- Nautical Institute
4. The Admiralty Manual of Navigation: Astro Navigation Vol. 2- Nautical Institute
5. Navigation Guide Vol. 2: Celestial Navigation- Alexander Simpson
6. Practical Navigation for Officers of the Watch- Frost, A
7. NAV Basics: Ocean Offshore and Celestial Navigation Vol.2- Witherby Seamanship International Ltd.

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding Recognize of important stars with reference to stellar constellations and stellar magnitudes	K2
CO-2	Understanding and Calculate Sunrise and Sunset time using Nautical Almanac. Determine the observed altitude of the sun when the true altitude is zero.	K2
CO-3	Identify Polaris. Identify certain major constellations and navigational stars' movement relative to Polaris and the movement of Polaris with the change of latitude.	K4
CO-4	Position fixing, Position fixing by long by Chron, Intercept, EX-Meridian(Sun) methods of sight calculation.	K5
CO-5	Define Twilights- civil, nautical and astronomical and Calculate twilight timings.	K1

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – IV					
Core	**Course Code: 11644**	**Ship Stability - II**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Ship Stability**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. Exp lain the theory of Trim, Changes in the position of COG & COB, Calculate location of COG, COB & COF, Change of Trimming Moment, Changeof trim due to change of density 2. To Understand how to use cross curves of stability and compute value of GZ for givendisplacement & KG. 3. To understand Righting Moment Calculations, Simpson's First Rule, Second Rule & Third Rule. 4. To understand Angle of Loll, Derive the formula for calculating TPC. Derive the formula for calculating FWA. Derive the formula for calculating MCTC. 5. Apply knowledge of above topics & solve numerical 44 to 67 from Text book- "Stability, Trim and cargo calculations on M.V.Hindship & Oil Tankers."
	Specific Learning Objectives
Unit - I	**Trim :** Exp lain the theory of Trim, Changes in the position of COG & COB, Role of COF in change of trim, Trimming Moment & MCTC. Calculate Changes of drafts & Trim due to Loading, discharging & shifting weights and find final drafts F & A. Calculate amount to be loaded, discharged or shifted to achieve desired drafts. Calculate amount loaded, discharged or shifted to keep aft draft constant. Calculate final F & A drafts using Trim Tables. **Effect of change of density on Trim:** Understand the theory behind Change of underwater volume, Bodily sinkage or rise due to change in density. 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. Calculate F & A drafts due to change of density for box shaped vessel and for avesselfor which hydrostatic particulars are provided.
Unit - II	**Curve of Statical Stability and Cross Curves:** Understand how to use cross curves of stability and compute value of GZ for given displacement & KG. Understand KN Cross curves of stability or tables & obtain GZ using formula GZ = KN – KG sin Θ. State that the KG used in formula for finding GZ using KN values is the corrected KG after application of FSC. Construct GZ curve using GZ values as obtained from cross curves. Using the GZ curve 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. Understand the GZ curve for a listed vessel and a vessel at her angle of loll. Obtain Dynamical Stability by computing area under the GZ curve up to given angle using Simpson's rules.
Unit - III	**Righting Moment Calculations:** Use Wall sided formula to obtain GZ value at moderate and large angles of heel. Use Atwood's formula to obtain GZ value at moderate and large angles of heel. Use KN values to obtain GZ at moderate and large values of heel. Calculate Righting Moment after obtaining GZ values by any of the aforesaid methods by multiplying the GZ with displacement of the vessel. **Simpson's Rule:** State Simpson's First Rule, Second Rule & Third Rule. Calculate areas, volumes, TPC, load displacement, centroids for areas & volumes using Simpson's Rule. Calculate areas, volumes, centroids using combination of Simpson's Rules whennumber of ordinates cannot be used singularly by any of the Rules. **Stability of Ships loading Grain:** Define Gra in, Angle of Repose, and Volu metric heeling moment. Explain the Hazards associated with respect to ship stability during carriage of grain in bulk. Describe Document of Authorization. Sketch and describe the stability criteria for grain cargo as per part B of chapter VI of SOLAS 74. Construct the GZ curve

	for grain laden vessel using KN values for various angles of heel. Construct the heeling arm curve by obtaining value of λ0& λ40. Obtain the angle of heel due to assumed shift of grain by the point ofintersection of the GZ curve and heeling arm curve. Determine by Stability calculations whether the ship satisfies the requirements of Stability criteria as specified in chapter VI of SOLAS 74.
Unit - IV	**Angle of Loll:** Define "Angle of Loll". Explain in detail with diagrams, how a vessel takes to angle of loll. Explain the danger to a ship at the angle of loll. Exp lain the Remedial Actions for Angle of Loll giving reasons for the ballastingsequence to rectify same. Calculate the value of angle of loll using the formula: TanΘ=√-2GM/BM **Derivation of the Formulae:** Derive the formula for calculating TPC. Derive the formula for calculating FWA. Derive the formula for calculating MCTC. Derive the formula for calculating BM (Transverse). Derive the Wall sided formula for calculating GZ at moderate or large angles of heel. Derive the Atwood's formula for calculating GZ at moderate or large angles of heel. Derive the formula for calculating Angle of lo ll. Derive the formula for calculating virtual loss of GM during dry docking. Derive the formula for calculating virtual loss of GM due to Free Surface Effect.
Unit - V	**Hydrostatic Curves and Tables of M.V. HINDSHIP:** Apply knowledge of above topics & solve numerical 44 to 67 from Text book- "Stability, Trim and cargo calculations on M.V.Hindship & Oil Tankers."

TEXT BOOKS

1. Ship Stability for Masters & / Mates - C.B. Barrass and D.R. Derrett
2. Stability, trim and cargo calculations on M.V. Hindship and Oil Tankers- Capt. Joseph & Capt. Rewari
3. Stability Table for Trim & stability particulars of M.V. Hindship (Stability tables)-BhandarkarPublication.

RECOMMENDED BOOKS FOR REFERENCE:

1. Ship Stability at the Operational Level- Subramaniam H
2. Ship Stability for Mates & Masters - Martin A. Rhodes
3. IMO - Grain Code

Related online content (Marine Insight. Marinegyaan. Oways online)

Course Outcomes		**Knowledge level**
CO-1	Understanding and Exp lain the theory of Trim, Changes in the position of COG & COB, Calculate location of COG, COB & COF, Change of Trimming Moment, Change of trim due to change of density	K2
CO-2	Understanding how to use cross curves of stability and compute value of GZ for given displacement & KG.	K2
CO-3	Understanding Righting Moment Calculations, Simpson's First Rule, Second Rule & Third Rule.	K1/K2
CO-4	Understand Angle of Loll, Derive the formula for calculating TPC. Derive the formula for calculating FWA. Derive the formula for calculating MCTC.	K2/K4
CO-5	Apply knowledge of above topics & solve numerical 44 to 67 from Text book- "Stability, Trim and cargo calculations on M.V.Hindship & Oil Tankers."	K1/K5

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – IV					
Core	**Course Code: 11645**	**Cargo Operation –II**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Cargo Operation**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand and Need for inspection of holds after discharge and before loading, Importance of cleaning holds. To study about the Deck Cargoes; Types of Deck Cargo; Hazards of storing cargoes on deck. 2. To understand the Dock Labour Regulation. Competent person, authorized person, responsible person, loose gear, lifting appliance. Duties and powers of the Dock Safety Inspector. Definitions & Terminology employed with Bulk Cargoes 3. To acquire the knowledge of Grain Cargoes under SOLAS Ch. VI, IMO Grain Code and Inspections of cargo spaces, hatch covers and ballast tanks. To understand Contents of Code of safe working practices for ships carrying timber deck cargoes. Stowage and securing of deck timber cargoes. 4. To understand the Procedures for Receiving, Tallying and Delivering Cargo, Mate's receipts, Bill of Lading, Charter Parties, Note of protest, Cargo claims. Third party damage. 5. To acquire the knowledge about the Dangerous Goods in Packaged Form (SOLAS Ch. VII, IMDG Code and MARPOL Annex III).
	Specific Learning Objectives
Unit - I	**Inspection and Preparation of Holds** Need for inspection of holds after discharge and before loading, Importance of cleaning holds, Items to be inspected during hold cleaning, Items to be inspected prior loadingcargo in holds. Log book Entries of cleaning. Use of dunnage, type & size of dunnage, Disposal of dunnage as per MARPOL. Importance of checking bilge suction, Method of checking bilge Suction, Use of deodorising wash. Blanking of ballast lines in holds- (Ballast holds used for heavy ballast) **Deck Cargo:** Deck Cargoes; Types of Deck Cargo; Hazards of storing cargoes on deck. Principles while storing deck cargo- states that stowage should leave safe access to essential equipments and space needed for normal operation of the ship such as- sounding pipes, devices for the remote operation of valves, mooring arrangements, firefighting and life-saving equipment, crew accommodation and working spaces, Protection for the crew (Gua rd rails). Efficient means of securing of deck cargoes. Need of battening of hatch cover before loading deck cargo, Dangerous Cargoes not permitted below deck. Maximum permissible load Unobstructed view from the navigating bridge. Actions in the event of encountering heavy weather with Deck Cargo. **Dock Labour Regulations:** Competent person, authorized person, responsible person, loose gear, lift ing appliance. Duties and powers of the Dock Safety Inspector. Annual thorough exa mination of cargo gear; Maintenance of cargo gear Markings of ship's lift ing appliances and cargo gear, Requirements for in itial and periodical testing of cargo gear and annealing; Register of lifting appliances and cargo handling gear (Chain Register). Precautions to be taken when using forklifts, bulldozers, grabs and otherheavy gear on board. The requirements of guarding dangerous parts of the machinery.
Unit - II	**Bulk Cargoes, Draft Survey & Calculations of Bulk cargo Loaded:** Definitions & Terminology employed with Bulk Cargoes: (Angle of repose, moisture migration, flow moisture point, flow state, transportable moisture limit, dry and wet shift, spontaneous combustion, Concentrates, Trimming). Types of Bulk Cargoes: Hygroscopic Cargoes, Heavy density cargoes, Cargoes liab le to shift/ liquefy, Cargoes liab le to spontaneous combustion. Classification of cargoes as per IMSBC Code. Main hazards and precautions with the shipment of bulk solids (Ores, Concentrates, HBI/DRI).

	Documentation required prior loading. Hazards associated with and precautions to be taken whilst loading carrying high density cargoes, Maximum allowable weight for single and adjacent holds, Water Ingress Alarm. Hazards associated with bulk cargoes and precautions prior, during and after loading of: Coal Sulphur, iron ore and urea. Protection of deck machinery from dust. BLU Code: Purpose and objectives of Bulk carrier loading and unloading, BLU Code: Purpose and objectives of Bulk carrier loading and unloading, Ship Shore check list as per BLU code. Material hazardous in Bulk. MSDS Sheets; Cargo stow plan; Precautions to be taken prior entering cargo holds when pesticides are used for fumigation; Use of Loadicator for stowage Plan, Trimming of Bulk Cargo, Draft Survey and calculation of cargo quantity.
Unit - III	**Grain Cargoes (SOLAS Ch. VI, IMO Grain Code)** Contents of Gra in Code, Definition of Grain, Filled and Partly filled compartments, Trimmed and untrimmed cargo, Specially suitable compartment. Preparation of holds for carriage of grain cargo especially for insect or rodent infestation; Pre loading inspections/surveys; Grain Cargo Hazards, Securing of free grain surface in filled and partly filled compartments, Separation of different grain cargoes loaded in same compartment; Use of Shifting boards Bundling arrangements and Saucering. Document of Authorisation, Grain loading stability criteria for ships with and without a DoA, Contents of Gra in loading booklet. Methods to reduce Grain heeling moments in order to meet Grain stability criteria. **Inspections of cargo spaces, hatch covers and ballast tanks:** Outline and describe the common damage/defects that may occur on watertight transverse bulkheads situated at the ends of dry cargo holds of a bulk carrier. Cracks may often be found at or near the connection of the stool of the transverse bulkhead and the tank top in bulk carriers having combination cargo/ballast holds. Actions to be taken to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling.
Unit - IV	**Timber:** Contents of Code of safe working practices for ships carrying timber deck cargoes. Stowage and securing of deck timber cargoes. Hazards involved with the carriage of deck timber cargo. Effect on stability due to absorption of water or ice accretion. Need for regular inspection of lashing arrangements. Need for controlling height of deck cargo. Need for provision of walkways and access to the top of the cargo. Action if cargo is lost overboard. Stability criteria to be fulfilled. Rolling period test for determining ship's stability and limitations of the method. **Procedures for Receiving, Tallying and Delivering Cargo:** Mate's receipts, Bill of Lading (Information available and different types of B/L) Charter Parties Note of protest, Cargo claims. Third party damage
Unit- V	**Dangerous Goods in Packaged Form (SOLAS Ch. VII, IMDG Code and MARPOL Annex III)** Definitions: (Dangerous Goods, HarmfulSubstances, UN No,IMDG Code) Classification of IMDG cargo, Marking & Labelling of DG Cargo, Structure of IMDG Code, Primary Hazard Class &Secondary Hazard Class. Use of IMDG Code and cargo information obtained from the same – UN No., General Index, MFA G, EmS Compatibility and segregation, Use of Segregation table Precautions when handling dangerous goods, Dangerous cargo manifest, Inspections before loading dangerous goods, Construction of magazine for carriage of e xp losives, Limitations on carriage of e xp losives. Precautions during stowage, handling, loading and carriage of explosives

TEXT BOOKS

1. Cargo Work for Ship officer – Capt Errol Fernandes
2. Cargo Work for Maritime Operation- D.J. House

RECOMMENDED BOOKS FOR REFERENCE:

1. Cargo Work for Ship officer – Capt Errol Fernandes
2. Cargo Work – Kemp and Young
3. Cargo Works – Taylor
4. Cargo Works – D.J. House
5. Cargo Notes- DhananjaySwadi
6. IMDG Code Vol I,II & Supplement

7. IMO Grain Code, IMSBC Code & BLU Code

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the for inspection of holds after discharge and before loading, Importance of cleaning holds. Understanding about the Deck Cargoes; Types of Deck Cargo; Hazards of storing cargoes on deck.	K2
CO-2	Understand and study about the Dock Labour Regulation. Competent person, authorized person, responsible person, loose gear, lifting appliance. Duties and powers of the Dock Safety Inspector. Definitions & Terminology employed with Bulk Cargoes	K2
CO-3	Ability to acquire the knowledge of Grain Cargoes under SOLAS Ch. VI, IMO Grain Code and Inspections of cargo spaces, hatch covers and ballast tanks. Ability to understand Contents of Code of safe working practices for ships carrying timber deck cargoes. Stowage and securing of deck timber cargoes	K1/K2
CO-4	Understanding the Procedures for Receiving, Tallying and Delivering Cargo, Mate's receipts, Bill of Lading, Charter Parties, Note of protest, Cargo claims. Third party damage.	K4
CO-5	Understanding the acquire the knowledge about the Dangerous Goods in Packaged Form (SOLAS Ch. VII, IMDG Code and MARPOL Annex III).	K1/K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – IV					
Core	**Course Code: 11646**	**Seamanship Lab - II**	**P**	**Credit:2**	**Weekly Hours:3**
Pre-Requisite	**Basic and Practical Knowledge of Seamanship**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. Working practices in handling Blocks , Tackles and container lashing, 2. Conduct practical exercise on the use of blocks, snatch blocks and the differential pulley 3. Identification of Nation flag of all countries using Interco, Recognition of House flag. 4. Demonstrate use of various types of Fires and Extinguishers. Refilling of Foam and DCP types Portable Fire Extinguishers. Working Procedures. 5. Demonstrate the correct method of connecting Life raft painter, hydrostatic release unit (HRU) and weak link. Identify Life boat equipment and explain their uses.
	Specific Learning Objectives
Unit - I	**Blocks , Tackles and container lashing:** Conduct practical exercise on the use of blocks, snatch blocks and the differential pulley (chain blocks). Demonstrate the method of reeving a threefold purchase. (Group activity of 2-3 cadets). Demonstrate overhauling of blocks.
Unit - II	**Conduct practical exercises** Conduct practical e xerc ises on the use and maintenance of various types of blocks, tackles, shackles and bottle screws / turnbuckles, including opening, greasing, (Group activity of 2-3 cadets). Demonstrate the use of container lashing gear. (Group activity of 2-3 cadets)
Unit – III	**Flag work:** Identification of Nation flag of all countries using Interco, Recognition of House flag. Identification of flag denoting numbers and substitute flags, How to bend on or unbend a flag from halyard, breaking a flag at close up, Flag hoisting practice at colours and sunset. Practical usage of "International Code of Signals".
Unit – IV	**Fire fighting:** Demonstrate use of various types of Fires and Ext inguishers. Demonstrate refilling of Foam and DCP types Portable Fire Extinguishers, Demonstrate connecting coupling to fire hose using Copper Seizing wir, Demonstrate handling charged fire hose. Demonstrate creating water wall with spray nozzle. Demonstrate donning of Fireman's outfit. Demonstrate donning of EEBD for emergency escape. Demonstrate donning of Self Contained Breathing Apparatus and refilling the air bottles by compressor. Demonstrate entering a smoke filled compartment wearing breathing apparatus. Fire Fighting Drills requirement and demonstration, Demonstrate rendering first aid to a person injured during fire.
Unit - V	**Life Saving Appliances** Demonstrate the correct method of connecting Life raft painter, hydrostatic release unit (HRU) and weak link. Identify Life boat equipment and expla in their uses. Identify parts of Life boat davit. Exp lain use, care and maintenance of Immersion suit, TPA and Life jacket. Identify different types of life buoy, their uses and maintenance. Explain changing of lifeboat falls end to end. Demonstrate Abandon ship drill. Demonstrate lifeboat launching and retrieval operation.

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the working practices in handling Blocks , Tackles and container lashing, Conduct practical exercise on the use of blocks, snatch blocks and the differential pulley	K2/K6
CO-2	Understanding of use of Tackles and container lashing, Conduct practical exercise on the use of blocks, snatch blocks and the differential pulley	K4
CO-3	Understanding and Identification of Nation flag of all countries using Interco, Recognition of House flag.	K2
CO-4	Demonstrate use of various types of Fires and Extinguishers. Refilling of Foam and DCP types Portable Fire Extinguishers. Working Procedures. Conduct a drill.	K4
CO-5	Demonstrate the correct method of connecting Life raft painter, hydrostatic release unit (HRU) and weak link. Identify Life boat equipment and explain their uses. Conduct a drill.	K4

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Semester – IV					
Allied	**Course Code: 11647**	**Marine Engineering, Automation & Control systems – II**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic and operational Knowledge of Marine Engineering, Automation & Control systems**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand and Familiar with the Internal Combustion Engine, Types of engines 2. To understand about the Marine Engineering Auxiliaries, properties of different types of fuels used on board ship. To understand and acquire knowledge about the Main Propulsion Units 3. Familiar with the Automation & Control Engineering. To understand about the Safety Arrangements, gas freeing, purging and inerting of a cargo tank 4. To understand the operation, Regulation and Explain with diagram a two ram electro hydraulic steering gear. To understand the use and operation of Deck Machinery on board ship. To understand and sketch the Pumps & Pumping Systems 5. To understand the Engine Room Watch Keeping, UMS & Equipment Operation. To understand the Refrigeration, Air Conditioning & Ventilation. To understand about the Clean fuel and alternate fuel
	Specific Learning Objectives
Unit - I	**Internal Combustion Engine:** Explain types of engines, Explain requirement of main and auxiliary engine on board Exp lain cycles of operation of two stroke diesel engine, Exp lain cycles of operation of four stroke diesel engine, Exp lain p-v diagrams of two stroke diesel engine and its significance, Explain p-v diagrams of four stroke diesel engine and its significance Describe the components of diesel engine **Marine Engineering Auxiliaries:** Describe the properties of different types of fuels used on board ship, Calculate bunker fuel required for the voyage and speed for a given daily consumption, Exp lain with diagram the working principle of impulse and reaction turbine, gas turbine and steam turbine, Describe the systems of turbines as prime mover for cargo pumping operations of tankers, Describe fixed pitched and variable pitch propellers. Define pitch, pitch angle, real and apparent slips, propeller efficiency, Calculate propeller pitch, slip and efficiency, Exp lain with diagram the shafting arrangement from main engine to propeller, Exp lain with diagram the working of thrust block, Explain the effect of condition of hull on fuel consumption and propeller efficiency, Describe the safety requirements and features of cargo winch, windlass, lifeboat winch, Describe the safety requirements for hydraulic, pneumatic electric drives, Exp lain with diagram of the working of sewage treatment plant, bilge oil water separator and incinerator Describe the regulations pertaining to ship concerned to air pollutionfrom machinery exhausts, water pollution from discharge of sewage and oily bilges from machinery spaces
Unit – II	**Main Propulsion Units (IC Engines & Others):** Define supercharging, Describe the process and different methods of scavenging Describe different types of exhaust gas turbocharging arrangements (constant pressure and pulse type), Exp lain about scavenge fire, its indication and actions to be taken in the event of fire in the scavenge space, Describe jacket water cooling systemof main engine Describe sea water cooling systemof main engine,Describe lubricating oil systemof main engine, Describe fuel oil systemof main engine, Explain functions of lubricating oil Describe the reasons of chemical treatment required for jacket water cooling system. Discuss various methods of chemical treatment. Describe starting air system of main engine, Discuss limitations and care

	required on IC engine during manoeuvring and at full power, Discuss warning up, starting, manoeuvring, reversing and full power running of the main engine, Discuss purpose of turbocharger and procedures of turbo chargerwashing, Define power weight ratio, specific fuel consumption, indicated horsepower, brake horse power, frictional horse power, shaft power, delivered power, thrust power, effective power, Define volumetric efficiency, mechanical efficiency, thermal efficiency, maximum continuous rating (MCR), heat balance sheet, major losses in IC engine **Automation & Control Engineering:** Exp lain the open loop and close loop control system, Explain with sketch, a proportional controller, Exp lain with sketch, a proportional and integral controller, Explain pneumatic, hydraulic, electrical and electronic control system, Describe main propulsion control system from bridge with controllable pitch propeller, bow thruster propulsive system Describe various arrangements necessary for appropriate and effective engineering watches to be maintained for the purpose of safety under normal circumstances and ums operations, Expla in the arrangements necessary to ensure a safe engineering watch is maintained when carrying dangerous cargo, Define trim indicator, heel indicator, draft gauge, load and stress indicators, Describe remote operation for loading, discharging and ballasting operations, Define the function of information display, data logging, alarmsystem on board ship.
Unit – III	**Safety Arrangements:** Exp lain gas freeing, purging and inerting of a cargo tank, Explain with diagram, inert gas production, generation from boiler e xhaust gas, Explain FSS code requirement for inert gas system, Explain different measuring instruments for different gases such as o2 analyser, exp losive meter, dragger pump, multi gas detector. **Steering Gears:** Exp lain with diagram a two ram electro hydraulic steering gear, Exp lain with diagram a four ram electro hydraulic steering gear, Explain with diagram rotary vane steering. Exp lain with diagram electric steering, Exp lain with diagram a variable delivery pump as used in electro hydraulic steering gear, State different rules and regulations of steering gear, Explain rudder drop allowance and jumping bar clearance
Unit – IV	**Deck Machinery:** Exp lain with diagram the working of a windlass. Exp lain with diagram the working of an automatic onstant tension mooring winch. Exp lain with diagram the working of a simple cargo gear rigging arrangement and the use of winche s in this arrangement. Explain with diagram the working of following: acock,saglobe valve, a gate valve and a butterfly va lve. Explain with diagram the working and signal control system of an airwhistle **Pumps & Pumping Systems:** Explain with diagram the working of different types of positivedisplacement pumps Explain with diagram the working of different types of centrifugalpumps. Explain the suitability of different pumps for specific purposes. Explain with diagram a typical bilge and ballast systemfor a dry cargoship. Explain with diagram the pumping systemof a gas carrier, chemicalcarrier and an oil tanker.
Unit – V	**Engine Room Watch Keeping & Equipment Operation:** Exp lain the watch keeping systems in E/ R and its necessity, Exp lain periodic checks carried out in UMS. List down the heavy weather precautions to be taken for steering, main propulsion and other machinery. List down the safety checks to be carried out while in port, anchorageand at sea. **Refrigeration, Air Conditioning & Ventilation:** Exp lain with diagram a vapour compression system, Exp lain desirable properties of a refrigerant, Exp lain with diagram the system of use of secondary refrigerant for cargo hold cooling, Exp lain a single duct air-conditioning system. Explain the requirement of efficient ventilation systemfor a ship, **Clean fuel and alternate fuel:** Explain the need of clean and alternate fuel, What are the clean and alternate fuels used in shipping.

TEXT BOOKS

1. Basic marine engineering - T. K. Grover

RECOMMENDED BOOKS FOR REFERENCE:

1. Engineering drawing - reeds,

2. Motor engineering knowledge for marine engineers - Reeds Vol 12,
3. Basic electro technology - Reeds Vol 6,
4. Marine electrical equipment & practice –MC George,
5. Marine engineering practice Vol 2 part 17 slow speed diesel engines by institute of marine engineers (England),
6. Materials for marine machinery - Fredrick &Capper
7. Strength of materials - Ryder,
8. General engineering knowledge for engineer - Reeds Vol 8,
9. Marine and offshore pumping and piping systems - Crawford,
10. Basic marine engineering - J. K. Dhar

Related online content		
Course Outcomes		**Knowledge level**
CO-1	Understanding and Familiar with the Internal Combustion Engine, Types of engines	K2
CO-2	Understanding about the Marine Engineering Auxiliaries, properties of different types of fuels used on board ship. Understanding and acquire knowledge about the Main Propulsion Units	K2
CO-3	Ability to Familiar with the Automation & Control Engineering. Ability understand about the Safety Arrangements, gas freeing, purging and inerting of a cargo tank. Understanding the operation and Explain with diagram a two ram electro hydraulic steering gear	K1/K2
CO-4	Understanding the use and operation of Deck Machinery on board ship. Understanding and sketch the Pumps & Pumping Systems	K4
CO-5	Understanding the Engine Room Watch Keeping, UMS & Equipment Operation. Understand the Refrigeration, Air Conditioning & Ventilation. Understanding about the Clean fuel and alternate fuel	K4

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B.Sc. Nautical Science

Semester – IV					
Allied	**Course Code: 11648**	**Meteorology**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic and thorough Knowledge of Meteorology Climatic Changes over Ocean**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the climatology – Temperature, Wind and Pressure over the Ocean and over the land 2. To understand the Weather System influence of Atmospheric layer and Air Mass, formation of Clouds and Climate changes. To Study about the Weather Reporting System, Describe the organization, functions and objectives of the World MeteorologicalOrganization, Indian Meteorological Department. 3. To understand and acquire the Weather Reports from Sat C and Weather Forecasting and Reporting System. To understand the Ice on the Sea: Different types of ice, icebergs, limits of icebergs, accumulation of ice on ships 4. To understand about the Tropical Revolving Storms (TRS), Formation and the effect of Seasons and Climates, Cyclone, Typhoon, Depression etc. To understand about the Ocean Circulation System and Sub- Surface Circulation, Oceanic Current, Cold and Warm Current affecting Marine Environment 5. To understand the Oceanic Waves and Tides**,** Causes for Waves and Tides, Tsunami. To identify the changes of Sea Water and Ocean Water- Temperature, salinity, density - their relationship and measurement; and vertical and horizontal distribution. To understand the Principles, uses and Operation of Ship Borne Meteorological Instruments - Aneroid Barometer, Barograph, Hygrometer etc.
	Specific Learning Objectives
Unit - I	**Climatology:** Wind and Pressure systems over the oceans. Draw the mean surface pressure and wind distribution over the earth's surface. Describe the characteristics and location of the doldrums, intertropical convergence zone, trade winds, subtropical oceanic highs, westerlies and polar easterlies. Apply the concept of horizontal temperature differences to a qualitative exp lanation of the formation of land and sea breezes. Exp lain the formation of anabatic and katabatic winds. List the regions of occurrence of anabatic and katabatic winds. Provide e xa mples of local winds. Genera l distribution of surface temperature, surface current, sea fog, pattern of clouds; 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 **Water Vapour:** Define 'water vapour'. Describe the properties of water vapour in the atmosphere. Define 'evaporation', 'condensation', 'latent heat of vaporization'. Define 'saturated air'. Describe the processes of mixing, cooling and the evaporation of water vapour, by which a sample of air may be brought to saturation. Define 'dewpoint', 'absolute humidity', 'relative humidity'. Define super cooling, and frost point. Explain diurnal and seasonalvariation of water vapour. **Visibility:** State that visibility is reduced by the presence of particles in the atmosphere, near the earth's surface and define 'fog', 'mist' and 'haze'. Apply the concept of processes leading to supersaturation to a classification of fogs as mixing, cooling or evaporation fogs. Exp lain qualitatively the formation of radiation fog, mentioning areas, seasons and reasons for its dispersal. State the effect of pollution on the formation of radiation fog Explain qualitatively the formation of advection fog, mentioning areas, seasons and reasons for dispersal. Explain qualitatively the conditions leading to the formation of sea smoke, and typical areas where sea smoke may be encountered. Describe methods of estimating the visibility at sea, by day and by night, and the difficulties involved.

Unit – II	**Weather Systems:** Define 'air mass'. Explain the formation of an air mass. Define 'source region' Explain the characteristics required of a source region. Describe the source region characteristics of arctic, polar, tropical and equatorialair-mass types – defines 'warm front', 'cold front'. Know the symbols for warm and cold fronts and identifies them on a weather map. Describe, with the aid of a diagram, the weather experienced during the passageof an idealized warm front. Describe, with the aid of a diagram, the weather experienced during the passageof an idealized cold front. Origin, life and movement of Frontal Depressions, Structure of Depressions. Weather associated with cyclone, Anticyclone, Ridge, col, Trough and otherpressure systems. **Weather Reports:** Describe the organization, functions and objectives of the World Meteorological Organization, Indian Meteorological Department. Describe the sources of weather information available to shipping including internet and emai. Weather reporting and recording procedures. Describe the services provided for shipping by Meteorological Offices. Describe the appropriate weather bulletin (SAT -C) and the contents of each of its sections. Describe the types of information received by facsimile machine. Describe the services provided for storm warnings (At Port). Explain the need for meteorological codes. Use the Ship's Code and Decode Book to code a ship's full report. Use the Ship's Code and Decode Book to decode a reduced report from a shorestation. **Weather Forecasting and Reporting System:** Interpretation of symbols and isobaric patterns on weather charts and facsimile charts. Cold and Warm Front, occlusion on a synoptic chart. Interpretation 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. Exp lain how weather observations at a ship can be used to improve the forecast derived from synoptic and prognostic charts. Evaluate the weather forecast information received. Vo luntary observing fleet under I.M.D; type and nature of information collected and International system of weather reporting.
Unit – III	**Tropical Revolving Storms (TRS):** Identify the Local names, seasons and areas affected; Origin, structure, movement and lifespan of TRS; Weather associated with TRS; Definitions and nomenclature; Warning signs of an approaching TRS; Characteristics of TRS; Forecasting techniques; Action to be taken when the presence of TRS is confirmed; Cyclone tracking and warning bulletins under international conventions; Practical Rules for navigation for manoeuvring in the vicinity of TRS; Avoidance of storm centres and the dangerous quadrants; Ideal conditions for the formation of TRS; Comparison between a TRS and a temperate latitude depression; Avoiding TRS – 1-2-3 theory and sector theory Define 'anticyclone'. Draw a synoptic pattern of an anticyclone, for both northern and southern hemispheres, showing isobars and wind circulation. Describe the weather associated with anticyclones. Describe a ridge of high pressure. Draw a synoptic pattern for a ridge, showing isobars and wind directions. Describe a typical weather sequence during the passage of a ridge between depressions across the observer's position. Describe a col or a void between a convergence of pressure systems Draw a synoptic pattern for a col or a void between a convergence of pressure systems, showing isobars and wind directions. Describe the weather associated with a col or a void between a convergence of pressure systems.
Unit - IV	**Sea Water:** Properties of ocean water- Temperature, salinity, density - their relationship and measurement; and vertical and horizontal distribution **Ocean Circulation System and Sub- Surface Circulation:** Identification of main ocean currents on the world map; 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. **Oceanic Waves and Tides:** 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 t ides; tide producing forces, types of tides, tide prediction and analysis; tidal streams. Relationship between tides and phases of moon. **Ice on the Sea:** Different types of ice, icebergs, limits of icebergs, accumulation of ice on ships
Unit - V	**Ship Borne Meteorological Instruments:** Principle, use and operation of Aneroid Barometer, Barograph, Hygrometer, Hydrometer, Stevenson's screen, Whirling psychrometer, Anemometer.

TEXT BOOKS

1. Marine Meteorology – Capt. H. Subramaniam
2. Ships' Code and Decode Book- The Met. Office

RECOMMENDED BOOKS FOR REFERENCE:

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

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the climatology – Temperature, Wind and Pressure over the Ocean and over the land Understanding the changes of Visibility reduced by the presence of particles in the atmosphere Understanding the Water Vapour - Describe the properties of water vapour in the atmosphere	K2/K3
CO-2	Understanding the Weather System influence of Atmospheric layer and Air Mass, formation of Clouds and Climate changes Ability to understand and acquire the Weather Reports from Sat C and Weather Forecasting andReporting System Study about the Weather Reporting System, Describe the organization, functions and objectives ofthe World Meteorological Organization, Indian Meteorological Department.	K2/K4
CO-3	Understanding about the Tropical Revolving Storms (TRS), Formation and the effect of Seasons and Climates, Cyclone, Typhoon, Depression etc.	K4
CO-4	Ability to understand the Ice on the Sea: Different types of ice, icebergs, limits of icebergs, accumulation of ice on ships Understanding about the Ocean Circulation System and Sub- Surface Circulation, Oceanic Current, Cold and Warm Current affecting Marine Environment Understanding the Oceanic Waves and Tides, Causes for Waves and Tides, Tsunami Understanding to identify the changes of Sea Water and Ocean Water- Temperature, salinity, density - their relationship andmeasurement; and vertical and horizontal distribution	K2 K4
CO-5	Understand the Principles, uses and Operation of Ship Borne Meteorological Instruments - Aneroid Barometer, Barograph, Hygrometer etc.	K2

ALAGAPPAUNIVERSITY

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Semester - IV					
SEC - V	**Course Code: 11649**	**Cyber Security, Internet of Things**	**T**	**Credit:1**	**Weekly Hours:1**
Pre-Requisite	**Basic and Practical Knowledge of the Cyber Security, Internet of Things**		**Syllabus Revised**		**2023 – 24**

Cyber Security - 20 Hours

Course Objectives	1. To understand and describe Cyber Security, Define different cyber security terminology 2. To understand the Cyber security key aspects, Cyber Security Vulnerabilities and Cyber Security Safeguards. 3. To understand about the Security protocol and implementation, measures to protect against cyber fraud 4. To understand and Describe technologies that led to evolution of IoT 5. Introduction and Application in the Maritime Industry
	Specific Learning Objective
Unit - I	**Introduction to Cyber Security:** Define and describe Cyber Security, Define different cyber security terminology, Explain types of cyber-attacks, Explain types of hackers, Explain different types of web.
Unit – II	**Cyber security key aspects:** Define and explain Cyber Security Vulnerabilities and Cyber Security Safeguards. Explain how to Securing Web Application, Services and Servers. Explain in details, Intrusion Detection and Prevention. Define and explain in detail Cyber space and the Law.
Unit – III	**Security protocol and implementation:** Define and explain Cyber Forensics. Explain and demonstrate General firewall settings. Explain and understand different measures to protect against cyber fraud, Analyse and explain Cyber-attacks, cyber netiquettes. Analyse and understand Cyber security on board ship with cyber netiquettes
Unit – IV	**Introduction to IoT** Describe technologies that led to evolution of IoT, Define and explain IoT and M 2M, IoT and Big Data. Describe IoT Standards. Explain and understand require ment of international standard (case study). Explain in details challenges in IoT with respect to marine domain
Unit - V	**Introduction and Maritime Industry:** Explain IoT standards in practice. Operating platforms/systems. Explain IoT in everyday life, Internet of Everything, Describe and explain IoT and Individual Privacy. Explain different IoT application in shipping industries, IoT Cloud services--SaaS, PaaS, IaaS

Cyber Security

TEXTBOOKS

1. Fundamentals of Cyber Security by Bhushan/Rathore/Jamshed
2. Internet of Things and its Applications by Prof.Satish Jain, Shashi Singh.

RECOMMENDED BOOKS FOR REFERENCE: (Cyber Security)

1. Cyber security??? Attack and Defense Strategies: Infrastructure Security with Red Teamand Blue Team Tactics by Erdal Ozkaya and Yuri Diogenes
2. Cyber security: the Beginner's Guide: A Comprehensive Guide to Getting Started in Cyber security, by Erdal Ozkaya. Packt Publishing
3. Cyber security Essentials, by Christopher Grow, Donald Short, Philip Craig, Charles J.
4. Cyber security for Beginners, by Raef Meeuwisse
5. Hacking: The Art of Exploitation (2ndEd.) by Jon Erickson
6. The Art of Invisibility:The World's Most Famous Hacker Teaches You How to Be Safe in the Age of Big Brother and Big Data by Kevin Mitnick

Internet of Things (IoT)

TEXT BOOKS

1. Internet of Things and its Applications by Prof. Satish Jain, Shashi Singh .

RECOMMENDED BOOKS FOR REFERENCE:

1 The Internet of Things" by Samuel Greengard
2 Getting started with Internet of Things" by Cuno Pfister
3 Learning Internet of Things" by Peter Waher
4 Precision: Principles, Practices and Solutions for the Internet of Things" by Timothy Chou.
5 The Fourth Industrial Revolution by Klaus Schwab
6 The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies by Erik Brynjolfssonand Andrew McAfee

Related online content		
Course Outcomes		**Knowledge level**
CO-1	Understanding and describe Cyber Security, Define different cyber security terminology	K2
CO-2	Understanding the Cyber security key aspects, Cyber Security Vulnerabilities and Cyber Security Safeguards.	K2
CO-3	Understanding about the Security protocol and implementation, measures to protect against cyber fraud	K2
CO-4	Understandng and Describe technologies that led to evolution of IoT	K4
CO-5	Introduction and Application in the Maritime Industry	K1

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - IV					
SEC - VI	**Course Code: 116410**	**Block chain Technology**	**T**	**Credit:1**	**Weekly Hours:1**
Pre-Requisite	**Basic Knowledge of the Block Chain Technology**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand and defining about the Block chain technology 2. To understand about the Block chain and Maritime Industry and how applicable to the Maritime Industry 3. To understand about Crypto-anarchism and Cypherpunks 4. To understand the details of block chain architecture. 5. To understand the Opportunities and Challenges of Blockchain in marine industry.
	Specific Learning Objectives
Unit – I	**Introduction to BCT:** Define Block chain technology: Why, What, How. Exp lain Technological and Cryptographic Elements in Blockchain.
Unit - II	**Define and describe Blockchain Platforms**. A decentralized society. Describe the current state of the Blockchain landscape. Describe Business applications and assessing blockchain.
Unit - III	**Block chain and mining and consensus:** Explain Crypto-anarchism and Cypherpunks. Explain and analyze hash cryptography, mining and consensus.
Unit - IV	**Block chain Architecture:** Proof-of-Work and Stake-of-Work consensus, blockmining, block tampering. Explain in detail block chain architecture.
Unit - V	**Blockchain in marine industry:** Explain and understand The Limitations, Opportunities and Challenges of Blockchain in marine industry.

TEXT BOOKS

1. Blockchain From Concept To Execution by Debajani Mohanty.

RECOMMENDED BOOKS FOR REFERENCE:

1 Blockchain: Blueprint for a new economy by Melanie Swan
2 Blockchain Revolution by Don and Alex Tapscott.
3 Cryptoassets by Chris Burniske and Jack Tatar
4 The Book of Satoshi by Phil Champagne
5 The Basics of Bitcoins and Blockchains by Antony Lewis
6 Blockchain Technology Explained: The Ultimate Beginner's Guide by Alan T. Norman
7 Blockchain Technology for Industry 4.0, Springer

Related online content		
Course Outcomes		**Knowledge level**
CO-1	Understanding and defining about the Block chain technology	K2
CO-2	Understanding about the Block chain and Maritime Industry and how applicable to the Maritime Industry	K3
CO-3	To understand about Crypto-anarchism and Cypherpunks	K2
CO-4	To understand the details of block chain architecture.	K4
CO-5	understand the Opportunities and Challenges of Blockchain in marine industry	K3

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

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Semester - V					
Core	**Course Code: 11651**	**Navigation & Collision Prevention Regulations (BA Chart 5049/5047/5048/2675)**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic and Practical Knowledge of Navigation and Collision Regulations**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand and familiar with the Definitions and Position fixing terms used in Chart Work, Methods to draw Position Line from the Celestial Objects. 2. To understand the basic theory of Tides and Calculate the tidal level in Standard and Secondary Ports 3. To understand the IALA Buoyage System in Coastal Area, Port Area and Pilotage 4. To understand and make Passage Planning – Appraisal, Planning, Execution and Monitoring and Practical knowledge on Chart Work 5.To thorough understanding in Collision Prevention Regulations Rules 1-41
	Specific Learning Objectives
Unit - I	**Position Fixing** Defines the following: Set, Rate, Drift, Leeway, Dead Reckoning Position (DR), Estimated Position (EP), Observed position (Fix). Defines the following:Ships speed, Effective speed, Course and Distance made good, Applied leeway. Calculates the following:Course and Distance Made Good with a Tidal Stream / Current, Course to Steer allowing for Current. Calculates the course to steer counteracting current and leeway including:Time and distance off when landmark is abeam, Time and distance off when a landmark is nearest. Calculates the estimated position allowing for current and leeway including: Time and distance off when landmark is abeam, Time and distance off when a landmark is nearest. Calculates the ships position by Running Fix, with or without current and Leeway. Astronomical Position Lines:Recalls the theory of Position lines in case of 'Long by Chron', 'Intercept' and 'Merpass', Plots the Astronomical Position Lines and obtains a position using it and a Terrestrial Position Line / Circle. Calculates vessel's position using a Transferred Position Circle withcurrent and leeway.
Unit – II	**Tide:** Describes the Basic Tidal theory including the cause and effect ofSpring tide and Neap Tide. Defines: Range of Tide, Duration of Tide, Chart Datum, Mean High Water Springs**.** Calculates the intermediate Times / Height of water for Standard Ports. Calculates the intermediate Times / Heights of water for Secondary Ports. Predicts the tidal current direction and rate from the information available on the chart.
Unit – III	**Buoyage system:** Exp lains the Principles and Rules of the International Association of Lighthouse Authorities Buoyage Systems 'A' and 'B' States the dangers of placing implicit reliance upon floating Navigational Aids. Describes the different types of buoys in the IALA system. Description, Exp lanation and Use of Lateral and Cardinal buoys. Description, Exp lanation and Use of : Isolated Danger Buoys, Safe Water Marking Buoys, Special Marking Buoys, Emergency Wreck Marking Buoys, Virtual buoys.
Unit – IV	**Passage Planning:** Plan a passage 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, Gu ide to Port Entry etc.);Reference to M.S notice 854 and IMO Res. A. 893 (21). The above to include – Appraisal – (Sources of Appraisal and Data to collect from the Sources) Ascertain the charts and publication required for the voyage and whether they are corrected and up-to-date, extract all relevant information from the publications such as Ocean Passages of the World, Sailing Directions, Routing

	Charts, List of Lights andFog Signals, List of Radio Signals, Guide to Port Entry and Routeing Charts Planning – (Planning on the Chart and Planning on the Voyage Plan Sheet) Plot courses on the charts, both small and large scale, way points, no-go areas, contingency anchorages, alerts, abort points and other relevant marks. Prepare a Voyage plan sheet Execution – During the voyage, fix positions as indicated on the passage plan, maintain sufficient bridge manning levels, obtain Navigational and weather warnings, maintain lookout and navigate to keep clear of other vessels and navigational hazards. Monitoring – Monitor frequently the traffic, position, weather, visibility and maintain a situational awareness at all times. Check the proper functioning of navigational instruments and fill up logsperiodically during
Unit - V	**Collision Prevention Regulations:** **Rules 1-41** Revision of points covered in T4206. Defines Masthead Light, Stern light, Side Lights and Towing Light. States the Range of the Navigation Lights. Describes / Recognizes Lights and Shapes carried by vessels when underway. Describes / Recognizes Lights and Shapes carried by vessels when making way through water. Describes / Recognizes Lights and Shapes carried by vessels when at Anchor. Describes / Recognizes Lights and Shapes carried by vessels Not Under Command, Restricted in her ability to Maneuver and when constrained by her draught. Describe / Recognize Lights and Shapes carried by vessels when engaged in special activities. Describes / Recognizes Lights and Shapes carried by Fishing vessels. Defines short and Prolonged blast. Describes the equipment carried for sound signals. Describes the sound signals to be used by vessels when in sight of one another including Manoeuvring signals. Describes the sound signals sounded by vessels whennavigating in or near an area of restricted visibility

TEXT BOOKS

1. Selected pages from Admiralty Tide Tables volume1, 2 & 3-1992 –Hydrographer of Navy
2. **IMO Rules of the Road – Bhandarkar Publications**
3. Chart Work for Mariner-Capt S.K.Puri

RECOMMENDED BOOKS FOR REFERENCE:

1. Admiralty Tide Tables
2. IALA Maritime Buoyage System
3. Ocean passages of the world
4. The Admiralty Manual of Navigation: Principles of Navigation: Vol. 1- Nautical Institute
5. Navigation Guide Vol. 1: Near Coastal Navigation- Alexander Simpson
6. NAV Basics: The Earth, the sailings, Tides & Passage Planning Vol.1- Witherby Seamanship International Ltd.
7. Admiralty publication NP 294 (How to keep charts up to date)
8. Modern Chart work- Squair, W.H
9. Chart Work: Basic Concepts & Miscellaneous Calculations- Chaudhari S.S
10. Chart Correction Log- Admiralty Charts and Publications
11. Catalogue of Admiralty Charts and Publications - Admiralty Charts and Publications 12.International Lights, Shapes and Sound Signals – D. A. Moore
13.International Regulations for Preventing Collisions at sea- Nautical Press

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding and familiar with the Definitions and Position fixing terms used in Chart Work, Methods to draw Position Line from the Celestial Objects.	K2
CO-2	Understanding the basic theory of Tides and Calculate the tidal level in Standard and Secondary Ports	K2
CO-3	Understanding the IALA Buoyage System in Coastal Area, Port Area and Pilotage	K3/K4
CO-4	Understanding and make Passage Planning – Appraisal, Planning, Execution and Monitoring and Practical knowledge on Chart Work	K4
CO-5	A thorough understanding in Collision Prevention Regulations Rules 1-41and ability to identify Buoys and Marks with models	K2/K5

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - V					
Core	**Course Code: 11652**	**Naval Architecture – I**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Naval Architecture**		**Syllabus Revised**		**2023 – 24**

Section A – Ship Stability

Course Objectives	1. To understand the Simpson's Rule and marine applications of Simpson's Rules 2. To understand the Centre of Pressure and its important 3. To understand the Bilge and methods of bilging in different types of vessels 4. To understand and Expla in stresses experienced by ships in still water and in seaway. To understand the Ship Construction, Shipyard Plans and Practices. Knowledge about the Specialised Ships - strength and construction of ships using Midship sections of Passenger ship, Ro-Ro ship, Refrigerated cargo ship, Liquefied gas carrier (LPG & LNG), Chemical tankers. 5. To understand the Principles of Ship Design**,** as Safety, sustainability, efficiency, nature of service, dimensions etc.
	Specific Learning Objectives
Unit - I	**Simpson's Rule:** Define Second moment of area (Moment of Inertia). Sketch and describe second moment of a rectangle about axis passing through centroid and about one of its sides. Sketch and describe Theorem of Parallel a xes. State marine applications of Simpson's Rules. Compute second moments of area about transverse axis passing throughcentre of flotation and about centerline using Simpson's Rules. **Centre of Pressure:** Define Centre of pressure and its importance. Compute Centre of pressure for regular shapes. Compute Centre of pressure for combination of regular shapes.
Unit – II	**Bilging:** Sketch, define and describe bilging of a box shaped vessel. Exp lain effects of bilg ing of a compartment with / without permeability. Calculation on bilging and flooding of a midship compartment for a box-shaped vessel. Exp lain actions to be taken in the event of partial loss of intact buoyancy by closing openings and using cross flooding arrangements.
Unit – III	**Stresses & Strains:** Exp lain stresses experienced by ships in still water and in seaway. Explain 'hogging' and 'sagging' and difference between them. Explain how hogging and sagging stresses result in tensile or compressive forces in the deck and bottom structure. Describe water pressure loads on the ship's hull. Describe liquid pressure loading on the tank structures. Describe qualitatively the stresses set up by liquid sloshing in a partly filled tank. Describe racking stress and its causes. Exp lain what is meant by 'pounding 'or 'slamming' and state which part of the ship is affected and strengthened. Explain what is meant by 'panting' and state which part of the ship is affected and strengthened. Describe stresses caused by localized loading.
Unit – IV	**Principles of Ship Design:** Exp lain the principles of ship design as Safety, sustainability, efficiency, nature of service, dimensions, manpower requirement, deadweight, seakeeping & manoeuvrability, strength, corrosion factor, economic factor, etc. Describe four stages of design as Concept, Preliminary, Contract and Detail design. Describe Plans and Specifications developed during ship design. **Specialised Ships:** Describe strength and construction of ships using Midship sections of Passenger ship, Ro-Ro ship, Refrigerated cargo ship, Liquefied gas carrier(LPG & LNG), Chemical tankers.

Unit – V	**Shipyard Plans and Practices:** Exp lain sequence of events in ship construction. 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, numericalcontrol. Explain progress of a plate from stockyard to ship. Exp lain various shipyard processes - Plate straightening, blasting and painting, edge preparation, Cutting, drilling, bending, shaping, Sub- assembly, assembly, Testing. Explain Launching of a ship and Sea Trials.

TEXT BOOKS

1. Ship Stability for Masters & / Mates - C.B.Barrass and D.R.Derrett
2. Ship construction –D.J. Eyres

RECOMMENDED BOOKS FOR REFERENCE:

1. Ship Stability for Mates & Masters - Martin A. Rhodes

2. Ship Construction for Engineers - Reid

3. Ship construction – Pursey

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the Simpson's Rule and marine applications of Simpson's Rules	K2
CO-2	Understanding the Centre of Pressure and its important	K2
CO-3	Understanding the Bilge and methods of bilging in different types of vessels . Understanding and Explain stresses experienced by ships in still water and in seaway	K1/K2
CO-4	Understanding the Principles of Ship Design**,** as Safety, sustainability, efficiency, nature of service, dimensions etc.	K4
CO-5	Understand the Ship Construction, Shipyard Plans and Practices. Knowledge about the Specialised Ships - strength and construction of ships using Midship sections of Passenger ship, Ro-Ro ship, Refrigerated cargo ship, Liquefied gas carrier(LPG & LNG), Chemical tankers.	K1/K4

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Semester - V					
Core	**Course Code: 11653**	**Ship Safety Equipment**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Safety Equipment**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the uses of Life Saving Appliances 2. Introduction and Explain objective of fire safety and functional requirement as per SOLAS. 3. To understand the Fire Prevention As per SOLAS Convention, Describe Class A, B and C Class divisions. 4. To understand about the Fire Detection and Safety Systems, Describe the Types of Detectors, Selection of Fire Detectors andAlarm systems and their operational limits 5. To understand the Fire Fighting Appliances, types and operational knowledge. Familiar with the Fire Control, Firefighting & Shipboard Organisation, Exp lain the conduct of Fire Drills and the statutory requirements for fire drills.
	Specific Learning Objectives
Unit - I	**Life Saving Appliances:** SOLAS requirements for LSA's on Cargo Ships, Classification of ships for LifeSaving appliances. **Life boat:** Describe the Construction and parts of life boat including Buoyancy Tanks, Means of propulsion. Exp lain the Different types of lifeboats - Totally enclosed lifeboats, partially enclosed lifeboats, Free-fall Lifeboats. List the different Lifeboat equipment and their uses. List the Pyrotechnics in Lifeboat. Explain the communication equipment on Lifeboats-Portable radio set, SART, EPIRB. Describe the Lifeboat launching Procedure including on load release/offload release system. List the Precautions when lowering/ launching survival crafts. Describe the procedures for retrieving enclosed lifeboats and free fall life. Boats, including cutoff switches. Exp lain requirement and operation of rescue boats. Describe the procedure and importance of Abandon Ship Drill and duties as per muster list. List the maintenance required in lifeboats. **Liferaft:** Describe "throw overboard" and "Davit launched" Liferaft. Explain the Construction and parts of life raft. List the Life raft equipment and their uses. Explain the liferaft launching procedures and use of HRU. Exp lain the use of repair kit. List the markings and servicing requirements. List the maintenance required. **Life Buoy:** Describe a lifebuoy and its attachments including MOB marker, S.I lights. Explain the Correct procedure for use of a lifebuoy. List the maintenance required. **Life Jacket:** Describe a life jacket and its attachments. Explain the correct method of donning a life jacket and jumping into water. State the maintenance required. **Immersion suits, TPAs:** Describe Immersion suit, and TPA, use, care and maintenance. **Line Throwing Appliances:** Describe line throwing appliance, use, care and maintenance. **Survival at sea:** Explain the techniques used for survival at sea and recovery ofperson. Explain LSA plan and training

	Manual. State the rescue operation (Med-Evac) by helicopter.
Unit – II	**Introduction to fire fighting:** Explain objective of fire safety and functional requirement as per SOLAS. Describe the theory and chemistry of fire. Explain fire triangle/tetrahedron, modes of combustion. List the different Classes of fire. Explain the control of class A, B and C fires. Explain Fire Safety Plan and Training Manual.
Unit – III	**Fire Prevention:** As per SOLAS Convention. Describe Class A, B and C Class divisions. Describe different types of Fire dampers and ventilators. State the use of IG systemfor fire prevention in tankers. Explain the construction of means of Escape, stairway, fire doors.
Unit – IV	**Fire Detection and Safety Systems:** Purpose and functional requirement as per SOLAS. Describe the Types of Detectors, Selection of Fire Detectors and Alarm systems and their operational limits. Describe the fixed fire detection and alarm system. Explain the periodic testing of sensors and detection system. Explain Fire control stations.
Unit – V	**Fire Fighting Appliances:** Describe the Construction, operation and merits of different types of portable and non-portable fire e xtinguishers and fixed fire extinguishing installations for ships. Exp lain Fire Pumps, Emergency Fire pumps, Fire mains, isolation valves, Relief valves, Fire hydrants and different types of fire hoses and nozzles used and their maintenance. Explain International shore connection. Describe various types of portable fire e xt inguishers, and their suitability for different types of fires, refilling, maintenance and testing. Describe the steam smothering system, Carbon dio xide smothering system, Inert gas system, Flue gas system, Foam s mothering system for liquid fires, High e xpansion foam system. Exp lain Fireman's outfit, Self-Contained Breathing Apparatus (SCBA), Safety lamps, fire a xe, and their maintenance. Explain use of EEBD for escape and its maintenance. **Fire Control, Firefighting & Shipboard Organisation:** Explain the Fire organization on ships. State Fire alarm and duties as per muster list. Exp lain the conduct of Fire Drills and the statutory requirements for fire drills. Fire safety precautions on cargo ships and tankers during working. Explain the automatic sprinkler system fitted onboard. Describe firefighting actions for fires in Accommodation, Machinery spaces, Boiler rooms, Cargo holds, Ga lley, etc. Describe procedure of firefighting in port and dry-dock. Describe the Procedure for re-entry after putting off fire. Explain the Rescue operations from affected compartment and First aid.

RECOMMENDED BOOKS FOR REFERENCE:

1. Life Boat and Life Raft - Capt. Puri S.K.
2. Survival at sea - C.H. Wright
3. Theory and Practice of Seamanship - Danton G.
4. Seamanship Notes - Kemp & Young
5. Seamanship & Nautical Knowledge- Nicholls
6. Life Saving Appliances Rules - Govt of India
7. Fire Fighting Appliances Rules -Govt of India
8. Seamanship – D.J House
9. LSA Code.
10. FSS Code

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the uses of Personal Life Saving Appliances	K2
CO-2	Introduction and Explain objective of fire safety and functional requirement as per SOLAS.	K1
CO-3	Understanding the Fire Prevention As per SOLAS Convention, Describe Class A, B and C Class divisions.	K2/K3
CO-4	Understanding about the Fire Detection and Safety Systems, Describe the Types of Detectors, Selection of Fire Detectors andAlarm systems and their operational limits	K4
CO-5	Understanding the Fire Fighting Appliances, types and operational knowledge. Familiar with the Fire Control, Firefighting & Shipboard Organisation, Explain the conduct of Fire Drills and the statutory requirements for fire drills.	K2/K4

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Semester - V					
Core	**Course Code: 11654**	**Navigation Watch Keeping & Bridge Equipment - II**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Acquire knowledge of Navigational Watch Keeping & Bridge Equipment**		**Syllabus Revised**		**2023 – 24**

Course Objectives	**Bridge Watch Keeping:** 1. To understand the Performing Safe Navigational Watch as per Section A- VIII/2 and B-VIII/2 of International Convention on Standards of Training and Watch keeping for Seafarers 2. To understand Bridge Procedures Guide and its Contents, Watch Keeping at Sea under Different Conditions in Different Area **Bridge Equipment:** 1. To understand the Fundamental working Principles of Marine Radar and ARPA 2. To understand about the Gyro Compass, Master Gyro, Gyro Repeaters and Gimbal. 3. To understand the uses of Magnetic Compass, Compass Card and Compass Error 4. To understand the principles and uses of Various Other Navigation Aids – GPS, DGPS, AIS, GMDSS Equipment, LRIT, SSAS and BNWAS.
	Specific Learning Objectives
	Bridge Watch-keeping
Unit - I	**Performing Safe Navigational Watch** as per Section A- VIII/2 and B-VIII/2 of International Convention on Standards of Training and Watch keeping for Seafarers, 1978 as amended (STCW Convention) including the content, application & intent of COLREGS72: Explain principles observed in keeping safe navigational watch. Exp lain relieving of duties, procedure of taking over watches. Explain effective use and testing of all navigational equipment during watch. 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. Determine standard compass error is at least once a watch and, when possible, after any major alteration of course. Compare standard and gyro compasses and repeaters frequently, and synchronize with the master compass.Describe manual testing of automatic pilot, functioning of navigation and signallights, radio equipment. 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 circumstancesin which to call the master. Action to be taken on receiving Storm Warning- Read barometer pressure, wind speed & direction, state of sea, gathering information from weather reports.
Unit - II	**Bridge Procedures Guide and its Contents:** Describe understanding of the principles of safe watchkeeping as detailed in theICS Bridge Procedures Guide. **Watch Keeping at Sea under Different Conditions in Different Area:** Explain watch keeping in clear weather, in hours of darkness, in coastalandcongested waters and in rough weather. Describe Ice navigation & Ice patrolling as per SOLAS (SAFETY OFNAVIGATION) **Tests as per Safety of Life at Sea(SOLAS), as amended:** Describe preparation for proceeding to sea, making port and entering harbours.
	Bridge Equipment
Unit - III	**Radar:** **Fundamental Principles of Radar** Exp lain radiation hazards and precautions, safety precautions necessary in the vicinity of open equipment, radiation hazard near antennae and open waveguides. Describe the characteristics of radar sets: Bearing range

	accuracy, HBW. VBW , pulse length, pulse recurrence rate. Sketch Block diagram and e xp lain use of various controls. Explain safe distances from radar spares and magnetic compasses. Describe maximum & minimum range of radar, range and bearing discrimination Exp lain e xternal factors affecting radar detection, radar horizon, sub refraction, super refraction & ducting, effect of precipitation and sea on radar detection. Explain factors that might cause faulty interpretation: Indirect echoes, side echoes, multiple echoes, second 'trace echoes. Exp lain range & bearing accuracy, error in range & bearing **Setting Up and Maintaining Displays of Radar and ARPA** Describe Setting Up and Maintaining Displays of Radar and ARPA: Function and adjustment of controls, transmitter controls, reception controls, display controls, different types of display, performance monitor, measurement of range & bearing. IMO Marine Radar Standards. Exp lain Marine Radar Performance Specifications, Performance standards for radar equipment, Limitations of the radar X-band and S-band. **Radar Plotting** Plot relative motion 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 andtrue presentation. **Automatic Radar Plotting Aid (ARPA):** Demonstrate setting vector lengths based on own vessel speed and range scale in use. Exp lain 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. Explain advantages of compass stabilization of a relative display, use of Trial manoeuvre and predictive motion vectors. **Use of Radar in Navigation:** Obtain position fix by radar bearings and ranges, Appreciate possible errors and reliability of fix, Explain use of Aids to radar navigation: Use of passive (trails, history) and activeaids, RACONs and SARTs. Explain AIS overlay on radar / ARPA Explain Radar overlay on ECDIS. Describe use of parallel indexing technique in radar navigation:
Unit - IV	**Gyro Compass:** Describe a free gyroscope and its gimbal mountings. State that in the absence of disturbing forces the spin axis of a free gyroscope maintains its direction in space. Exp lain what is meant by gyroscopic inertia and precession. Describe the precession resulting from a torque about a xes perpendicular to the spin axis. Exp lain that friction at gimbal pivots produces torques which give rise to precession. State that the rate of precession is proportional to the applied torque. State that 'tilt' as movement of the spin axis in the vertical plane. State that 'drift' as the apparent movement of the gyroscope in azimuth resulting from the earth's rotation. Expla in how a free gyroscope can be made north-seeking by the use of gravity controland describes the resulting oscillations of the axis Describe the use of damping in azimuth and damping in tilt to cause settling ofthe axis and thus produce a gyrocompass. **Magnetic Compass:** Describe the method of determination and compensation of the effects of a ship'smagnetic field on the magnetic compass. Method of obtaining a table of deviations. Explain Heeling error effect and method of correction. Cause sitting of compasseswith reference to the proximity of magnetic material and electric appliances. Care and maintenance of liquid compass.
Unit - V	**Various Other Navigation – Aids** **GPS** – Describe World Geodetic System 1984 (W GS 84) as a terrestrial reference system (geodetic datum) which is used by the GPS satellites for position fixing. Explain the basic working principle of GPS, its advantages & limitations, alarm setting & errors, system configuration, frequencies used, 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, why a fix obtained from the GPS receiver cannot be plotted directly onto a navigational chart, datum shifts.

	Augmented Satellite systems(DGPS): Explain working principle & limitations of Differential GPS (DGPS) system. **Regional Satellite Navigation systems:** Introduction to RSNS- Exp lain China's BeiDou (COMPASS) Navigation satellite system, India's Indian Regional Navigational satellite system (IRNSS- Navik), Japan's Quasi-Zenith satellite system (QZSS) and France's Doppler Orbitography and Radio Positioning Integrated by satellite (DORIS), **GLONASS, Galileo.** **Automatic Identification System (AIS):** Describe types & purpose of AIS information e xchange, data e xchange, Information displayed on AIS screen, limitations & precautions of AIS duringuse of AIS for collision avoidance. **LRIT (Long Range Identification and Tracking)** Explain purpose of LRIT, Data transmitted by LRIT, authorized receivers/ usersof LRIT. Compare LRIT and AIS. **Ship Security Alert System (SSAS):** Describe operation, precaution while using and its limitations **VDR (Voyage Data Recorder):** Describe concept and purpose of VDR, details & duration of data recorded onVDR, modules of VDR float free Playback Options S-VDR. **Bridge Navigation Watch Alarm System (BNWAS)** Explain operation, precautions & limitations. **Introduction to Intelligent Awareness System used for Navigation** **The concept of "Digital Twins"**

TEXT BOOKS

1. Bridge Equipment, Charts & Publication Nutshell Series Book 5- Capt. H. Subramaniam
2. Modern electronic Navigation Aids-Bhatia & Sinha
3. Nautical watch Keeping- Capt. H. Subramaniam
4. Ship-borne radar ARPA- Capt. H. Subramaniam

RECOMMENDED BOOKS FOR REFERENCE:

1. Bridge Procedure Guide - ICS
2. Bridge Team work - Nautical Institute
3. Watch Keeping Notes – E. Fernandes
4. Electronic Navigation Systems by L. Tetley & D. Calcutt
5. Ship Magnetic Compass- Capt T.K. Joseph & Capt. S S S Rewari

Bridge Equipment:

1. To understand the Fundamental working Principles of Marine Radar and ARPA

2. To understand about the Gyro Compass, Master Gyro, Gyro Repeaters and Gimbal.

3. To understand the uses of Magnetic Compass, Compass Card and Compass Error

4. To understand the principles and uses of Various Other Navigation Aids – GPS, DGPS, AIS, GMDSS Equipment, LRIT, SSAS and BNWAS.

Watch Keeping:

1. To understand the Performing Safe Navigational Watch as per Section A- VIII/2 and B-VIII/2 ofInternational Convention on Standards of Training and Watch keeping for Seafarers

2. To understand Bridge Procedures Guide and its Contents**,** Watch Keeping at Sea under Different Conditions in Different Area

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	**Watchkeeping:** Understanding the Performing Safe Navigational Watch as per Section A- VIII/2 and B-VIII/2 of International Convention on Standards of Training and Watch keeping for Seafarers	K2
CO-2	Understanding Bridge Procedures Guide and its Contents**,** Watch Keeping at Sea under Different Conditions in Different Area	K2
CO-3	**Bridge Equipment:** Understanding the Fundamental working Principles of Marine Radar and ARPA	K1/K2
CO-4	Understanding about the Gyro Compass, Master Gyro, Gyro Repeaters and Gimbal.	K1/K2
CO-5	Understanding the uses of Magnetic Compass, Compass Card and Compass Error. Understanding the principles and uses of Various Other Navigation Aids – GPS, DGPS, AIS, GMDSS Equipment, LRIT, SSAS and BNWAS.	K2

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B.Sc. Nautical Science

Semester – V					
Core	**Course Code: 11655**	**Ship Operation Technology Lab**	**P**	**Credit:2**	**Weekly Hours:4**
Pre-Requisite	**Practical Knowledge of Ship Operation, Mooring and Risk Assessment**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To enumerate the Watch Keeping Equipment & Marine Communication Equipment 2. To understand the standard marine communication phrase and the language used. 3. To understand the action and precautions on Navigating Bridge during Pilot Embarkation and Disembarkation 4. To understand the procedure for Enclosed Space Entry and the checklist prior entering Enclosed Space and use of Gas measuring equipment. To understand the Safe working practices as per Code of safe working practices for Merchant Seaman. To understand about the Corrosion Prevention & Surface Preparation methods required prior painting a surface. 5. To understand to carry out risk assessment for working on mast, funnel painting, ballast tank entry. Mooring: To demonstrates reeving the wire on the drum of mooring winch correctly, taking rope stopper and wire stopper
	Specific Learning Objectives
Unit - I	**Watch Keeping & Marine Communication:** Demonstration clear concise communication with positive reporting is adopted at all t ime in a seaman like manner with due regards to standard marine communication phrase. Morse symbols for the alphabet and numerals, to send and receive Morse code messages by flash lamp up to six words per minute. Knowledge of operation of radio equipment to be carried and used in a life boat & life raft (EPIRB, SART etc.), Demonstrate close loop communications using VHF / Walkie Talkies, Ship to Ship and Ship to Shore communication e xerc ises by portable VHF sets, Use of EPIRB & SART, Ability to transmit and receive the distress signal "SOS", urgency signal and Safety signal. **SMCP:** Demonstration of clear concise communication with positive reporting is adopted at all t imes in a seaman like manner with due regards to standard marine communication phrase.
Unit - II	**Pilot Embarking and Disembarking:** Explain action and precautions on Navigating Bridge during Pilot Embarkation and Disembarkation. **Safe Working Practices:** Safe working practices as per Code of safe working practices for Merchant Seaman.
Unit - III	**Enclosed Space Entry:** Filling up the checklist prior entering Enclosed Space and use of Gas measuring equipment- Exp losimeter, O2Analyser, Multi gas detector, Carbon mono xide detector, rescue of a person from enclosed space Demonstrate entering enclosed spaces with atmospheres suspected to be unsafe for entry- donning SCBA, permit systems and adequate safe working practices. (Group activity). **Risk Assessment Practical:** Carry out risk assessment for working on mast, funnel painting, ballast tank entry. Demonstrate use of gas measuring instruments.
Unit - IV	**Corrosion Prevention & Surface Preparation:** Demonstrate understanding of importance of 'Surface Preparation methods' required prior painting a surface. Demonstrate the proper use of following Electric and Pneumatic machines for surface preparation - Needle Guns, Chipping Machines, Angle Grinders. Demonstrate the understanding of maintenance routines of above

	Equipment. Demonstrate how 'Wet' and 'Dry' film thickness can be measuredafter painting a surface. Explain the difference in results after painting a surface usinga brush, a roller and using a spray machine. Demonstrate the use of a 'Paint Spray Machine' to paint agiven surface after takingall due precautions.
Unit - V	**Moorings:** Demonstrate taking rope stopper and wire stopper. Demonstrate rigging of slip wire. Demonstrates reeving the wire on the drum of mooring winch correctly. Demonstrate putting number of lines on a single bollard. Demonstrate connecting mooring wire to tail by Mandal / Tonsberg shackle

Related online content (Marine Insight. Marinegyaan. Oways online)

Course Outcomes		**Knowledge level**
CO-1	Enumerate the Watch Keeping Equipment & Marine Communication Equipment	K4
CO-2	Understanding the standard marine communication phrase and the language used. Understanding the action and precautions on Navigating Bridge during Pilot Embarkation and Disembarkation	K2
CO-3	Understand the procedure for Enclosed Space Entry and the checklist prior entering Enclosed Space and use of Gas measuring equipment. Understanding to carry out risk assessment for working on mast, funnel painting, ballast tank entry	K2/K3
CO-4	Understanding the Safe working practices as per Code of safe working practices for Merchant Seaman. Understanding about the Corrosion Prevention & Surface Preparation methods' required prior painting a surface.	K4
CO-5	Demonstrates reeving the wire on the drum of mooring winch correctly, taking rope stopper and wire stopper	K2/K5

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – V					
Core	**Course Code: 11656**	**Navigation Lab - I**	**P**	**Credit:2**	**Weekly Hours:4**
Pre-Requisite	**Practical Knowledge of Navigation Equipment**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand and familiar with the Compass and Boxing of Compass and Practical Knowledge of Compass Points and Compass Error 2. Knowledge about coding and decoading of weather messages. 3. Uuderstand the First Aid in emergencies 4. COLREGS: Identification of various collision situations in clear visibility and action to avoid collision, using magnetic board, wooden models or any other aid. 5. Practical knowledge of Stimulator in Navigation, Radar, ARPA, GPS
	Specific Learning Objectives
Unit - I	**General:** Carry out Boxing of Compass. Demonstrate use of azimuth mirror in a binnacle/ repeater for taking compassbearings of terrestrial and celestial objects.
Unit - II	**Read the aneroid barometer** Read the aneroid barometer and calculate atmospheric pressure at sea level, byapplying the corrections. Calculate the dew point using a hygrometer. Demonstration for the use and reading of Barograph. Uses the Ship's Code and Decode Book to decode a reduced report from ashore station.
Unit - III	**International Code of Signals** Use of International Code of Signals. Use of Medical First Aid Guide.
Unit – IV	**COLREGS:** Identification of various collision situations in clear visibility and action to avoid collision, using magnetic board, wooden models or any other aid. (The answers should include - 'Recognition', 'Responsibility', 'Action', 'Appropriate sound signal and day light signals' and 'Any ordinary practice of seaman' and 'Observance of good seamanship'.) Identification of lights and shapes and IALA buoys.
Unit - V	**OOW Simulator:** Carries out Look Out Duties – Reporting in Points. Carries out Helmsman Duties: Responses to Orders, Steers a Straight Line Course, Alters to new course with Minimum Overshoot. Identifies different Speed Logs and Expla in the various controls on them . Operates an Echo Sounder. Explains the various controls on Auto Pilot. Alters vessels course on Auto Pilot Changes over between Hand Steering and Auto Pilot and vice versa. Explains the functions of Off Course Alarm and sets a given value. Navigates through the Menu of GPS. Synchronizes Master Gyro with Repeaters. Operates a Marine Radar in Relative Motion. Starts a Radar Changes over between Head Up, North Up and Course Up. Correlates Radar Image with Chart Uses the EBL and VRM. Plots vessels position on the Chart

Related online content (Marine Insight. Marinegyaan. Oways online)

Course Outcomes		**Knowledge level**
CO-1	Understanding and familiar with the Compass and Boxing of Compass and Practical Knowledge of Compass Points and Compass Error	K2

CO-2	Knowledge on Coding and decoding of weather messages from ship	K4
CO-3	Uuderstand the First Aid in emergencies	
CO-3	Understanding COLREGS: Identification of various collision situations in clear visibility and action to avoidcollision, using magnetic board, wooden models or any other aid.	K2/K4
CO-3	Practical knowledge of Stimulator in Navigation, Radar, ARPA, GPS	K6

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - V					
DSE - I	**Course Code: 11657**	**Specialized Cargo Operation**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Cargo Operation**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. Introduction to Containerisation - Parts and Features of a container, Types, sizes and markings of containers, CSC Plate. 2. To understand about the Reefer Ships and Refrigerated Cargo 3. To understand about the Oil Cargoes, Oil Tanker Operations and Related Pollution- Prevention Regulations under MARPOL Annex - I 4. To familiar with Heavy Lift Ships and Project Cargoes, Heavy Lift Ship Operations, Elements for consideration of Heavy Lift Operations. 5. To understand about the Chemical Tankers (SOLAS Chapter VII, MARPOL Annex II, IBC Code), Exp lain various categories (X, Y, Z, OS) of cargoes. To undertand the Gas Tankers :(Ch. VII of SOLAS, SIGTTO and IGC Code) LNG, LPG, LEG and Chemical Gases in Bulk. To understand the Ro- Ro Ships, Types and the car decks for the loading of trailers and vehicles, Floating decks, Offshore Supply Vessels.
	Specific Learning Objectives
Unit - I	**Containers and Containerisation:** Introduction to Containerisation- Parts and Features of a container Types, sizes and markings of containers,CSC Plate. Segregation and care of containers carrying dangerous goods. Stowage and securing gear of containers viz. container shoes, stacking cones, interlayer stackers, twist locks, bottle screws and turnbuckles. Stowage Arrangement of a container ship, and how the position of container is designated, Bay plans and stack weight, Loadicator and Loading Plans.Factors affecting a container stow: Stability, trim, list, stresses, stack height, weight, dangerous goods, special requirements. Anti-heeling tanks, Torsional stresses, contents of Container Securing code. Special requirements of Dangerous Cargo, reefer containers and out-of-gauge containers; DG Manifest, Reefer Manifest, Temperature Log. Damages to container.
Unit – II	**Reefer Ships and Refrigerated Cargo:** Exp lain how hold and lockers are prepared for loading refrigerated cargo. Exp lain the need of pre-cooling of spaces and dunnage to be used. Expla in the dunnage requirements for refrigerated cargo. It is essential that any dunnage to be used is placed in the space before pre-cooling, since the use of warm dunnage could cause considerable damage. Exp lain the cargo should be inspected ashore by the ship's officers before loading to see that it is in good condition and has been properly pre-cooled where it is required. Exp lain the random inspection of the cargo should be made during loading. Exp lain that damaged product or carcasses which have thawed should be rejected or loaded separately as they could cause spoiling of the remainder of the cargo which was in good condition. Exp lain that on cargoships with a limited amount of refrigerated space, it is usual practice to arrange that the refrigerated cargo is to be loaded last and discharged first at its destination. Give the e xa mple of commodities which are carried in chilled condition, Examples of frozen cargo. Genera l outline of refrigeration systems (Direct, Indirect and air-cooled systems). Care, monitoring and records of cargo during passage, Purpose of temperature recording.
Unit – III	**Oil Cargoes, Oil Tanker Operations and Related Pollution- Prevention Regulations:** Tanker Arrangement-Describe for crude carriers and product tankers, the general arrangement of: Cargo tanks, pumprooms, segregated ballast tanks, slop tanks, cofferdams-peak tanks, Ventilators leading to accommodation and machinery spaces. Definitions: (Crude oil, Refined products, Spiked crude, Sour crude, Vapour ressure,Reid vapour

	pressure, Upper and lower flammable limits, Pour point, Flash Point, Threshold Limit Va lue, Permissible Exposure Limits, Vo latile Liquid). Hazards of Oil Cargoes, Flammability diagram. Cargo piping system (Free flow, Ring main, Direct) along with Advantages &Disadvantages. Explain Pollution prevention arrangements (Segregated ballast, Clean ballast, Slop tank and handling of slops, Load-on- top, ODMCS). Requirement of IG system. Describe Inert gas system including boiler uptake valve, scrubber, blowers, o xygen analyser, deck seal, non-return valve, PV valve, PV breaker and mast riser. Hazards of Inert Gas. Explain Inerting, purging and gas freeing operations. Crude Oil Washing, its hazards and benefits, COW checklist, MARPOL regulations for COW. Preparation for cargo tank entry. Items of pre-arrival checklist. Loading and discharging operations on a tanker. Care of cargo during transit. Use of Oxygen analyser, Explosimeter, Tankscope, Multigas detector and Dragger tubes. Introduction to Cargo pumps (Centrifugal, Reciprocating, Eductor). Contents of International Safety Gu ide for Oil Tankers and Terminals ISGOTT. Cargo calculations for quantity and ullage of oil cargo based on volume and height of space, density of cargo and temperature change- For a box shape ship
Unit – IV	**Heavy Lift Ships and Project Cargoes:** Heavy Lift Ship Operations, Elements for consideration of Heavy Lift Operations. Effect of the heavy lifts on the seaworthiness and the stability of the ship; Precautions to be taken whilst loading/discharging heavy lifts , Transportation and Planning Considerations for Heavy Lift Cargoes.
Unit – V	**Chemical Tankers (SOLAS Chapter VII, MARPOL Annex II, IBC Code):** Exp lain Type 1, Type 2 and Type 3 chemical tankers. Exp lain various categories (X, Y, Z, OS) of cargoes. Hazards associated with chemical cargoes (Reactivity, Flammability, Toxicity, Health & Pollution Hazards) and control measures, PPE. State the gas measuring equipment carried on chemical tankers. Purpose and use of IBC code. Information available in cargo data sheet. Purpose and objective of P & A manual, Certificate of Fitness. Cargo Record Book. Typical tank arrangements with piping. Tank cleaning and control of pollution in chemical tankers. Hazards involved with tank cleaning operation. Use of slop tanks. Exp lain "closed circuit" loading operation using a vapour- return line with the help of simple diagram. Purpose of using the Framo pumps unloading operation. Va rious types of tank coatings, introduction to CHRIS Code. **Gas Tankers :(Ch. VII of SOLAS, SIGTTO and IGC Code) LNG, LPG, LEG and Chemical Gases in Bulk:** Type A, Type B and Type C tanks; each cargo tank is fitted with high level alarm and auto- shut off. Purpose and objectives of the IGC Code. Certificate of fitness. Hazards of gas cargoes and control measures adopted. 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. Various types of ships (Fully pressurized, Semi pressurized, Fully refrigerated). Va rious types of tanks (integral, membrane, semi-membrane, independent and internally insulated tank) **Ro- Ro Ships:** Preparation of the car decks for the loading of trailers and vehicles, Floating decks. Procedures for opening, closing, securing of bow, stern and side doors and ramps (e xte rnal/ internal). Care and maintenance of the systems. Maintaining water-tight integrity of the cargo decks. Ventilation System, Fire Precautions ,Vehicle stowage and securing, Ro-Ro ship stability & inherent dangers.

TEXT BOOKS

1. Cargo Work for Ship officer – Capt Errol Fernandes
2. Cargo Works – D.J. House

RECOMMENDED BOOKS FOR REFERENCE:

1. Cargo Work – Kemp and Young
2. Cargo Works – Taylor

3. Cargo Notes- Dhananjay Swadi
4. ISGOTT, IGC Code, IBC Code,CSC ,MARPOL

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Introduction to Containerisation - Parts and Features of a container, Types, sizes and markings of containers, CSC Plate.	K1
CO-2	Understanding about the Reefer Ships and Refrigerated Cargo	K2
CO-3	Understanding about the Oil Cargoes, Oil Tanker Operations and Related Pollution- Prevention Regulations under MARPOL Annex - I	K2/K3
CO-4	Familiar with Heavy Lift Ships and Project Cargoes, Heavy Lift Ship Operations, Elements for consideration of Heavy Lift Operations.	K4
CO-5	Understanding about the Chemical Tankers (SOLAS Chapter VII, MARPOL Annex II, IBC Code), Explain various categories (X, Y, Z, OS) of cargoes. Understanding the Gas Tankers :(Ch. VII of SOLAS, SIGTTO and IGC Code) LNG, LPG, LEG and Chemical Gases in Bulk. Understanding the Ro- Ro Ships, Types and the car decks for the loading of trailers and vehicles, Floating decks, Offshore Supply Vessels.	K2/K3

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B.Sc. Nautical Science

Semester - V					
DSE - II	**Course Code: 11658**	**Marine Environmental Protection**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of MARPOL 73/78**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the brief history of MARPOL Convention and MARPOL Annexes . To understand the MARPOL Annex – I, Prevention Pollution by Oil, Oil record book, SOPEP locker. 2. To understand the MARPOL Annex II: (Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk): 3. To understand the MARPOL Annex III: (Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form). To understand the MARPOL Annex IV: (Regulations for the Prevention of Pollution by Sewagefrom Ships) 4. To understand the Marpol Annex V: (Regulations for the Prevention of Pollution by Garbage from Ships). To understand the Marpol Annex VI: (Regulations for the Prevention of Air Pollution from ship) 5. To understand and familiar with the Ballast Water Management and Ballast WaterManagement Plan and a Ballast Water Record Book. To understand about the Anti-Fouling Paint Pollution and Anti-Fouling Equipment on board. National Pollutant Discharge Elimination System (NPDES) of US Clean Water Act and the Oil Pollution Act of 1990 (OPA-90)
	Specific Learning Objectives
Unit – I	**MARPOL Convention General :** Exp lain brief history of MARPOL convention. Define, harmful substance, discharge, ship, and incident. State that violations of the Convention are prohibited. Describe the inspections which may be made by Port State authorities and outline actions which they may take. Describe the provisions for the detection of violations and enforcement of the Convention. State that reports on incidents involving harmful substances must be madewithout delay. **Marpol Annex I: (Regulations for the Prevention of Pollution by Oil):** Define/e xpla in- 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. Describe the surveys and inspections required under the provisions of MARPOL. State that the condition of the ship and its equipment should be maintained to conform to the provisions of the Convention. State that the certificate issued after survey is the International Oil Pollution Prevention (IOPP) Certificate. List the conditions under which oily mixtures may be discharged into the seafrom an oil tanker. List the conditions under which oily mixtures from machinery-space bilgesmay be discharged into the sea. State that the provisions do not apply to the discharge of clean or segregatedballast. 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. 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. List the special areas for the purposes of Annex I. 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 specialarea. Describe the conditions under which an oil tanker may discharge oilymixtures through ODMCS. Describe the conditions under which a ship, other than an oil tanker, may discharge oily mixtures in a special area. Describe conditions in which processed bilge water from machinery spaces may be discharged in a special area. State that ballast water should not normally be carried in cargo tanks of tankers provided with segregated ballast tanks. Exp lain the exceptions in which ballast may be carried in cargo tanks. State that, in new ships of 400 tons gross tonnage and above and in new oil tankers of 150 tons gross tonnage and above, no ballast water should normally be carried in any oil fuel tank. Pumping, piping and discharge arrangement in oil tankers. MARPOL line. Describe Crude oil washing operation. **Oil Record Book (Part I – Machinery space operations and Part II – Cargo/ballast operations)** Describe the requirements for the provision of Oil Record Books. List the various entries that need to be made in the Oil Record Book withrespect to above for following operations: Exp lain that each completed operation shall be signed by the officer or officers in charge of the operations and master of the ship. 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. **SOPEP:** 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. State it is an advice to the master how to react in case of an oil spill to preventor at least mitigate negative effects on the environment. State that the Plan contains operational aspects for various oil spill scenarios and lists communication information to be used in case of such incidents. 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. List the contents of SOPEP. 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.
Unit – II	**Marpol Annex II: (Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk):** **Cargo categories –** State that the requirements of Annex II apply to all ships carrying noxious liquid substances in bulk. Exp lain the categories of no xious liquid chemicals. State that the conditions for the discharge of any effluent containing substances falling in those categories. State that more stringent requirements apply in special areas. State that pumping and piping arrangements are to be such that, after unloading, the tanks designated for the carriage of liquids of category Z do not retain more than certain stipulated quantities of residue. **Procedures and Arrangements Manual** - 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. **Cargo Record Book –** To be completed, on a tank-by-tank basis, whenever any operations with respect to a noxious liquid substance take place. **Shipboard Marine Pollution Emergency Plan (SMPEP) –** Exp lain 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 no xious liquid substances to prevent or at least mitigate

	negative effects on the environment. Describe that the Plan contains operational aspects for various spill scenarios and lists communication information to be used in case of such incidents. Exp lain that such plan has to fulfil the requirements for the SOPEP and additionally for the Shipboard Marine Pollution Emergency Plan for noxious liquid substances. Explain that if a combined plan "Shipboard Marine Pollution Emergency Plan" (SMPEP) is carried, it has to be in accordance with the guidelines. Explain Reception facilities and cargo unloading Terminal arrangements.
Unit – III	**Marpol Annex III: (Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form):** 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. State that packaging, containers and tanks should be adequate to minimize hazard to the marine environment. Describe the requirements for marking and labelling packages, freight containers, tanks and wagons. Describe the notification procedures for loading/unloading harmful substances as per MARPOL Annex III. Describe the documentation relating to the carriage of harmful substances bysea. State that certain harmful substances may be prohibited for carriage or limited as to the quantity which may be carried aboard any one ship. State that jettisoning of harmful substances is prohibited except for thepurpose of securing the safety of the ship or saving life at sea **Marpol Annex IV: (Regulations for the Prevention of Pollution by Sewage from Ships):** 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 facilit ies at ports and terminals for the reception of sewage, and requirements for survey and certification. Describe the provisions regarding the discharge of sewage into the sea State that an International Sewage Pollution Prevention Certificate is issued by national shipping administrations to ships under their jurisdiction showing compliance. 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. State that the discharge of sewage into the sea is prohibited, e xcept 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.
Unit – IV	**Marpol Annex V: (Regulations for the Prevention of Pollution by Garbage from Ships):** Define, for the purposes of Annex V: Garbage, nearest land, special area. State that the disposal into the sea of all plastics is prohibited. State the regulations concerning the disposal of other garbage. List the special areas for the purposes of Annex V **Garbage Management Plan:** State that the ships have to carry a garbage management plan which thecrew are required to follow. Describe the content of the Garbage Management Plan, Garbage Record Book Exp lain Placards:Garbage Record Book - Describe the various operations when the Garbage Record Book has to be completed and various entries that need to be made. Exp lain the disposal criteria for cargo residues/cargo hold washing waterresidues. **Marpol Annex VI: (Regulations for the Prevention of Air Pollution fromship):**

	Define, for the purposes of Annex VI:continuous feeding, emission control area (ECA), new installations, Nitrogen Oxide (NOx) technical code, ozone- depleting substances, sludge oil, shipboard incineration, particular matter (PM), volatile organic compounds (VOCs). Describe the provision for the issuance of International Air Pollution Prevention certificate, duration of validity of the certificate. Describe the regulation regarding NOx in regulation 13 of Annex VI. Describe the requirement for SOx emission control area (SECA). Describe the requirement for fuel oil quality in regulation 18 of Annex VI. List the special areas for the purposes of Annex VI. Volatile Organic Compound (VOC) Management Plan- Exp lain Volatile Organic Compounds (VOC). Explain that VOC emissions from ships can be due to incomplete combustion processes and include crankcase, e xhaust and evaporation emissions. SEEMPissue or endorsement of a certificate,Ships Energy Efficiency Management Plan(SEEMP). Describe EEDI. (Energy Efficiency Design Index). Information to be included in the bunker delivery note.
Unit – V	**Ballast Water Management:** Define:ballast water, ballast water management, sediments. State that in order to show compliance with the requirements of the Convention each vessel shall have on board a valid Certificate, a Ballast Water Management Plan and a Ballast Water Record Book. Describe the various methods of ballast e xchange. Describe the standards that need to be observed in ballast water exchange. Explain the safety procedure to be followed during BWM for ship and crew. **Anti-Fouling Paint Pollution:** Introduction, Brief History, Antifouling, Effects and Zones, Antifouling purpose and types, Environmental Impact. State that convention prohibits the use of harmful organotins in anti-fouling paints used on ships and will establish a mechanism to prevent the potential future use of other harmful substances in anti-fouling system. **Anti-Pollution Equipments (Introduction):** Describe the operating procedures of anti-pollution equipment :sewage plant, incinerator, comminutor and ballast water treatment plant **National Response Centre with respect to pollution prevention:** General idea Ship Recycling: Brief history, IMO Guidelines on ship recycling, concept ofGreen Passport for ships **National Pollutant Discharge Elimination System (NPDES) of US Clean Water Act.** Give an overview of NPDES. Explain that the VRPVessel Response Plan is a plan required for vessels trading to/from/in USA and this US Coast Guard's new regulations to improve pollution Explain that the Oil Pollution Act of 1990 (OPA-90) and the international treaty, MARPOL 73/78, require owners/operators of certain vessels to prepare Vessel Response Plans (VRP) and/or Shipboard Oil Pollution Emergency Plans (SOPEP) and in addition, for certain vessels carrying noxious liquid substances a Shipboard Marine Pollution Emergency Plan (SMPEP).

RECOMMENDED BOOKS FOR REFERENCE:

1. MARPOL 73/ 78 as Amended (Latest Edition)
2. International convention on Ballast Water Management.
3. International convention on Anti-fouling Paint Pollution.

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the brief history of MARPOL Convention and MARPOL Annexes I – VI. Understanding the MARPOL Annex – I, Prevention Pollution by Oil, Oil record book, SOPEP locker	K1/K2
CO-2	Understanding the MARPOL Annex II: (Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk)	K2
CO-3	Understanding the MARPOL Annex III: (Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form). Understanding the MARPOL Annex IV: (Regulations for the Prevention of Pollution by Sewagefrom Ships)	K1/K2
CO-4	Understanding the Marpol Annex V: (Regulations for the Prevention of Pollution by Garbage from Ships). Understanding the Marpol Annex VI: (Regulations for the Prevention of Air Pollution fromship), SECA	K4
CO-5	Understanding and familiar with the Ballast Water Management and Ballast WaterManagement Plan and a Ballast Water Record Book. Understanding about the Anti-Fouling Paint Pollution andAnti-Fouling Equipment on board. Understand the National Pollutant Discharge Elimination System (NPDES) of US Clean Water Act and the Oil Pollution Act of 1990 (OPA-90)	K2/K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – VI					
Core	**Course Code: 11661**	**Voyage Planning & ECDIS (BA Chart 5049/ 5047/5048/2675)**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic and Practical Knowledge of Voyage Planning in Paper Chart and ECDIS**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To acquire the Knowledge of Voyage planning and its execution 2. To understand the various Ship Reporting System and Bridge Resource Management . To understand about the Weather routing services available to shipping; Shore based weather routeing, Routeing Charts 3. To familiar with the practical knowledge in Voyage Planning Exercises. To familiar with the ECDIS - Advantages and Disadvantages of ECDIS over paper chart; Limitations of ECDIS. 4. GMDSS: History, Statutory framework (As per SOLAS, ITU), Equipment specs in A1, A2, A3 and A4, Carriage requirement. 5. Knowledge about the Documents: Nautical Publications – Sailing Directions, ALRS, ATT, Ocean Passage, M and MS notices, Guide to Port Entry etc.
	Specific Learning Objectives
Unit - I	**Knowledge of Voyage planning and its execution** 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, Gu ide to Port Entry etc.); Landfall in thick and clear weather; Selection of a suitable anchorage. **(Practical Voyage Planning Exercises)** **Appraisal –** Ascertain the charts and publication required for the passage (use the Admiralty Catalogue to identify the charts) and whether they are corrected and up-to-date, Extract all relevant information from the publications and obtain weather prognosis. **Planning –** Plot courses on the charts, both small and large scale, way points, no-go areas, contingency anchorages, alerts, abort points and other relevant marks; Select a suitable anchorage; Selection of ocean routes; Prepare a Voyage Plan document. **Execution**–During the voyage, fix positions as indicated on the voyage plan, maintain sufficient bridge manning levels, obtain Navigational and weather warnings, maintain lookout and navigate to keep clear of other vessels and navigational hazards. **Monitoring –** Monitor frequently the traffic, position, weather, visibility and maintain a situational awareness at all times. Check the proper functioning of navigational instruments and fills up logs periodically during watch. Plan a passage 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.)
Unit - II	**Ship reporting systems:** The use of reporting in accordance with general principles for shipreporting systems. VTS reporting procedures. INSPIRES/ INDSAR as per M.S. Notice of DGS.

	Bridge Resource Management: Knowledge of bridge resource management principles including: allocation, assignment, and Prioritization o resources; Knowledge of bridge resource management principles including: effective communication assertiveness and leadership; Knowledge of bridge resource management principles including: obtaining and maintaining situational awareness; Bridge resource management's situational awareness wrt followings Ocean Passages, In coastalwaters, Restricted visibility, Pilot embarked; Actionon receiving storm warming
Unit - III	**Weather Routeing:** Weather routing services available to shipping; Shore based weather routeing. Information of current, wind and ice to select an optimum route, use of wave charts to select the best route. Basic considerations in Voyage Planning, selection and use of data; Least time track and ship's performance curves. **Voyage Planning Exercises:** Selection of ocean routes; Shore-based whether routeing; Planning & e xecutive a coastal passage; Navigation in pilotage waters; Approaching andpassing through a traffic separation scheme.
Unit - IV	**ECDIS** Introduction of ECDIS, Generation and components of ECDIS. Advantages and Disadvantages of ECDIS over paper chart; Limitations of ECDIS. Definitions: ENC, SENC, ECDIS, Standard Display, Base Display, Vector Chart, Raster Chart, ECS, RCDS, Safety Contours, Safety Depth, Shallow and Deep contours, SCAMIN, Overscale, Underscale, Duel Fuel System. Features of ECDIS; Difference between Raster Chart and Vector Chart. IMO Performance standard for ECDIS,Resolution MSC 232(82). Traditional Symbols (NP 5011) & Simplified Symbols (NP 5012), Chart Scale, Information Layers. Chart Quality and Accuracy (CATZOC).
Unit - V	**GMDSS:** Introduction History. Statutory framework (As per SOLAS, ITU). Functional requirements, Sea Areas Definitions, Carriage requirements in general, Equipment specs in A1, A2, A3 and A4, Carriage requirement details, means of ensuring availability, Primary and Secondary alerting means, Bridge Alarm Panel. Radio Regulation Theory. Authority of Master, Secrecy of Correspondence. World Wide Navigational Warning System & India's role as co-coordinator for Navarea 8 **Documents:** A systematic knowledge and use of the contents of the Sailing Directions; A systematic knowledge and use of the contents of List of light and fogsignals, List of radio signals; A systematic knowledge and use of the contents of the, Ocean passage ofthe world; A systematic knowledge and use of the contents of the Notices tomariners, M & MS Notices; A systematic knowledge and use of the contents of the Guide to port entry.

TEXT BOOKS

1 Chart Work: Basic Concepts & Miscellaneous Calculations- ChaudhariS.S

RECOMMENDED BOOKS FOR REFERENCE:

1. Chart Work for Mariners- Puri, S.K.
2. Admiralty publication NP 294 (How to keep charts up todate)
3. Catalogue of Admiralty Charts and Publications- AdmiraltyCharts andPublications
4. Chart Correction Log- Admiralty Charts andPublications
5. NAV Basics: The Earth, the sailings, Tides & Passage Planning Vol.1- Wither bySeamanshipInternational Ltd.
6. The Admiralty Manual of Navigation: Principles of Navigation:Vol.1- NauticalInstitute
7. Navigation Guide Vol. 1: Near Coastal Navigation- AlexanderSimpson
8. Practical Navigation for Officers of the Watch- Frost,A
9. Modern Chart work- Squair,W.H
10. Ocean passages of the world

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Acquire the Knowledge of Voyage planning and its execution – Practical Voyage Planning	K4
CO-2	Understanding the various Ship Reporting System and Bridge Resource Management	K2
CO-3	Understanding about the Weather routing services available to shipping; Shore based weather routeing, Routeing Charts. Understanding and familiar with the practical knowledge in Voyage Planning Exercises	K1/K2
CO-4	Understanding andfamiliar with the ECDIS - Advantages and Disadvantages of ECDIS over paper chart; Limitations ofECDIS.	K1/K4
CO-5	Understanding GMDSS: History, Statutory framework (As per SOLAS, ITU), Equipment specs in A1, A2, A3 and A4, Carriage requirement list and details. Knowledge about the Documents: Nautical Publications – Sailing Directions, ALRS, ATT, Ocean Passage, M and MS notices, Guide to Port Entry etc.	K1/K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – VI					
Core	**Course Code: 11662**	**Naval Architecture – II**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Naval Architecture and Stability of the Ship**		**Syllabus Revised**		**2023 – 24**

	Section A – Ship Stability (40 Hrs)
Course Objectives	1. To understand about Dry Docking and Calculations 2. To understand the effect of Shear Force & Bending Moments and Effect of Increased Beam and Freeboard 3. To understand and known the basic principles and calculations about the Stress calculating Instrument (Loadicator), Inclination 4.To understand about the ship construction, the Factor of Subdivision and Criterion Numeral 5. To understand and knowledge about the Ship's Corrosion & Control. To understand with the Class Surveys, IACS, PSC, FSC, Certifications.
	Specific Learning Objectives
Unit - I	**Dry – Docking:** Explain critical period, critical instant, and loss of metacentric height during dry-docking. Explain importance of trim during dry-docking. Calculations based on above.
Unit - II	**Shear Force & Bending Moments:** Exp lain shearing force & bending moments of a box shaped vessel. Calculate & graphically represent SF/BM of a box shaped vessel in even keel condition under various conditions of loads. State the hazards on exceeding SF / BM **Effect of Increased Beam and Freeboard:** Describe the effect of increasing the beam on ship's stability with the help of GZ curve. Describe the effect of increasing the freeboard on ship's stability with the help of GZ curve.
Unit - III	**Stress calculating Instrument (Loadicator):** States that each ship above a specified length is required to carry a loading manual, in which are set ou acceptable loading patterns to keep shear forces and bending moments within acceptable limits. Explain documents for Loading Instrument, Class Certificate, Class approved Loading Manual, Class approved tes conditions. Describe the input parameters and output results. Describe the testing procedure and importance of maintaining record. Explain likelihood of overstressing hull structure when loading certain bulk cargoes. Demonstrate calculations of intact stability using stress calculating equipment (Loadicator) **Inclining Experiment:** State the objective of inclining experiment. Describe the procedure of inclining experiment. State precautions to be observed. Compute light ship KG.

	Section B – Ship Construction (40 Hrs)
Unit - IV	**Factor of Subdivision and Criterion Numeral:** Define floodable length, permissible length, factor of subdivision, criterion of service numeral. Exp lain that permissible length affecting hull division on passenger ships. Expla in the application of the factor of subdivision to a passenger ship's ability to withstand the flooding of adjacent main compartments. Describes the requirements regarding unsymmetrical flooding. Describe the use of cross-flooding fittings. Describes stability criteria for Passenger ship in damaged condition.
Unit - V	**Ship's Corrosion & Control:** Describes corrosion and factors affecting corrosion. Exp lain causes of corrosion in steel and also between dissimilar metals. Explain various types of corrosion experienced by ships. Describe methods of corrosion control in steel work and alsobetween dissimilar metals including Cathodic Protection, Impressed Current System. **Class Surveys:** Exp lain the role and functions of Classification Societies. State Va rious classification societies and IACS Members, Describe surveys for assignments & retention of class. Exp lain Harmonized System of Survey and Certification and its benefits. Describe Enhanced Programme of Inspections during Surveys of Bulk Carriers and Oil Tankers. Define – overall survey, close-up survey, substantial corrosion, corrosion prevention system. Sketch and describe crit ical structure areas. Describes the preparation for enhanced survey. **Introduction to Autonomous and Semi-Autonomous ships**

TEXT BOOKS

1. Ship Construction by Capt. Errol Fernandes
2. Ship construction –D.J. Eyres
3. Ship Stability for Masters & / Mates - C.B. Barrass and D.R. Derrett
4. Ship Stability Operational Level- Capt. H. Subramaniam

RECOMMENDED BOOKS FOR REFERENCE:

1. Ship Construction for Engineers - Reid
2. Ship construction –Pursey
3. Taylor- Ship construction
4. Reed's Ship Construction for Marine Students E.A.Stokes

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding Dry Docking and Calculations before entering docking and undocking	K2/K5
CO-2	Understanding the effect of Shear Force & Bending Moments and Effect of Increased Beam and Freeboard	K2/K4
CO-3	Understanding and known the basic principles and calculations about the Stress calculating Instrument (Loadicator), Inclination due to various effects	K1/K2
CO-4	Understand about the ship construction, the Factor of Subdivision and Criterion Numeral in passengers ship.	K4
CO-5	Understand and knowledge about the Ship's Corrosion & Control, Understand with the Class Surveys, IACS, PSC, FSC, Certifications. Introduction to Autonomous and Semi-Autonomous ships	K1

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – VI					
Core	**Course Code: 11663**	**Ship Maintenance and Emergencies**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Ship Maintenance and Emergencies**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand with the General and basic ship maintenance. To understand and readiness for Inspection & Maintenance of Ship and Equipment 2. To understand about the Planned Maintenance System - the Routine Maintenance is to be carried out as per PMS. To understand the role of ship's crew during various emergencies as per Muster list. 3. To understand and familiar the Dry Docking Operations. To understand with the Maintenance of Crew Accommodation, the need of Good housekeeping/hygiene on board 4. To understand the basic knowledge of various surveys conducted on board. 5. To understand about the Respond to Distress Signal at Sea, SAR, Contingencies and Signals
	Specific Learning Objectives
Unit - I	**General Ship Maintenance:** List the equipment / tools used for surface preparation. Classify the various Swedish Standards of steel preparation such as St-2, St-3, Sa-2, Sa- 2.5, Sa- 3. Understand the corrosion reaction i.e. principle of Galvanic cell. Understand the purpose of Sacrificial Anode & Impressed Current System. Introduction of Laser application for removing rust on steel surfaces. Describe the required standard of preparation of steelwork depending upon the type of paint to be applied. State that paints consist mainly of a Binder, a pigment and a solvent, and e xp lains the purpose of each. Understand the concept of MSDS for particular paint system. Describe the action of Anodic Primers and Resistance type primers. 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, Epo xy paints, Polyurethane paints. Describe the action of Antifouling Paint and use of Self Polishing Antifouling Paint. Explain typical paint schemes for dry dock, underwater areas, boot topping, weather decks, superstructures & tank interiors. Describe the various Painting Defects, their Causes and Prevention State the methods of measuring wet paint thickness and dry paint thickness. Describe procedures for cleaning and polishing of brass and copper. **Inspection & Maintenance of Ship and Equipment:** Exp lain the procedure how to inspect the items in the Tanks/Holds, including Tank Tops, Deck Heads, bulk heads, pipe lines, valves, sounding pipes, longitudinal, web frames / girders, bilge Striker plate, bell mouths, drain holes, ladders where applicable. Exp lain that spaces are prepared for survey and inspection by cleaning, descaling, demucking, desludging, etc. Describe the maintenance of mooring winches/windlass and Inspection of chain lockers, anchor cables and anchors. Describe maintenance of crane, lifeboat davits as per PMS. List the different types of Lubricants. Explain the purpose & method of Lubrication. State the dangers of excess lubrication
Unit - II	**Planned Maintenance System:** State that Routine Maintenance is to be carried out as per PMS. List out the advantages of planned maintenance over breakdown maintenance. Exa mples of maintenance as per PMS: - Hatches / Cranes / Gangway. State that hatch cover wheels, gears, racks and pinions and other moving parts, side cleats should be kept lubricated. Exp lain that hydraulic systems for cargo holds should be checked for leakage, especially in tween decks where it may cause cargo damage. Exp lain that the weather tightness of hatch covers is checked by hose testing, Ultrasonic testing. Describe Maintenance of Gantry cranes/Deck crane/ - wires, sheaves & blocks. Describe maintenance of Gangway & Accommodation ladders. **Contingency Plans for Response to Emergencies:** State the purpose of emergency drills. List the contents of muster list. State the purpose of division of crew into different teams. Understand the role of ship's crew during various emergencies as per Muster list. Identify

	different element of Muster list in regard to emergencies relating to Oil Spill, Rescue from Enclosed space & Piracy. 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.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 ofblankets to passengers. Expla in contents of Fire control plans and importance of fire drills. Describe the immediate response on hearing an Emergency Alarm. Describe the arrangement for towing and being taken in tow. Exp lain towing equipment and tools on board ship, describe methods of towing disabled ship and communication between two ships. Describe the procedure for abandoning ship. List the precautions required to be observed prior entering battery room and paint room. Explain the importance of clear and concise communication.
Unit - III	**Dry Docking Operations:** List out the preparation to be carried out on board prior to dry docking of the vessel. List the various ships plans used during dry dock. Explain the precautions to be taken before entering the dry dock. List out the items to e xa mine in the dry dock such as shell plating, cargo holds, tanks, sea chest / overboard/sea suction valves, echo sounder and Dopplerfittings, stern frame, rudder, propeller, anodes, anchors and chain cables, etc. Describe the examinations to be made of the above listed items Describe the cleaning, preparation and painting of the hull in the dry dock. State the checks to be made prior to flooding of dry dock. **Maintenance of Crew Accommodation:** State that Ship Sanitation Certificate/Exe mption Certificate requirements. Explain the need of Good housekeeping/hygiene on board. Describe the methods of controlling insect infestation. State the safety precautions to be observed during and after Fumigation.
Unit -IV	**Preparation for Various Surveys of Ships:** Understand the basic knowledge of various surveys conducted on board. Preparation for SEQ Survey - LSA/FFA items - weekly, monthly, quarterly, six monthly and yearly tests and maintenance to be carried out on - S.C.B.A. Sets (Fireman outfit), Emergency Fire pumps, Fire Hoses & Hydrants, Fire Flaps, Fire Detection Equip.(Sensors), Portable fire Extinguishers, Fixed Foam system & Remote Control Monitors, Emergency Generator, Fixed CO2 Systems, Life buoys, Life Boats, Life rafts, Navigation. Preparation for Load Line Survey – Load line Items such as - Ventilators including Fire Dampers, weather t ight & Water tight Doors, hatch covers, Air pipes, freeing ports, bulwarks, scuppers, Load lines & Draft Marks. Preparation for SRT Survey – GMDSS Equipment. Preparation for IOPP Survey & Safety Construction Survey.
Unit - V	**Respond to Distress Signal at Sea:** Describe the actions to be taken on receipt of a distress message / sighting a distress signal and consequent response. Describe the procedures for carrying out SAR – various search patterns & signals to be made by ships & aircraft. Describe the precautions to be taken while manoeuvring the ship prior to the launching of lifeboat or rescue boats. Describe the methods of picking up the survivors from sea using lifeboats and life rafts. Describe procedures and precautions during Helicopter Operations. Understand the contents and application of IAMSAR Volume III. Understand the use of man overboard function in GPS for homing into theman in the water. Exp lain the actions to be taken in case of a man overboard including the initial manoeuvring and immediate actions. Describe various types of turns used for rescuing Man Overboard (Williamson Turn Scharnov Turn Single Turn/Anderson Turn).

TEXT BOOKS

1. Ship Board Operations by H.I. Lavery

RECOMMENDED BOOKS FOR REFERENCE:

1. Life Boat and Life Raft - Capt. Puri S.K.
2. Survival at sea - C.H. Wright
3. Theory and Practice of Seamanship - Danton G.
4. Seamanship Notes - Kemp & Young
5. Seamanship & Nautical Knowledge- Nicholls

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understand with the General and basic ship maintenance. Understand and readiness for Inspection & Maintenance of Ship and Equipment	K2
CO-2	Understand about the Planned Maintenance System - the Routine Maintenance is to be carried out as per PMS. Understand and familiar with the role of ship's crew during various emergencies as per Muster list.	K1/K2
CO-3	Understand and familiar the Dry Docking Operations, Docking and undocking, Understand with the Maintenance of Crew Accommodation, the need of Good housekeeping/hygiene on board	K1/K3
CO-4	Understand the basic knowledge of various surveys conducted on board. LSA/FFA, GMDSS items – SEQ Survey, IOPP etc.	K4
CO-5	Understand about the Respond to Distress Signal at Sea, SAR, Contingencies and Signals	K1/K4

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – VI					
Core	**Course Code: 11664**	**Ship Handling & Collision Prevention Regulations**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Ship Handling and Collition Regulations**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand the Types of Anchors and Anchoring Work 2. To understand Ship Manoeuvring, Application of constant radial turn techniques and Mooring 3. To understand COLREGS, Application of International Regulations for Preventing Collisions at Sea (IRPCS) 1972 4. To acquire the knowledge about Navigation in restricted visibility and in Polar Region 5. To familiar with the various Contingencies and Piracy attack
	Specific Learning Objectives
Unit - I	**Types of Anchors and Anchor Work:** Describe parts of anchor used on ships. **Explain the terms:** a'cockbill(anchor ready for letting go), Anchor aweigh, clear hawse, foul hawse, clear or foul anchor, anchor dragging, long stay, short stay, up and down, to veer cable, weighing anchor, yawing, brought up to three in water / four on deck, devil's claw. Exp lain securing anchor for sea, covering spurling pipe. State the markings on anchor cable, use of bow stopper, Exp lain standing moor, running moor. Exp lain Windlass, cable, link, swivel, joining shackle, shackle as a term of length, bitter end. **Anchoring:** Exp lain the Procedures for anchoring in deep water and in shallow water. Exp lain the Load on anchor due to wind, current, waves, Yawing, factors involved in determining the length of cable to be used. Exp lain anchor holding power, Dragging anchor, clearing fouled anchor, hanging off anchor, slipping cable. State the use of correct terminology for communication between bridge and anchor station crew. Use of anchor buoys and Causes for loss of anchor.
Unit - II	**Ship Manoeuvring:** Exp lain the effects of various deadweights, draughts, trim, speed and under- keel clearance on turning circles and stopping distances. Exp lain Manoeuvring Data of Ship: Advance, transfer, drift angle, tactical diameter, trackreach, head reach, side reach, turning circles of a ship in loaded and ballast condition,andat different speeds. Define directional stability. Application of constant radial turn techniques, determining wheel over position, determining radius. Exp lain the Effect of wind and current on ship handling: Effect of wind and current on a given ship while moving and when making large turns. Exp lain 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. Exp lain Shallow-water effects, squat and bank effects . State the reduction in under keel clearance due to rolling and pitching. Explain Interaction between passing ships and between own ship and near by banks (canal effect). Explain the Effectiveness of Bow thrusters and stern thrusters. **Mooring:** Exp lain Safe practices during mooring operation. snap back zone. Describe the Mooring plan of a ship, optimum mooring pattern and rope leads. State the load on mooring lines due to wind, current, waves, surging at berth. State OCIMF recommendations on mooring equipment. Exp lain Joining of two mooring ropes, slip wire, Synthetic fibre tails. State the dangers of mixed mooring systems. Explain the making fast of tugs, using fenders during berthing/unberthing. Exp lain Heaving load, render load, stalling load, Correct layers of lines on split drums, correct reeling of lines on drum of mooring winch.Self-tensioning winches. Exp lain the Mooring Winch Brake testing. Exp lain the Danger of belaying rope on a single bollard. Exp lain SPM and CBM Mooring.
Unit - III	**COLREGS:** Application of International Regulations for Preventing Collisions at Sea (IRPCS) 1972, as amended including- Overview of the Annexures to Colregs. Describe the positioning, spacing and screening of lights.

Unit - IV	**Navigation in restricted visibility** Exp lain Navigational Equipment and Techniques used for safe navigation in Restricted visibility (blind navigation / blind pilotage techniques). Describe the Procedures for embarkation and disembarkation of pilot. **Ice Navigation:** List the contents of Polar Code. Exp lain the Basic ship handling in ice. Exp lain sighting and reporting of ice, working through ice, navigation in ice. Explain the effects of ice accretion on stability of the vessel.
Unit - V	**Contingencies:** Explain the actions to be taken as per Contingency Plans in the followingemergencies- Grounding, Beaching, Collision, Steering failure, Parting of moorings at berth, Spills of dangerous goods. **Piracy:** Explain the Best Management Practices for protection against Piracy

TEXT BOOKS

1. IMO Rules of the Road-Bhandarkar Publications
2. Theory and Practice of Seamanship - Danton G

RECOMMENDED BOOKS FOR REFERENCE:

1. Life Boat and Life Raft - Capt. Puri S.K.
2. Survival at sea - C.H. Wright
3. Seamanship Notes - Kemp & Young
4. Seamanship & Nautical Knowledge- Nicholls
5. OCIMF / SIGTO/INTERTANCO
6. Seamanship Technique– D.J House
7. BMP 5
8. Polar code
9. Mariner's Guide to preventing collision- Capt. Yashwant Chhabra

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the types of anchor, Anchoring terms, Position and place of anchoring	K2/K5
CO-2	Understand the Ship Manoeuvring, the effects of various deadweights, draughts, trim, speed and under- keel clearance on turning circles and stopping distances.	K2
CO-3	Overview of the Annexures to Colregs - Describe the positioning, spacing and screening of lights.	K1/K6
CO-4	Understand and familiar with the Navigational Equipment and Techniques used for safe navigation in Restricted visibility (blind navigation / blind pilotage techniques).	K4
CO-5	Contingency Plans in the following emergencies- Grounding, Beaching, Collision, Steering failure, Parting of moorings at berth, Spills of dangerous goods, Piracy attacks	K1/K3

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester – VI					
Core	**Course Code: 11665**	**IMO & International Conventions**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of IMO and MS Act 1958**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To understand IMO Conventions and Organizations – Structures and Duties 2. To understand the Indian Merchant Act – MS Act 1958 3. To familiar with the International Law of the Sea – Regarding Sea Zones 4. To familiar with the Maritime Labour Convention and Maritime Safety 5. To familiar with International Ship and Port Facility Security Code (ISPS Code)
	Specific Learning Objectives
Unit - I	**International Organisations & IMO:** State that maritime law is based partly on generally accepted customary rules developed over many years and partly on statute law enacted by States. State that matters of safety, protection of the marine environment and conditions of employment are covered by statute law. State that the main sources of maritime law are international conventions. State that the adoption of international conventions and agreements is intended to provide uniform practice internationally. 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. State that, to implement a convention or other international agreement, a State must enact national legislation giving effect to and enforcing its provisions. State that recommendations which are not internationally binding may be implemented by a State for ships flying its flag. Exp lain that the main originators of international conventions concerned with maritime law are: International Maritime Organization (IMO), International Labour Organization (ILO), Comite Maritime International (CMI), United Nations. Describe: Flag State jurisdiction, Coastal State jurisdiction, Port State jurisdiction. Describe main elements of SOLAS, MARPOL and STCW. Explain the significance of the 'no more favourable treatment' clause in the SOLAS, MARPOL, STCW and ILO Minimum Standards in Merchant Ships Conventions. Distinguish between private and public international law. Explain that public maritime law is enforced through: Surveys, Inspection and Certification, penal sanctions (fines, imprisonment), administrative procedures (inspection of certificates and records, detention). State that the operation of a ship is governed by the national laws and of the flag State including those laws and regulations giving effect to international conventions. State that differences of detail usually exist in thenational laws of different states implementing the same convention. State that, when serving in a ship flying aforeign flag, it is essential that the master and chief mate familiarize themselves with the laws and regulations of the flag State. State that, when in port, a ship must also comply with the appropriate laws and regulations of the port State. Describe the importance of keeping up to date with developments in new and amendedlegislation. Organizations with maritime functions; UNO, WHO, ITF, UNCITRAL, UNCTAD, WTO (Outline of work relevant to maritime sector). IMO Instruments: Conventions, Protocols, Codes, Recommendationsand Guidelines. (purpose and e xa mples of each) IMO Conventions: List of IMO conventions, Development, adoption, conditionsfor coming into force, implementation, enforcement and amendments of conventions.
Unit - II	**Indian Merchant Shipping Act, 1958:** Definitions. Registration of Indian ships; Section 20 to 74. Seamen and Apprentices. Section 88 to 218. Investigation and inquiries. Section 357 to 389

Unit - III	**International Law of the Sea:** Historical Background; UNCLOS 1982; Definitions - Baselines; Internal Waters and Territorial Sea Contiguous Zone; Hot Pursuit, Continental Shelf; Exclusive Economic Zone; The High Seas, Lega jurisdictions and Freedoms in various zones; Nationality of Ships, Duties of Flag states and Flag State Control Responsibilities of coastal states, Settlement of Disputes; Law of the Sea Tribunal. UNCLOS definition o marine pollution and duties of states towards environmental protection. UNCLOS definition of piracy. IMO's definition of "armed robbery" Duties of states to suppress piracy.
Unit - IV	**Maritime Labour Convention and Maritime Safety:** International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW): Explain the general obligations under the Convention. Define, for the purpose of the Convention: Certificate of Competency, Certificate of Proficiency, seagoing ship. Describe the issue o certificates and their endorsement by the issuing Administration. Describe the control which may be e xe rcise by a duly authorized control officer. Exp lain that the regulations contain:Mandatory minimum requirements for the certificate of Competency and certificate of Proficiency. International Convention for the Safety o Life at Sea, 1974 as amended (Brief contents of all chapters) (SOLAS). International Convention on Load Lines, 1966 (LL 1966), as amended. State that no ship to which the Convention applies may proceed to sea o 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. Explain to which ships the Convention applies. Describe the duration of validity of an International Load Line Certificate (1966). Exp lain the circumstances in which an International Load Line Certificate (1966) would be cancelled by the Administration. State the control to which ships holding an International Load Line Certificate (1966) are subject when in the ports of other Contracting Govern ments. 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. International Safety Management (ISM) Code: Objectives and Functions of the code, Outline of the contents of all 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 o 500gt and upwards. State that a Safety Management System in compliance with the ISM Code must be in place onboard all vessels of 500gt and upwards from 1 July 2002, 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. ILO's Convention – MLC 2006 – 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).
Unit - V	**Other Conventions and Codes:** 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 o security, Contingency plans to deal with security incidents. Purpose of LLMC, CLC 1992, FUND 1992, Supplementary Fund and Bunker Conventions. Purpose of International Convention on salvage 1982. Nairobi convention on removal of wrecks (purpose and responsibility for wreck removal. Code of Casualty Investigation (IMO): Brief outline of contents.

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 200
6. STCW as amended
7. UNCLOS
8. Maritime Legislation and Shipboard Management for deck officers by Capt. M.V. Naik& Capt. C.L. Dubey
9. Website for reference: www.imo.org

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	State that matters of safety, protection of the marine environment and conditions of employment are covered by statute law.	K1/K2
CO-2	Indian Merchant Shipping Act, 1958: Registration if Indian Ships, Seaman Welfare and Investigation.	K1
CO-3	Understanding the Baselines; Internal Waters and Territorial Sea; Contiguous Zone; Hot Pursuit, Continental Shelf; Exclusive Economic Zone; The High Seas, Legal jurisdictions and Freedoms in various zones; Nationality of Ships, Duties of Flag states and Flag State Control.	K1/K2
CO-4	Understanding the Maritime Labour Convention and Maritime Safety	K4
CO-5	Understand the ISPS, Security threats, SSO, CSO, PFSO, SSP, ISSC, Security duties, Security Levels	K2

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Semester – VI					
Core	**Course Code: 11666**	**Navigation Lab - II**	**P**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Basic and Practical Knowledge of Navigation Lab**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To identify certain major stellar constellations and navigational stars using star finder. 2. To identify various collision situations in restricted visibility and take action to avoid collision. 3. ToFamiliar with the operation of Simulator, Radar and ARPA 4. Understand the ECDIS- the basics of Electronic Chart system and Practical 5. Understand the Basic Operational principles of VHF, MF/HF and Sat C
	Specific Learning Objectives
Unit - I	**General:** Identify certain major stellar constellations and navigational stars using star finder. Demonstrate taking altitude of celestial bodies using sextant. Calculate Gyro Error using the Sun.
Unit - II	**COLREGS:** Identify various collision situations in restricted visibility and take action to avoid collision. Execute Radar Plotting on the sheet to obtain desired CPA.
Unit - III	**OOW SIMULATOR:** Demonstrate the ability to manoeuvre the vesselusing a constant Radius Turn **Operate an ARPA –** Acquire Targets on ARPA, Interpret ARPA information such as Range and bearing, course and speed of other ships, time and distance of closest approach, Identify and Select True and relative vectors and sets the Vector lengths, Identify and Select Trails – Long / Short, Recognize on Radar - RACONs and SARTs, Draw parallel Indexes, Carry out Trial Manoeuvres and interprets the information, Operate Radar in True Motion. Deal with simulated collision situations between own- ship and target vessel in Clear Visibility. Deals with simulated collision situation between own ship and target vessel inRestricted Visibility.
Unit - IV	**ECDIS Practical:** Demonstrates the uses of All specific functions including:North Up / Course Up Orientation, Change of Scale, Overlays, Layers, Traditional / Simplified Symbols, Safety / Shallow / Deep Contours, Safety Depths, CATZOC Prepare a passage plan on ECDIS from Port "A" to Port "B. Sea area selection:Route planning information, Construction of a route -Draw Courses Graphically and Alphanumerically, Indicate Courses and Distances, Set Track Limits, Set appropriate Alarms, Curve track planning, Create Maps, Prepare Schedule, Obtain Tidal Information, Carry out Route Check, Modify Route, Planning notes, Safety values, Check for navigational safety of monitored area, Vector time. Monitor the vessel's progress on the above plan Updating of ENC – Maintaining charts up to date including the use of AIO.
Unit - V	**GMDSS Practical:** Transmits a distress message by VHF DSC. Transmits a distress message by MF DSC. Transmits a distress message by HF DSC. Transmits a distress message using Sat C.

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Demonstrate taking altitude of celestial bodies using sextant and Calculate Compass and Gyro Errors	K4
CO-2	Execute Radar Plotting on the sheet to obtain desired CPA	K5
CO-3	Operate an ARPA – Acquire Targets on ARPA, Interpret ARPA	K6
CO-4	ECDIS Practical: Demonstrates the uses of All specific functions including:North Up / Course Up Orientation	K3
CO-5	GMDSS Practical: VHF, MF, HF and Sat C	K1/K2

ALAGAPPA UNIVERSITY

B.Sc. Nautical Scence

Semester – VI					
DSE - III	**Course Code: 11667**	**Human Resource Development & Shipping Management**	**T**	**Credit:2**	**Weekly Hours:4**
Pre-Requisite	**Basic Knowledge of Development of Shipping Industry**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1. To familiar with the types of Shipping Services and Structure 2. To familiar with the Chartering, Freight brokering, Clearing and Forwarding 3.To familiar with the Human Resources, Human Values and Stresses 4. To Familiar with the MS Act 1958, Recruitment and Placement, Article of Agreement and Welfare of the Crew 5. To Learn about Leadership, Teamwork, Motivation and Positive Attitude.
	Specific Learning Objectives
Unit - I	**Basic Structure and organization of Shipping:** State the types of Shipping Services - Liner and Tramp. State the types of ships and cargoes in Liner and Tramp shipping. State the Freight brokers, Clearing and Forwarding Agents, Bunker and Stores suppliers, shipping Agencies. Exp lain the Role of Shipping Companies. List the types of Shipping Companies. State the various departments in shipping company's office and their functions. Describe Role of superintendents and Designated Person Ashore. Sketch Company's Organizational Chart. Describe Shipboard organizational structure. Describe functions and responsibilities of shipboard staff. List cadet's duties on board.
Unit - II	**Ship Chartering:** Exp lain the meaning of charter types of charters and their relevance to trade. State the charter markets of the world. Exp lain the common charter parties. Exp lain the terms- Laydays, Laycan, Laytime, Demmurage Despatch, Freight, NOR, Safe port, Safe berth. **Contract of Affreightment:** List the Responsibilities, obligations, immunities and liabilities of carrier and shipper and the limitations of liab ilit ies as per the, Carriage of Goods by Sea Act, 1925. The Indian Multimodal Transport of Goods Act, 1993. Hague Visby rules; Hamburg rules, Rotterdam Rules.
Unit - III	**Human Resource Management: General** State the Function, Requirement & Selection of Personnel. Explain the Performance Appraisal and Reward System. State the Working Conditions as per MLC. State the Employer's Liabilities for Health and Safety. State the relation with Trade Union & Workers Participation in Management. Explain Cross cultural, multi-racial and multi-lingual environment. **Human values:** State the Indian insight on managing self, human relationships, managing stress, decision making and resolving ethical dilemma; enhancing life satisfaction. State personal traits that will assist in effective functioning onboard, physical fitness, health and personal hygiene, travel arrangements. List human factors and their importance. Exp lain the Importance of Interpersonal relationship. State that Building positive attitude and behavior by developing a professional and organizational culture. Explain mental gymnastics & creative problem solving techniques 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.

Unit - IV	**Personnel Management: Shipping** **MS Act 1958:** Section 95 (registration of recruitment and placement agencies) Part VII (Employment of seafarers on Indian flag vessel) **Recruitment and placement rules 2005:** Exp lain & define significance of the RPS, Rules, 2005. State the purpose of the rule, benefit to seafarers under the rule, responsibilities of employer, rights and responsibilities of the seafarer. Access information regarding registered recruitment and placement agencies. **Article of Agreement (Indian Ships):** State general content of agreement. State Responsibilities of employer & seafarer **Collective Bargaining Agreement (foreign flagship):** State general content of agreement. State the needs of foreign shipping companies to comply with RPSL rules. State the responsibilities of foreign employer & seafarer. Exp lain the Nature of the job at sea demands of the career technical, practical, physical, emotional and sychological. State onboard human relations role of human error in accidents.
Unit - V	**Communication and Negotiation:** State the importance of communication; interpersonal communication. State the barriers to effective interpersonal communication, communication in organizations. State how to use communication skills for negotiating and managing conflicts. Exp lain importance of effective communication, time management & planning. **Leadership, Teamwork, Motivation and Positive Attitude** State the Importance of teamwork, team spirit. State the Necessity of positive attitudes, work ethics, allocation,assignment, and prioritization of resources.Explain assertiveness and motivation and decision making. Explain Motivational Theory: McGregor's Theory X and Theory Y, Maslow's Hierarchy of Needs Theory, Herzberg's Motivation-Hygiene Theory. Exp lain Trait's approaches to leadership, Fiedler's contingency approach to leadership. Exp lain the Managerial Grid. State knowledge, skills, attitude. Exp lain Age, Fatigue, Control of human errors, Situationalawareness. State the Need for familiarisation with work environment andprocedures.

TEXT BOOKS:

1. Future of Human Resource Management – Raman Preet

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 DongWookSong 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.

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding the Types of Shipping Services, Basic Structure and organization of Shipping	K2
CO-2	Understanding Various Types of Chartering, Charterers and freights	K2
CO-3	Understandingthe Human Resource Management and Human Values of Personnel, Ships and Environment	K1
CO-4	Ability understand the MSAct 1958, Recruitment and Placement Act 2005 and Articles of Agreement	K4
CO-5	State the importance of communication; interpersonal communication. Understanding the Leadership, Teamwork, Motivation and Positive Attitude	K3

ALAGAPPA UNIVERSITY

B.Sc. Nautical Science

Semester - VI					
DSE - IV	**Course Code: 11668**	**Maritime Risk Management**	**T**	**Credit:3**	**Weekly Hours:4**
Pre-Requisite	**Knowledge of Good Officer Like Qualities.**		**Syllabus Revised**		**2023 – 24**

Course Objectives	1.To Familiar with the Risk Assessment, Safety and health at work place 2.To give an overview on hazards on board ships 3.To Familiar to identify the categorized Hazardous substances 4.To Classify Work Activities- Identify Hazards-Identify Risk Controls 5. To Review adequacy of Action Plan
	Specific Learning Objectives
Unit - I	**Introduction of Risk Assessment:** Define Risk assessment, Health and Safety at work place. Describe the obligation of Employer and Employee. Explain the Principles of Risk Assessment. Exp lain Risk Assessment in practice, such as Tool Box Meeting, Take 5, etc.
Unit – II	**Hazard Identification and Reporting:** **Give an overview** of Ship design and structure for identification of Hazards on board ship. Exp lain the Hazards which can be removed /Hazards which cannotbe removed.
Unit - III	**Categories of Hazards:** Exp lain Categories of Hazard. Exp lain Common areas of Hazard. Introduction to Hazard checklist. Explain what should be assessed / who has to carry out theassessment / process of Identifying Hazards.
Unit - IV	**Practice and Exercise on making Risk Assessment:** **G**uidance On Main Elements of Risk Assessment. Classify Work Activities- Identify Hazards-Identify Risk Controls-Estimate Risk-Determine the tolerability of the risks-Prepare Risk.
Unit - V	**Action Plan:** 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. Risk Assessment exercise.

RECOMMENDED BOOKS FOR REFERENCE:

1. Code of Safe Working Practices.
2. ISM Code.
3. M & MS Notices for Case Studies.

Related online content (Marine Insight. Marinegyaan. Oways online)		
Course Outcomes		**Knowledge level**
CO-1	Understanding Risk assessment, Health and Safety at work place..	K2
CO-2	Understanding identification of Hazards on board ship.	K2
CO-3	Prepare Risk Control Action Plan to improve risk controls as necessary	K4
CO-4	To Classify Work Activities- Identify Hazards-Identify Risk Controls	K3
CO-5	To Review adequacy of Action Plan	K4

UG Programme

Passing minimum

- A candidate shall be declared to have passed in each course if he/she secures not less than 40% marks in the End Semester Examinations and 40% marks in the Internal Assessment and not less than 40% in the aggregate, taking Continuous assessment and End Semester Examinations marks together.
- The passing minimum for CIA shall be 40% out of 25 marks (i.e.10 marks) in Theory/ Practical Examinations.
- The passing minimum for University Examinations shall be 40% out of 75 marks (i.e. 30 marks) for Theory /Practical papers.
- The candidates not obtain 40% in the Internal Assessment are permitted to improve their Internal Assessment marks in the subsequent semesters (2 chances will be given) by writing the CIA tests or by submitting assignments.
- Candidates, who have secured the pass marks in the End-Semester Examination and in the CIA but failed to secure the aggregate minimum pass mark (E.S.E + C I.A), are permitted to improve their Internal Assessment mark in the following semester and/or in University examinations.
- A candidate shall be declared to have passed in the Dissertation/Project report/Internship report if he/she gets not less than 40% marks in the Internal Assessment and End Semester Examinations and not less than 40% in the aggregate, taking Continuous assessment and End Semester Examinations marks together.
- A candidate who gets less than 40% in the Dissertation / Internship/ Project Report must resubmit the thesis. Such candidates need to take again the Viva-Voce on the resubmitted report/thesis.

18.2 Grading of the Courses

The following table gives the marks, Grade points, Letter Grades, and classifications meant to indicate the overall academic performance of the candidate.

Conversion of Marks to Grade Points and Letter Grade (Performance in Course / Paper)

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	SCRIPTION
- 100	**9.0 – 10.0**	**O**	**tstanding**
- 89	**8.0 – 8.9**	**D+**	**cellent**
- 79	**7.5 – 7.9**	**D**	**tinction**
- 74	**7.0 – 7.4**	**A+**	**ry Good**
- 69	**6.0 – 6.9**	**A**	**od**
- 59	**5.0 – 5.9**	**B**	**erage**
- 49	**4.0 – 4.9**	**C**	**isfactory**

- 39	**0.0**	**U**	**appear**
SENT	**0.0**	**AAA**	**SENT**

a) Successful candidates passing the examinations and earning a GPA between 9.0 and 10.0 and marks from 90 – 100 shall be declared to have Outstanding (O).

b) Successful candidates passing the examinations and earning GPA between 8.0 and 8.9 and marks from 80 - 89 shall be declared to have Excellent (D+).

c) Successful candidates passing the examinations and earning GPA between 7.5 – 7.9 and marks from 75 - 79 shall be declared to have Distinction (D).

d) Successful candidates passing the examinations and earning GPA between 7.0 – 7.4 and marks from 70 - 74 shall be declared to have Very Good (A+).

e) Successful candidates passing the examinations and earning GPA between 6.0 – 6.9 and marks from 60 - 69 shall be declared to have Good (A).

f) Successful candidates passing the examinations and earning GPA between 5.0 – 5.9 and marks from 50 - 59 shall be declared to have Average (B).

g) Successful candidates passing the examinations and earning GPA between 4.0 – 4.9 and marks from 40 - 49 shall be declared to have Satisfactory (C).

h) Candidates earning GPA between 0.0 and marks from 00 - 39 shall be declared to have Re-appear (U).

i) Absence from an examination shall not be taken as an attempt.

From the second semester onwards the total performance within a semester and continuous performance starting from the first semester are indicated respectively **by** Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA).

These two are calculated by the following formulate

GRADE POINT AVERAGE (GPA) = $\Sigma_i C_i \; G_i / \Sigma_i C_i$

GPA = Sum of the multiplication of grade points by the credits of the courses

Sum of the credits of the courses in a Semester

18.3 Classification of the final result

The final result of the candidate shall be based only on the CGPA earned by the candidate.

a) Successful candidates passing the examinations and earning CGPA between 9.5 and 10.0 shall be given Letter Grade (O+) and those who earned CGPA between 9.0 and 9.4 shall be given Letter Grade (O) and declared to have First Class –Exemplary*.

b) Successful candidates passing the examinations and earning CGPA between 7.5 and 7.9 shall be given Letter Grade (D), those who earned CGPA between 8.0 and 8.4 shall be given Letter Grade (D+) and those who earned

CGPA between 8.5 and 8.9 shall be given Letter Grade (D++) and declared to have First Class with Distinction*.

c) Successful candidates passing the examinations and earning CGPA between 6.0 and 6.4 shall be given Letter Grade (A), those who earned CGPA between 6.5 and 6.9 shall be given Letter Grade (A+), and those who earned CGPA between 7.0 and 7.4 shall be given Letter Grade (A++) and declared to have First Class.

d) Successful candidates passing the examinations and earning CGPA between 5.0 and 5.4 shall be given Letter Grade (B) and those who earned CGPA between 5.5 and 5.9 shall be given Letter Grade (B+) and declared to have passed in the Second Class.

e) Successful candidates passing the examinations and earning CGPA between 4.0 and 4.4 shall be given Letter Grade (C) and those who earned CGPA between 4.5 and 4.9 shall be given Letter Grade (C+) and declared to have passed in the Third Class.

f) Absence from an examination shall not be taken as an attempt.

Final Result

CGPA	Grade	Classification of Final Result
9.5 – 10.0 9.0 and above but below 9.5	**O+** **O**	First Class – Exemplary*
8.5 and above but below 9.0 8.0 and above but below 8.5 7.5 and above but below 8.0	**D++** **D+** **D**	First Class with Distinction*
7.0 and above but below 7.5 6.5 and above but below 7.0 6.0 and above but below 6.5	**A++** **A+** **A**	First Class
5.5 and above but below 6.0 5.0 and above but below 5.5	**B+** **B**	Second Class
4.5 and above but below 5.0 4.0 and above but below 4.5	**C+** **C**	Third Class
0.0 and above but below 4.0	**U**	Re-appear

CUMULATIVE GRADE POINT AVERAGE (CGPA) = $\Sigma_n \Sigma_i C_{ni} G_{ni} / \Sigma_n \Sigma_i C_{ni}$

CGPA = Sum of the multiplication of grade points by the credits of the entire programme

Sum of the credits of the course for the entire Programme

Where '**Ci**' is the Credit earned for Course i in any semester; '**Gi**' is the Grade Point obtained by the student for Course i and 'n' refers to the semester in which such courses were credited.

CGPA (Cumulative Grade Point Average) = Average Grade Point of all the Courses passed starting from the first semester to the current semester.

Note: * The candidates who have passed in the first appearance and within the prescribed Semesters of the UG Programme (Major, Allied, and Elective courses alone) are eligible for this classification.