



NATIONAL BOARD FOR TECHNICAL EDUCATION

PLOT B BIDA ROAD, P.M.B. 2239, KADUNA, NIGERIA

HIGHER NATIONAL DIPLOMA

IN

MARINE ENGINEERING TECHNOLOGY PROGRAMME

CURRICULUM AND COURSE SPECIFICATIONS

IN

COLLABORATION WITH

NIGERIAN MARITIME ADMINISTRATION AND SAFETY AGENCY

NIMASA TOWERS, 35 ADETOKUNBO ADEMOLA STREET, VICTORIA ISLAND, LAGOS, NIGERIA

MARCH, 2026

PREFACE

The National Diploma (ND) and Higher National Diploma (HND) Marine Engineering Technology Curricula was reviewed meticulously to reflect the requirements and standards of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, as amended, to enable our training programmes meet internationally recognized benchmarks for competence, safety and professional performance in the Marine Engineering discipline. The reviewed curricula are meant to equip cadets with the requisite knowledge, practical skills, and professional attitudes necessary for effective performance in both shipboard and shore-based Marine Engineering roles. By harmonizing academic training with STCW requirements, we are ensuring that our diplomates are not only competitive in the global maritime industry but also capable of upholding the highest standards of safety, environmental stewardship, and technical proficiency.

The Nigerian Maritime Administration and Safety Agency (NIMASA) have been instrumental to the successful completion of this review. Through its commitment to enhancing the quality of maritime education and aligning national training frameworks with global conventions, NIMASA has once again demonstrated visionary leadership in strengthening Nigeria's maritime sector. This accomplishment would not have been possible without the expertise and dedication of the distinguished resource persons drawn from academia, the maritime industry, regulatory authorities, and professional bodies. Their depth of knowledge, critical insights, and collaborative spirit greatly enriched the review process. We sincerely acknowledge their invaluable and robust contributions with immense gratitude.

We are confident that this reviewed curriculum will serve as a solid foundation for producing competent Marine Engineering professionals who will contribute meaningfully to the growth and sustainability of the maritime industry at both national and international levels.

Prof. Idris M. Bugaje
Executive Secretary
National Board for Technical Education (NBTE)
Kaduna,
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March, 2026

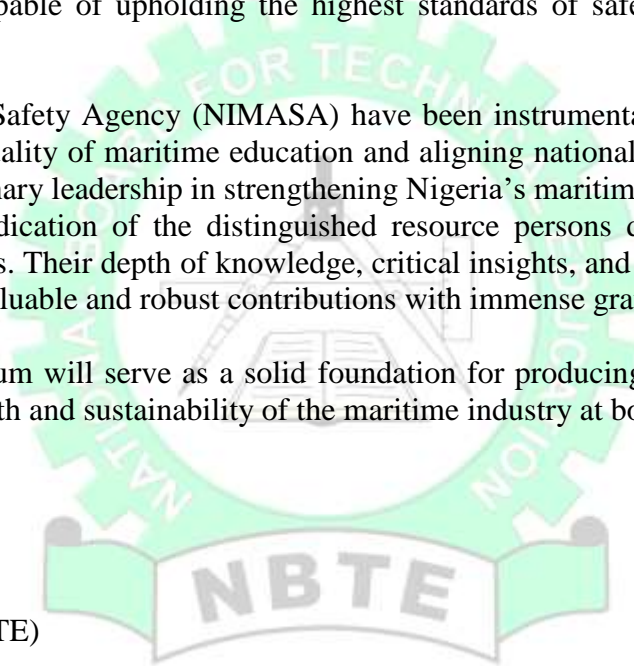
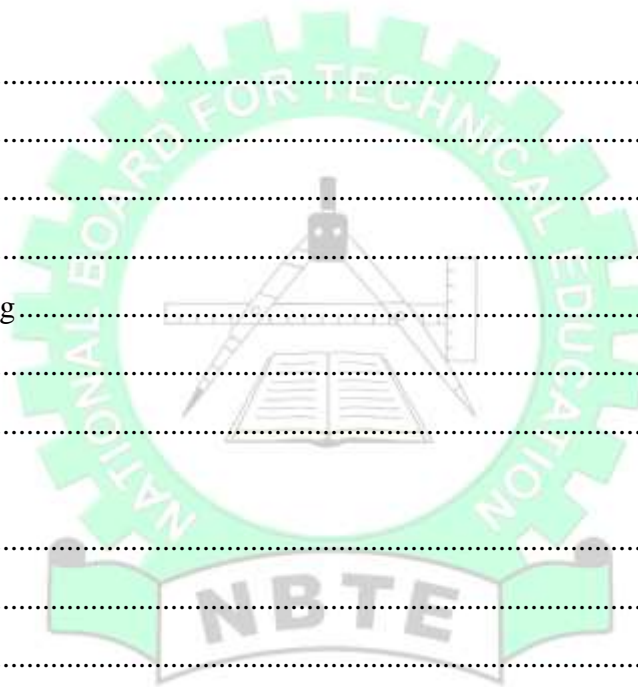


TABLE OF CONTENTS

Preface	i
General Information.....	iv
Curriculum Table	1
Year I Semester I	3
Marine Diesel Engines.....	4
Marine Boilers and Steam Systems	8
Marine and Power Electronics	15
Computer Applications in Marine Engineering.....	21
Marine Electro-Technology II	26
Maritime Communication in English II.....	34
Year I Semester II.....	40
Marine Auxiliary Systems	41
Technology of Materials	47
Ship Propulsion Systems	55
Refrigeration and HVAC Systems.....	59
Marine Operations and Engineering Management	63
Marine Safety, Law and Legislative Compliance.....	67



Year II Semester I.....	71
Electrical and Electronic Systems Management.....	72
Marine Machinery Troubleshooting and Fault Diagnosis	77
Marine Machinery Performance Assessment	86
Marine Pollution Prevention and Environmental Protection II	92
Ship Construction and Stability for Engineers	100
Research Methodology	104
Advanced Safety Training	112
Ship Automation and Control Systems.....	138
Year II Semester II.....	145
Shipboard Maintenance Management	146
Marine Structural Analysis	155
Dry Docking, Ship Repairs and Refit Management	159
Engine Room Resource Management.....	164
Maritime Law and Maritime Labour Convention.....	171
List of Minimum Resources	176
List of Workshop Participants	189



GENERAL INFORMATION

1. PROGRAMME NOMENCLATURE

Higher National Diploma in Marine Engineering Technology Programme.

2. PROGRAMME GOAL

The HND Marine Engineering Technology Programme curriculum prepares competent, safety-oriented, and decision-capable officers to manage, operate, and maintain shipboard machinery systems with proficiency in propulsion, auxiliary, and electrical equipment, safe maintenance, vessel stability, emergency response, and leadership, in full compliance with the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 as amended.

3. OBJECTIVES OF THE PROGRAMME

At the end of the programme, the diplomates should be able to:

- i. Manage the operation of propulsion plant machinery;
- ii. Plan and schedule operations;
- iii. Supervise, surveillance, performance assessment and maintain safety of propulsion plant and auxiliary machinery;
- iv. Manage fuel, lubrication and ballast operations;
- v. Manage operation of electrical and electronic control equipment;
- vi. Manage troubleshooting, restoration of electrical and electronic control equipment to operating condition;
- vii. Manage safe and effective maintenance and repair procedures;
- viii. Detect and identify the cause of machinery malfunctions and correct faults;
- ix. Ensure safe working practices;
- x. Control trim, stability and stress;
- xi. Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment;
- xii. Maintain safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems;
- xiii. Develop emergency and damage control plans and handle emergency situations;
- xiv. Use leadership and managerial skills.

4. ENTRY REQUIREMENTS

The entry requirements for admission into the HND in Marine Engineering Technology programme are:

- i. All entry requirements into ND Marine Engineering Technology and ND Boat and Ship Building Technology including five (5) G.C.E (O'Level) WASC, NECO, SAISSCE or NABTEB subjects passed at not more than two sittings. The subjects must be passed at credit level and should include English Language, Mathematics, Physics, Chemistry and any other relevant subject;
- ii. A minimum of at least lower credit in National Diploma (ND) in Marine Engineering Technology or ND Boat and Ship Building Technology with one year post graduation experience in relevant industry;
- iii. A candidate with pass at ND level must have acquired at least two years of cognate experience in order to qualify for admission.

5. PROGRAMME STRUCTURE AND DURATION

The HND Marine Engineering Technology programme is structured to last for two (2) years or four (4) semesters of classroom, laboratory, workshop and simulation activities. The Higher National Diploma is a two-year terminal academic programme.

Each semester shall be for 17 weeks, made up of as follows:

- 15 contact weeks of teaching (i.e. lectures and practical sessions etc.), and
- 2 weeks for registration and examinations

6. CURRICULUM

6.1 The curriculum of all HND programme consists of three (3) main components. These are

- a. General Studies/Education
- b. Foundation Courses.
- c. Professional/Core Courses

6.2 The General Studies component shall include courses in Science and Technology related programmes, English Language, Computer/ICT, and Entrepreneurship Development. The General Studies component shall account for not more than 10-15% of total contact hours for the programme.

Foundation courses include courses in Mathematics, Computer Science, Mechanical, Electrical/Electronic Engineering. The number of hours will account for about 10-15% of the total contact hours.

Professional and core courses are the core Marine Engineering Technology Courses which give the students the theoretical and practical skills needed to practice in Marine Engineering Technology. These may account for between 70-80% of the contact hours.

This curriculum is aligned with Chapters III, V, VI, and VIII of the STCW Convention, 1978, as amended and Competence Table of the STCW Code (Regulation III/2, Section A-III/2).

7. STAFFING REQUIREMENTS

7.1 Core Teaching Staff

A minimum of four (4) core teaching staff who should possess minimum of any of the underlisted qualifications:

- i. Holders of Class 2/1 Marine Engineering (Unlimited) for Lecturers/Instructors Cadre;
- ii. Holders of Class 2/1 Marine Engineering (Unlimited) plus additional qualification such PGD, MSc, etc for Lecturer Cadre;
- iii. Holders of HND/B.Eng and M.Eng in Marine Engineering with Class 2/1 Engineering (Unlimited);
- iv. Holders of HND/B.Eng and M.Eng in Mechanical Engineering;
- v. Holders of HND/B.Eng and M.Eng in Naval Architecture or related discipline.

7.2 Technical Staff

Technical staff shall have ND and HND in Marine Engineering or B.Sc in Marine Engineering.

7.3 Headship of the Department

The Head of Department shall have at least Class 2/1 Marine Engineering Certificate of Competency (Unlimited), a First Degree, and Masters' Degree in Marine Engineering or related field. He or she shall not be less than the rank of a Senior Lecturer and is registered with relevant professional body.

7.4 Career/Academic Prospects

7.4.1 Career Opportunities

The HND Marine Engineering Technology Programme prepares students for career in the following areas:

- i. International Maritime Organization (IMO);
- ii. United Nations (UN);
- iii. African Union (AU);
- iv. Second Engineer and Chief Engineer certification;
- v. Maritime Administration leadership roles;
- vi. Ship Management;
- vii. Offshore Engineering;
- viii. Consultancy roles.

7.4.2 Academic Prospects

They can also proceed for further studies in Postgraduate Studies programmes in Marine, Mechanical, or Energy Engineering fields, Naval Architecture, Offshore Engineering, etc.

8. CERTIFICATION

A diplomate of this programme shall be awarded HND in Marine Engineering Technology.

9. ACCREDITATION

The Higher National Diploma (HND) in Main Engineering Technology shall be accredited by NBTE before the diplomas can be awarded the diploma certificate. Details about the process of accrediting a programme for the award of the HND are available from the Executive Secretary, National Board for Technical Education (NBTE) Plot 'B', Bida Road, P.M.B. 2239, Kaduna, Nigeria.

10. CONDITIONS FOR THE AWARD OF THE HND

10.1 Institutions offering accredited programmes will award the Higher National Diploma to candidates who successfully completed the programme after passing prescribed coursework, examinations and final year projects. Such candidates should have completed a minimum of between 72 to 80 semester credit units depending on the programme.

10.2 Higher National Diplomas shall be classified as follows:

Distinction	CGPA of 3.50 and above
Upper Credit	CGPA of 3.00- 3.49
Lower Credit	CGPA of 2.50 – 2.99
Pass	CGPA of 2.00 – 2.49

10.3 Grading of Courses:

Courses shall be graded as follows:

MARKED RANGE	LETTER GRADE	WEIGHTING
75% and above	A	4.00
70% – 74%	AB	3.50
65% – 69%	B	3.25
60% – 64%	BC	3.00
55% – 59%	C	2.75
50% – 54%	CD	2.50
45% – 49%	D	2.25
40% – 44%	E	2.00
Below 40%	F	0.00

The pass mark for all professional or core courses is 60% in line with STCW Code, and 40% for General Studies and Non-Professional Courses in line with NBTE Academic Guidelines.

11. GUIDANCE NOTE FOR TEACHERS

11.1 The new curriculum is drawn in unit courses. This is keeping with the provisions of the National Policy on Education, which stresses the need to introduce the semester credit units which will enable a student who so wish to transfer the units already completed in an institution of similar standard from which he is transferring.

11.2 In designing the units, the principles of the modular system byproduct have been adopted; thus, making each of the professional modules, when completed, provide the students with technological/managerial skills, which can be used for employment purposes.

11.3. As the success of the credit unit system depends on the articulation of programmes between the institutions and industry, the curriculum content has been written in the behavioral objectives, so that it is clear to all, the Specific Learning Objective of the student who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance-based curriculum which state categorically, the special learning objective for the students, also, there is a deliberate attempt to further involve the staff of the department teaching by having another column called Teacher's Activities. This is to ensure that the teachers deliver the required learning objectives. There is a third column for the Resources required for each learning objective. Each department is expected to develop its own teaching curriculum from this minimum Guide curriculum and ensure that the resources required are available. The Academic Board of the institution may vet departmental submission on the final curriculum. Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the Technical Vocational Education and Training (TVET) Institutions.

11.4 The teaching of the theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory if possible. For each course, there should be a balance of theory to practice in the ratio 50:50 or 60:40, or the reverse.

12. PRACTICAL LOGBOOK

Practical Logbooks to be kept by each student shall contain all day-to-day, weekly summary and semester summary of all the practical activities from day one to the end of the programme. This is to be checked, marked, endorsed and recorded by the lecturers concerned at the end of every week.

13. FINAL PROJECT

Final year students in this programme are expected to carry out a project work. This could be on individual basis or teamwork. The project should, as much as possible be related to the programme and core professional discipline. Project reports should be well presented and should be properly supervised. The department should make its own arrangement of schedules for project work.

14. GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

Please, download the Guidelines for the Implementation of MSQ in Polytechnics in Nigeria, available on NBTE website (www.nbte.gov.ng/downloads).

CURRICULUM TABLE

YEAR I – SEMESTER I

S/N	Course Code	Course Title	L	T	P	CU	CH
1.	MEC 315	Mechanics of Machines	1	0	2	3	3
2.	MSQ 311	Principles of Quality Assurance Assessment	1	0	1	2	2
3.	MTH 312	Advanced Calculus	1	1	0	2	2
4.	MEA 321	Applied Thermodynamics	1	0	2	3	3
5.	MEP 323	Energy Conversion and Heat Transfer	1	0	2	3	3
6.	MAR 311	Marine Diesel Engines	2	0	2	4	4
7.	MAR 312	Marine Boilers and Steam Systems	2	0	2	4	4
8.	MAR 313	Marine and Power Electronics	2	0	2	4	4
9.	MAR 314	Computer Applications in Marine Engineering	2	0	2	4	4
10.	MAR 315	Marine Electro-Technology II	2	0	2	4	4
11.	MAR 316	Maritime Communication in English II	2	0	0	2	2
Total			17	1	17	35	35

YEAR I – SEMESTER II

S/N	Course Code	Course Title	L	T	P	CU	CH
1.	SME 311	Engineers in Society	2	0	0	2	2
2.	MTH 311	Advanced Algebra	1	1	0	2	2
3.	MEC 323	Advanced Fluid Mechanics	2	0	2	4	4
4.	ENT 326	Practice of Entrepreneurship I	2	0	2	4	4
5.	MSQ 311	Principles of Quality Assurance Assessment	1	0	1	2	2
6.	MAR 321	Marine Auxiliary Systems	2	0	2	4	4
7.	MAR 322	Technology of Materials	2	0	2	4	4
8.	MAR 323	Ship Propulsion Systems	2	0	2	4	4
9.	MAR 324	Refrigeration and HVAC Systems	2	0	2	4	4
10.	MAR 325	Marine Operations and Engineering Management	2	0	0	2	2
11.	MAR 326	Marine Safety, Law and Legislative Compliance	2	0	0	2	2
			20	1	11	34	34

YEAR II – SEMESTER I

S/N	Course Code	Course Title	L	T	P	CU	CH
1.	MTH 413	Numerical Methods and Computation	1	1	0	2	2
2.	ENT 416	Practice of Entrepreneurship II	2	0	2	4	4
3.	MAR 411	Electrical and Electronic Systems Management	2	0	2	4	4
4.	MAR 412	Marine Machinery Troubleshooting and Fault Diagnosis	2	0	2	4	4
5.	MAR 413	Marine Machinery Performance Assessment	2	0	2	4	4
6.	MAR 414	Marine Pollution Prevention and Environmental Protection II	2	0	2	4	4
7.	MAR 415	Ship Construction and Stability for Engineers	2	0	2	4	4
8.	MAR 416	Research Methodology	2	0	0	2	2
9.	MAR 417	Advanced Safety Training	2	0	0	2	2
10.	MAR 418	Ship Automation and Control Systems	2	0	2	4	4
Total			19	1	14	34	34

YEAR II – SEMESTER II

S/N	Course Code	Course Title	L	T	P	CU	CH
1.	MTH 413	Statistical Methods in Engineering	1	1	0	2	2
2.	MAR 421	Shipboard Maintenance Management	2	0	2	4	4
3.	MAR 422	Marine Structural Analysis	1	0	2	3	3
4.	MAR 423	Dry Docking, Ship Repair and Refit Management	2	0	2	4	4
5.	MAR 424	Engine Room Resource Management	2	0	2	4	4
6.	MAR 425	Maritime Law and Maritime Labour Convention (MLC)	1	0	1	2	2
7.	MAR 426	Final Year Project	0	0	6	6	6
Total			9	1	15	25	25



YEAR I SEMESTER I

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE TITLE: MARINE DIESEL ENGINES	Course Code: MAR 311	Contact Hours: 4 hours/week
Year: I Semester: I	Credit Unit: 4	Theoretical: 2 hours/week
	Pre-requisite:	Practical: 2 hours/week
<p>GOAL: This course is designed to equip students with management-level competence in the operation, monitoring, troubleshooting, and maintenance planning of marine diesel propulsion plants. It prepares students to analyse performance, diagnose faults, approve corrective actions, and supervise maintenance to ensure safe, efficient, and compliant machinery operation. The course also introduces dual-fuel engine systems, equipping students with knowledge of modern propulsion technologies in line with STCW Code, Section A-III/2.</p>		
<p>GENERAL OBJECTIVES: On completion of this course, the students should be able to:</p> <ol style="list-style-type: none"> 1.0 Analyze advanced marine diesel engine systems and operations; 2.0 Evaluate performance monitoring and trend analyses; 3.0 Analyze troubleshooting, fault diagnosis, and corrective actions; 4.0 Evaluate maintenance planning, reliability, and management decisions; 5.0 Analyze dual-fuel engine systems for modern propulsion. 		
<p>COMPETENCES: STCW Code, Section A-III/2</p> <ul style="list-style-type: none"> • Manage the operation of propulsion plant machinery 		

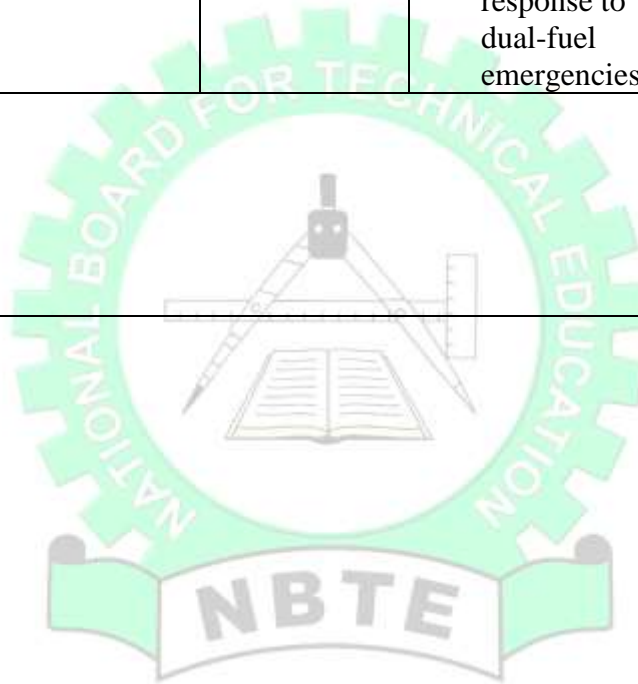
PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
Course Title: MARINE DIESEL ENGINES		Course Code: MAR 311		Contact Hours: 4 hours/week		
		Credit Unit: 4		Theoretical: 2 hours/week		
Year: I Semester: I		Pre-requisite:		Practical: 2 hours/week		
COURSE SPECIFICATION:						
General Objectives 1.0: Analyze advanced marine diesel engine systems and operations.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain construction and operating principles of large marine diesel engines. 1.2 Analyze propulsion-plant operating modes under varying load conditions. 1.3 Define engine control and monitoring systems. 1.4 Evaluate operating limits and safety margins.	<ul style="list-style-type: none"> Lectures; guided discussions; case studies of propulsion operation. Explain management-level of propulsion-plant operation. 	<ul style="list-style-type: none"> Engine diagrams; Manufacturer manuals; smart board; projector. 	1.1 Identify major engine systems. 1.2 Measure operating parameters of diesel engine system.	<ul style="list-style-type: none"> Supervise system identification exercises. Guide parameter analysis. 	<ul style="list-style-type: none"> Engine system diagrams. Manufacturer manuals etc.
General Objective 2.0: Evaluate performance monitoring and trend analyses.						
4-7	2.1 Analyze engine performance data and operating logs. 2.2 Explain fuel consumption and efficiency trends. 2.3 Identify early signs of abnormal engine behaviour. 2.4 Enumerate alarms and	<ul style="list-style-type: none"> Lectures. Worked examples. Performance case studies. Explain 	<ul style="list-style-type: none"> Engine log sheets Performance charts Projector. 	2.1 Plot and interpret performance trends. 2.2 Identify deviations from normal	<ul style="list-style-type: none"> Supervise plotting exercises Guide deviation analysis. 	<ul style="list-style-type: none"> Engine log sheets Performance charts.

	condition-monitoring indicators.	competence in performance-trend evaluation.		operation.		
General Objective 3.0: Analyze troubleshooting, fault diagnosis, and corrective actions.						
8-11	<p>3.1 List common and complex diesel-engine faults.</p> <p>3.2 Analyze causes of abnormal temperatures, pressures, and vibrations.</p> <p>3.3 Evaluate risks associated with continued operation.</p> <p>3.4 Describe corrective and contingency actions.</p> <p>3.5 Demonstrate sound engineering judgement in fault situations.</p>	<ul style="list-style-type: none"> • Case studies • Scenario analysis • Guided discussions. 	<ul style="list-style-type: none"> • Fault reports • Diagnostic guides • Projector etc. 	<p>3.1 Simulate fault scenarios.</p> <p>3.2 Analyze observed faults.</p> <p>3.3 Recommend corrective actions.</p>	<ul style="list-style-type: none"> • Supervise fault simulations • Guide corrective action planning. 	<ul style="list-style-type: none"> • Fault simulation kits • Diagnostic manuals etc.
General Objective 4.0: Evaluate maintenance planning, reliability, and management decisions.						
12-13	<p>4.1 Explain maintenance strategies for diesel propulsion systems.</p> <p>4.2 Outline condition-based and planned maintenance approaches.</p> <p>4.3 Prioritize maintenance based on operational demands.</p> <p>4.4 Evaluate maintenance impact on safety and efficiency.</p> <p>4.5 Explain the term 'reliability'.</p>	<ul style="list-style-type: none"> • Case-based lectures • Review sessions • Management discussions. 	<ul style="list-style-type: none"> • PMS documentation, company procedures projector etc.. 	<p>4.1 Develop maintenance plans.</p> <p>4.2 Justify maintenance priorities.</p>	<ul style="list-style-type: none"> • Supervise maintenance planning exercises • Facilitate group decision-making. 	<ul style="list-style-type: none"> • PMS documentation company procedures etc.
General Objective 5: Analyze dual-fuel engine systems for modern propulsion.						
14 - 15	<p>5.1 Explain construction and operating principles of dual-fuel engines</p>	<ul style="list-style-type: none"> • Lectures • Case studies of dual-fuel 	<ul style="list-style-type: none"> • Dual-fuel engine 	<p>5.1 Identify dual-fuel system components.</p>	<ul style="list-style-type: none"> • Supervise simulator exercises 	<ul style="list-style-type: none"> • Dual-fuel simulator • emission

	<p>(diesel-gas).</p> <p>5.2 Evaluate fuel changeover procedures and safety requirements.</p> <p>5.3 Analyze efficiency and emissions performance of dual-fuel systems.</p> <p>5.4 Discuss management responsibilities in dual-fuel operation and compliance with IMO regulations.</p>	<p>operation</p> <ul style="list-style-type: none"> Regulatory review. 	<p>diagrams</p> <ul style="list-style-type: none"> IMO/IEC standards projector. 	<p>5.2 Demonstrate fuel changeover on simulator.</p> <p>5.3 5.3 Record efficiency/emission data.</p> <p>5.4 Role-play management response to dual-fuel emergencies.</p>	<ul style="list-style-type: none"> Guide changeover drills Facilitate role-play. 	<p>charts</p> <ul style="list-style-type: none"> PPE IMO manuals.
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Course Assessment:

Course work: 10%
 Test/Assignments: 10%
 Practical: 40%
 Examination: 40%
Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE TITLE: MARINE BOILERS AND STEAM SYSTEMS	COURSE CODE: MAR 312	Contact Hours: 4 hours/week
Year: I Semester: I	Credit Unit: 4	Theoretical: 2 hours/week
	Pre-requisite:	Practical: 2 hours/week
<p>GOAL: This course is designed to develop management-level competence in the operation, supervision, performance assessment, maintenance and emergency management of marine boilers, steam turbines and associated systems; enabling students to plan, conduct and evaluate safe start-up, normal operation, shutdown and preservation procedures, perform steam-plant performance calculations (heat balance, efficiency, fuel and feedwater requirements), apply water chemistry and combustion control measures, execute statutory inspection and survey requirements, and integrate turbine and boiler systems into shipboard propulsion and auxiliary plant, as contained in the STCW Code, Section A-III/2.</p>		
<p>GENERAL OBJECTIVES:</p> <p>On completion of this course, the students should be able to:</p> <ol style="list-style-type: none"> 1.0 Understand boilers, types, design principles and safe sequence of instruction; 2.0 Analyse Boiler construction, mountings, fittings, and materials; 3.0 Analyse Design features and operative mechanism of marine steam turbines and associated auxiliaries; 4.0 Understand Combustion, burners and fuel systems; 5.0 Analyse Boiler water, chemistry, treatment and feed systems; 6.0 Understand Feedwater systems and economizers, and their interaction with auxiliaries; 7.0 Apply Start-up, control systems and shutdown/preservation; 8.0 Understand Steam distribution, traps and condensate recovery; 9.0 Understand Steam-plant auxiliaries and routine checks; 10.0 Evaluate Maintenance, inspection, statutory surveys and certification; 11.0 Analyse Performance assessment and calculations; 12.0 Analyse Blowdown, feedwater calculations, troubleshooting and emergency response. 		
<p>COMPETENCES:</p> <ul style="list-style-type: none"> • Supervise, surveillance, performance assessment and maintain safety of propulsion plant and auxiliary machinery • Manage safe and effective maintenance and repair procedures • Detect and identify the cause of machinery malfunctions and correct faults • Ensure safe working practices 		

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
Course Title: MARINE BOILERS AND STEAM SYSTEMS		Course Code: MAR 312		Contact Hours: 2 hours/week		
		Credit Unit: 4		Theoretical: 2 hours/week		
Year: I Semester: I		Pre-requisite:		Practical: 2 hour/week		
COURSE SPECIFICATION:						
General Objective 1.0: Understand boilers, types, design principles and safe sequence of instruction						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Explain role and purpose of marine boilers and steam systems. 1.2 Classify boiler types (fire-tube, water-tube, package, auxiliary). 1.3 Explain boiler operation.	<ul style="list-style-type: none"> • Introductory lectures • Concept mapping • Present course sequence and learning path • Compare types with diagrams. 	<ul style="list-style-type: none"> • IMO Model Course 7.02, summary standard boiler textbooks, projector; diagrams etc. 	1.1 Identify boiler types from diagrams/models. 1.2 Match boiler type to ship application and duty.	<ul style="list-style-type: none"> • Guided identification exercise • Group classification tasks. 	Scale models, diagrams, projector, whiteboard etc.
General Objective 2.0: Analyse Boiler construction, mountings, fittings, and materials						
2	2.1 Describe boiler constructional features: shell, drums, tubes, furnace, refractory. 2.2 Explain boiler mountings and fittings: safety valves, gauge glasses, feed pumps,	<ul style="list-style-type: none"> • Detailed lecture with labelled cross-sections; failure-mode case studies; guided sketches. 	<ul style="list-style-type: none"> • Manufacturer manuals, sectional drawings, slides, whiteboard. 	2.1 Identify and label mountings on mock-up/diagram. 2.2 Test safety valve and gauge cocks.	<ul style="list-style-type: none"> • Hands-on identification • Supervised testing of mountings • Safety briefing. 	Mock-up panels, Safety valve trainer, Gauge glass assembly, PPE.

	blowdown valves. 2.3 Explain materials selection and common failure modes.					
General Objective 3.0: Analyse Design features and operative mechanism of marine steam turbines and associated auxiliaries						
3	3.1 Describe design features of steam turbines (impulse, reaction, axial stages). 3.2 Explain operative mechanism: steam admission, expansion, rotor dynamics, governor action. 3.3 Describe turbine auxiliaries: lube oil system, gland steam, turning gear, seals.	<ul style="list-style-type: none"> Lectures with turbine cutaway diagrams and animations Explain thermodynamic basis and governor logic Questions and Answers. 	IMO Model Course 7.02 turbine module, manufacturer manuals, cutaway diagrams, animations.	3.1 Identify turbine components on model/cutaway. 3.2 Demonstrate governor and control valve operation; inspect lube oil components.	<ul style="list-style-type: none"> Supervise hands-on inspection of turbine mock-up Operate governor/control valve trainer Safety checks. 	Turbine cutaway model, governor trainer, lube oil rig, PPE.
General Objective 4.0: Understand Combustion, burners and fuel systems.						
4	4.1 Explain combustion fundamentals: stoichiometry; excess air; fuel gas composition. 4.2 Describe burner types and fuel supply systems (pressure spill, rotary cup,	<ul style="list-style-type: none"> Lecture with combustion calculations and worked examples Burner videos and diagrams Safety notes. 	<ul style="list-style-type: none"> Combustion charts, burner manuals, fuel system schematics, calculator. 	4.1 Inspect burner components and atomizer types. 4.2 Perform basic burner adjustment and record flue gas readings.	<ul style="list-style-type: none"> Demonstrate burner start/adjust Supervise flue gas measurement and interpretation. 	<ul style="list-style-type: none"> Burner trainer, fuel gas analyser, fuel system mockup, PPE.

	atomizing). 4.3 Explain fuel systems in ships					
General Objective 5.0: Analyse Boiler water, chemistry, treatment, and feed systems						
5	5.1 Explain boiler water impurities, scaling, corrosion and carry-over. 5.2 Describe water treatment methods: deaeration, chemical dosing, blowdown control. 5.3 Discuss feed systems onboard ships.	<ul style="list-style-type: none"> Lecture, case studies of chemistry failures Demonstrate sampling and interpretation. 	<ul style="list-style-type: none"> Water chemistry charts, IMO guidance, test kit manuals, slides etc. 	5.1 Test boiler water samples (pH, hardness, conductivity). 5.2 Demonstrate controlled blowdown and record parameters.	<ul style="list-style-type: none"> Supervise sampling, chemical test procedures, and blowdown operation on trainer. 	<ul style="list-style-type: none"> Water test kits, deaerator/boiler trainer, PPE, logbooks.
General Objective 6.0: Understand Feedwater systems and economizers, and their interaction with auxiliaries						
6	6.1 Describe feedwater systems. 6.2 Explain the auxiliaries of feed water systems: feed pumps, deaerators, feed heaters, economizers. 6.3 Explain interaction between feed systems and turbine/generator auxiliaries.	<ul style="list-style-type: none"> Lecture with system flow diagrams; discuss feedwater control and economizer function; failure modes. 	<ul style="list-style-type: none"> Feed system schematics; economizer diagrams; slides. 	6.1 Operate feed pump trainer and deaerator mockup 6.2 Inspect economizer and feed heater components.	<ul style="list-style-type: none"> Supervise pump operation, deaerator checks and economizer inspection. 	<ul style="list-style-type: none"> Feed pump trainer; deaerator rig; economizer mockup; gauges.
General Objective 7.0: Apply Start-up, control systems and shutdown preservation.						
7	7.1 Describe pre-start checks, ignition,	<ul style="list-style-type: none"> Step-by-step walkthrough of 	<ul style="list-style-type: none"> Control schematics; 	7.1 Perform pre-start checks on	<ul style="list-style-type: none"> Supervise start/stop drills. 	<ul style="list-style-type: none"> Boiler simulator

	<p>warm-up and steam raising procedures.</p> <p>7.2 Explain control systems: feedwater control, combustion control, interlocks, alarms, PLC basics.</p> <p>7.3 Outline safe shutdown, preservation and lay-up procedures.</p>	<p>start/stop sequences</p> <ul style="list-style-type: none"> Show control loop diagrams and interlock logic; PLC demo and alarm scenarios. 	<p>PLC examples; start/stop checklists; projector.</p>	<p>simulator/trainer</p> <p>7.2 Execute supervised start-up and controlled shutdown</p>	<ul style="list-style-type: none"> Monitor control responses Log parameters and debrief. 	<p>; control panel trainer; checklists; logbooks.</p>
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General Objective 8.0: Understand Steam distribution, traps and condensate recovery

8	<p>8.1 Explain steam mains, branches, traps, condensate return and flash steam.</p> <p>8.2 Describe trap selection</p> <p>8.3 Discuss testing condensate handling.</p>	<ul style="list-style-type: none"> Lecture with flow diagrams; fault scenarios for condensate failure. Discuss trap selection and placement. 	<ul style="list-style-type: none"> Steam system schematics; trap manuals; projector. 	<p>8.1 Test steam traps and condensate return components.</p> <p>8.2 Operate condensate pump trainer and demonstrate trap testing.</p>	<ul style="list-style-type: none"> Supervise trap testing, pump operation and fault simulation. 	<p>Trap test rig; condensate pump trainer; pressure gauges; PPE.</p>
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General Objective 9.0: Understand Steam-plant auxiliaries and routine checks

9	<p>9.1 Describe soot blowers, air ejectors, condensers, feedwater heaters, fans, and blowers.</p> <p>9.2 Explain maintenance and operational checks</p>	<ul style="list-style-type: none"> Lecture, equipment manuals review, maintenance scheduling and risk assessment discussion. 	<ul style="list-style-type: none"> Auxiliary equipment manuals; maintenance checklists; slides etc. 	<p>9.1 Operate auxiliary trainers (soot blower, air ejector) and perform routine checks.</p> <p>9.2 Record maintenance observations and prepare defect reports.</p>	<ul style="list-style-type: none"> Supervise auxiliary operation and maintenance exercises; review reports and corrective actions. 	<p>Soot blower trainer; air ejector rig; maintenance tools; logbooks.</p>
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	for auxiliaries. 9.3 State the safety measures to be observed					
General Objective 10.0: Evaluate Maintenance, inspection, statutory surveys and certification.						
10-11	10.1 Explain statutory requirements, classification society surveys, certificates and survey intervals for boilers and turbines. 10.2 Describe inspection techniques: visual, NDT overview, internal/ external surveys. 10.3 Discuss Boiler tube leakage repairs	<ul style="list-style-type: none"> Case studies of survey reports; review statutory checklists; discuss survey planning, documentation, and certification. 	<ul style="list-style-type: none"> Classification society guides (summaries); survey checklists; sample reports. 	10.1 Prepare inspection checklist and carry out a mock internal/external inspection. 10.2 Document findings in standard survey format.	<ul style="list-style-type: none"> Guide inspection exercise. Supervise documentation and report writing, debrief on compliance. 	Inspection tools; sample survey reports; logbooks; cameras.
General Objective 11.0: Analyse Performance assessment and calculations.						
12-13	11.1 Use steam tables: enthalpy, specific volume, and saturation properties. 11.2 Perform basic heat balance and	<ul style="list-style-type: none"> Worked examples using steam tables; step-by-step heat balance; spreadsheet demonstration and problem sets. 	<ul style="list-style-type: none"> Steam tables; calculation templates; case study plant data; calculator/spreadsheet. 	11.1 Carry out heat balance and efficiency calculation from sample plant data. 11.2 Record and interpret results; compare with expected	<ul style="list-style-type: none"> Supervise calculation exercises; validate student results. Discuss corrective actions and optimization. 	<ul style="list-style-type: none"> Plant data sets; steam tables; calculators; spreadsheet

	calculate boiler efficiency (direct and indirect). 11.3 Estimate fuel consumption from plant data.			performance.		templates
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General Objective 12.0: Analyse Blowdown, feedwater calculations, troubleshooting and emergency response.

14-15	<p>12.1 Calculate blowdown rate, feedwater requirement and make-up water.</p> <p>12.2 Diagnose common faults (low water, carry-over, flame failure, turbine vibration) and plan corrective actions; emergency response procedures.</p>	<ul style="list-style-type: none"> • Problem sets on blowdown/feed calculations. • Troubleshooting methodology. • Emergency case studies and response planning. 	<ul style="list-style-type: none"> • Calculation templates; troubleshooting flowcharts; emergency procedure checklists. 	<p>12.1 Simulate fault scenarios (low water, flame failure, turbine trip) and execute emergency procedures.</p> <p>12.2 Produce corrective action plan and maintenance request.</p>	<ul style="list-style-type: none"> • Run simulator fault drills. • Supervise emergency response and debrief. • Assess corrective plans. 	<ul style="list-style-type: none"> • Calculation templates; troubleshooting flowcharts; emergency procedure checklists; steam tables.
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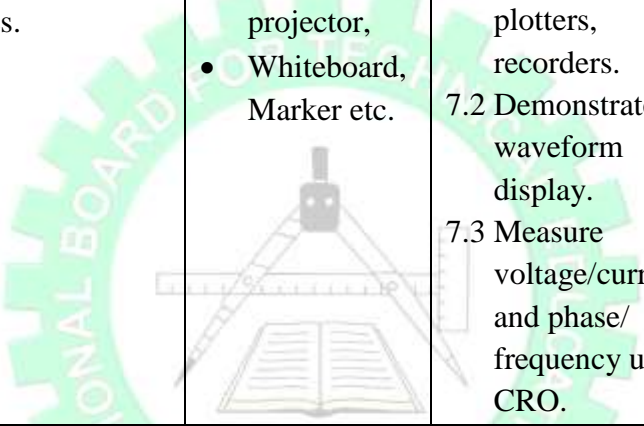
Course Assessment:
 Course work: 10%
 Test/Assignments: 10%
 Practical: 40%
 Examination: 40%
Total: 100%

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE: MARINE AND POWER ELECTRONICS	Course Code: MAR 313	Contact Hours: 4 Hrs/week
Year: I Semester: I	Credit Unit: 4	Theoretical: 2Hrs/Week
	Pre-requisite: 1. Marine Electro-Technology I 2. Electrical Machines and Shipboard Power Systems	Practical: 2Hrs/Week
GOAL: This course is designed to develop management-level competence in marine electronics and power electronics, enabling students to understand, operate, and supervise semiconductor devices, amplifiers, stabilizers, converters, inverters, and electronic control units. The course prepares graduates to manage shipboard automation, propulsion systems, and fault diagnosis, in line with STCW Code, Section A-III/2.		
GENERAL OBJECTIVES: On completion of this course, the student will be able to: <ol style="list-style-type: none"> 1.0 Understand basic electronics. 2.0 Know the construction, principles of operation, and application of semiconductor devices. 3.0 Understand thermionic devices. 4.0 Know the construction, principles of operation, and application of transistors. 5.0 Understand amplifiers and feedback amplifiers. 6.0 Understand stabilized power supplies. 7.0 Know and use output devices. 8.0 Understand power electronics (converters, inverters, rectifiers, control circuits). 9.0 Understand Application of Marine and Power Electronics in Shipboard Systems (propulsion, automation, and fault management). 		
COMPETENCES: STCW Code, Section A-III/2 <ul style="list-style-type: none"> • Operation and monitoring of electrical and electronic control equipment. • Troubleshooting and restoration of electrical and electronic systems to operating condition. • Maintenance and repair of electrical and electronic equipment. • Integration of power-electronic systems into shipboard propulsion and auxiliary systems. 		

PROGRAMME: HIGHER NATIONAL DIPLOMA (HND) IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE AND POWER ELECTRONICS		Course Code: MAR 313		Credit Unit: 4	Contact Hours: 4 Hours/Week	
					Theoretical: 2 Hours/Week	
Year I Semester I		Pre-requisite: Electrical Machines and Shipboard Power Systems		Practical: 2 Hours/Week		
GENERAL OBJECTIVE 1.0: Understand Basic Electronics						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcome	Teacher Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
1	1.1 Describe the electronic theory of matter. 1.2 List semi-conductor devices 1.3 Explain the applications of semiconductor devices.	<ul style="list-style-type: none"> Explain with sketches. Prepare detailed notes for the students. Ask the students to perform tasks. 	<ul style="list-style-type: none"> Multimedia Projector, Textbooks. Whiteboard. 	1.1 Identify electronic components 1.2 Identify semi-conductor devices	<ul style="list-style-type: none"> Demonstrate for the students to learn and allow them to do the same. 	<ul style="list-style-type: none"> Electronic lab kits, CRO, electronic lab equipment.
General Objective 2.0: Know the Construction, Principles of Operation and Application of Various Semi-Conductor Devices						
2-3	2.1 Explain thyristors and thermistors, as semiconductor devices. 2.2 State characteristics of thermistors. 2.3 Describe the construction and principles of operation for thyristors. 2.4 Outline the	<ul style="list-style-type: none"> Explain with sketches. Prepare detailed notes for the students. 	<ul style="list-style-type: none"> Charts, slides, textbooks, white board, marker, multimedia. 	2.1 Identify thyristors as four-layer semiconductors . 2.2 Identify thermistors and measure resistance changes.	<ul style="list-style-type: none"> Demonstrate device operation, supervise practice. 	<ul style="list-style-type: none"> Semi-conductor kits, lab boards.

	applications of thermistors and thyristors in marine engineering					
General Objective 3.0: Know Thermionic Devices						
4	3.1 Explain thermionic emission. 3.2 Explain valves (diodes, triodes, and pentodes). 3.3 Discuss applications of thermionic emission in modern electronic systems	<ul style="list-style-type: none"> Lecture with sketches, problem-solving. 	<ul style="list-style-type: none"> Textbooks, multimedia projector, whiteboard, marker, etc. 	3.1 Identify thermionic valves (diodes, triodes, and pentodes). 3.2 Demonstrate thermionic emission in lab experiments.	<ul style="list-style-type: none"> Demonstrate experiments, supervise practice. 	<ul style="list-style-type: none"> Lab kits, CRO/Digital Oscilloscope.
General Objective 4.0: Know the construction, principles of operation and application of Transistors						
5-6	4.1 Describe construction and operation transistors. 4.2 Explain biasing methods. 4.3 Explain temperature effects and compensation.	<ul style="list-style-type: none"> Explain with sketches, derive equations, and assign tasks. 	<ul style="list-style-type: none"> Textbooks, Projector, Whiteboard, Multi-media Projector, diskettes, CDs transparencies etc. 	4.1 Identify transistor types (PNP, NPN). 4.2 Demonstrate biasing circuits (self-bias, collector-base bias). 4.3 Observe temperature effects and compensation methods.	<ul style="list-style-type: none"> Demonstrate transistor circuits, supervise practice. 	<ul style="list-style-type: none"> Transistor kits, lab boards.
General Objective 5.0: Understand Amplifiers and Feedback Amplifiers						
7-8	5.1 State classes of amplifiers.	<ul style="list-style-type: none"> Explain with sketches, derive 	<ul style="list-style-type: none"> Textbooks, diagrams, 	5.1 Identify amplifier	<ul style="list-style-type: none"> Demonstrate amplifier 	<ul style="list-style-type: none"> Amplifier kits, CRO.

	<p>5.2 Explain biasing conditions.</p> <p>5.3 Describe common collector and DC amplifiers.</p> <p>5.4 Explain feedback phenomena.</p> <p>5.5 Derive gain expressions.</p>	<p>equations, and assign calculations.</p>	<p>projector.</p>	<p>classes (A, B, AB, C).</p> <p>5.2 Demonstrate biasing conditions in circuits.</p> <p>5.3 Construct common collector amplifier.</p> <p>5.4 Demonstrate positive and negative feedback.</p> <p>5.5 Measure gain with and without feedback.</p>	<p>circuits, supervise practice.</p>	<p>Digital Oscilloscope.</p> <ul style="list-style-type: none"> • Electronics Laboratory
<p>General Objective 6.0: Understand Stabilized Power Supplies</p>						
9-10	<p>6.1 Explain rectification principles.</p> <p>6.2 Explain smoothing circuits and filters.</p> <p>6.3 Compare filter performance.</p> <p>6.4 Explain stabilized power supply circuits (shunt, series regulators).</p>	<ul style="list-style-type: none"> • Lecture 6.1-6.4 with diagrams, case studies. 	<ul style="list-style-type: none"> • Textbooks, projector, charts, • Whiteboard, Marker, Multimedia, etc. 	<p>6.1 Perform half-wave and full-wave rectification</p> <p>6.2 Construct smoothing circuits with capacitors/ inductors.</p> <p>6.3 Compare filter performance experimentally</p>	<ul style="list-style-type: none"> • Demonstrate rectifier circuits, supervise practice. 	<ul style="list-style-type: none"> • Rectifier kits, lab boards, Electronics laboratory.

				6.4 Build stabilized power supply circuits using regulators.		
General Objective 7.0: Know the applications of electronic display units						
11-12	<p>7.1 List output devices.</p> <p>7.2 Describe Cathode Ray Oscilloscope (CRO), Oscillographs, X-Y plotters, Ultra-Violet (UV) recorders.</p> <p>7.3 Explain waveform, voltage/current, and phase/frequency measurements.</p>	<ul style="list-style-type: none"> Explain with sketches, prepare notes. 	<ul style="list-style-type: none"> Textbooks, multimedia projector, Whiteboard, Marker etc. 	<p>7.1 Identify CRO, oscillographs, plotters, recorders.</p> <p>7.2 Demonstrate waveform display.</p> <p>7.3 Measure voltage/current and phase/frequency using CRO.</p>	<ul style="list-style-type: none"> Demonstrate CRO and plotter usage. 	<ul style="list-style-type: none"> CRO, plotters, recorders.
General Objective 8.0: Understand Power Electronics (converters, inverters, rectifiers, and control circuits).						
13-14	<p>8.1 Explain converters, inverters, and rectifiers.</p> <p>8.2 Describe control circuits and electronic control units.</p> <p>8.3 State applications in shipboard propulsion and automation.</p>	<ul style="list-style-type: none"> Lecture with diagrams, case studies, STCW reference table. 	<ul style="list-style-type: none"> STCW Code, power electronics textbooks. 	<p>8.1 Construct and test converter circuits.</p> <p>8.2 Demonstrate inverter operation.</p> <p>8.3 Operate rectifier circuits and measure outputs.</p>	<ul style="list-style-type: none"> Demonstrate inverter/converter circuits, supervise practice. 	<ul style="list-style-type: none"> Power electronics kits/trainer, shipboard simulators.
General Objective 9.0: Understand Application of Marine and Power Electronics in Shipboard Systems (propulsion, automation,						

and fault management).

15	<p>9.1 Explain the application of marine and power electronics in shipboard systems.</p> <p>9.2 Analyze faults and propose management-level solutions.</p> <p>9.3 Discuss automation in shipboard system.</p>	<ul style="list-style-type: none"> • Case-based lectures, group discussions, guided presentations • Present case studies on automation and propulsion systems. 	<ul style="list-style-type: none"> • STCW Code, marine system diagrams. 	<p>9.1 Present applications in marine context.</p> <p>9.2 Analyze case studies and propose solutions.</p> <p>9.3 Demonstrate integration of electronics into propulsion/ auxiliary systems.</p>	<ul style="list-style-type: none"> • Guide group presentations, supervise discussions. 	<ul style="list-style-type: none"> • CAD projector, shipboard diagrams.
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Course Assessment:

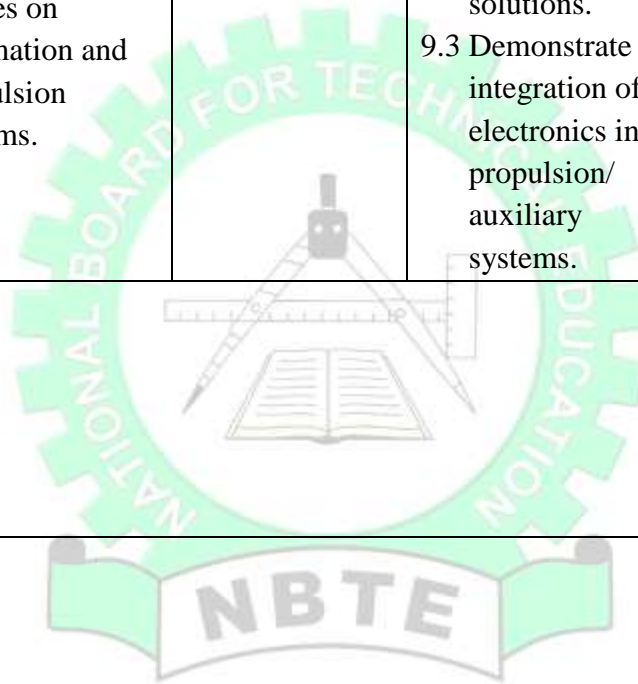
Course work: 10%

Test/Assignments: 10%

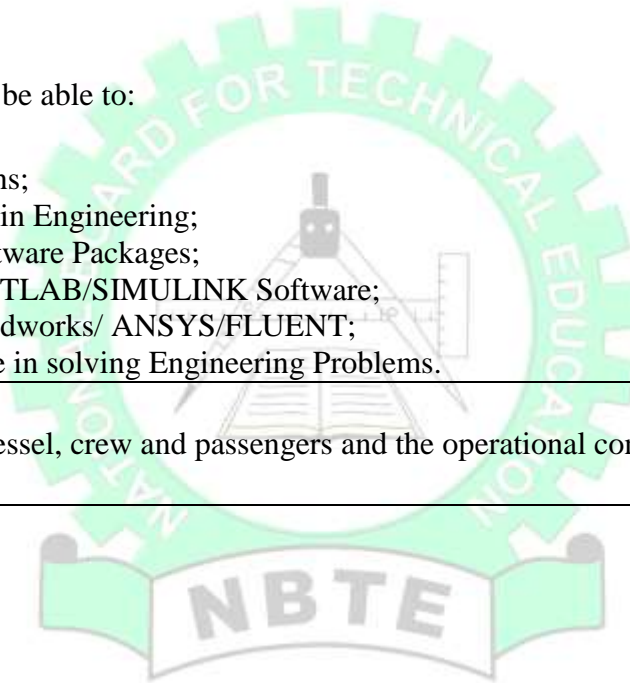
Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: COMPUTER APPLICATIONS IN MARINE ENGINEERING	Course Code: MAR 314	Credit Unit: 4	Contact Hours: 4 Hours/ Week
			Theoretical: 2 Hours/ Week
GOAL: This course is designed to equip the students with knowledge and skills of computer application, modelling and simulation software packages.			
Year: I Semester I	Pre-requisite:	Practical: 4 Hours/Week	
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Know basic Computer Applications; 2.0 Understanding System Modelling in Engineering; 3.0 Understand various Computer software Packages; 4.0 Know how to get started with MATLAB/SIMULINK Software; 5.0 Know how to get started with Solidworks/ ANSYS/FLUENT; 6.0 Understand the use of the software in solving Engineering Problems. 			
COMPETENCE			
<ul style="list-style-type: none"> • Maintain safety and security of the vessel, crew and passengers and the operational conditioning of ships s digital skills r safety systems. 			



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: COMPUTER APPLICATIONS IN MARINE ENGINEERING		Course Code: MAR 314	Credit Unit: 4	Contact Hours: 4 Hours/ Week		
Year: I Semester I		Pre-requisite:		Theoretical: 2 Hours/ Week		
Year: I Semester I		Pre-requisite:		Practical: 2 Hours/Week		
General Objective 1.0: Know basic Computer Applications						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Explain elements of word processing 1.2 Discuss the basics of spread sheet 1.3 Review PowerPoint	<ul style="list-style-type: none"> Review and discuss Microsoft equation editor, excel, and power point 	<ul style="list-style-type: none"> Projector, whiteboard, Microsoft software Personal computer Relevant textbooks on computer appreciation 	1.1 Apply MS word to write equations, and type technical works 1.2 Demonstrate technical ability in spread sheet application 1.3 Generate slides with shapes, pie chart and bar chart using power point.	Design a data set for analysis using Excel and ask Students to do so	<ul style="list-style-type: none"> Practical manuals, Computers, etc.
General Objective: 2.0: Understand System Modelling in Engineering						
2-3	2.1 Define system modeling. 2.2 Explain types of models 2.3 Discuss why models are necessary in Engineering 2.4 Describe how to develop models	<ul style="list-style-type: none"> Define and discuss model on modelling 	<ul style="list-style-type: none"> Projector Personal computer White board 	2.1 Use CAD/CAM software to develop models of marine engineering components	<ul style="list-style-type: none"> Guide Students to use Simulink to model physical system (Mass-spring 	

					system, Pendulum, etc.)	
General Objective 3.0: Understand Various Computer Software Packages						
4	<p>3.1 Explain computer software packages.</p> <p>3.2 Enumerate various types of computer software packages</p> <p>3.3 Discuss merits and demerits of software packages.</p> <p>3.4 Explain various area of application in Marine Engineering</p>	<ul style="list-style-type: none"> Explain computer software packages and usage 	<ul style="list-style-type: none"> Projector Whiteboard Relevant Computer, textbooks 	3.1 Install relevant computer software packages on computer system.	<ul style="list-style-type: none"> Assist Students to discuss various application areas in Marine Engineering 	
General Objective 4.0: Know How to Get Started With MATLAB/SIMULINK Software						
5--7	<p>4.1 Define MATLAB and its toolboxes.</p> <p>4.2 Discuss how to get started with MATLAB.</p> <p>4.3 Explain SIMULINK and model development</p> <p>4.4 Discuss symbolic Maths toolbox</p> <p>4.5 Carry out sample</p>	<ul style="list-style-type: none"> Explain the features of MATLAB/SIMULINK in window environments 	<ul style="list-style-type: none"> Whiteboard and marker Lecture materials, computer installed with MATLAB/SIMULINK Software. 	4.1 Solve physical problems using MATLAB/SIMULINK.	<ul style="list-style-type: none"> Guide Students to develop M-Files, save, debug and run. 	

	calculation with MATLAB					
General Objective 4.0: Know How to Get Started With SOLIDWORKS/Ansys/Fluent						
8-11	5.1 Start SOLIDWORKS from desktop 5.2 Familiarize with window environment and features of SOLIDWORKS 5.3 Explain 2D sketching using SOLIDWORKS. 5.4 Discuss basic modeling SOLIDWORKS	<ul style="list-style-type: none"> Explain the features of SOLIDWORKS window environment Illustrate activities in 5.1 and 5.4 	<ul style="list-style-type: none"> Whiteboard and marker, relevant textbooks, and lecture materials Computer installed with latest SOLIDWORKS and AUTOCAD software 	5.1 Identify SOLIDWORKS window environment 5.2 Carry out sketch, extrude and dimension the selected part	<ul style="list-style-type: none"> Guide the Students to identify different features of SOLIDWORKS and sketch a given mechanical part 	
General Objective 6.0: Understand the Use Of The Softwares In Solving Engineering Problems						
13-15	6.1 Explain physical application with MATLAB/SIMULINK <ol style="list-style-type: none"> Eigenvalue and Eigenvectors AVR system Stability studies 6.2 Discuss applications with SOLIDWORKS/ANSYS/AUTOCAD/FLURENT <ol style="list-style-type: none"> Stress in a plate Manifold 	<ul style="list-style-type: none"> Illustrate activities in 6.1 and 6.2 	<ul style="list-style-type: none"> Whiteboard and marker Relevant textbooks and lecture materials Computer installed with latest MATLAB/SIMULINK/ANSYS/AUTOCAD 	6.1 Perform model development in SIMULINK 6.2 Write M-Files in MATLAB 6.3 Carry out 3D and flow simulation process	<ul style="list-style-type: none"> Demonstrate 6.1 and 6.2 and ask Students to do them simple structured program 	

	assembly iii. Car Jack analysis					
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Course Assessment:

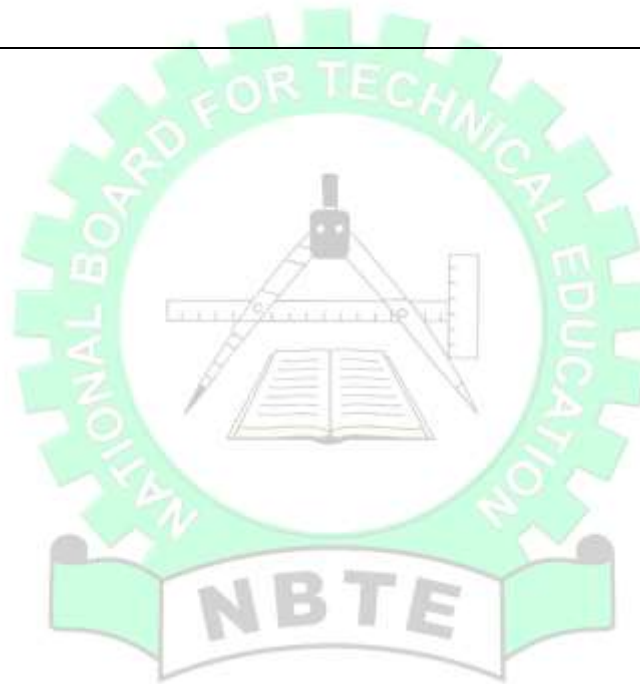
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE TITLE : MARINE ELECTRO-TECHNOLOGY II	Course Code: MAR 315	Contact Hours: 4 Hrs./Week
Year: I Semester: I	Credit Units: 4	Theoretical: 2 Hrs/Week
	Pre-requisite: MARINE ELECTRO-TECHNOLOGY I	Practical: 2 Hrs/Week
<p>GOAL: This course is designed to equip students with competence in DC and AC motors, transformers, renewable energy applications, and advanced high-voltage systems, preparing them for management-level responsibilities in marine engineering. The course emphasizes performance analysis, efficiency calculations, advanced fault diagnosis, and safe operation of HV installations, in line with STCW Code, Section A-III/2 and A-III/6</p>		
<p>GENERAL OBJECTIVES: On completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1.0 Understand the Performance of DC Motors; 2.0 Understand the Performance of AC Motors; 3.0 Know the Applications of DC and AC Motors in Marine Engineering Systems; 4.0 Understand the Performance and Operation of Transformers; 5.0 Understand the Performance and Management of Shipboard Generators and Emergency Power Systems; 6.0 Know the Applications of Renewable Energy Concepts in Marine Engineering; 7.0 Understand High-Voltage Advanced Systems in Shipboard Electrical Installations; 8.0 Understand Advanced High Voltage Systems Integration and Case Studies. 		
<p>COMPETENCES:</p> <ul style="list-style-type: none"> • Operation, monitoring, and management of electrical machines and systems. • Advanced fault diagnosis and efficiency analysis. • Safe management of high-voltage installations. • Performance testing of motors and transformers. • Understand the Application of renewable energy in shipboard systems. • Safe operation and emergency response in HV systems. 		

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING		
COURSE TITLE: MARINE ELECTRO-TECHNOLOGY II	Course Code: MAR 315	Contact Hours: 4 HRS./WEEK
	Credit Unit: 3	Theoretical: 2 HRS./WEEK
Year: I Semester: I	Pre-requisite: MARINE ELECTRO-TECHNOLOGY I	Practical: 2 HRS./WEEK

COURSE SPECIFICATION:

General Objective: 1.0: Understand the performance of DC motors

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1 – 2	1.1 Explain speed control methods. 1.2 Derive speed equation. 1.3 Derive torque equation and calculate back emf. 1.4 Describe the torque vs. current, and speed vs. current curves. 1.5 Solve efficiency problems.	<ul style="list-style-type: none"> Explain with sketches, derive equations, solve sample problems, and assign calculations. 	<ul style="list-style-type: none"> Textbooks, diagrams, projector. 	1.1 Perform load test on DC shunt motor. 1.2 Demonstrate speed control methods. 1.3 Determine efficiency using Swinburne Test.	<ul style="list-style-type: none"> Demonstrate experiments, supervise practice, provide manuals. 	<ul style="list-style-type: none"> DC motor lab kits, measuring instruments.

General Objective: 2.0: Understand the performance of AC motors

3 – 4	2.1 Explain rotating magnetic field. 2.2 Explain different types of AC motors: <ol style="list-style-type: none"> 1-Phase and 3-phase motors. 	<ul style="list-style-type: none"> Lecture with sketches, derive equations, solve problems, assign calculations. 	<ul style="list-style-type: none"> AC motor diagrams, textbooks, projector. 	2.1 Perform load test on AC motor. 2.2 Demonstrate speed control. 2.3 Determine efficiency using test methods.	<ul style="list-style-type: none"> Demonstrate experiments, supervise practice. 	<ul style="list-style-type: none"> AC motor lab kits, voltmeters, Multimeter.
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	<p>ii. Synchronous and Asynchronous (induction) motors.</p> <p>2.3 Determine:</p> <p>i. Synchronous speed</p> <p>ii. Rotor speed</p> <p>iii. Slip,</p> <p>iv. Frequency.</p> <p>2.4 Evaluate rotor output and losses.</p> <p>2.5 Describe construction of induction motors.</p> <p>2.6 Sketch torque/slip curves.</p> <p>2.7 Explain starters (Direct-On-Line - DOL, Star/Delta, slip-ring).</p>					
<p>General Objective: 3.0: Know the Applications of DC and AC motors in marine engineering systems</p>						
<p>5</p>	<p>3.1 Describe motor enclosures and their relevance to shipboard motor protection.</p> <p>3.2 Explain speed variation methods.</p> <p>3.3 Describe induction motor starting.</p>	<ul style="list-style-type: none"> • Explain with sketches, assign problem-solving tasks, discuss marine applications. 	<ul style="list-style-type: none"> • Marine electrical diagrams, textbooks. 	<p>3.1 Inspect different motor enclosures (open, drip-proof, totally-enclosed fan-cooled) in a workshop or laboratory, and explain their functions.</p>	<ul style="list-style-type: none"> • Demonstrate wiring operations, supervise practice. 	<ul style="list-style-type: none"> • Wiring kits, marine circuit diagrams.

	<p>3.4 Solve power factor improvement problems.</p> <p>3.5 State marine applications of electric motors.</p>			<p>3.2 Connect a small AC motor to a variable frequency drive (VFD) and observe speed changes.</p> <p>3.3 Demonstrate starting a large induction motor using pony motor or reduced-voltage starter.</p> <p>3.4 Connect an induction motor to a supply, measure power factor with and without capacitor banks.</p> <p>3.5 Use simulator or ship visit to identify equipment powered by AC and DC motors.</p>		
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General Objective: 4.0: Understand the performance and operation of transformers

<p>6-7</p>	<p>4.1 Describe three-phase systems.</p> <p>4.2 Calculate:</p> <ol style="list-style-type: none"> i. Turns ratio and efficiency. ii. Neutral current in unbalanced 	<ul style="list-style-type: none"> • Explain with sketches, derive equations, assign problem-solving tasks. 	<ul style="list-style-type: none"> • Transformer diagrams, textbooks, projector. 	<p>4.1 Conduct open/ short circuit tests.</p> <p>4.2 Measure winding resistances.</p> <p>4.3 Demonstrate efficiency tests.</p>	<ul style="list-style-type: none"> • Demonstrate experiments, supervise practice. 	<ul style="list-style-type: none"> • Transformer lab kits, measuring instruments.
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	<p>systems.</p> <p>4.3 Explain transformer functions.</p> <p>4.4 Derive emf equation.</p> <p>4.5 Explain phasor diagrams using sketches.</p> <p>4.6 Explain auto-transformer operation.</p> <p>4.7 List transformer losses and efficiency.</p>					
General Objective: 5.0: Understand the performance and management of shipboard generators and emergency power systems.						
8-9	<p>5.1 Explain constructional features and operating principles of shipboard main generators.</p> <p>5.2 Describe emergency generators, backup batteries, and SOLAS emergency power requirements.</p> <p>5.3 Explain generator paralleling, synchronization, and load-sharing principles.</p> <p>5.4 Discuss changeover arrangements between main and</p>	<ul style="list-style-type: none"> Lectures with diagrams of generator systems; case studies of SOLAS requirements; worked examples of synchronization calculations; group discussion on management responsibilities. 	<ul style="list-style-type: none"> Generator diagrams; SOLAS regulations; IMO/STCW manuals; textbooks; projector. 	<p>5.1 Identify main and emergency generator components in laboratory or simulator.</p> <p>5.2 Demonstrate synchronization and paralleling of generators using trainer kits.</p> <p>5.3 Perform changeover between main and emergency power supplies.</p> <p>5.4 Test backup/emergency batteries and record performance.</p>	<ul style="list-style-type: none"> Supervise generator identification; guide synchronization and paralleling exercises; oversee changeover drills; facilitate battery testing; conduct role-play drills. 	<ul style="list-style-type: none"> Generator trainer kits; synchronization panels; battery test equipment; SOLAS/IMO manuals; PPE; logbooks.

	emergency power supplies. 5.5 Evaluate management responsibilities in generator operation, monitoring, and fault response.			5.5 Role-play management-level decision making during generator fault/emergency scenarios.		
General Objective 6.0: Understand the Applications of renewable energy concepts in marine engineering.						
10	6.1 State types of renewable energy. 6.2 Explain concepts of renewable sources. 6.3 Illustrate applications in marine plants.	<ul style="list-style-type: none"> Explain with sketches, guide student research, discuss case studies. 	<ul style="list-style-type: none"> Online resources, textbooks, projector. 	6.1 Demonstrate renewable energy applications (solar panel, wind turbine models).	<ul style="list-style-type: none"> Supervise demonstrations, guide group presentations. 	<ul style="list-style-type: none"> Renewable energy kits, online simulations.
General Objective: 7.0: Understand advanced high-voltage (HV) systems in shipboard electrical installations						
11-13	7.1 Explain HV generation and distribution onboard ships. 7.2 Discuss HV hazards (arc flash/blast, insulation breakdown, step/touch potential). 7.3 Describe HV switchgear and monitoring systems. 7.4 Calculate fault current and insulation resistance.	<ul style="list-style-type: none"> Lecture on HV propulsion systems, using diagrams. Present case studies. Explain gas-insulated switchgear (GIS), and vacuum breakers. Explain isolation procedures, role of management in HV safety, integrating STCW Table A-III/2 requirements. 	<ul style="list-style-type: none"> IMO/STCW code, HV schematics, IEC/IEEE standards. Safety manuals, HV distribution diagrams, PPE charts. White board, smart board, multimedia systems. 	7.1 Identify HV generation and distribution components. 7.2 Demonstrate awareness of HV hazards. 7.3 Trace HV distribution paths and identify switchgears. 7.4 Perform advanced isolation and permit-to-work procedures.	<ul style="list-style-type: none"> Supervise HV component identification, hazard recognition drills, tracing exercises. Organize role-play, supervise drills, facilitate group presentations. 	<ul style="list-style-type: none"> HV training boards, PPE kits, lock-out/tag-out devices. HV simulators, lock-out/tag-out kits, PPE.

	<p>7.5 Apply advanced isolation and permit-to-work procedures.</p> <p>7.6 Apply relevant IMO Maritime Safety Committee (MSC.1/Circ.1366) Instruments, and IEC/IEEE standards that ensure regulatory compliance in the design, operation, and safety of shipboard high-voltage systems.</p> <p>7.7 Explain management responsibilities in HV safety and emergency response.</p>			<p>7.5 Role-play management-level responsibilities in HV safety drills.</p>		
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General Objective 8.0: Understand High Voltage Advanced Systems Integration and Case Studies.

<p>14 – 15</p>	<p>8.1 Discuss how motors, transformers, and HV systems to shipboard operations are integrated.</p> <p>8.2 Explain how improved power management is achieved through integrated HV advanced systems.</p>	<ul style="list-style-type: none"> • Case-based lectures, group discussions, guided presentations. 	<ul style="list-style-type: none"> • IMO/STCW manuals, marine system drawings. 	<p>8.1 Present applications in marine context.</p> <p>8.2 Analyse case studies and propose solutions.</p> <p>8.3 Perform simulation exercises using HV Simulators (software, hardware).</p>	<ul style="list-style-type: none"> • Guide group presentations, supervise discussions. 	<ul style="list-style-type: none"> • CAD projector, shipboard diagrams.
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	<p>8.3 Discuss safety and maintenance activities when working with HV advanced systems.</p> <p>8.4 Analyse case studies of electrical failures.</p> <p>8.5 Present solutions for efficiency and safety improvement.</p>					
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Course Assessment:

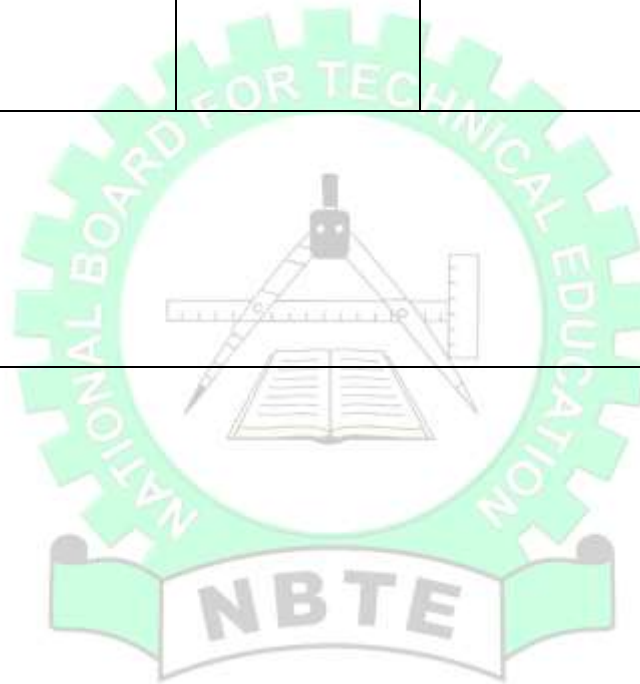
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARITIME COMMUNICATION IN ENGLISH II	Course Code: MAR 316	Credit Unit: 2	Contact Hours: 2Hours/Week
			Theoretical: 2Hours/Week
Year: I Semester: I	Pre-requisite: MARITIME COMMUNICATION IN ENGLISH I		Practical: 0
<p>GOAL: This course is designed to equip students with management level competence in English communication, enabling them to apply IMO Standard Marine Communication Phrases (SMCP) confidently in routine and emergency contexts, demonstrate professional oral and written communication in technical, managerial, and multicultural crew settings, prepare and present structured engineering reports, log entries, and shore correspondence with clarity and accountability, lead and manage communication effectively in meetings, negotiations, safety briefings, and ship–shore exchanges, and integrate maritime English into leadership, compliance, and safety practices in accordance with STCW Code, Section A-III/2.</p>			
<p>GENERAL OBJECTIVES: On completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1.0 Develop Advanced Proficiency in Maritime English; 2.0 Understand Competence in IMO SMCP; 3.0 Comprehend Technical Reading and Writing; 4.0 Understand Oral Communication for Multicultural Crews; 5.0 Build Competence in Emergency Communication (SMCP); 6.0 Develop Professional English for Managerial Tasks; 7.0 Integrate Maritime English into Leadership and Management; 8.0 Apply Professional Communication for Safety and Compliance. 			
<p>COMPETENCE:</p> <ul style="list-style-type: none"> • Application of advanced maritime English and IMO SMCP, producing clear documentation, leading managerial communication, and integration of English into leadership, compliance, and safety practices under STCW Code, Section A-III/2. 			

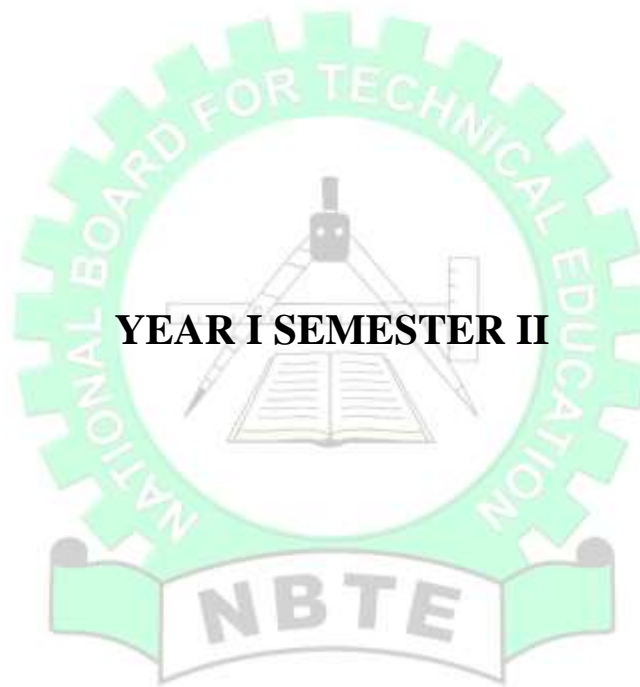
PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARITIME COMMUNICATION IN ENGLISH II		Course Code: MAR 316		Contact Hours: 2 Hours/Week		
		Credit Unit: 4		Theoretical: 2 Hours/Week		
Year: I Semester: I		Pre-requisite:		Practical: 2 Hours/Week		
General Objective 1.0: Develop Advanced Proficiency in Maritime English						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
1–2	1.1 Explain the role of English in marine engineering management. 1.2 Use advanced technical vocabulary for machinery/ systems. 1.3 Apply standardized maritime terminology (STCW/SMCP).	<ul style="list-style-type: none"> • Deliver lectures on maritime English fundamentals. • Guide discussions on technical vocabulary • Facilitate Q&A sessions. 	<ul style="list-style-type: none"> • Whiteboard, smartboard, PowerPoint slides, multimedia systems, projectors, technical manuals, engineering glossaries. 	1.1 Use correct terminology in spoken communication. 1.2 Interpret technical texts accurately	<ul style="list-style-type: none"> • Role-play exercises. • Pronunciation drills. • Demonstrate pronunciation drills. assign reading of manuals • Vocabulary quizzes. 	<ul style="list-style-type: none"> • Language lab, audio pronunciation software etc
General Objective: 2.0: Understand Competence in IMO SMCP						
3	2.1 Apply SMCP in routine operations. 2.2 Use SMCP in emergency situations. 2.3 Explain the need for clarity in multicultural crew communication.	<ul style="list-style-type: none"> • Conduct roleplay of bridge/engine room dialogues. • Show video examples. • Lead simulations. • Correct student usage in real-time. 	<ul style="list-style-type: none"> • IMO SMCP handbook, audio recordings, videos, smartboard, projector 	2.1 Simulate bridge-engine room dialogues. 2.2 Practice emergency calls. 2.3 Demonstrate	<ul style="list-style-type: none"> • Communication drills, emergency simulations. 	<ul style="list-style-type: none"> • Engine room simulator, VHF radio sets, audio playback.

				emergency SMCP phrases.		
GENERAL OBJECTIVE 3.0: Comprehend Technical Reading and Writing						
4-5	<p>3.1 Interpret manuals and logbooks.</p> <p>3.2 Prepare structured engineering reports.</p> <p>3.3 Apply formal writing standards in documentation.</p>	<ul style="list-style-type: none"> • Explain report structures. • Provide worked examples • Supervise drafting exercises, review log entries • Organize peer correction sessions. • Draft professional engineering documents. • Review reports for clarity. 	<ul style="list-style-type: none"> • Whiteboard, PowerPoint slides, sample reports, logbook templates, multimedia systems. 			
GENERAL OBJECTIVE 4.0: Understand Oral Communication for Multicultural Crews						
6-7	<p>4.1 Explain barriers to oral communication.</p> <p>4.2 Discuss techniques for effective dialogue.</p> <p>4.3 Explain the causes of conflict during oral communication among multicultural crew.</p> <p>4.4 Discuss conflict resolution strategies.</p>	<ul style="list-style-type: none"> • Facilitate group discussions. • Present case studies; Moderate debates • Demonstrate effective meeting protocols • Coach students on presentation delivery. • Conduct meetings and presentations. • Resolve communication 	<ul style="list-style-type: none"> • Smartboard, videos, crew resource management scenarios, projectors 			

		challenges.				
GENERAL OBJECTIVE 5.0: Build Competence in Emergency Communication – SMCP						
8-9	<p>5.1 Explain emergency communication in shipboard operation.</p> <p>5.2 Apply SMCP in distress calls.</p> <p>5.3 Convey safety-critical information clearly.</p> <p>5.4 Explain the preparation of incident reports.</p>	<ul style="list-style-type: none"> • Supervise incident report writing • Play audio/video of real emergencies • Lead debrief sessions. • Practice emergency dialogues. • Deliver clear safety briefings. • Prepare incident reports. 	<ul style="list-style-type: none"> • Distress call templates, safety manuals, multimedia systems, projector, videos. 			
General Objective 6.0: Develop Professional English for Managerial Tasks						
10	<p>6.1 Analyse negotiation language.</p> <p>6.2 Deliver clear presentations.</p> <p>6.3 Create structured reports for shore authorities.</p>	<ul style="list-style-type: none"> • Conduct seminars on negotiation language • Review structured reports • Provide feedback on delivery. • Prepare presentations using PowerPoint software and AI applications • Conduct meetings professionally. 	<ul style="list-style-type: none"> • Whiteboard, smartboard, meeting templates, presentation guides, PowerPoint slides, multimedia systems 			
General Objective 7.0: Integrate Maritime English into leadership and management						
11-12	7.1 Explain the importance of	<ul style="list-style-type: none"> • Lead case study analysis 	<ul style="list-style-type: none"> • Shore 			

	<p>effective communication strategies in leadership.</p> <p>7.2 Discuss communication plans.</p> <p>7.3 Explain accountability in communication.</p> <p>7.4 Describe how to apply communication plan to reach target audience.</p> <p>7.5 Justify management decisions.</p>	<ul style="list-style-type: none"> • Supervise group projects • Coach students in leadership communication • Facilitate group feedback sessions • Deliver structured briefings. • Demonstrate accountability in communication. • Demonstrate shore reporting formats. • Draft communication plans. 	<p>reporting samples, management communication guides, smartboard, projector, videos</p>			
General Objective 8.0: Apply Professional Communication for Safety and Compliance						
13-14	<p>8.1 Recognize importance of communication for safety.</p> <p>8.2 Explain compliance with STCW standards.</p> <p>8.3 Explain the importance of effective communication with shore authorities.</p>	<ul style="list-style-type: none"> • Review lectures • Conduct compliance simulations • Demonstrate ship–shore correspondence • Supervise safety briefings • Organize revision exercises. • Deliver safety briefings. • Simulate ship–shore communication 	<ul style="list-style-type: none"> • STCW Code extracts, IMO publications, smartboard, projector, multimedia systems 			

		<ul style="list-style-type: none"> • Demonstrate compliance with STCW standards 				
General Objective 9.0: Know How to Develop a Resumé.						
15	<p>9.1 Define a Resumé</p> <p>9.2 Outline importance of Resumé</p> <p>9.3 State the steps in developing a resumé e.g.:</p> <ol style="list-style-type: none"> i. Choose a format ii. Write header iii. Objective iv. Skills v. Experiences vi. Education, etc. <p>9.4 Explain different types of writing resumé.</p>	<ul style="list-style-type: none"> • Explain resumé • Explain the importance of resumé • Explain the steps in developing a resumé e.g.: <ol style="list-style-type: none"> i. Choose a format ii. Write header iii. Objective iv. Skills v. Experiences vi. Education, etc. • Write a resumé using application software. 	<ul style="list-style-type: none"> • Textbooks, Projector, Whiteboard, marker, internet, computer systems. 			
<p>ASSESSMENT</p> <p>Course Assessment:</p> <p>Course work: 10%</p> <p>Test/Assignments: 10%</p> <p>Practical: 40%</p> <p>Examination: 40%</p> <p>Total: 100%</p>						



YEAR I SEMESTER II

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARINE AUXILIARY SYSTEMS	Course Code: MAR 321	Credit Unit: 4	Contact Hours: 4 Hours/Week
			Theoretical: 2 Hours /Week
Year: I Semester: II	Pre-requisite:		Practical: 2 Hours/Week
<p>GOAL: This course is designed to equip students with management-level competence in the supervision, evaluation, and safe operation of marine auxiliary systems. It equips them with knowledge of how auxiliary machinery—including lubrication systems, fuel systems and purifiers, starting air systems, cooling systems, piston cooling, bearings, fuel tanks and heating arrangements, steering gear, deck machinery, and freshwater generators—are integrated with overall propulsion plant management. Students will develop the ability to assess reliability and operational risks, approve maintenance actions, and ensure compliance with established safety and operational standards, as contained in the STCW Code, Section A-III/2.</p>			
<p>GENERAL OBJECTIVES:</p> <p>On completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1.0 Evaluate the overview of marine auxiliary systems and their integration with propulsion plant; 2.0 Comprehend lubrication systems for safe and efficient operation; 3.0 Understand fuel systems and purifiers to ensure reliability and compliance; 4.0 Analyze and supervise starting air systems for safe engine operation; 5.0 Evaluate and supervise cooling systems to maintain plant reliability; 6.0 Evaluate piston cooling and bearing systems for operational safety; 7.0 Analyze steering gear, deck machinery, and control interfaces for compliance and safety; 8.0 Evaluate reliability, approve maintenance planning, and exercise supervisory decision-making; 9.0 Analyze the operations of freshwater generators for shipboard use. 			
<p>COMPETENCE</p> <ul style="list-style-type: none"> • Operation, surveillance assessment and maintaining safety of propulsion plant and auxiliary machinery 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE AUXILIARY SYSTEMS		Course Code: MAR 321	Credit Unit: 4	Contact Hours: 4 Hours/Week		
				Theoretical: 2 Hours/Week		
Year: I Semester: II		Pre-requisite:		Practical: 2 Hours/Week		
General Objective 1.0: Analyze and evaluate the overview of marine auxiliary systems and their integration with propulsion plant						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 2	1.1 Explain the scope and role of auxiliary machinery in ship operation. 1.2 Describe integration of auxiliary systems with propulsion plant. 1.3 Identify critical auxiliary systems affecting ship safety. 1.4 Evaluate system interdependence and redundancy.	<ul style="list-style-type: none"> • Introductory lectures; guided system overview; case studies of auxiliary failures. 	<ul style="list-style-type: none"> • Plant schematics IMO/STCW references etc. 	1.1 Identify auxiliary systems from diagrams. 1.2 Simulate system interconnections with propulsion plant. 1.3 Demonstrate management-level oversight of auxiliaries.	<ul style="list-style-type: none"> • Supervised identification • Simulation exercises • Group discussions. 	<ul style="list-style-type: none"> • Full Mission Engine Simulator • Machinery diagrams; logbooks etc.
General Objective: 2.0: Comprehend lubrication systems for safe and efficient operation.						
3 – 4	2.1 Explain design and operation of main engine lube oil supply pumps. 2.2 Describe turbocharger lubrication	<ul style="list-style-type: none"> • Lectures with diagrams • Case studies • Worked examples of purifier efficiency. 	<ul style="list-style-type: none"> • Lube oil system schematics; purifier manuals. 	2.1 Identify lube oil pumps and system components. 2.2 Demonstrate purifier operation and efficiency test.	<ul style="list-style-type: none"> • Supervise pump identification • Guide purifier operation • Oversee inspections. 	<ul style="list-style-type: none"> • Purifier trainer; engine workshop; PPE.

	<p>arrangements.</p> <p>2.3 Explain cylinder liner lubrication systems and control.</p> <p>2.4 Discuss lube oil purifiers and separation principles.</p> <p>2.5 Evaluate risks and management strategies for lubrication failures.</p>			<p>2.3 Inspect cylinder liner lubrication system.</p> <p>2.4 Conduct fault simulation and propose corrective actions.</p>		
General Objective 3.0: Evaluate and manage fuel systems and purifiers to ensure reliability and compliance.						
5-6	<p>3.1 Explain fuel supply and booster pump operation.</p> <p>3.2 Describe fuel storage and consumption systems.</p> <p>3.3 Explain fuel/diesel oil purifiers and separation principles.</p> <p>3.4 Evaluate risks in fuel handling and management strategies.</p>	<ul style="list-style-type: none"> Lectures with system diagrams Case studies of contamination Worked examples. 	<ul style="list-style-type: none"> Fuel system schematics; purifier manuals. 	<p>3.1 Identify fuel pumps and system components.</p> <p>3.2 Demonstrate purifier operation and efficiency test.</p> <p>3.3 Inspect fuel storage tanks and heating systems.</p> <p>3.4 Conduct fault simulation and propose corrective actions.</p>	<ul style="list-style-type: none"> Supervise pump identification Guide purifier operation Oversee tank inspection. 	<ul style="list-style-type: none"> Fuel purifier trainer; shipboard diagrams; PPE.
GENERAL OBJECTIVE 4.0: Analyze starting air systems for safe engine operation.						
7	4.1 Explain operation	<ul style="list-style-type: none"> Lectures with 	<ul style="list-style-type: none"> Starting air 	4.1 Identify air	Supervise	Starting air

	<p>of air compressors and bottles.</p> <p>4.2 Describe starting air lines and control systems.</p> <p>4.3 Discuss emergency starting air arrangements.</p> <p>4.4 Evaluate risks and management strategies for failures.</p>	<p>diagrams; case studies of failures; worked examples.</p>	<p>schematics; compressor manuals etc.</p>	<p>compressors and system components.</p> <p>4.2 Demonstrate starting air system operation.</p> <p>4.3 Inspect starting air lines and control systems.</p> <p>4.4 Conduct fault simulation and propose corrective actions.</p>	<p>compressor identification; guide system operation; oversee inspections.</p>	<p>trainer; compressor models; PPE.</p>
General Objective 5.0: Understand the Operation of Fresh Water Generator						
8-9	<p>5.1 Explain jacket cooling freshwater system.</p> <p>5.2 Describe Sea water cooling system and sea chest.</p> <p>5.3 Discuss cooling pumps and piping arrangements.</p> <p>5.4 Evaluate risks and management strategies for failures of freshwater system.</p>	<ul style="list-style-type: none"> Lectures with diagrams; case studies; worked examples of pump efficiency. 	<ul style="list-style-type: none"> Cooling system schematics; pump manuals. 	<p>5.1 Identify cooling system components.</p> <p>5.2 Demonstrate cooling system operation.</p> <p>5.3 Inspect cooling pumps and piping.</p> <p>5.4 Conduct fault simulation and propose corrective actions.</p>	<ul style="list-style-type: none"> Supervise identification; guide operation; oversee inspections. 	<ul style="list-style-type: none"> Cooling system trainer; engine workshop; PPE.
General Objective 6.0: Evaluate piston cooling and bearing systems for operational safety.						
10	<p>6.1 Explain oil and water piston</p>	<ul style="list-style-type: none"> Lectures with diagrams; 	<ul style="list-style-type: none"> Piston 	<p>6.1 Inspect piston cooling system</p>	<ul style="list-style-type: none"> Supervise 	<ul style="list-style-type: none"> Bearing

	cooling systems. 6.2 Describe pedestal and intermediate shaft bearings. 6.3 Evaluate risks and management strategies for failures.	case studies; worked examples.	cooling schematics; bearing manuals.	components. 6.2 Demonstrate piston cooling system operation. 6.3 Inspect pedestal and intermediate shaft bearings. 6.4 Conduct fault simulation and propose corrective actions.	inspections; guide operation; facilitate fault drills.	models; piston cooling trainer; PPE.
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General Objective 7.0: Analyze steering gear, deck machinery, and control interfaces for compliance and safety.

11-12	7.1 Explain operating principles of steering gear systems. 7.2 Evaluate deck machinery power and control interfaces. 7.3 Assess safety features and redundancy. 7.4 Apply classification society rules.	<ul style="list-style-type: none"> Lectures; operational reviews; case studies; STCW references. 	<ul style="list-style-type: none"> Steering gear schematics; control diagrams. 	7.1 Identify steering system components. 7.2 Perform creep test. 7.3 Simulate steering gear breakdown.	<ul style="list-style-type: none"> Supervise identification; guide creep test; oversee breakdown simulation. 	<ul style="list-style-type: none"> Engine workshop; steering gear trainer; PPE.
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General Objective 8.0: Evaluate reliability, approve maintenance planning, and exercise supervisory decision-making.

13	8.1 Assess reliability and failure risks. 8.2 Approve maintenance and	<ul style="list-style-type: none"> Review lectures; case study 	<ul style="list-style-type: none"> Maintenance records; failure 	8.1 Propose corrective actions. 8.2 Justify management	<ul style="list-style-type: none"> Supervise case study analysis; Facilitate group 	<ul style="list-style-type: none"> Machinery data sheets; schematics.
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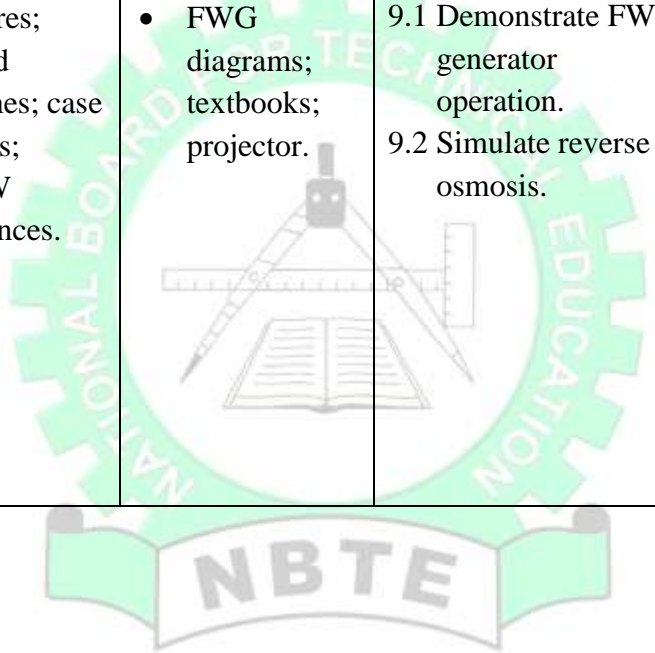
	inspection schedules. 8.3 Evaluate performance data. 8.4 Integrate decisions into plant management.	evaluations; management discussions.	reports.	decisions. 8.3 Demonstrate supervisory judgment.	decision-making.	
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General Objective 9.0: Analyze the operation of freshwater generator for shipboard use.

14-15	9.1 Explain uses of freshwater generator (FWG) onboard. 9.2 List types of FWG. 9.3 Sketch layout of FWG piping system. 9.4 Describe steam trap 9.5 Explain reverse osmosis.	<ul style="list-style-type: none"> Lectures; guided sketches; case studies; STCW references. 	<ul style="list-style-type: none"> FWG diagrams; textbooks; projector. 	9.1 Demonstrate FW generator operation. 9.2 Simulate reverse osmosis.	<ul style="list-style-type: none"> Supervise students' practical activities ; Guide simulation exercises. 	<ul style="list-style-type: none"> Simulator; marine engine workshop; ocular vision simulator.
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Course Assessment:

Course work: 10%
 Test/Assignments: 10%
 Practical: 40%
 Examination: 40%
Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: TECHNOLOGY OF MATERIALS	Course Code: MAR 322	Credit Unit: 4	Contact Hours: 2 Hours/ Week
			Theoretical: 2 Hours / Week
Year: I Semester II	Pre-Requisite:		Practical: 2 Hours / Week
GOAL: The course is designed to equip students with management-level knowledge and skills on marine materials and metallurgy to the evaluation of material suitability, identification of failure and degradation mechanisms, and approval of maintenance, repair, and replacement decisions, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Understand Engineering Materials for Marine Applications; 2.0 Know Metallurgy, Heat Treatment and Material Behaviour; 3.0 Understand Corrosion, Fatigue and Failure Mechanisms; 4.0 Maintenance, Repair & Replacement Decision-Making; 5.0 Understand the Concept of Melting and Corrosion; 6.0 Understand Different Types of Casting, and Powder Metallurgy; 7.0 Know the principles of rolling, forging, extrusion & drawing, and understand miscellaneous cold working process; 8.0 Know the properties of non-ferrous metals as affected by thermal treatment, and understand the element of binary phase diagrams; 9.0 Understand Metallurgical Test. 			
COMPETENCE			
<ul style="list-style-type: none"> • Manage maintenance and repair of ship machinery. • Detect and identify the cause of machinery malfunctions and correct faults. 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: TECHNOLOGY OF MATERIALS		Course Code: MAR 322		Credit Unit: 4	Contact Hours: 4 Hours/Week	
					Theoretical: 2 Hours/Week	
Year: I Semester: II		Pre-requisite:			Practical: 2 Hours/Week	
General Objective 1.0: Understand Engineering Materials for Marine Applications						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	SPECIFIC LEARNING OUTCOMES	TEACHER'S ACTIVITIES	RESOURCES	SPECIFIC LEARNING OUTCOMES	TEACHER'S ACTIVITIES	RESOURCES
1	1.1 Classify engineering materials used in marine applications. 1.2 Explain mechanical and physical properties of metals and alloys. 1.3 Evaluate suitability of materials for ship machinery and structures. 1.4 Explain effects of marine environment on material performance.	<ul style="list-style-type: none"> Lectures Guided technical discussions Relate material properties to operational requirements 	<ul style="list-style-type: none"> Material charts Machinery component samples 	1.1 Identify materials used in ship components.	<ul style="list-style-type: none"> Material-identification exercises Demonstrate management-level understanding of material-selection criteria. 	<ul style="list-style-type: none"> Practical Manuals, Samples of materials etc.
General Objective: 2.0: Know Metallurgy, Heat Treatment & Material Behaviour						
2	2.1 Explain metallurgical structures and phase behaviour. 2.2 Describe heat-	<ul style="list-style-type: none"> Lecture 2.1-2.5 Case-based discussions 	<ul style="list-style-type: none"> Phase diagrams Heat-treatment charts 	2.1 Interpret metallurgical data. 2.2 Identify treatment-related defects.	<ul style="list-style-type: none"> Data-interpretation exercises 	<ul style="list-style-type: none"> Foundry workshop, Strength of Material Laboratory

	<p>treatment processes and their effects.</p> <p>2.3 Evaluate material behaviour under operational stresses.</p> <p>2.4 Assess implications of improper heat treatment.</p> <p>2.5 Support management decisions involving material performance.</p>					etc.
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General Objective 3.0: Understand Corrosion, Fatigue and Failure Mechanisms

3	<p>3.1 Explain corrosion mechanisms in marine environments.</p> <p>3.2 Explain fatigue, creep, and fracture failures.</p> <p>3.3 Identify early signs of material degradation.</p> <p>3.4 Evaluate risks associated with continued operation.</p>	<ul style="list-style-type: none"> Lectures 3.1-3.4 Failure case studies 	<ul style="list-style-type: none"> Failure reports Corrosion models 	<p>3.1 Diagnose probable failure causes.</p> <p>3.2 Recommend corrective actions.</p> <p>3.3 Perform test to analyse fatigue, creep and fracture of materials.</p>	<ul style="list-style-type: none"> Scenario-based analysis. Explain management-level judgments in failure prevention 	<ul style="list-style-type: none"> Strength of Material Laboratory to analyse fatigue, creep, and fracture failures.
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General Objective 4.0: Know Maintenance, Repair and Replacement Decision-Making

4-5	<p>4.1 Evaluate material condition during inspections.</p>	<ul style="list-style-type: none"> Review lectures 4.1-4.4 	<ul style="list-style-type: none"> Inspection reports. Maintenance 	<p>4.1 Justify maintenance decisions.</p> <p>4.2 Present</p>	<ul style="list-style-type: none"> Case-study evaluations 	<ul style="list-style-type: none"> Inspection reports. Maintenance
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	<p>4.2 Approve repair or replacement decisions.</p> <p>4.3 Assess long-term reliability and safety implications.</p> <p>4.4 Integrate material considerations into maintenance planning.</p>	<ul style="list-style-type: none"> Decision-analysis in workshops practices 	<p>records.</p>	<p>management-level recommendations.</p> <p>4.3 Demonstrate sound engineering judgment at management level.</p>		<p>records.</p>
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General Objective 5.0: Understand the Concept of Melting and Corrosion

<p>6-7</p>	<p>5.1 Define melting of metals and alloy</p> <p>5.2 List the furnaces used for melting</p> <p>5.3 Describe the procedure for melting cast iron, aluminium alloys, and copper base alloys.</p> <p>5.4 Explain and describe the different types of corrosion</p> <p>5.5 List factors and explain the principles and effects of corrosion and protection of ship structures.</p>	<ul style="list-style-type: none"> Explain with sketch. Prepare lecture notes for students 	<ul style="list-style-type: none"> O/H projector Multi-media projector Diskettes, CDs Pay a visit to casting workshop. Training as per column 2 Table A-III/3 of STCW 1978 as amended. 	<p>5.1 Demonstrate the procedure necessary to melt metal.</p> <p>5.2 Carry out corrosion testing and monitoring.</p>	<ul style="list-style-type: none"> Demonstrate and ask the students to carryout practical on non-ferrous metal. Prepare practical manual Carryout the effect of brine with different concentration on metals and alloys. 	<ul style="list-style-type: none"> Foundry workshop, practical manual, practical logbook
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General Objective 6.0: Understand Different Types of Casting, and Powder Metallurgy

<p>8-9</p>	<p>6.1 Define casting 6.2 List various casting processes 6.3 Explain ingot casting of steel and non-ferrous metals 6.4 Enumerate the basic steps in a sand – casting methods 6.5 Enumerate possible defect in the list above. 6.6 Describe and perform the operation of cement carbides manufacture. 6.7 List the advantages and disadvantages of the process above. 6.8 Discuss the applications of powder metallurgy</p>	<ul style="list-style-type: none"> • Explain with sketch various casting process. • Prepare lecture notes for students. • Ask students to perform tasks 	<ul style="list-style-type: none"> • Slide show, Overhead projector, slides and white board. Visit the casting workshop. • Training as per column 2, Table A-III/3 of STCW 1978 as amended. 	<p>6.1 Demonstrate sand casting processes 6.2 Perform experiment to illustrate cement carbides manufacture.</p>	<ul style="list-style-type: none"> • Use aluminium ingots to demonstrate sand-casting processes and identify possible defects. • Demonstration of cement carbides operation 	<ul style="list-style-type: none"> • Foundry workshop. Practical manual
<p>General Objective 7.0: Know the principles of rolling, forging, extrusion and drawing, and understand miscellaneous cold working process</p>						
<p>10-11</p>	<p>7.1 Describe the rolling operation. 7.2 List the types of rolling mills 7.3 Explain the principles of forging</p>	<ul style="list-style-type: none"> • Explain with sketch various casting process. • Prepare lecture notes 	<ul style="list-style-type: none"> • Visit the casting workshop. • Slide show, Overhead projector, slides and 	<p>7.1 Identify casting defects and their causes 7.2 Identify tools for cupping and re-drawing operations</p>	<ul style="list-style-type: none"> • Demonstrate cutting of a flat sheet using shearing cutting machine 	<ul style="list-style-type: none"> • Foundry workshop

	<p>7.4 List common types of extrusion by direct and indirect methods</p> <p>7.5 Explain defects in extruded sections</p> <p>7.6 Explain the processes of drawing rod, wire, and tubes</p> <p>7.7 Outline defects encountered in deep-drawing components.</p> <p>7.8 Outline the procedures for shearing, bending, rubber-pressing, spinning, coining, and embossing</p> <p>7.9 List the applications of the processes listed above</p>	<p>for students.</p> <ul style="list-style-type: none"> • Ask students to perform tasks 	<p>white board.</p> <ul style="list-style-type: none"> • Training as per column 2 • Table A-III/3 of STCW 1978 as amended. 	<p>and observe safety precautions: deep drawing, re- drawing and lubrication.</p> <p>7.3 Demonstrate the following processes</p> <ol style="list-style-type: none"> Rolling Forging Extrusion Drawing Deep drawing <p>7.4 Identify the tools/equipment used for cold-working</p> <p>7.5 Demonstrate cold-working processes</p>		
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General Objective 8.0: Know the properties of non-ferrous metals as affected by thermal treatment, and understand the element of binary phase diagrams

<p>12-13</p>	<p>8.1 Explain the structural and property changes of aluminium due to heat treatment</p> <p>8.2 List the engineering applications of heat-</p>	<ul style="list-style-type: none"> • Explain with sketches. • Prepare lecture notes for students. • Ask students to perform tasks 	<ul style="list-style-type: none"> • Slide show, Overhead projector, slides and white board. • Visit the casting workshop 	<p>8.1 Identify the various effects of heat treatment on property and structure of aluminium</p> <p>8.2 Identify different</p>	<ul style="list-style-type: none"> • Demonstrate for the students to learn and ask them to do same 	<p>Optical microscope with camera, Polishing and grinding machines. Etchants Polishing and</p>
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	<p>treated aluminium alloys</p> <p>8.3 Explain the structural and property changes of copper alloys</p> <p>8.4 Explain the term re-crystallization temperature</p> <p>8.5 Explain diffusion of metals.</p> <p>8.6 Describe the information of solid solutions and dispersed phases in steel alloys.</p> <p>8.7 Describe the formation of precipitation hardening</p> <p>8.8 State the influence of alloy Structure on strength, ductility, fracture, creep characteristics</p>		<ul style="list-style-type: none"> • Optical microscope with camera and laptops • Polishing and grinding machines. • Etchants • Polishing and grinding papers of different grades (100-1200) 	<p>phases available in steel alloys.</p> <p>8.3 Demonstrate the effect of different phases on the structure and property of steel alloys</p>		<p>grinding papers of different grades (100-1200), foundry workshop</p>
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General Objective 9.0: Understand Metallurgical Tests

<p>14-15</p>	<p>9.1 Describe the following non-destructive test (NDT): liquid penetrates, magnetic</p>	<ul style="list-style-type: none"> • Explain with sketches. • Prepare lecture notes for students. 	<ul style="list-style-type: none"> • Slide show, overhead projector, slides, and white board. 	<p>9.1 Cadets should know how to carry out NDT test</p> <p>9.2 Carry out liquid penetrant and</p>	<ul style="list-style-type: none"> • Demonstrate for the students to learn and ask them to do same 	<ul style="list-style-type: none"> • Penetration hammer, ultrasonic, etc. • Ultrasonic,
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	<p>crack detection, radiographic inspection, and ultrasonic testing</p> <p>9.2 Outline the procedures and carry out the following tests:</p> <ol style="list-style-type: none"> i. Creep testing ii. Tensile testing (stiffness and proof of stress) iii. Hardness testing iv. Impact testing v. Fretting 	<ul style="list-style-type: none"> • Ask students to perform tasks 	<ul style="list-style-type: none"> • Penetration hammer, ultrasonic, etc. • Ultrasonic, radiographic, magnetic particles and dye penetrant equipment. 	<p>magnetic crack detection tests.</p> <p>9.3 Carry out the following tests:</p> <ol style="list-style-type: none"> i. Creep testing ii. Tensile testing (stiffness and proof of stress) iii. Hardness testing iv. Impact testing v. Fretting 		<p>radiographic, magnetic particles and dye penetrant</p>
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Course Assessment:

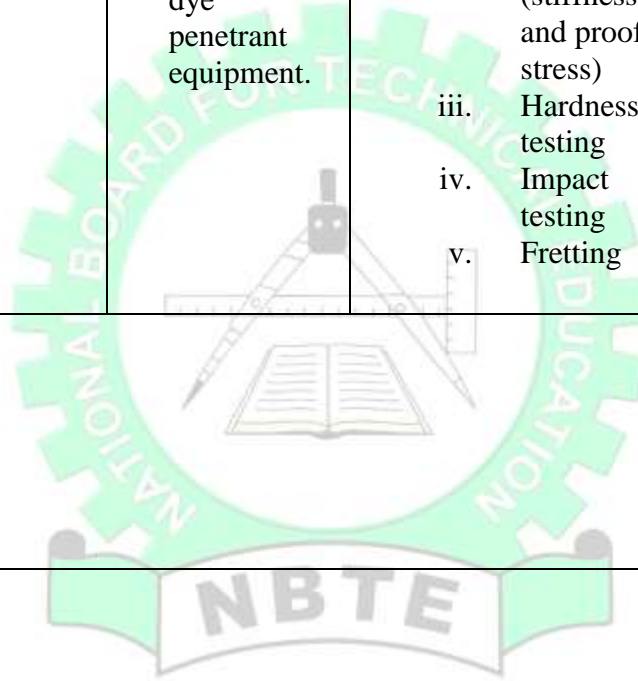
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: SHIP PROPULSION SYSTEMS	Course Code: MAR 323	Credit Unit: 4	Contact Hours: 4hours/ Week
			Theoretical: 2hours / Week
YEAR: I SEMESTER: II	PRE-REQUISITE:		Practical: 2hours /Week
GOAL: The course is designed to equip students with y management-level knowledge and skills of ship propulsion system design and operation, evaluate propulsion configurations and efficiency, assess operational limitations, and make informed engineering decisions affecting ship performance, safety, reliability, and compliance, in accordance with STCW Code, Section-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Know Propulsion System Types and Design Philosophy; 2.0 Know Propulsion Efficiency, Power Transmission and Operational Limits; 3.0 Understand Propulsion System Operation, Monitoring and Risk Management; 4.0 Understand Propulsion Modification, Optimization and Management Decisions. 			
COMPETENCE			
<ul style="list-style-type: none"> • Manage the operation of propulsion plant machinery 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: SHIP PROPULSION SYSTEMS		Course Code: MAR 323		Credit Unit: 4	Contact Hours: 4hours/Week	
						Theoretical: 2hours/Week
Year: I Semester: II		Pre-requisite:				Practical: 2hours/Week
General Objective 1.0: Know Propulsion System Types and Design Philosophy						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Explain the objectives of propulsion system design. 1.2 Differentiate between conventional and alternative propulsion arrangements. 1.3 Describe propulsion-system selection criteria for different ship types. 1.4 Evaluate design trade-offs affecting efficiency, reliability, and safety.	<ul style="list-style-type: none"> Lecture 1.1 - 1.4. Guided design discussions 	<ul style="list-style-type: none"> Propulsion schematics Ship design references 	1.1 Identify propulsion configurations from diagrams.	<ul style="list-style-type: none"> Configuration-identification exercises Demonstrate management-level understanding of propulsion design decisions. Relate propulsion type to ship operational profile. 	<ul style="list-style-type: none"> Ship schematics, propulsion schematics
General Objective: 2.0: Know Propulsion Efficiency, Power Transmission and Operational Limits						
4-7	2.1 Assess propulsion efficiency and power transmission losses. 2.2 Explain propeller-	<ul style="list-style-type: none"> Lecture 2.1 – 2.5 Performance-analysis 	<ul style="list-style-type: none"> Power curves Performanc 	2.1 Analyze propulsion performance data.	<ul style="list-style-type: none"> Data-analysis exercises 	

	<p>engine matching principles.</p> <p>2.3 Evaluate operational limitations of propulsion systems.</p> <p>2.4 Interpret propulsion performance data and trends.</p> <p>2.5 Support management decisions on fuel efficiency and power management.</p>	<p>sessions</p>	<p>e charts</p>	<p>2.2 Identify inefficient operating conditions.</p>		
General Objective 3.0: Understand Propulsion System Operation, Monitoring and Risk Management						
8-11	<p>3.1 Supervise propulsion system operation under varying conditions.</p> <p>3.2 Evaluate operational risks affecting propulsion performance.</p> <p>3.3 Assess impact of propulsion decisions on ship safety and manoeuvrability.</p> <p>3.4 Integrate propulsion management with bridge and operational requirements.</p>	<ul style="list-style-type: none"> Lecture 3.1 – 3.4 Operational case studies 	<ul style="list-style-type: none"> Engine-room records Incident reports 	<p>3.1 Identify abnormal propulsion behaviour.</p> <p>3.2 Recommend corrective operational actions.</p>	<ul style="list-style-type: none"> Scenario-based discussions Demonstrate management-level judgement in propulsion oversight. 	
General Objective 4.0: Understand Propulsion Modification, Optimization and Management Decisions						
12-15	<p>4.1 Evaluate propulsion system modification</p>	<ul style="list-style-type: none"> Review lectures on 	<ul style="list-style-type: none"> Modification proposals 	<p>4.1 Run simulations to</p>	<ul style="list-style-type: none"> Case-study evaluations 	

	<p>proposals.</p> <p>4.2 Assess implications of design changes on performance and compliance.</p> <p>4.3 Support optimization strategies for propulsion efficiency.</p> <p>4.4 Integrate propulsion decisions into overall plant management.</p>	<p>4.1 – 4.4</p> <ul style="list-style-type: none"> Design-evaluation workshops 	<ul style="list-style-type: none"> Performance reports 	<p>justify propulsion-system decisions.</p> <p>4.2 Explain sound engineering judgments at management level</p>		
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Course Assessment:

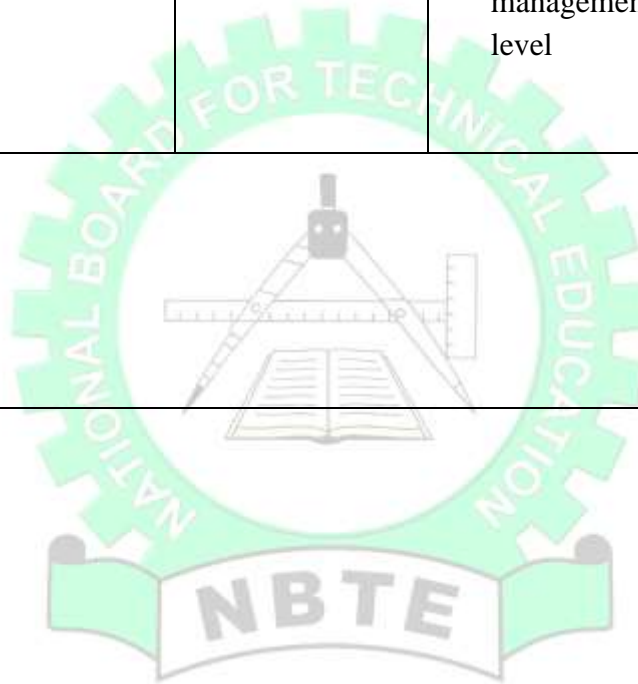
Course work: 10%

Test/Assignments: 10%

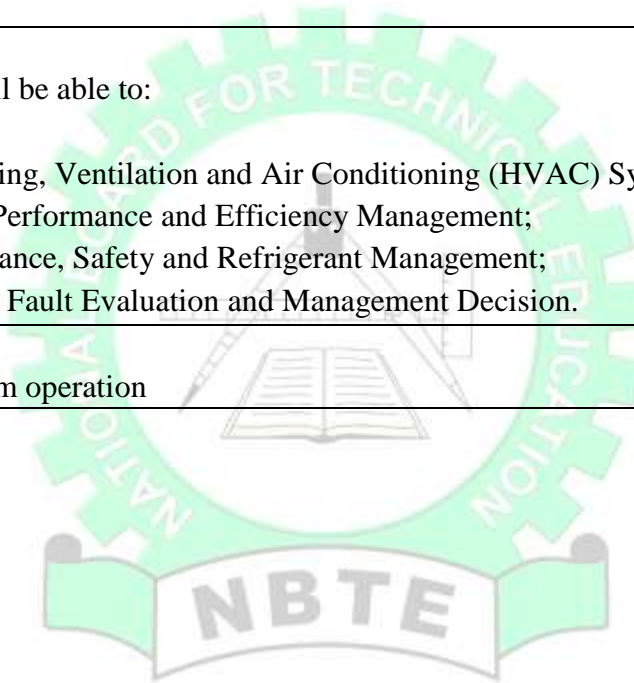
Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: REFRIGERATION AND HVAC SYSTEMS	Course Code: MAR 324	Credit Unit: 4	Contact Hours: 4hours/ Week
			Theoretical: 2hours / Week
YEAR: I SEMESTER: II	PRE-REQUISITE:		Practical: 2hours / Week
GOAL: The course is designed to equip students with management-level competence in marine refrigeration and HVAC systems, focusing on system operation, control, efficiency, and compliance with environmental and safety requirements, in accordance with STCW Code, Section-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Know Refrigeration and Heating, Ventilation and Air Conditioning (HVAC) System Fundamentals; 2.0 Understand System Control, Performance and Efficiency Management; 3.0 Know Environmental Compliance, Safety and Refrigerant Management; 4.0 Know Maintenance Planning, Fault Evaluation and Management Decision. 			
COMPETENCE			
<ul style="list-style-type: none"> • Supervise refrigeration and HVAC system operation 			



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: REFRIGERATION AND HVAC SYSTEMS		Course Code: MAR 324		Credit Unit: 4	Contact Hours: 4hours/Week	
					Theoretical: 2hours/Week	
Year: I Semester: II		Pre-requisite:			Practical: 2hours/Week	
General Objective 1.0: Know Refrigeration and Heating, Ventilation and Air Conditioning (HVAC) System Fundamentals						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Explain the role of refrigeration and HVAC systems on board ships. 1.2 Describe refrigeration cycles and HVAC operating principles. 1.3 Identify major components and control elements of systems. 1.4 Explain the importance of HVAC systems for crew welfare and cargo safety	<ul style="list-style-type: none"> Lectures 1.1 – 1.4. Guided technical discussions 	<ul style="list-style-type: none"> Refrigeration cycle diagrams HVAC schematics 	1.1 Identify system components from diagrams.	<ul style="list-style-type: none"> System-identification exercises Demonstrate management-level understanding of system integration with ship operations. Explain system flow paths. 	Practical Manual, writing materials, HVAC models etc.
GENERAL OBJECTIVE: 2.0: Understand System Control, Performance and Efficiency Management						
4-7	2.1 Supervise operation of refrigeration and HVAC systems. 2.2 Evaluate system performance indicators and efficiency.	<ul style="list-style-type: none"> Lectures 2.1 – 2.5 Performance-analysis sessions 	<ul style="list-style-type: none"> Performance charts Operating manuals 	2.1 Analyze system performance data. 2.2 Identify inefficient operating	<ul style="list-style-type: none"> Data-analysis exercises. Supervise students running the compressor and evaluating system performance 	<ul style="list-style-type: none"> Refrigeration and Air Conditioning laboratory

	<p>2.3 Identify causes of reduced cooling or airflow performance.</p> <p>2.4 Assess operational risks associated with system malfunction.</p> <p>2.5 Support management decisions related to energy efficiency and reliability.</p>			conditions.	indicators, efficiency, and cooling status.	
GENERAL OBJECTIVE 3.0: Know Environmental Compliance, Safety and Refrigerant Management						
8-11	<p>3.1 Explain environmental regulations affecting refrigeration systems.</p> <p>3.2 Assess safety risks related to refrigerants and system pressures.</p> <p>3.3 Supervise refrigerant handling and leak-prevention measures.</p> <p>3.4 Ensure compliance with environmental and safety procedures.</p>	<ul style="list-style-type: none"> Lectures 3.1 - 3.4. Regulatory case studies 	<ul style="list-style-type: none"> Safety codes Environmental guidelines 	<p>3.1 Identify unsafe operating conditions.</p> <p>3.2 Propose corrective safety actions.</p> <p>3.3 Perform Refrigerant leak tests.</p>	<ul style="list-style-type: none"> Scenario-based discussions Demonstrate responsible management judgment in environmental protection. 	<ul style="list-style-type: none"> Refrigeration and Air Conditioning laboratory, Refrigerant Leakage Tests equipment
GENERAL OBJECTIVE 4.0: Know Maintenance Planning, Fault Evaluation & Management Decisions						
12-15	<p>4.1 Evaluate refrigeration and HVAC maintenance requirements.</p> <p>4.2 Approve maintenance schedules and corrective actions.</p> <p>4.3 Assess system faults and operational</p>	<ul style="list-style-type: none"> Review lectures 4.1-4.4 Fault-analysis workshops 	<ul style="list-style-type: none"> Maintenance records Fault reports System Manual 	<p>4.1 Develop maintenance schedules for HVAC systems</p>	<ul style="list-style-type: none"> Case-study evaluations Demonstrate sound engineering judgment at management level. Recommend corrective actions. Justify management decisions. 	<ul style="list-style-type: none"> System Manual, practical manual, writing materials, etc.

	limitations. 4.4 Integrate HVAC management into overall plant operation.					
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Course Assessment:

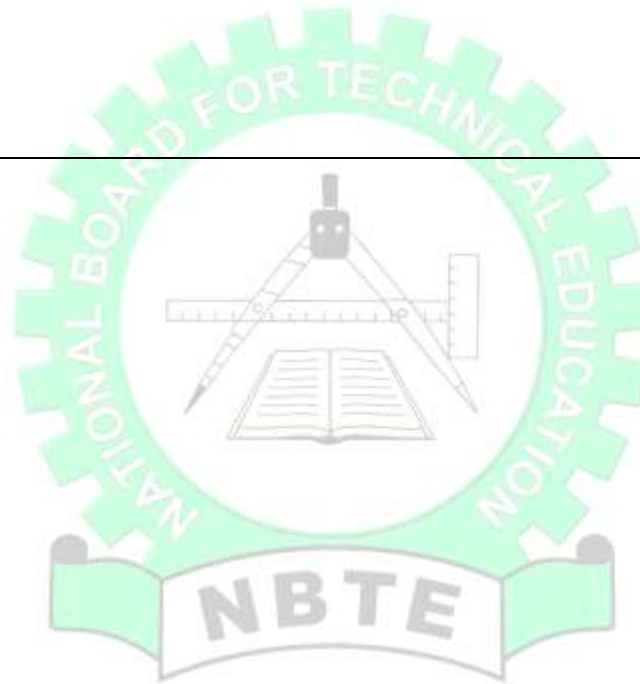
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARINE OPERATIONS AND ENGINEERING MANAGEMENT	Course Code: MAR 325	Credit Unit: 2	Contact Hours: 2hours/week
			Theoretical: 2hours/week
Year: I Semester: II	Pre-requisite:		Practical: 0
GOAL: The course is designed to equip students with management-level knowledge and skills on marine operations and engineering management, including planning, scheduling, documentation, supervision, and leadership within the engine department, in order to ensure safe working practices, efficient operations, and compliance with company and statutory requirements, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Understand Marine Operations and Engineering Management Principles; 2.0 Know Maintenance Planning, Scheduling and Documentation; 3.0 Understand Leadership, Supervision and Safe Working Practices; 4.0 Know Operational Control, Decision-Making and Management Review. 			
COMPETENCE			
<ul style="list-style-type: none"> • Ensure safe working practices. Use leadership and managerial skills. 			



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE OPERATIONS AND ENGINEERING MANAGEMENT		Course Code: MAR 325		Credit Unit: 2	Contact Hours: 2hours/Week	
					Theoretical: 2hours/Week	
Year: I Semester: II		Pre-requisite:		Practical: 0		
General Objective 1.0: Understand Marine Operations and Engineering Management Principles						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Explain the scope of marine operations management. 1.2 Describe the role of engineering management at shipboard management level. 1.3 Explain organisational structure within the engine department. 1.4 Identify management responsibilities related to safety and efficiency.	<ul style="list-style-type: none"> Lectures 1.1 – 1.4. Guided discussions Interpret engine-department organizational structures. Relate management roles to operational outcomes. Demonstrate awareness of professional and ethical responsibilities of engineering managers. 	<ul style="list-style-type: none"> Organisational charts Engine-room management manuals 			

General Objective: 2.0: Know Maintenance Planning, Scheduling and Documentation						
4-7	<p>2.1 Apply basic maintenance-planning principles.</p> <p>2.2 Explain preventive and planned maintenance concepts.</p> <p>2.3 Interpret maintenance schedules and records.</p> <p>2.4 Support operational scheduling within the engine department.</p>	<ul style="list-style-type: none"> • Lectures 2.1 – 2.4. • Case discussions • Prepare simple maintenance plans. • Analyse maintenance documentation. • Demonstrate management judgment in maintenance coordination 	<ul style="list-style-type: none"> • PMS records • Maintenance schedules 			
General Objective 3.0: Understand Leadership, Supervision and Safe Working Practices						
8-11	<p>3.1 Explain leadership principles applicable to engine-room operations.</p> <p>3.2 Supervise personnel to ensure safe working practices.</p> <p>3.3 Identify human-element factors affecting performance.</p> <p>3.4 Apply communication and teamwork principles.</p>	<ul style="list-style-type: none"> • Lectures 34.1 – 3.4 • Leadership case studies • Identify unsafe work practices. • Propose corrective supervisory actions. • Demonstrate professional leadership awareness at management level. 	<ul style="list-style-type: none"> • Safety manuals • Human-element guidelines 			
General Objective 4.0: Know Operational Control, Decision-Making and Management Review						

<p>12-15</p>	<p>4.1 Support operational decision-making in the engine department. 4.2 Evaluate operational plans and outcomes. 4.3 Integrate safety, efficiency, and compliance considerations. 4.4 Review management actions and propose improvements</p>	<ul style="list-style-type: none"> • Review lectures 4.1 – 4.4. • Management workshops • Analyze operational scenarios. • Justify management decisions. • Demonstrate sound judgment in engineering operations management. 	<ul style="list-style-type: none"> • Operational reports • Case studies 			
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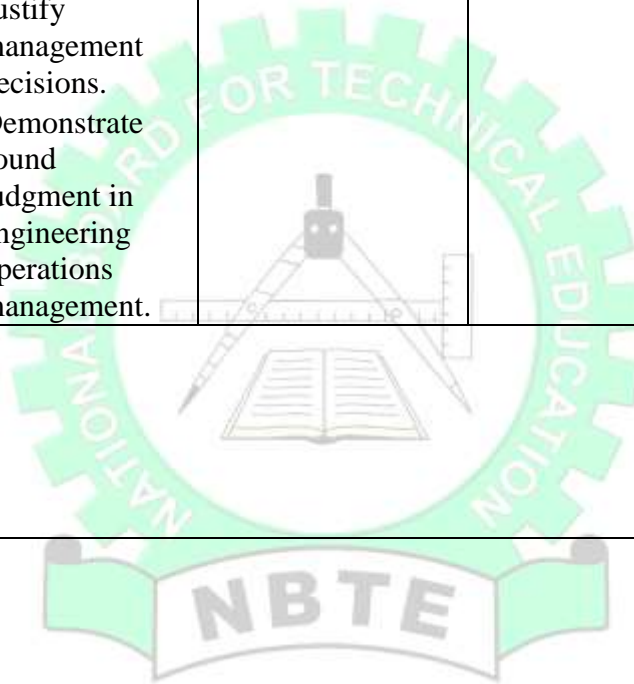
Course Assessment:

Course work: 20%

Test/Assignments: 20%

Examination: 60%

Total: 100%



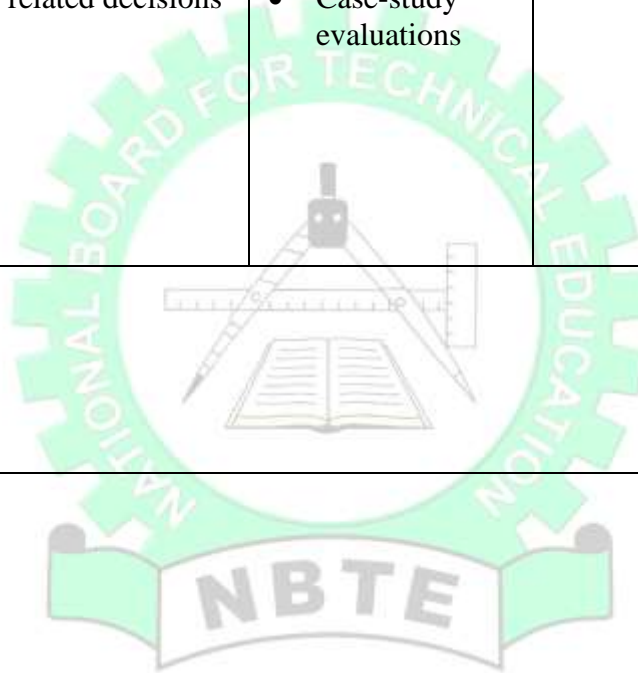
PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARINE SAFETY, LAW AND LEGISLATIVE COMPLIANCE	Course Code: MAR 326	Credit Unit: 2	Contact Hours: 2hours/ Week
			Theoretical: 2hours / Week
Year: I Semester: II	Pre-requisite:	Practical: 0	
GOAL: The course is designed to equip students with management-level knowledge of marine safety management, maritime law, and legislative compliance, enabling them to support lawful ship operations, contribute to safety management systems, and monitor compliance with international and national maritime regulations, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ul style="list-style-type: none"> 1.0 Know Marine Safety, Law and Legislative Compliance; 2.0 Know Maritime Law, Conventions and Regulatory Responsibilities; 3.0 Know Environmental Protection, Security and Compliance Monitoring; 4.0 Know Management Responsibilities, Audits and Compliance Decision-Making. 			
COMPETENCE			
<ul style="list-style-type: none"> • Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment. 			

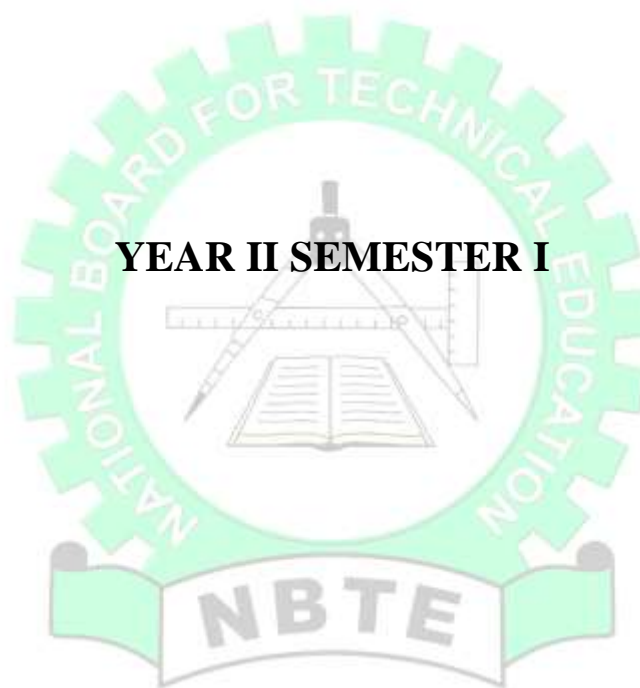


PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE SAFETY, LAW AND LEGISLATIVE COMPLIANCE		Course Code: MAR 326	Credit Unit: 2	Contact Hours: 2hours/Week		
Year: I Semester: II		Pre-requisite:		Theoretical: 2Hours/Week		
				Practical: 0		
General Objective 1.0: Know Marine Safety, Law and Legislative Compliance.						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Explain the concept and objectives of marine safety management. 1.2 Identify key international maritime safety conventions. 1.3 Describe the role of marine engineers in safety compliance. 1.4 Explain management-level responsibilities for shipboard safety.	<ul style="list-style-type: none"> • Lectures 1.1-1.4 • Guided discussions • Identify applicable safety requirements for ship operations. • Relate safety obligations to engineering duties. • Group discussions • Practical illustrations • Demonstrate awareness of the relationship between safety, law, and compliance. 	<ul style="list-style-type: none"> • Safety management manuals • International Convention • White board, Textbooks, Multimedia, PowerPoint slides, Projector 			

General Objective: 2.0: Know Maritime Law, Conventions and Regulatory Responsibilities					
4-7	<p>2.1 Identify major maritime conventions affecting Marine Engineers.</p> <p>2.2 Explain flag-state and port-state control concepts.</p> <p>2.3 Describe statutory certification and survey requirements.</p> <p>2.4 State the needs for compliance with national and international regulations.</p> <p>2.5 Explain management awareness of legal accountability.</p>	<ul style="list-style-type: none"> • Lectures 2.1-2.5 • Legal case discussions • Interpret compliance documentation. • Identify non-compliance scenarios. 	<ul style="list-style-type: none"> • Convention extracts • Inspection reports • White board, Textbooks, Multimedia, PowerPoint slides, Projector • Case-study analysis 		
General Objective 3.0: Know Environmental Protection, Security and Compliance Monitoring					
8-11	<p>3.1 Explain marine environmental protection obligations.</p> <p>3.2 Identify engineering responsibilities for pollution prevention.</p> <p>3.3 Describe basic ship security and protection measures.</p> <p>3.4 Encourage monitoring of compliance with environmental and security rules.</p> <p>3.5 Explain professional judgement in compliance oversight.</p>	<ul style="list-style-type: none"> • Lectures 3.1-3.5 • Regulatory case studies • Identify pollution-risk situations. • Propose corrective compliance actions. • Scenario-based discussions 	<ul style="list-style-type: none"> • Environmental guidelines • Security procedures • White board, Textbooks, Multimedia, PowerPoint slides, Projector 		
General Objective 4.0: Know Management Responsibilities, Audits and Compliance Decision-Making					

<p>12-15</p>	<p>4.1 Encourage safety and compliance audits on board ships. 4.2 Evaluate compliance performance and identify gaps. 4.3 Recommend corrective and preventive actions. 4.4 Integrate safety, legal, and operational considerations into management decisions. 4.5 Explain the need for sound judgement in legislative compliance matters.</p>	<ul style="list-style-type: none"> • Review lectures 4.1-4.5 • Compliance workshops • Analyze audit findings. • Justify compliance-related decisions 	<ul style="list-style-type: none"> • Audit reports • Safety records • White board, Textbooks, Multimedia, PowerPoint slides, Projector • Case-study evaluations 			
<p>Course Assessment: Course work: 20% Test/Assignments: 20% Examination: 60% Total: 100%</p>						





YEAR II SEMESTER I

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE: ELECTRICAL AND ELECTRONIC SYSTEMS MANAGEMENT	Course Code: MAR 411	Contact Hours: 4 Hrs/Week
Year: II Semester: I	Credit Unit: 4	Theoretical: 2 Hrs/Week
	Pre-requisite: Marine and Power Electronics	Practical: 2 Hrs/Week
<p>GOAL: This course is designed to equip students with management-level competence in electrical and electronic systems management, enabling students to understand, operate, supervise, and integrate shipboard electrical/electronic systems. The course prepares graduates to manage power generation, distribution, and diagnostics, automation, and high-voltage systems in line with STCW Code, Section A-III/2.</p>		
<p>GENERAL OBJECTIVES: On completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1.0 Comprehend the principles of electrical and electronic systems management; 2.0 Apply maintenance and reliability concepts to shipboard electrical/electronic systems; 3.0 Manage electrical power generation, distribution, and utilization onboard ships; 4.0 Apply diagnostic and fault management techniques in electrical/electronic systems; 5.0 Understand safety, regulatory, and environmental considerations in system management; 6.0 Integrate modern technologies (automation, monitoring, renewable energy) into shipboard systems; 7.0 Demonstrate managerial and documentation skills in electrical/electronic system operations. 		
<p>COMPETENCES:</p> <ul style="list-style-type: none"> • Operation and monitoring of shipboard electrical/electronic systems • Troubleshooting and restoration of electrical/electronic systems to operating condition • Maintenance and repair of electrical/electronic equipment • Integration of advanced electrical/electronic systems into shipboard propulsion and auxiliary systems 		

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE TITLE: ELECTRICAL AND ELECTRONIC SYSTEMS MANAGEMENT	Course Code: MAR 411	Contact Hours: 4 Hours/Week
	Credit Unit: 4	Theoretical: 2 Hours/Week
Year II Semester: I	Pre-Requisite: MARINE ELECTRO-TECHNOLOGY II	Practical: 2 Hour/Week

General Objective 1.0: Comprehend the principles of electrical and electronic systems management.

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Describe principles of electrical/electronic systems management. 1.2 Explain lifecycle stages (design, operation, maintenance, disposal). 1.3 Explain the emerging trends in Electrical/Electronic Systems	<ul style="list-style-type: none"> Lecture with diagrams, case studies, guided discussion. 	<ul style="list-style-type: none"> Textbooks, ship electrical diagrams, multimedia projector. 	1.1 Identify subsystems of shipboard electrical/electronic systems. 1.2 Map system architecture using case study.	<ul style="list-style-type: none"> Guide mapping exercise, supervise group work. 	<ul style="list-style-type: none"> Shipboard system diagrams, CAD projector.

General Objective 2.0: Apply maintenance and reliability concepts to shipboard electrical/electronic systems.

3-4	2.1 Explain preventive, predictive, and corrective maintenance. 2.2 Define reliability 2.3 Explain the following terms: i. Mean Time	<ul style="list-style-type: none"> Lecture with sketches, derive reliability equations, assign calculations. 	<ul style="list-style-type: none"> Maintenance logs, charts, textbooks.. 	2.1 Perform insulation resistance test using megger. 2.2 Compute MTBF and MTTR from sample data.	<ul style="list-style-type: none"> Demonstrate megger use, supervise calculations. 	<ul style="list-style-type: none"> Megger, lab kits, maintenance records.
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	Between Failures (MTBF) ii. Mean Time To Repair (MTTR).					
General Objective 3.0: Manage electrical power generation, distribution, and utilization onboard ships.						
5-6	3.1 Explain shipboard power generation systems (diesel alternators, emergency generators). 3.2 Describe distribution systems (switchboards, bus bars, and circuit breakers). 3.3 Explain load management and power factor correction.	<ul style="list-style-type: none"> Lecture with diagrams, guided discussion, case studies. 	<ul style="list-style-type: none"> Ship power diagrams, textbooks, projector. 	3.1 Calculate load sharing between two alternators. 3.2 Perform apparent, real, and reactive power calculations.	<ul style="list-style-type: none"> Guide calculations, supervise problem-solving. 	<ul style="list-style-type: none"> Alternator data, CRO, simulation software.
General Objective 4.0: Apply diagnostic and fault management techniques in electrical/electronic systems.						
7-8	4.1 Identify fault types (open circuit, short circuit, and insulation breakdown). 4.2 Explain diagnostic tools (multimeter, CRO, protective relays). 4.3 Describe fault isolation and reporting.	<ul style="list-style-type: none"> Lecture, problem-solving, case studies. 	<ul style="list-style-type: none"> Multimeter, CRO, relay manuals. 	4.1 Troubleshoot simulated fault in motor circuit. 4.2 Compute fault current using $I = V/Z$.	<ul style="list-style-type: none"> Demonstrate troubleshooting, supervise calculations. 	<ul style="list-style-type: none"> Relay test kits, CRO, lab boards.

General Objective: 5.0: Understand safety, regulatory, and environmental considerations in system management.						
9-10	5.1 Explain electrical safety codes (IEC, IMO, SOLAS). 5.2 Describe permit-to-work and lock-out/tag-out procedures. 5.3 Discuss environmental impact of electrical/electronic systems.	<ul style="list-style-type: none"> Lecture, case studies, guided discussion. 	<ul style="list-style-type: none"> IMO conventions, IEC standards, textbooks. 	5.1 Draft permit-to-work documentation. 5.2 Simulate lock-out/tag-out procedure.	<ul style="list-style-type: none"> Supervise documentation exercise, guide simulation. 	<ul style="list-style-type: none"> Safety manuals, reporting templates.
General Objective: 6.0: Integrate modern technologies (automation, monitoring, renewable energy) into shipboard systems.						
11-12	6.1 Explain automation and monitoring systems (SCADA, PLCs). 6.2 Describe renewable energy integration (solar, wind, hybrid). 6.3 Explain smart sensors and IoT applications.	<ul style="list-style-type: none"> Lecture with diagrams, PLC simulation, renewable energy case studies. 	<ul style="list-style-type: none"> PLC kits, renewable energy textbooks, projector. 	6.2 Simulate PLC control loop. 6.3 Compute solar panel output given irradiance and efficiency.	<ul style="list-style-type: none"> Demonstrate PLC simulation, supervise calculations. 	<ul style="list-style-type: none"> PLC software, solar panel data, lab kits.
General Objective 7.0: Demonstrate managerial and documentation skills in electrical/electronic system operations.						
13-15	7.1 Explain maintenance scheduling and documentation. 7.2 Describe budgeting and resource allocation. 7.3 Discuss reporting and	<ul style="list-style-type: none"> Lecture, group discussion, case studies. 	<ul style="list-style-type: none"> Logbooks, reporting templates, textbooks. 	7.1 Prepare sample maintenance schedule for shipboard electrical systems. 7.2 Present case study documentation	<ul style="list-style-type: none"> Supervise documentation, guide group presentations. 	<ul style="list-style-type: none"> IMO reporting templates, CAD projector.

	communication in system management.			exercise.		
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Course Assessment:

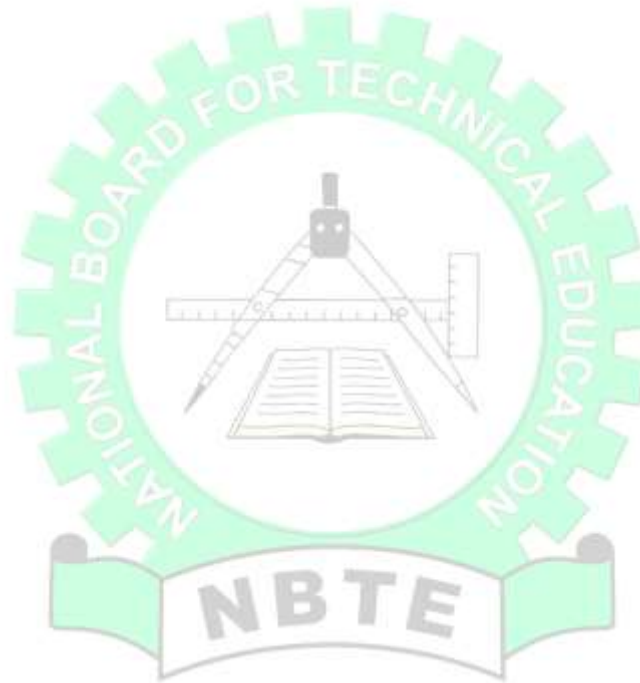
Course work: 10%

Test/Assignments: 10%

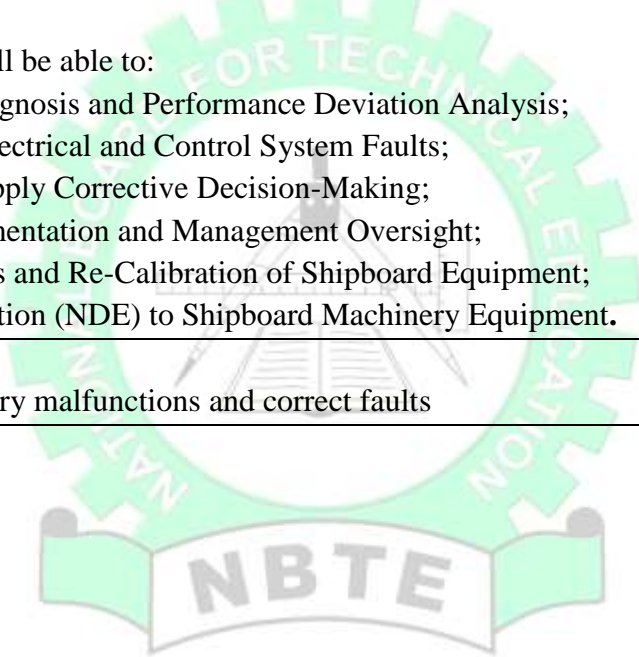
Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARINE MACHINERY TROUBLESHOOTING AND FAULT DIAGNOSIS	Course Code: MAR 412	Credit Unit: 4	Contact Hours: 4 Hours/ Week
			Theoretical: 2hours / Week
Year: II Semester 1	Pre-requisite:		Practical: 2hours / Week
GOAL: The course is designed to equip students with skills and knowledge to diagnose, evaluate, and manage machinery malfunctions at management level, apply structured fault-finding logic across mechanical, electrical, and control systems, assess operational risk, and approve corrective and preventive actions in compliance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
1.0 Apply the Principles of Fault Diagnosis and Performance Deviation Analysis;			
2.0 Detect Shipboard Mechanical, Electrical and Control System Faults;			
3.0 Perform Risk Assessment and Apply Corrective Decision-Making;			
4.0 Carryout Fault Reporting, Documentation and Management Oversight;			
5.0 Carryout Inspection, Adjustments and Re-Calibration of Shipboard Equipment;			
6.0 Apply Non-Destructive Examination (NDE) to Shipboard Machinery Equipment.			
COMPETENCE			
<ul style="list-style-type: none"> • Detect and identify the cause of machinery malfunctions and correct faults 			



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE MACHINERY TROUBLESHOOTING AND FAULT DIAGNOSIS		Course Code: MAR 412		Credit Unit: 4	Contact Hours: 4hours/Week	
					Theoretical: 2hours/Week	
Year: II Semester I		Pre-requisite:		Practical: 2hours/Week		
General Objective 1.0: Apply the Principles of Fault Diagnosis and Performance Deviation Analysis						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-2	1.1 Explain systematic approaches to shipboard machinery troubleshooting. 1.2 Distinguish symptoms from root causes of shipboard machinery faults. 1.3 Interpret performance data from operating shipboard machinery. 1.4 Identify deviations from normal operation. 1.5 Document records of shipboard operations and maintenance. 1.6 Explain logical fault-finding sequences at management level.	<ul style="list-style-type: none"> Lectures Guided discussions 	<ul style="list-style-type: none"> Machinery manuals Performance logs Multimedia Systems, white board, etc. 	1.1 Analyse machinery performance records. 1.2 Identify abnormal trends. 1.3 Apply logical fault-finding sequences at management level.	<ul style="list-style-type: none"> Case-based analysis exercises 	<ul style="list-style-type: none"> Simulator, Live engines, Operational logbooks, Manufacturers' manuals, Practical manuals, etc.
General Objective 2.0: Detect Shipboard Mechanical, Electrical and Control System Faults.						
3-4	2.1 Explain common	<ul style="list-style-type: none"> Lectures 	<ul style="list-style-type: none"> Electrical 	2.1 Trace fault	<ul style="list-style-type: none"> Fault-scenario 	

	<p>mechanical faults in marine propulsion and auxiliary machinery.</p> <p>2.2 Discuss common approaches to correct mechanical faults in marine propulsion and auxiliary systems.</p> <p>2.3 Evaluate electrical and electronic system malfunctions in shipboard machinery.</p> <p>2.4 Explain steps to rectify shipboard electrical and electronic systems malfunction.</p> <p>2.5 Explain the use of manufacturers' manuals to diagnose faults on shipboard machinery</p> <p>2.6 Describe control and automation system failures and alarms.</p> <p>2.7 Collate faults and warning signals across integrated ship systems.</p>	<ul style="list-style-type: none"> • Fault-tree explanations 	<p>diagrams</p> <ul style="list-style-type: none"> • Control logic schematics • Machinery manuals • Performance logs • Multimedia Systems, white board, etc. 	<p>logic across systems.</p> <p>2.2 Diagnose common mechanical faults in marine propulsion and auxiliary machinery</p> <p>2.3 Propose diagnostic pathways.</p> <p>2.4 Identify control and automation system failures and alarms.</p> <p>2.5 Interpret faults and warning signals across integrated ship systems.</p>	<p>simulations</p> <ul style="list-style-type: none"> • Case-based analysis exercises 	
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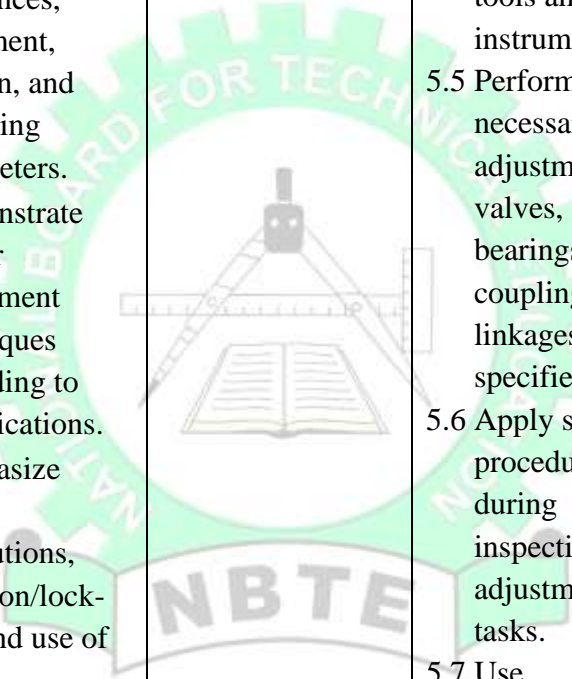
GENERAL OBJECTIVE 3.0: Perform Risk Assessment and Apply Corrective Decision-Making

5-6	<p>3.1 Explain the risks associated with continued shipboard machinery operation.</p>	<ul style="list-style-type: none"> • Case-study reviews • Risk-analysis 	<ul style="list-style-type: none"> • Incident reports • Risk 	<p>3.1 Simulate scenarios to justify management-</p>	<ul style="list-style-type: none"> • Decision-making scenarios 	<ul style="list-style-type: none"> • Simulator, Live engines, Operational
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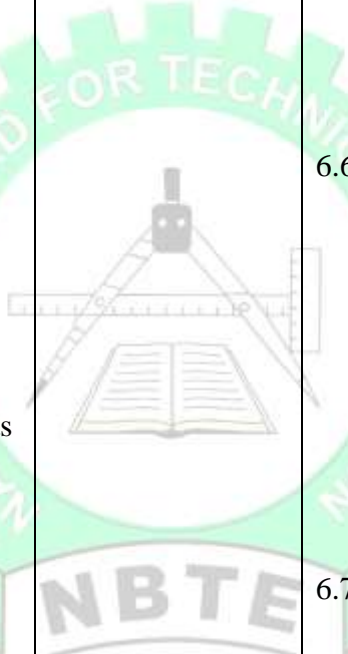
	<p>3.2 Decide between continued operation, derating, or shutdown.</p> <p>3.3 Discuss risks associated with each of the sequence in (3.2).</p> <p>3.4 Explain the importance of following approved corrective and preventive actions.</p> <p>3.5 Explain risk management in shipboard operation, taking into consideration safety, operational, and commercial decisions.</p>	<p>discussions</p>	<p>matrices</p> <ul style="list-style-type: none"> • Multimedia Systems, white board, etc. 	<p>level decisions during continued operation, derating, and shutdown procedure.</p> <p>3.2 Perform preventive and corrective measures limited to risk assessment.</p> <p>3.3 Assess risks associated with continued shipboard machinery operation.</p>	<ul style="list-style-type: none"> • Guide the students to perform the practical works • Provide well-structured practical manuals for the students 	<p>logbooks, Manufacturers' manuals, Practical manuals, etc.</p>
<p>General Objective 4.0: Carryout Fault Reporting, Documentation and Management Oversight</p>						
<p>7-8</p>	<p>4.1 Prepare fault and incident reports.</p> <p>4.2 Review maintenance and repair documentation.</p> <p>4.3 Ensure compliance with company procedures and statutory requirements.</p> <p>4.4 Evaluate lessons learned from machinery failures.</p>	<ul style="list-style-type: none"> • Review lectures • Documentation workshops 	<ul style="list-style-type: none"> • PMS records • Class reports • Multimedia Systems, white board, etc. 	<p>4.1 Evaluate fault reports.</p> <p>4.2 Propose system improvements.</p>	<ul style="list-style-type: none"> • Documentation analysis exercises 	

General Objective 5.0: Carryout Inspection, Adjustments and Re-Calibration of Shipboard Equipment.

<p>9-11</p>	<p>5.1 Explain the purpose and importance of routine inspection and adjustment of marine machinery and equipment.</p> <p>5.2 Identify the tools, instrument, and safety precautions required for effective inspection and adjustment tasks onboard.</p> <p>5.3 Discuss systematic inspection of engine room equipment to detect wear, misalignment, leakage, overheating, and abnormal conditions.</p> <p>5.4 Explain the importance of measurement and interpretation of clearances, tolerances, pressures, temperatures, and alignments using appropriate measuring instruments.</p> <p>5.5 Discuss the procedure to perform necessary adjustments on machinery components</p>	<ul style="list-style-type: none"> • Explain the purpose and importance of routine inspection and adjustment in machinery reliability. • Review manufacturer’s limits, tolerances, and PMS procedures relevant to selected equipment. • Demonstrate correct use of inspection and measuring tools (feeler gauge, dial gauge, vernier caliper, thermometer, pressure gauge). • Demonstrate step-by-step inspection of selected 	<ul style="list-style-type: none"> • Multimedia Systems, white board, etc. 	<p>5.1 Use the tools and instruments required for effective inspection and adjustment tasks onboard, observing safety precautions.</p> <p>5.2 Carryout systematic inspection of engine room equipment to detect wear, misalignment, leakage, overheating, and abnormal conditions.</p> <p>5.3 Carry out systematic inspection of machinery components and identify abnormal conditions.</p> <p>5.4 Measure</p>	<ul style="list-style-type: none"> • Guide the students to perform the practical works 	<p>Engine Maintenance and Repairs workshop</p>
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	<p>such as valves, bearings, belts, couplings, and linkages to maintain optimal performance.</p> <p>5.6 Explain the use of manufacturer’s specifications and planned maintenance procedures during inspection and adjustment operations.</p> <p>5.7 Summarize the importance of record and report inspection findings and adjustments made in maintenance logs and reports.</p> <p>5.8 List safe working practices and teamwork during inspection and adjustment of equipment onboard vessels.</p>	<p>components (valves, bearings, belts, couplings, linkages).</p> <ul style="list-style-type: none"> • Show how to check clearances, alignment, tension, and operating parameters. • Demonstrate proper adjustment techniques according to specifications. • Emphasize safety precautions, isolation/lock-out, and use of PPE. • Supervise students during hands-on practice and correct errors in technique. 		<p>clearances, alignment, tension, temperature, and pressure using appropriate tools and instrument.</p> <p>5.5 Perform necessary adjustments on valves, bearings, belts, couplings, and linkages within specified limits.</p> <p>5.6 Apply safety procedures during inspection and adjustment tasks.</p> <p>5.7 Use manufacturer’s specifications and Planned Maintenance System (PMS) guidelines during</p>		
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		<ul style="list-style-type: none"> • Guide students on how to document findings and adjustments in maintenance records. 		<p>maintenance work.</p> <p>5.8 Accurately record inspection results and adjustments made in maintenance logs.</p>		
General Objective 6.0: Apply Non-Destructive Examination (NDE) to Shipboard Machinery Equipment.						
12-15	<p>6.1 Explain the purpose and principles of non-destructive examination (NDE) in marine machinery maintenance.</p> <p>6.2 Identify common NDE methods used onboard ships and the types of defects each method can detect.</p> <p>6.3 Select appropriate NDE techniques for different shipboard machinery components and materials.</p> <p>6.4 State safety precautions to be</p>	<ul style="list-style-type: none"> • Introduce the concept, purpose, and importance of NDE in marine maintenance practice. • Explain the principles of common NDE methods (VI, DPT, MPI, UT, Eddy current, Thermography). • Display real tools/equipment or videos demonstrating NDE procedures. • Demonstrate step- 	<ul style="list-style-type: none"> • Multimedia Systems, white board, etc. 	<p>6.1 Conduct proper visual inspection on machinery parts and identify visible defects.</p> <p>6.2 Perform penetrant testing to detect surface cracks on non-porous materials</p> <p>6.3 Carry out magnetic particle inspection on ferromagnetic components.</p> <p>6.4 Observe all safety</p>		

	<p>observed before conducting NDE.</p> <p>6.5 Describe visual inspection, penetrant testing, and magnetic particle inspection on selected components.</p> <p>6.6 Explain interpretation of NDE results to determine the presence of cracks, corrosion, wear, misalignment, and internal defects.</p> <p>6.7 Summarize the importance of record and report of NDE findings in line with planned maintenance and class requirements.</p> <p>6.8 Discuss the need for teamwork and safe working practices during NDE activities.</p> <p>6.9 Enumerate the limitations of NDE</p>	<p>by-step procedures for visual inspection, dye penetrant test, and magnetic particle inspection.</p> <ul style="list-style-type: none"> • Highlight safety precautions and PPE required during NDE operations. • Guide students in selecting appropriate NDE methods for different machinery parts. • Supervise students during practical sessions and correct improper techniques. • Provide sample defect images and help students interpret inspection results. • Emphasize proper documentation and reporting of NDE 		<p>precautions while performing NDE procedures.</p> <p>6.5 Identify different types of defects revealed by each NDE method</p> <p>6.6 Interpret NDE results to determine the presence of cracks, corrosion, wear, misalignment, and internal defects.</p> <p>6.7 Select suitable NDE methods for specific shipboard equipment.</p> <p>6.8 Accurately record and report inspection results in a</p>		
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	methods and applications.	findings in maintenance records.		maintenance log.		
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Course Assessment:

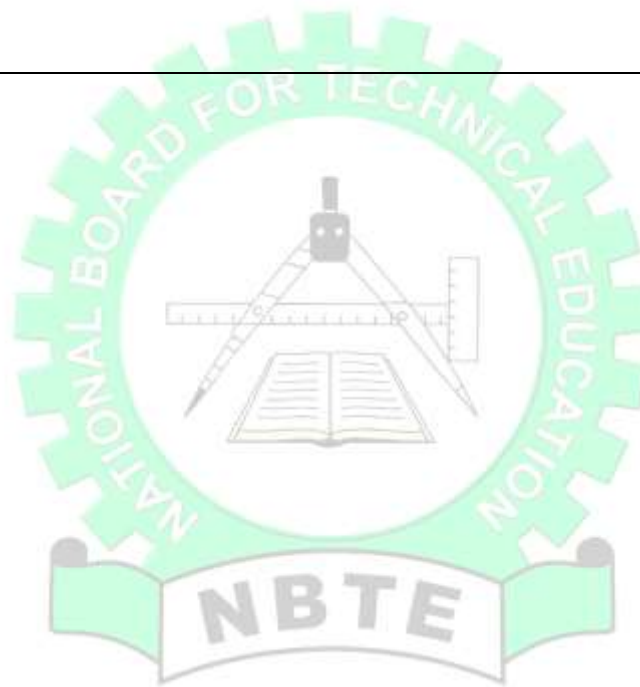
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARINE MACHINERY PERFORMANCE ASSESSMENT	Course Code: MAR 413	Credit Unit: 4	Contact Hours: 4 Hours/ Week
			Theoretical: 2 Hours / Week
Year: II Semester 1	Pre-requisite:		Practical: 2 Hours / Week
GOAL: The course is designed to equip students with knowledge and skills to plan, schedule, monitor, and evaluate the operational performance of marine machinery systems, using data-driven performance indicators to optimize efficiency, ensure safety, and support corrective management decisions, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Apply Principles of Machinery Operations Planning; 2.0 Understand Machinery Performance Indicators and Trend Monitoring; 3.0 Understand Fuel Efficiency, Optimization and Operational Risk Assessment; 4.0 Apply Corrective Action Planning and Management Review; 5.0 Evaluate Performance of Main and Auxiliary Machinery; 6.0 Understand the Interpretation of Logs, Alarms and Monitoring Instruments; 7.0 Diagnose Performance Deterioration and Faults; 8.0 Assess Using Temperature, Pressure, Vibration, Flow, Lube Parameters; 9.0 Understand the Interpretation of Manufacturer Curves and Sea Trial Data; 10.0 Understand Condition Monitoring of Pumps, Compressors, Boilers, Heat Exchangers; 11.0 Evaluate Automation, Control and Alarm Systems; 12.0 Understand Machinery Operational Limits and Constraints; 13.0 Prepare Technical Performance Reports and Recommendations; 14.0 Assess Main Engine Turbocharger Performance. 			
COMPETENCE			
<ul style="list-style-type: none"> • Manage the operation of propulsion plant machinery. Operation, surveillance assessment and maintaining safety of propulsion plant and auxiliary machinery. 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE MACHINERY PERFORMANCE ASSESSMENT		Course Code: MAR 413	Credit Unit: 4	Contact Hours: 4Hours/Week		
Year: II Semester: I		Pre-requisite:		Theoretical: 2Hours/Week		
				Practical: 2Hours/Week		
General Objective 1.0: Apply Principles of Machinery Operations Planning						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Explain machinery operational planning principles 1.2 Relate voyage plan to machinery readiness 1.3 Identify factors affecting machinery availability 1.4 Develop machinery operational plans	<ul style="list-style-type: none"> Explain planning concepts with engine room scenarios Use case studies of voyage preparation Guide students in plan development 	<ul style="list-style-type: none"> Engine room manuals Voyage plan samples Whiteboard, projector etc. 	1.1 Prepare a machinery readiness checklist 1.2 Develop an operational plan for a given voyage	<ul style="list-style-type: none"> Supervise checklist preparation Review and correct plans 	<ul style="list-style-type: none"> Sample logbooks Machinery checklists
General Objective 2.0: Understand Machinery Performance Indicators and Trend Monitoring						
2	2.1 Identify key performance indicators (KPIs). 2.2 Explain trend monitoring principles. 2.3 Interpret performance graphs.	<ul style="list-style-type: none"> Demonstrate KPI charts Explain trend analysis with samples 	<ul style="list-style-type: none"> Engine performance graphs Sample data sheets 	2.1 Plot and interpret trend graphs 2.2 Detect abnormalities from data	<ul style="list-style-type: none"> Provide data for plotting Guide interpretation 	<ul style="list-style-type: none"> Graph sheets Engine log data

General Objective 3.0: Understand Fuel Efficiency, Optimization and Operational Risk Assessment						
3	3.1 Explain factors affecting fuel efficiency 3.2 Describe combustion optimization 3.3 Identify risks from poor performance	<ul style="list-style-type: none"> Lecture on fuel systems Discuss case studies 	<ul style="list-style-type: none"> Fuel system diagrams Manuals 	3.1 Calculate fuel consumption rates 3.2 Assess combustion condition from data	<ul style="list-style-type: none"> Provide sample readings Supervise calculations 	<ul style="list-style-type: none"> Calculator Engine data sheets
General Objective 4.0: Apply Corrective Action Planning and Management Review						
4	4.1 Explain corrective action process 4.2 Describe management review procedures 4.3 Prepare performance reports	<ul style="list-style-type: none"> Teach report structure Discuss decision-making process 	<ul style="list-style-type: none"> Sample reports Templates 	4.1 Write a corrective action report. 4.2 Conduct a mock management review	<ul style="list-style-type: none"> Assess reports Role-play review session 	<ul style="list-style-type: none"> Report templates
General Objective 5.0: Evaluate Performance of Main and Auxiliary Machinery						
5	5.1 Describe performance parameters of engines and auxiliaries 5.2 Explain assessment techniques	<ul style="list-style-type: none"> Use diagrams and manuals Explain parameter limits 	<ul style="list-style-type: none"> Machinery manuals Charts 	5.1 Assess machinery condition from readings	Provide simulated readings	Sample engine room data
General Objective 6.0: Understand the Interpretation of Logs, Alarms and Monitoring Instruments						
6	6.1 Explain logbook importance 6.2 Interpret alarm records 6.3 State instruments used to monitor marine machinery	<ul style="list-style-type: none"> Show real log sample Explain alarm history 	<ul style="list-style-type: none"> Logbooks Alarm printouts 	6.1 Detect faults from logs and alarms	<ul style="list-style-type: none"> Provide faulty log scenarios 	<ul style="list-style-type: none"> Sample logs
General Objective 7.0: Diagnose Performance Deterioration and Faults						
7	7.1 Identify symptoms	<ul style="list-style-type: none"> Discuss fault 	<ul style="list-style-type: none"> Fault charts 	7.1 Diagnose given	<ul style="list-style-type: none"> Present case 	<ul style="list-style-type: none"> Case study

	of poor performance 7.2 Explain diagnostic methods 7.3 Differentiate between fault and performance deterioration	cases • Teach root cause analysis		fault scenarios	problems	sheets
General Objective 8.0: Assess Using Temperature, Pressure, Vibration, Flow, Lube Parameters						
8	8.1 Explain significance of machine parameters of marine machinery 8.2 State normal operating ranges 8.3 Discuss how these parameters can be used to determine the operating conditions of marine machinery	• Use charts and videos	• Parameter charts	8.1 Interpret parameter readings	• Provide instrument readings	• Thermometer, pressure gauge samples
General Objective 9.0: Understand the Interpretation of Manufacturer Curves and Sea Trial Data						
9	9.1 Explain performance curves 9.2 Interpret sea trial results	• Teach curve reading	• Manufacturer manuals • Sea trial reports	9.1 Analyze curves for condition assessment	• Provide curve samples	• Performance charts
General Objective 10.0: Understand Condition Monitoring of Pumps, Compressors, Boilers, Heat Exchangers						
10	10.1 Discuss the importance of condition monitoring 10.2 Explain monitoring methods for auxiliaries. 10.3 Discuss the processing and	• Use system diagrams	• Auxiliary manuals	10.1 Assess auxiliary condition from data	• Provide readings	• Sample data sheets

	analysis of condition monitoring data					
General Objective 11.0: Evaluate Automation, Control and Alarm Systems						
11	11.1 Explain automation role. 11.2 Describe alarm effectiveness 11.3 Discuss various forms of control systems used in marine machinery.	<ul style="list-style-type: none"> Show control panel layouts 	<ul style="list-style-type: none"> Control diagrams 	11.1 Assess alarm responses	<ul style="list-style-type: none"> Simulate alarm cases 	<ul style="list-style-type: none"> Alarm simulation charts
General Objective 12.0: Understand Machinery Operational Limits and Constraints						
12	12.1 Explain operational limits 12.2 Explain effects of overload and sea condition 12.3 State how to manage operational limits and constraints associated with marine machinery	<ul style="list-style-type: none"> Discuss limit cases 	<ul style="list-style-type: none"> Limit charts 	12.1 Identify limit violations from data	<ul style="list-style-type: none"> Provide overload scenarios 	<ul style="list-style-type: none"> Sample data
General Objective 13.0: Prepare Technical Performance Reports and Recommendations						
13	13.1 Explain report structure 13.2 Recommend corrective actions 13.3 Discuss the roles of technical performance reports in engine room operations.	<ul style="list-style-type: none"> Teach report writing 	<ul style="list-style-type: none"> Report samples 	13.1 Write full performance assessment report	<ul style="list-style-type: none"> Grade reports 	<ul style="list-style-type: none"> Templates
General Objective 14.0: Assess Main Engine Turbocharger Performance						

14-15	14.1	Explain turbocharger function and parameters	<ul style="list-style-type: none"> • Use diagrams and videos • Explain scavenge air system 	<ul style="list-style-type: none"> • Turbocharger diagrams • Engine manuals 	14.1	Diagnose turbocharger issues from readings	<ul style="list-style-type: none"> • Provide turbocharger data scenarios 	<ul style="list-style-type: none"> • Sample engine data • Turbocharger charts
	14.2	Relate turbocharger performance to combustion and exhaust condition						

Course Assessment:

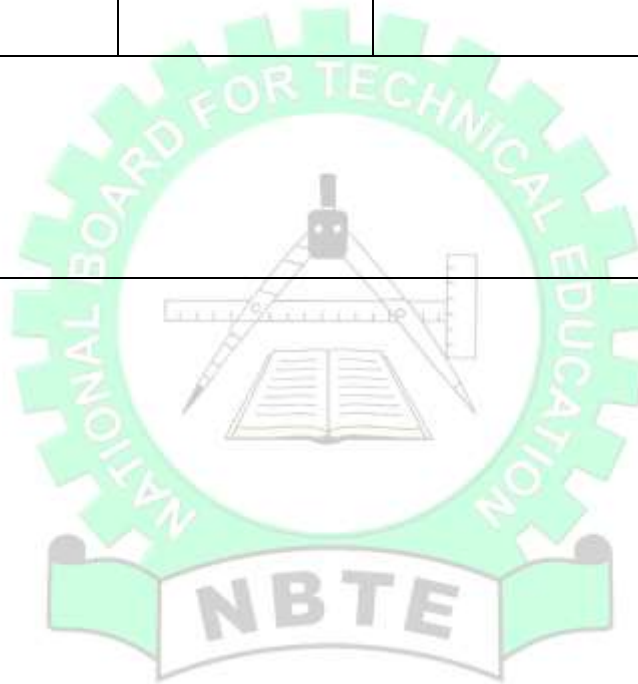
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARINE POLLUTION PREVENTION AND ENVIRONMENTAL PROTECTION II	Course Code: MAR 414	Credit Unit: 4	Contact Hours: 4 Hours/ Week
			Theoretical: 2 Hours / Week
Year: II Semester I	Pre-requisite:		Practical: 2 Hours/Week
GOAL: This course is designed to equip the students with applied management-level knowledge and skills on marine pollution prevention, to supervise environmentally sensitive shipboard operations, ensure full compliance with MARPOL and related environmental regulations, and respond effectively to pollution incidents, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Implement Marine Pollution Prevention and MARPOL Framework; 2.0 Implement Oil, Fuel, Waste and Ballast Water Management Procedures; 3.0 Maintain Environmental Documentation, Records and Compliance Monitoring; 4.0 Carryout Pollution-Incident Response and Management Decision-Making; 5.0 Maintain proper operation, monitoring, and maintenance of shipboard pollution prevention equipment and systems; 6.0 Supervise crew adherence to pollution prevention practices and promote environmental awareness onboard; 7.0 Incorporate environmental protection considerations into planned maintenance, watchkeeping, and operational decision-making; 8.0 Promote a culture of environmental stewardship and continuous improvement in pollution prevention practices onboard vessels; 			
COMPETENCE			
<ul style="list-style-type: none"> • Monitor and control compliance with legislative requirements and measures to ensure protection of the marine environment. 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE POLLUTION AND ENVIRONMENTAL PROTECTION II						
Year II Semester I		Course Code: MAR 414		Credit Unit: 4	Contact Hours: 4 Hours/Week	
					Theoretical: 2 Hours/Week	
PRE-REQUISITE: Marine Pollution and Environmental Protection I					Practical: 2 Hours/Week	
General Objective 1.0: Implement Marine Pollution Prevention and MARPOL Framework						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-2	1.1 Explain sources and impacts of marine pollution. 1.2 Describe the structure and objectives of MARPOL. 1.3 Identify MARPOL Annexes relevant to engine-room operations. 1.4 Explain management responsibilities for pollution prevention. 1.5 Explain professional environmental awareness at management level.	<ul style="list-style-type: none"> Lectures Guided discussions 	<ul style="list-style-type: none"> MARPOL Convention extracts. Environmental manuals. Whiteboard, multimedia systems, smart board etc. 	1.1 Identify pollution risks in engine-room operations. 1.2 Relate MARPOL requirements to engineering duties. 1.3 Demonstrate professional environmental awareness at management level.	<ul style="list-style-type: none"> Group discussions Practical illustrations 	<ul style="list-style-type: none"> MARPOL Convention extracts Environmental manuals
General Objective: 2.0: Implement Oil, Fuel, Waste and Ballast Water Management Procedures.						
3-4	2.1 Explain oil and fuel-handling operations safely. 2.2 Explain the operation of	<ul style="list-style-type: none"> Lectures Case-study reviews 	<ul style="list-style-type: none"> Oily-water separator manuals Ballast 	2.1 Supervise oil and fuel-handling operations safely.	<ul style="list-style-type: none"> Scenario-based discussions 	<ul style="list-style-type: none"> Oily-water separator manuals. Ballast

	<p>pollution-prevention equipment.</p> <p>2.3 Discuss management of waste and garbage in compliance with relevant regulations.</p> <p>2.4 Explain the awareness of ballast-water management requirements.</p> <p>2.5 Explain compliance-focused operational decisions.</p>		<p>guidelines</p> <ul style="list-style-type: none"> • Whiteboard, multimedia systems, smart board. 	<p>2.2 Manage waste and garbage in compliance with regulations.</p> <p>2.3 Identify non-compliant practices.</p> <p>2.4 Demonstrate awareness of ballast-water management requirements.</p> <p>2.5 Propose corrective pollution-prevention actions.</p>		<p>guidelines.</p> <ul style="list-style-type: none"> • Simulator/ Animation, Videos, ODMCS (Oil Discharge Monitoring and Control System) • Oil Record Book
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GENERAL OBJECTIVE 3.0: Maintain Environmental Documentation, Records and Compliance Monitoring.

<p>5-6</p>	<p>3.1 Explain maintenance of pollution-prevention records.</p> <p>3.2 Explain the importance of Oil Record Books and environmental logs.</p> <p>3.3 Explain how documentation for inspections and audits are prepared.</p> <p>3.4 Identify documentation deficiencies affecting compliance.</p> <p>3.5 Explain management-level judgement in</p>	<ul style="list-style-type: none"> • Lectures • Audit-focused workshops 	<ul style="list-style-type: none"> • Oil Record Books • Inspection checklists. • Whiteboard, multimedia systems, smart board. 	<p>3.1 Review environmental records critically. Recommend documentation improvements.</p> <p>3.2 Supervise maintenance of pollution-prevention records.</p> <p>3.3 Prepare documentation for inspections and audits.</p>	<ul style="list-style-type: none"> • Record-review exercises 	<ul style="list-style-type: none"> • Oil Record Books • Inspection checklists. • Simulator/ Animation, Videos, ODMCS (Oil Discharge Monitoring and Control System) • Oil Record Book
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	compliance monitoring.			3.4 Demonstrate management-level judgement in compliance monitoring.		
General Objective 4.0: Carryout Pollution-Incident Response and Management Decision-Making.						
7-8	<p>4.1 Respond to pollution incidents in accordance with procedures.</p> <p>4.2 Evaluate causes and consequences of pollution events.</p> <p>4.3 Recommend corrective and preventive actions.</p> <p>4.4 Integrate environmental considerations into management decisions.</p> <p>4.5 Demonstrate sound Chief-Engineer-level judgement in environmental protection.</p>	<ul style="list-style-type: none"> Review lectures Incident-response workshops 	<ul style="list-style-type: none"> SOPEP manuals Incident reports 	<p>4.1 Analyse pollution incidents.</p> <p>4.2 Justify compliance-focused responses.</p>	<ul style="list-style-type: none"> Case-study evaluations 	
General Objective 5.0: Maintain proper operation, monitoring, and maintenance of shipboard pollution prevention equipment and systems.						
9-10	<p>5.1 Explain the working principles of Oily Water Separator (OWS), Oil Content Monitor (OCM), Incinerator, and Sewage Treatment Plant.</p> <p>5.2 Describe the operational limits and discharge criteria under MARPOL</p>	<ul style="list-style-type: none"> Use diagrams, manuals, and videos to explain OWS, OCM, Incinerator, and Sewage Treatment 	<ul style="list-style-type: none"> Equipment Manuals and Diagrams (OWS, OCM, Incinerator, Sewage Treatment Plant), 	<p>5.1 Operate OWS and verify discharge is within permissible ppm limits.</p> <p>5.2 Carry out routine inspection and maintenance of</p>	<ul style="list-style-type: none"> Demonstrate components, alarms, readings, and common faults in workshop/ lab sessions. 	<ul style="list-style-type: none"> Equipment Diagrams (OWS, OCM, Incinerator, Sewage Treatment Plant) Engine Room

	<p>Annex I, IV, V and VI.</p> <p>5.3 Explain components requiring routine inspection, testing, and calibration in pollution prevention equipment.</p> <p>5.4 Interpret alarms, fault indications, and monitoring readings from pollution control systems.</p> <p>5.5 Outline planned maintenance requirements for pollution prevention equipment.</p>	<p>Plant.</p> <ul style="list-style-type: none"> • Present case studies of equipment failure leading to pollution. 	<p>P&IDs, and manufacturer's drawings</p> <ul style="list-style-type: none"> • Oil Record Books samples • MARPOL Discharge charts • White board, Videos, Manuals • Sample PMS cards and maintenance schedules • Training videos on operation and fault diagnosis 	<p>OCM, pipelines, valves, and sampling arrangements.</p> <p>5.3 Test and maintain Sewage Treatment Plant and Incinerator in accordance with manuals.</p> <p>5.4 Record maintenance and operational data in Oil Record Book and relevant logs.</p> <p>5.5 Troubleshoot common faults in pollution prevention equipment.</p>	<ul style="list-style-type: none"> • Guide students through MARPOL discharge criteria using sample logbooks. • Demonstrate planned maintenance using PMS cards and real scenarios. 	<p>Simulator or training panels</p> <ul style="list-style-type: none"> • Oil Record Books samples • MARPOL Discharge charts • White board, Videos, Manuals
<p>General Objective 6.0: Supervise crew adherence to pollution prevention practices and promote environmental awareness onboard.</p>						
<p>11-12</p>	<p>6.1 Explain crew responsibilities under MARPOL and company environmental policies.</p> <p>6.2 Describe procedures for waste segregation, storage, and disposal onboard.</p> <p>6.3 Discuss the unsafe practices that may lead to marine pollution.</p>	<ul style="list-style-type: none"> • Lead discussions on MARPOL responsibilities and company policies. • Review Oil and Garbage Record Book 	<ul style="list-style-type: none"> • MARPOL Convention handbook (Annex I, IV, V, VI) • Company Environmental Policy and SMS (Safety Management 	<p>6.1 Conduct toolbox talks and training sessions on pollution prevention.</p> <p>6.2 Supervise garbage segregation and proper waste handling onboard.</p>	<ul style="list-style-type: none"> • Guide students in preparing toolbox talks. • Demonstrate waste segregation and proper garbage 	<ul style="list-style-type: none"> • MARPOL Convention handbook (Annex I, IV, V, VI) • Company Environmental Policy and SMS (Safety Management

	<p>6.4 Explain the importance of environmental awareness and training for crew.</p> <p>6.5 Describe reporting procedures for pollution incidents and near misses.</p>	<p>samples.</p>	<p>System) manuals</p> <ul style="list-style-type: none"> • Garbage segregation charts and color-coded bins • Oil Record Book and Garbage Record Book samples • Toolbox talk templates and drill checklists • Case study materials on pollution incidents • White board, Videos, Manuals 	<p>6.3 Monitor crew compliance during bunkering, sludge handling, and bilge operations.</p> <p>6.4 Enforce correct record-keeping in Garbage Record Book and Oil Record Book.</p> <p>6.5 Lead drills and exercises related to pollution response and prevention.</p>	<p>handling.</p> <ul style="list-style-type: none"> • Conduct role-plays on bunkering, sludge, and bilge supervision • Review Oil and Garbage Record Book samples and run mock pollution drills. 	<p>System) manuals</p> <ul style="list-style-type: none"> • Garbage segregation charts and color-coded bins • Oil Record Book and Garbage Record Book samples • Toolbox talk templates and drill checklists • Case study materials on pollution incidents
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General Objective 7.0: Incorporate environmental protection considerations into planned maintenance, watchkeeping, and operational decision-making.

<p>13-14</p>	<p>7.1 Explain how planned maintenance affects pollution prevention systems reliability.</p> <p>7.2 Describe watchkeeping duties related to pollution monitoring.</p> <p>7.3 Identify operational</p>	<ul style="list-style-type: none"> • Explain how pollution checks fit into watchkeeping routines and logs. • Show how PMS schedules 	<ul style="list-style-type: none"> • Engine room logbooks and watchkeeping checklists • Planned Maintenance System (PMS) software/cards 	<p>7.1 Incorporate pollution prevention checks into watchkeeping routines.</p> <p>7.2 Use Planned Maintenance</p>	<ul style="list-style-type: none"> • Demonstrate how pollution checks fit into watchkeeping routines and logs. 	<ul style="list-style-type: none"> • Engine room logbooks and watchkeeping checklists • Planned Maintenance System (PMS) software/cards
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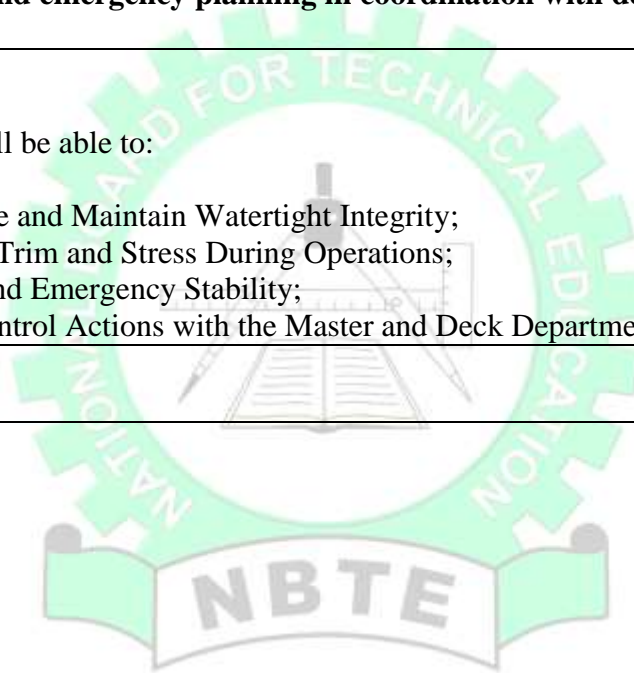
	<p>decisions that may increase pollution risk.</p> <p>7.4 Explain environmental risk assessment in daily engine room operations.</p> <p>7.5 Relate fuel management, ballast operations, and sludge handling to environmental protection.</p>	<p>pollution control equipment servicing.</p> <ul style="list-style-type: none"> • Explain operational scenarios and risk assessment exercises (fuel, bilge, ballast). • Emphasize proper documentation for compliance. 	<ul style="list-style-type: none"> • Risk assessment templates for transfer operations • Operational scenario worksheets (fuel, bilge, ballast) • Sample checklists for pollution prevention during watch • White board, Videos, Manuals 	<p>System (PMS) to schedule pollution control equipment servicing.</p> <p>7.3 Monitor transfer operations (fuel, bilge, ballast) to prevent accidental discharge.</p> <p>7.4 Apply risk assessment before maintenance or operational tasks.</p> <p>7.5 Maintain accurate records during watch for environmental compliance.</p>	<ul style="list-style-type: none"> • Use operational scenarios and risk assessment exercises (fuel, bilge, ballast). • Simulate watchkeeping decisions affecting environmental safety. 	<ul style="list-style-type: none"> • Risk assessment templates for transfer operations • Operational scenario worksheets (fuel, bilge, ballast) • Sample checklists for pollution prevention during watch
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General Objective 8.0: Promote a culture of environmental stewardship and continuous improvement in pollution prevention practices onboard vessels.

<p>15</p>	<p>8.1 Explain the concept of environmental stewardship in maritime operations.</p> <p>8.2 Describe methods for continuous improvement</p>	<ul style="list-style-type: none"> • Facilitate discussions on environmental leadership onboard. • Review sample 	<ul style="list-style-type: none"> • Audit and inspection report samples • Environmental performance KPI templates 	<p>8.1 Participate in environmental audits and inspections.</p> <p>8.2 Review pollution</p>	<ul style="list-style-type: none"> • Review sample audit/inspection reports and KPIs. 	
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	<p>in pollution prevention.</p> <p>8.3 Identify key performance indicators (KPIs) for environmental compliance.</p> <p>8.4 Explain the role of audits, inspections, and feedback in improving practices.</p> <p>8.5 Describe leadership responsibilities in promoting environmental culture onboard.</p>	<p>audit/inspection reports and KPIs.</p> <ul style="list-style-type: none"> Encourage students to suggest improvements in pollution practices. 	<ul style="list-style-type: none"> Corrective and preventive action (CAPA) forms Posters and awareness materials for environmental culture Case studies on best environmental practices in shipping <p>White board, Videos, Manuals</p>	<p>prevention performance and suggest improvements.</p> <p>8.3 Encourage reporting of unsafe or polluting practices without blame.</p> <p>8.4 Implement corrective and preventive actions from audit findings.</p> <p>8.5 Lead by example in maintaining high environmental standards onboard.</p>	<ul style="list-style-type: none"> Organize group work on corrective and preventive actions. Use debates and case studies to reinforce best practices. 	
<p>Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%</p>						

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: SHIP CONSTRUCTION AND STABILITY FOR ENGINEERS	Course Code: MAR 415	Credit Unit: 4	Contact Hours: 4 Hours/ Week
			Theoretical: 2 Hours / Week
Year: II Semester I	Pre-requisite:		Practical: 2 Hours / Week
GOAL: This course is designed to equip the students with knowledge and skills to apply management-level awareness of ship construction, watertight integrity, and stability principles, evaluate how engineering operations and decisions affect trim, stability, and stress, and support damage-control and emergency planning in coordination with deck management, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Evaluate Ship Construction, Structure and Maintain Watertight Integrity; 2.0 Evaluate and Control Ship Stability, Trim and Stress During Operations; 3.0 Assess Damage, Manage Flooding and Emergency Stability; 4.0 Coordinate Stability and Damage Control Actions with the Master and Deck Department. 			
COMPETENCE:			
<ul style="list-style-type: none"> • Control trim, stability and stress 			



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: SHIP CONSTRUCTION AND STABILITY FOR ENGINEERS			Course Code: MAR 415	Credit Unit: 4	Contact Hours: 4 Hours/Week	
Year II Semester I			Pre-requisite:		Theoretical: 2 Hours/Week	
Practical: 2 Hours/Week						
General Objective 1.0: Evaluate Ship Construction, Structure and Maintain Watertight Integrity						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Explain ship structural members and strength considerations. 1.2 Interpret ship construction plans and compartmentation. 1.3 Evaluate causes of structural failure and hull stress. 1.4 Explain principles of watertight subdivision and integrity. 1.5 Assess effects of hull damage on buoyancy and strength.	<ul style="list-style-type: none"> • Explain ship plans, midship section, and subdivision drawings. • Discuss hull stresses: hogging, sagging, panting, pounding. • Illustrate watertight integrity principles using diagrams. • Relate structural failure cases to real incidents. 	<ul style="list-style-type: none"> • Ship construction drawings and plans. • IMO damage control manual samples. • Models/charts of ship structure. • STCW & SOLAS references. • Smartboard, Whiteboard, Multimedia, Videos 	1.1 Identify structural members on ship plans/models. 1.2 Inspect watertight doors, hatches, and openings. 1.3 Conduct watertight integrity checks onboard/simulator. 1.4 Assess structural risk from simulated damage.	<ul style="list-style-type: none"> • Demonstrate identification of members using models/plans. • Supervise inspection of watertight fittings. • Simulate hull breach scenarios. • Guide students in integrity check procedures. 	<ul style="list-style-type: none"> • Ship model or mock-up. • Watertight doors/hatch samples or videos. • Damage control simulator/videos. • Inspection checklist.

General Objective: 2.0: Evaluate and Control Ship Stability, Trim and Stress During Operations

<p>4-7</p>	<p>2.1 Explain principles of intact stability (KB, GM, GZ). 2.2 Interpret stability curves and stability booklets. 2.3 Evaluate effects of free surface, ballast and fuel transfer. 2.4 Assess trim, list and longitudinal stress conditions. 2.5 Explain engineering influence on stability.</p>	<ul style="list-style-type: none"> • Demonstrate stability calculations and curve interpretation . • Explain free surface effect with sketches. • Discuss ballast/fuel transfer scenarios. • Relate engine room operations to stability changes. 	<ul style="list-style-type: none"> • Stability booklet/sample loading manual. • Stability diagrams and charts. • Whiteboard illustrations. • IMO stability criteria. • Multimedia Videos 	<p>2.1 Calculate GM, trim and list from given data. 2.2 Use stability booklet to assess ship condition. 2.3 Simulate ballast/fuel transfer and observe effects. 2.4 Evaluate stress conditions from loading cases.</p>	<ul style="list-style-type: none"> • Supervise stability calculations exercises. • Use simulator or software for loading conditions. • Guide students through ballast operation simulation. 	<ul style="list-style-type: none"> • Stability calculation worksheets. • Computer/simulator software. • Sample loading conditions data sheets.
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General Objective 3.0: Assess Damage, Manage Flooding and Emergency Stability

<p>8-11</p>	<p>3.1 Explain damage stability principles. 3.2 Assess flooding effects on buoyancy and stability. 3.3 Explain counter-flooding and cross-flooding arrangements. 3.4 Describe damage</p>	<ul style="list-style-type: none"> • Use diagrams to explain flooding stages. • Discuss SOLAS damage stability requirements 	<ul style="list-style-type: none"> • Damage control plan samples. • Flooding diagrams/charts . • SOLAS regulations extracts. 	<p>3.1 Interpret a ship's damage control plan. 3.2 Simulate flooding scenarios and corrective action. 3.3 Demonstrate counter-flooding decision</p>	<ul style="list-style-type: none"> • Conduct flooding simulation exercises. • Guide students in reading damage control plans. • Supervise 	<ul style="list-style-type: none"> • Damage control plan drawing. • Flooding simulator/videos. • Emergency drill checklist.
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	control plans and emergency procedures. 3.5 Evaluate progressive flooding risks.	<ul style="list-style-type: none"> • Explain counter-flooding strategy with cases. • Review sample damage control plans. 		making. 3.4 Participate in emergency stability drills.	emergency response drills.	
General Objective 4.0: Coordinate Stability and Damage Control Actions with the Master and Deck Department						
12-15	<p>4.1 Explain roles of engine and deck departments in stability management.</p> <p>4.2 Describe communication procedures during emergencies.</p> <p>4.3 Explain decision-making process in damage situations.</p> <p>4.4 Discuss case studies on poor coordination.</p>	<ul style="list-style-type: none"> • Discuss bridge–engine room communication flow. • Analyze real accident case studies. • Explain command structure during emergencies. 	<ul style="list-style-type: none"> • Case study reports. • Shipboard emergency plans. • Communication flow charts. • Whiteboard, Multimedia, Videos 	<p>4.1 Participate in simulated bridge–engine room emergency communication.</p> <p>4.2 Demonstrate reporting and decision-support to the Master.</p> <p>4.3 Take part in coordinated damage control drills.</p>	<ul style="list-style-type: none"> • Conduct role-play emergency scenarios. • Supervise communication drills. • Evaluate students’ coordination performance 	<ul style="list-style-type: none"> • Role-play scripts/scenarios. • Communication equipment (simulated radios). • Drill assessment checklist.
<p>Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%</p>						

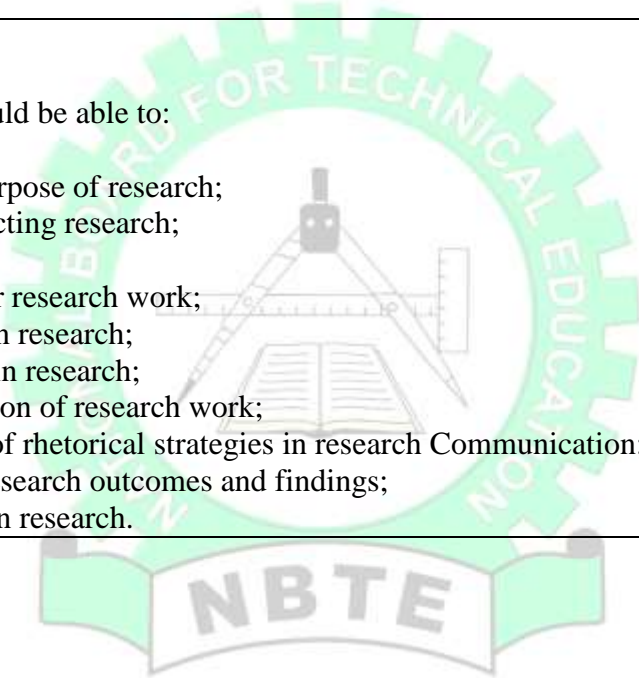
PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE: RESEARCH METHODOLOGY	Course Code: MAR 416	Contact Hours: 2Hrs/Week
	Credit Unit: 2	Theoretical: 2Hrs/Week
Year: II Semester: I	Pre-requisite:	Practical: 0

GOAL: This course is designed to equip the students with knowledge on research and data collection

GENERAL OBJECTIVES:

On completion of this course, the student should be able to:

- 1.0 Understand the meaning, types and purpose of research;
- 2.0 Understand various methods of conducting research;
- 3.0 Know the approach to research;
- 4.0 Understand the process of planning for research work;
- 5.0 Understand sampling technique used in research;
- 6.0 Understand the role of basic statistics in research;
- 7.0 Understand the conduct and organization of research work;
- 8.0 Understand the meaning and concept of rhetorical strategies in research Communication;
- 9.0 Understand drafting and writing -up research outcomes and findings;
- 10.0 Understand the knowledge and skills in research.



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: RESEARCH METHODOLOGY		Course Code: MAR 416		Contact Hours: 2Hrs/Week		
Credit Unit: 2				Theoretical: 1 Hr/Week		
COURSE SPECIFICATION: Theoretical and Practical				Practical: 1 Hr/Week		
General Objective 1: Understand the meaning, types and purpose of research.						
Week	Specific Learning Objectives	Teachers Activities	Learning Resources	Specific Learning Objectives	Teachers Activities	Learning Resources
1-2	1.1 Define research. 1.2 Explain types of research i.e., historical, descriptive, experimental research etc. 1.3 Explain aim and purpose of research.	<ul style="list-style-type: none"> Define research. Explain types of research i.e., historical, descriptive, experimental research etc. Explain aim and purpose of research. 	<ul style="list-style-type: none"> Textbooks, White board, Marker Internet etc 			
General Objective 2: Understand various methods of conducting research.						
3-4	2.1 Explain research methodology. 2.2 List various methods of conducting research i.e. Authoritarian method, mystical approach, logical approach, scientific approach etc.). 2.3 Explain the merits and demerits of each of the methods of conducting research.	<ul style="list-style-type: none"> Explain research methodology Explain various methods of conducting research i.e. Authoritarian method, mystical approach, logical approach, scientific approach etc.) Explain the merits and demerits of each of the methods of conducting research. 	<ul style="list-style-type: none"> Textbooks, White board, Marker Internet etc 			
General Objective 3: Know the approach to research.						
5-6	3.1 Define research titles.	<ul style="list-style-type: none"> Explain factors to 	<ul style="list-style-type: none"> Textbook 			

	<p>3.2 Explain factors to consider when choosing research titles.</p> <p>3.3 Explain the importance of research titles</p> <p>3.4 Discuss the dos and don'ts of research titles.</p>	<p>consider when choosing research titles</p>	<p>s,</p> <ul style="list-style-type: none"> • White board, • Marker • Internet etc 			
General Objective 4: Understand the process of planning for research work.						
7-8	<p>4.1 Explain research design giving examples.</p> <p>4.2 Explain study design used for descriptive and experimental research.</p> <p>4.3 Explain intervention and non-intervention studies, questionnaire, interview, home and observation.</p> <p>4.4 State merits and demerits of various research designs.</p>	<ul style="list-style-type: none"> • Explain research design giving examples. • Explain study design used for descriptive and experimental research. • Explain intervention and non-intervention studies, questionnaire, interview, home and observation. • State merits and demerits of various research designs. 	<ul style="list-style-type: none"> • Textbooks, • White board, • Marker • Internet etc 			
GENERAL OBJECTIVE 5: Understand sampling technique used in research						
9	<p>5.1 Define sampling and sampling technique.</p> <p>5.2 Define sample and sample size.</p> <p>5.3 Explain various types of sampling techniques e.g simple random, stratified, cluster etc.</p> <p>5.4 Explain the advantages and disadvantages of each type of sampling techniques in 5.3 above.</p> <p>5.5 Explain the calculation of</p>	<ul style="list-style-type: none"> • Define sampling and sampling technique Define sample and sample size • Explain various types of sampling techniques e.g., simple random, stratified, cluster etc. • Explain the advantages and disadvantages of each type of sampling techniques in 5.3 above • Explain the calculation 				

	sample size for a given population. 5.6 Describe the application of the sampling techniques in research.	of sample size for a given population • Describe the application of the sampling techniques in research.				
General Objective 6: Understand the roles of basic statistics in research						
10	6.1 Define basic statistics. 6.2 Explain various test statistic used in research e.g (Chi-Square, Z test, ANOVA, Correlation, regression analysis, student t – test etc.) 6.3 Describe characteristics of each of the test statistic in 6.2 above	<ul style="list-style-type: none"> • Define basic statistics • Explain various test statistic used in research e.g (Chi-Square, Z test, ANOVA, Correlation, regression analysis, student t – test etc.) • Describe characteristics of each of the test statistic in 6.2 above 	<ul style="list-style-type: none"> • Textbooks, • White board, • Marker etc. 			
General Objective 7: Understand the conduct and organization of research work						
11-12	7.1 Explain how to carry out descriptive research using any of the appropriate designs. 7.2 Explain how to collect data for a given research title. 7.3 Explain how to analyze data using appropriate test statistic methods. 7.4 Explain how to interpret the result obtained at the end of the research work. 7.5 Explain steps to write up the report at the end of the conduct of research 7.6 Organize the project work	<ul style="list-style-type: none"> • Explain how to carry out descriptive research using any of the appropriate designs • Explain how to collect data for a given research title • Explain how to analyze data using appropriate test statistic methods • Explain how to Interpret the result obtained at the end of the research work. • Explain how to Write up the report at the end of the conduct of research • Explain how to organize 	<ul style="list-style-type: none"> • Computer set • Statistical kit • Packages 	<ul style="list-style-type: none"> • Carry out descriptive research using any of the appropriate designs • Collect data for a given research title • Analyze data using appropriate test statistic methods • Interpret the result obtained at the end of the research work. • Write up the report at the end of the conduct of research • Organize the project 	<p>Guide students to:</p> <p>Carry out descriptive research using any of the appropriate designs</p> <p>Collect data for a given research title</p> <p>Analyze data using appropriate</p>	<p>Sample data collection design</p> <p>Computers</p> <p>Statistical soft wares</p>

	to cover the topics discussed	the project work to cover the topics discussed		work to cover the topics discussed	test statistic methods Interpret the result obtained at the end of the research work. Write up the report at the end of the conduct of research Organize the project work to cover the topics discussed	
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General Objective 8: Understand the meaning and concept of rhetorical strategies in research Communication

13	8.1 Define rhetorical strategies. 8.2 Outline types of rhetorical strategies; i. Argumentation strategy; ii. Cause and Effect Strategy; iii. Division strategy; iv. Compare and contrast strategy; v. Narrative Strategy; vi. Description Strategy; vii. Exemplification Strategy;	<ul style="list-style-type: none"> • Define rhetorical strategies. • Outline types of rhetorical strategies: <ol style="list-style-type: none"> i. Argumentation strategy ii. Cause and Effect Strategy, iii. Division strategy, iv. Compare and contrast strategy, v. Narrative Strategy, vi. Description Strategy, 	<ul style="list-style-type: none"> • White board • Marker • Computers • Projectors • Charts • Diagrams • Posters etc. • Audio Equipment • Audio-visual media etc. 	<ul style="list-style-type: none"> • Adopt the strategies in 8.5 on a related topic in research activities 	Guide and Supervise Students to carry out activities listed in 8.5	Text books Relevant of ware
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	<p>8.3 Explain each of the types of rhetorical strategies in 8.2 above.</p> <p>8.4 Compare and contrast the types of rhetorical strategies in research.</p> <p>8.5 Describe the process of search strategies in research communication:</p> <ol style="list-style-type: none"> i. Finding literature sources, reference, resources – textbooks, references, textbooks, etc. ii. Using research databases, electronic sources, web / Internet resources, iii. Integrating and crediting sources and avoiding plagiarism. 	<p>vii. Exemplification Strategy</p> <ul style="list-style-type: none"> • Explain each of the types of rhetorical strategies in 8.2 above. • Compare and contrast the types of rhetorical strategies in research. • Explain the process of search strategies in research <p>Communication:</p> <ol style="list-style-type: none"> i. Finding literature sources, reference, resources – textbooks, references, textbooks, etc. ii. Using research databases, electronic sources, web / Internet resources, iii. Integrating and crediting sources and avoiding plagiarism. 				
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General Objective 9: Understand drafting and writing -up research outcomes and findings.

14	<p>9.1 Define the following basic concepts:</p> <ol style="list-style-type: none"> i. Research Findings, ii. Reports, iii. Proposals, <p>9.2 Explain each of the concepts listed in 9.1.</p> <p>9.3 Explain the steps involved in drafting and writing</p>	<ul style="list-style-type: none"> • List the characteristics of research findings, report, proposal etc 	<ul style="list-style-type: none"> • White board • Marker • Computers • Projectors • Charts • Diagrams • Posters etc. • Audio 	<ul style="list-style-type: none"> • Apply the steps stated in 9.3 to write a mini report. • Make oral presentation of the report. 	<p>Guide and supervise students to carry out research activities</p>	<p>Library / Online / Internet Resources: Textbooks Journals Reference materials</p>
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	<p>research outcomes:</p> <ol style="list-style-type: none"> i. Title of report ii. Introduction/ background: definition of terms and concepts, purpose /objectives, research questions / hypotheses iii. Writing the body: literature review, build essay around the focus of study or report, explanations, summaries, analysis, use of tables, chart, diagrams etc. iv. Writing conclusion; summarize argument, draw conclusions, make recommendations, v. Revising the final drafts: observe sequence of ideas, , use transition, check punctuations, spellings and follow rules of grammar etc. vi. Documentation: citation of all materials used; accuracy of all works cited. vii. Typesetting, finishing, and binding: print document and bind in 		<p>Equipment</p> <ul style="list-style-type: none"> • Audio-visual media etc 			
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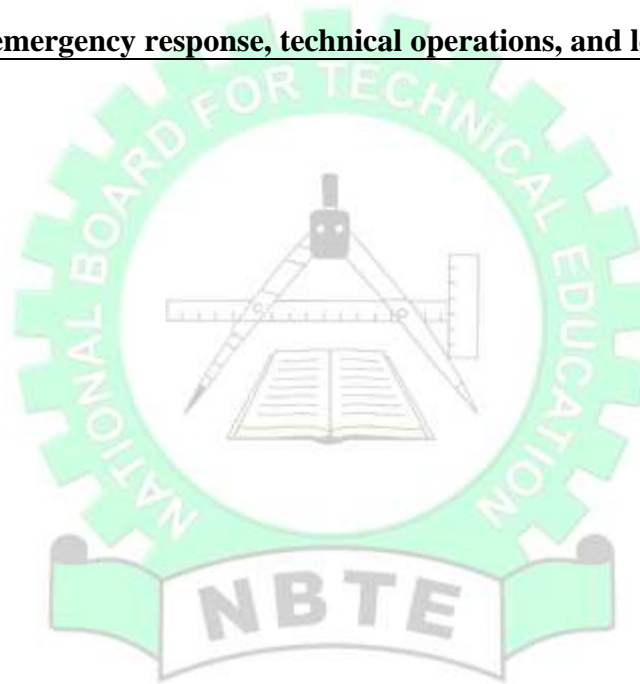
	<p>relation to use and keep personal copy for back-up.</p> <p>9.4 State uses of research findings, reports, proposals etc.</p>					
General Objective 10: Understand the knowledge and skills in research						
15	<p>10.1 List published reports, findings, and outcomes etc.</p> <p>10.2 Explain listed publications, reports, outcomes in 10.1.</p> <p>10.3 Identify organizations that are involved in communicating research findings.</p> <p>10.4 State uses of research communication within academic community.</p>	<ul style="list-style-type: none"> Show the students examples of published report, research findings, journal publications. Use the following tools: Posters, Charts, textbooks, journals etc to teach. 	<ul style="list-style-type: none"> White board, Marker, Computers, Projectors, Posters, audio-visual media etc. 	<ul style="list-style-type: none"> Visit a nearby maritime facility within the Local Government or State and write a short report 	<p>Guide and supervise Students to carry out the industrial visits.</p>	<p>Library / Online / Internet Resources: Textbooks Journals Reference materials</p>
<p>Course assessment</p> <p>Course work: 10%</p> <p>Test/Assessment: 10%</p> <p>Practical: 40%</p> <p>Examination: 40%</p> <p>Total: 100%</p>						

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE TITLE: ADVANCED SAFETY TRAINING	Course Code: MAR 417	Contact Hours: 4 Hrs/Week
Year: II Semester: I	Credit Unit: 4	Theoretical: 2 Hrs/Week
	Pre-requisite: Basic Safety Training	Practical: 2 Hrs/Week
GOAL: This course is designed to equip students with ability to develop, integrate, and apply advanced maritime safety, emergency response, technical operations, and leadership competencies at the management level, enabling marine engineering officers to analyse complex situations, evaluate risks, and implement effective strategies in compliance with the STCW Code, Section A-III/2, IMO conventions, and international best practices.		
GENERAL OBJECTIVES:		
On completion of this course, the student will be able to:		
<ol style="list-style-type: none"> 1.0 Analyse shipboard fire hazards, Apply advanced firefighting techniques, and Evaluate command and control during emergencies. (Advanced Fire Fighting (AFF)); 2.0 Recognize medical emergencies, demonstrate first aid procedures, and Apply treatment protocols for injuries and illnesses. (Medical First Aid (MFA)); 3.0 Assess patient conditions, administer medical care for serious illness or injury, and Manage shipboard medical records and telemedicine. (Medical Care (Medi-Care)); 4.0 Operate survival craft equipment, demonstrate launching and handling procedures, and Evaluate survival strategies in emergencies. (Proficiency in Survival Craft and Rescue Boat (PSCRB)); 5.0 Prepare fast rescue boats for deployment, Navigate in rescue scenarios, and Perform casualty recovery operations. (Fast Rescue Boat (FRB)); 6.0 Explain oil tanker safety principles, Apply advanced oil cargo handling procedures, and Evaluate pollution prevention measures specific to oil tankers. (Advanced Oil Tanker Cargo Operation (STCW Code A-V/1-1-2)); 7.0 Explain chemical tanker safety principles, Apply advanced chemical cargo handling procedures, and Evaluate pollution prevention measures specific to chemical tankers. (Advanced Chemical Tanker Cargo Operation (STCW Code A-V/1-1-3)); 8.0 Identify LNG hazards, Operate cargo systems safely, and Assess emergency response procedures for liquefied gas tankers. (Advanced Liquefied Gas Tanker Cargo Operations); 9.0 Explain high-voltage safety principles, Demonstrate switching operations, and Apply fault diagnosis at management level. (High Voltage Training (Management Level)); 10.0 Analyse human factors affecting maritime operations, Demonstrate leadership and communication skills, and Apply resource management principles. (Human Element and Leadership Management (HELM, Management Level)); 		

- 11.0 Plan engine room operations, Coordinate team tasks effectively, and Evaluate decision-making under stress conditions. (Engine Room Resource Management (ERM));
- 12.0 Operate simulator systems, Demonstrate troubleshooting procedures, and Evaluate performance in simulated emergencies. (Engine Room Simulator Course);
- 13.0 Explain ISM Code principles, Apply compliance oversight, and Prepare management reports for safety audits. (International Safety Management (ISM));
- 14.0 Identify ship security threats, Apply ISPS Code procedures, and Demonstrate security drills and threat response strategies. (Ship Security Officer (SSO)).

COMPETENCES:

- **Apply advanced maritime safety, emergency response, technical operations, and leadership competencies**



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY		
COURSE TITLE: ADVANCED SAFETY TRAINING	Course Code: MAR 417	Contact Hours: 4 Hours/Week
	Credit Unit: 4	Theoretical: 2 Hours/Week
Year II Semester: I	Pre-requisite: BASIC SAFETY TRAINING	Practical: 2 Hours/Week

COURSE SPECIFICATION:

General Objective 1.0: Analyse shipboard fire hazards, Apply advanced firefighting techniques, and Evaluate command and control during emergencies. (Advanced Fire Fighting (AFF))

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Evaluate fire risks in all shipboard spaces. 1.2 Develop shipboard fire prevention and control plans. 1.3 Organize inspection, testing, and maintenance of fire detection and extinguishing systems. 1.4 Plan strategies for combating different classes of fire. 1.5 Assess readiness of fire-fighting appliances and fixed installations. 1.6 Manage command, communication, and coordination during fire emergencies.	<ul style="list-style-type: none"> Advanced lectures on ship fire safety management Analysis of real ship fire case studies Demonstration of fixed fire-fighting system layouts (CO₂, foam, sprinkler) Group discussions on fire command decisions Review of SOLAS fire control plans and safety manuals 	<ul style="list-style-type: none"> STCW Code A-VI/3, A-III/2 SOLAS Chapter II-2 (Fire Protection) IMO Model Course 2.03 (Advanced Fire Fighting) Ship fire control plans and manuals Videos and diagrams of fire systems 	1.1 Command and coordinate fire-fighting teams during simulated shipboard fires. 1.2 Direct the operation of fixed fire-fighting systems (CO ₂ flooding, foam systems, sprinklers). 1.3 Supervise boundary cooling and fire containment procedures. 1.4 Control isolation of fuel, ventilation, and	<ul style="list-style-type: none"> Simulated fire command scenarios Live demonstrations of fixed fire systems operation Team-based fire drill supervision exercises Breathing apparatus command and rescue supervision drills Post-drill debrief and 	<ul style="list-style-type: none"> Fire ground / fire simulator facility Fixed fire-fighting system mock-ups (CO₂, foam, hydrants) Breathing apparatus sets and PPE Fire control plan diagrams Drill evaluation checklists and report templates

	<p>1.7 Control ventilation, fuel, and electrical systems to limit fire spread.</p> <p>1.8 Evaluate crew performance during drills and emergencies.</p> <p>1.9 Investigate fire incidents and recommend corrective actions.</p> <p>1.10 Ensure compliance with SOLAS fire safety regulations.</p> <p>1.11 Develop and supervise fire training and drill programs.</p>			<p>electrical systems during fire.</p> <p>1.5 Conduct fire drills as a fire commander.</p> <p>1.6 Supervise the use of breathing apparatus and rescue operations.</p> <p>1.7 Demonstrate decision-making under realistic fire emergency simulations.</p> <p>1.8 Evaluate team performance and debrief after fire exercises.</p> <p>1.9 Prepare fire incident reports and improvement plans.</p>	<p>performance evaluation sessions</p>	
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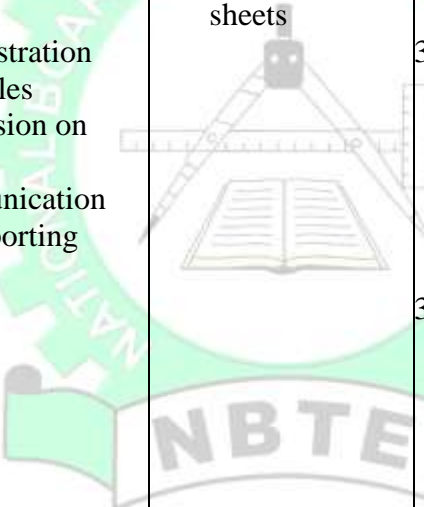
General Objective 2.0: Recognize medical emergencies, Demonstrate first aid procedures, and Apply treatment protocols for injuries and illnesses. (Medical First Aid (MFA))

3	<p>2.1 Assess casualties using systematic medical evaluation.</p> <p>2.2 Determine appropriate first aid for shipboard injuries and illnesses.</p> <p>2.3 Manage bleeding, shock, burns,</p>	<ul style="list-style-type: none"> Lectures on shipboard medical management and casualty assessment Case studies of real maritime medical 	<ul style="list-style-type: none"> STCW Code A-VI/4-1 IMO Model Course 1.14 (Medical First Aid) Ship Captain’s Medical Guide 	<p>2.1 Conduct systematic casualty examination in simulated scenarios.</p> <p>2.2 Perform CPR, bleeding control,</p>	<ul style="list-style-type: none"> Hands-on drills with mannequins for CPR and casualty handling Role-play medical 	<ul style="list-style-type: none"> CPR mannequins and first aid training kits Stretchers, bandages, splints, burn dressings
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	<p>fractures, and unconsciousness.</p> <p>2.4 Administer CPR and life-support measures.</p> <p>2.5 Organize and supervise medical care during emergencies.</p> <p>2.6 Evaluate symptoms and select treatment from the ship's medical chest.</p> <p>2.7 Interpret telemedical advice and apply instructions correctly.</p> <p>2.8 Manage ship hospital arrangement, hygiene, and infection control.</p> <p>2.9 Coordinate casualty evacuation and medical transfer.</p> <p>2.10 Maintain medical records and incident documentation.</p> <p>2.11 Train crew in basic first aid and emergency response.</p>	<p>emergencies</p> <ul style="list-style-type: none"> • Demonstration of ship's medical chest contents and uses • Discussion on radio medical advice procedures (TMAS) • Review of medical record keeping and reporting formats 	<ul style="list-style-type: none"> • Medical manuals and posters • Sample medical logbooks and report forms 	<p>fracture immobilization, and burn treatment.</p> <p>2.3 Demonstrate the use of items from the ship's medical chest correctly.</p> <p>2.4 Simulate receiving and applying telemedical advice.</p> <p>2.5 Supervise team response during medical emergency drills.</p> <p>2.6 Prepare a casualty for evacuation or transfer.</p> <p>2.7 Demonstrate infection control and hygiene procedures in ship hospital.</p> <p>2.8 Complete medical incident reports after simulations.</p>	<p>emergency scenarios and team coordination</p> <ul style="list-style-type: none"> • Demonstration and practice with medical equipment and supplies • Simulation of telemedical consultation and response • Supervised preparation of mock medical reports 	<ul style="list-style-type: none"> • Sample ship medical chest with equipment • PPE and hygiene materials • Medical report templates and checklists
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General Objective: 3.0: Assess patient conditions, Administer medical care for serious illness or injury, and Manage shipboard medical records and telemedicine. (Medical Care (Medi-Care))

4	3.1 Diagnose common	<ul style="list-style-type: none"> • Detailed lectures 	<ul style="list-style-type: none"> • STCW Code 	3.1 Carry out patient	<ul style="list-style-type: none"> • Hands-on 	<ul style="list-style-type: none"> • Medical
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	<p>illnesses and injuries likely to occur onboard ships.</p> <p>3.2 Plan and manage medical treatment using the Ship Captain’s Medical Guide.</p> <p>3.3 Explain the use, dosage, and administration of medicines in the ship’s medical chest.</p> <p>3.4 Interpret symptoms to determine appropriate treatment and monitoring.</p> <p>3.5 Manage serious medical conditions such as heart attack, stroke, severe burns, fractures, and poisoning.</p> <p>3.6 Explain procedures for suturing wounds and advanced wound care.</p> <p>3.7 Describe methods of administering injections and intravenous therapy.</p> <p>3.8 Interpret and apply telemedical advice (TMAS) effectively.</p> <p>3.9 Manage infection control, hygiene, and</p>	<p>on shipboard diagnosis and treatment planning</p> <ul style="list-style-type: none"> • Study of Ship Captain’s Medical Guide and medical chest inventory • Case studies of maritime medical emergencies • Demonstration of drug administration principles • Discussion on TMAS communication and reporting 	<p>A-VI/4-2</p> <ul style="list-style-type: none"> • IMO Model Course 1.15 (Medical Care) • Ship Captain’s Medical Guide • Medical textbooks and posters • Sample medical logbooks and drug inventory sheets 	<p>examination and diagnosis in simulated scenarios.</p> <p>3.2 Administer injections, dress wounds, and perform suturing techniques.</p> <p>3.3 Set up and manage intravenous (IV) therapy under supervision.</p> <p>3.4 Demonstrate proper use of medicines and medical equipment from the ship’s medical chest.</p> <p>3.5 Simulate treatment of severe burns, fractures, poisoning, and cardiac emergencies.</p> <p>3.6 Conduct telemedical consultation and apply received instructions.</p> <p>3.7 Supervise medical</p>	<p>practice with medical mannequins and training kits</p> <ul style="list-style-type: none"> • Demonstration and practice of suturing, injections, and IV setup • Role-play emergency medical scenarios and team coordination • Supervised use of medical chest equipment and drugs • Simulation of casualty evacuation procedures 	<p>mannequins and training first aid kits</p> <ul style="list-style-type: none"> • Suturing kits, syringes, IV sets, dressings • Sample ship medical chest with drugs and equipment • Stretchers, PPE, hygiene materials • Medical report templates and TMAS communication forms
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	<p>disease prevention onboard.</p> <p>3.10 Organize medical evacuation and patient transfer procedures.</p> <p>3.11 Maintain medical logs, treatment records, and drug inventory control.</p> <p>3.12 Train and supervise crew members in assisting with medical care.</p>			<p>assistance from crew during emergency treatment.</p> <p>3.8 Prepare a patient for evacuation or helicopter transfer.</p> <p>3.9 Maintain accurate medical treatment records after simulation.</p> <p>3.10 Demonstrate assessment, monitoring, and supportive care for a seafarer unable to urinate independently, following medical protocols and telemedical guidance. (Catheter)</p>		
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General Objective: 4.0: Operate survival craft equipment, Demonstrate launching and handling procedures, and Evaluate survival strategies in emergencies. (Proficiency in Survival Craft and Rescue Boat (PSCRB))

5	<p>4.1 Explain the construction, equipment, and capabilities of survival craft and rescue boats.</p> <p>4.2 Evaluate readiness and maintenance requirements of</p>	<ul style="list-style-type: none"> Lectures on survival craft design, equipment, and SOLAS requirements Demonstration using survival 	<ul style="list-style-type: none"> STCW Code A-VI/2-1 SOLAS Chapter III (Life-Saving Appliances) IMO Model Course 1.23 	<p>4.1 Command and supervise launching and recovery of lifeboats and rescue boats.</p> <p>4.2 Direct crew during muster,</p>	<ul style="list-style-type: none"> Supervised lifeboat and rescue boat launching drills Command-role simulations 	<ul style="list-style-type: none"> Lifeboats, life rafts, and rescue boats Davits and launching appliances Signaling equipment
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<p>4.3</p> <p>4.4</p> <p>4.5</p> <p>4.6</p> <p>4.7</p> <p>4.8</p> <p>4.9</p> <p>4.10</p>	<p>lifeboats, life rafts, and rescue boats.</p> <p>Plan and organize muster, embarkation, and launching procedures during emergencies.</p> <p>Describe command structure and crew responsibilities in survival craft operations.</p> <p>Explain methods of survival at sea, including rationing, morale, and exposure protection.</p> <p>Describe search and rescue principles and communication procedures.</p> <p>Explain operation of survival craft engines, steering systems, and accessories.</p> <p>Outline procedures for recovering persons from the sea safely.</p> <p>Explain use of signaling equipment and emergency communication devices.</p> <p>Evaluate risks and safety precautions</p>	<p>craft plans and diagrams</p> <ul style="list-style-type: none"> • Case studies of abandon-ship and rescue operations • Group discussion on command decisions during abandon-ship scenarios • Review of muster lists and emergency procedures 	<p>(PSCRB)</p> <ul style="list-style-type: none"> • Survival craft manuals and diagrams • Muster list samples and emergency plans 	<p>embarkation, and lowering procedures.</p> <p>4.3 Operate and supervise survival craft engines, steering, and equipment.</p> <p>4.4 Coordinate rescue operations and recovery of persons from the sea.</p> <p>4.5 Demonstrate use of signaling devices and emergency communication equipment.</p> <p>4.6 Manage survival craft after launching, including ration control and morale.</p> <p>4.7 Supervise righting of capsized life rafts and boarding procedures.</p> <p>4.8 Conduct PSCRB drills as officer in charge.</p> <p>4.9 Evaluate crew</p>	<p>during abandon-ship exercises</p> <ul style="list-style-type: none"> • Hands-on operation of survival craft engines and equipment • Practical recovery of persons from water exercises • Post-drill evaluation and debrief sessions 	<p>(flares, EPIRB, SART)</p> <ul style="list-style-type: none"> • Life-saving appliances and PPE • Drill report templates and checklists
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	<p>during launching and recovery of survival craft.</p> <p>4.11 Ensure compliance with SOLAS requirements for life-saving appliances.</p> <p>4.12 Plan drills and training for crew on survival craft and rescue boat duties.</p>			<p>performance and carry out post-drill debriefing.</p> <p>4.10 Prepare reports on survival craft drills and equipment conditions.</p>		
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General Objective: 5.0: Prepare fast rescue boats for deployment, Navigate in rescue scenarios, and Perform casualty recovery operations. (Fast Rescue Boat (FRB))

6	<p>5.1 Explain the construction, equipment, and performance characteristics of fast rescue boats.</p> <p>5.2 Evaluate readiness, maintenance, and inspection requirements of FRB and launching appliances.</p> <p>5.3 Plan and organize FRB deployment during man-overboard and rescue operations.</p> <p>5.4 Describe command structure and crew responsibilities in FRB operations.</p> <p>5.5 Explain search</p>	<ul style="list-style-type: none"> • Lectures on FRB design, capabilities, and SOLAS requirements • Demonstration using FRB plans, diagrams, and videos • Case studies of man-overboard and rescue scenarios • Group discussions on command decisions during FRB deployment • Review of muster lists and emergency procedures 	<ul style="list-style-type: none"> • STCW Code A-VI/2-2 • SOLAS Chapter III (Life-Saving Appliances) • IMO Model Course 1.24 (Fast Rescue Boats) • FRB manuals and equipment diagrams • Muster lists and rescue plans 	<p>5.1 Command and supervise launching and recovery of the fast rescue boat.</p> <p>5.2 Direct crew during man-overboard and rescue boat deployment.</p> <p>5.3 Operate and supervise FRB engine, steering, and onboard equipment.</p> <p>5.4 Coordinate search patterns and recovery of persons from the sea.</p> <p>5.5 Demonstrate effective communication</p>	<ul style="list-style-type: none"> • Supervised FRB launching and recovery drills • Command-role simulations during man-overboard exercises • Hands-on operation of FRB engines and controls • Practical rescue and casualty recovery exercises 	<ul style="list-style-type: none"> • Fast rescue boat with launching appliance • Life-saving appliances and PPE • Communication equipment (VHF radios) • Dummy casualty for recovery practice • Drill report templates and checklists
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	<p>patterns, rescue techniques, and recovery procedures.</p> <p>5.6 Describe communication procedures between FRB, bridge, and rescue coordination teams.</p> <p>5.7 Explain operational limitations and safety precautions in rough weather and emergency conditions.</p> <p>5.8 Outline procedures for casualty handling and transfer from FRB to ship.</p> <p>5.9 Ensure compliance with SOLAS requirements for rescue boats.</p> <p>5.10 Plan drills and training for crew assigned to FRB duties.</p>			<p>between FRB and the ship.</p> <p>5.6 Supervise casualty handling and safe transfer back to the ship.</p> <p>5.7 Conduct FRB drills as officer in charge.</p> <p>5.8 Evaluate crew performance and carry out post-drill debriefing.</p> <p>5.9 Prepare reports on FRB drills and equipment condition.</p>	<ul style="list-style-type: none"> • Post-drill evaluation and debrief sessions 	
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General Objective: 6.0: Explain oil tanker safety principles, Apply advanced oil cargo handling procedures, and Evaluate pollution prevention measures specific to oil tankers.

7	<p>6.1 Explain the physical and chemical properties of oil cargoes and associated hazards.</p> <p>6.2 Evaluate cargo plans,</p>	<ul style="list-style-type: none"> • Lectures on oil cargo properties, hazards, and tanker systems • Case studies of tanker accidents 	<ul style="list-style-type: none"> • STCW Code A-V/1-1-2 • IMO Model Course 1.02 (Advanced Oil Tanker Cargo 	<p>6.1 Supervise and control cargo loading, discharging, and ballasting operations.</p>	<ul style="list-style-type: none"> • Simulator or mock cargo control exercises • Hands-on demonstrati 	<ul style="list-style-type: none"> • Cargo control simulator or mock-up system • Gas detectors and monitoring instruments
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	<p>stability requirements, and stress considerations during cargo operations.</p> <p>6.3 Plan and supervise loading, discharging, tank cleaning, and ballasting operations.</p> <p>6.4 Explain the operation and safety of cargo pumps, pipelines, valves, and inert gas systems.</p> <p>6.5 Assess risks of fire, explosion, pollution, and contamination during cargo handling.</p> <p>6.6 Explain gas measurement, tank atmosphere control, and enclosed space precautions.</p> <p>6.7 Ensure compliance with MARPOL, SOLAS, and tanker safety regulations.</p> <p>6.8 Describe emergency procedures for cargo leaks, spills, and fire incidents.</p> <p>6.9 Evaluate cargo documentation,</p>	<p>and pollution incidents</p> <ul style="list-style-type: none"> • Demonstration of cargo system diagrams and inert gas layouts • Group discussion on cargo planning and risk assessment • Review of cargo checklists, MSDS, and regulatory requirements 	<p>Operations)</p> <ul style="list-style-type: none"> • SOLAS & MARPOL regulations • Tanker safety guides (ISGOTT) • Cargo system plans and manuals 	<p>6.2 Direct operation of cargo pumps, valves, pipelines, and inert gas system.</p> <p>6.3 Conduct gas testing and tank atmosphere monitoring.</p> <p>6.4 Coordinate communication with terminal staff during cargo operations.</p> <p>6.5 Manage tank cleaning and gas freeing procedures safely.</p> <p>6.6 Demonstrate emergency response to cargo leaks, spills, or fire.</p> <p>6.7 Supervise crew safety and use of PPE during cargo handling.</p> <p>6.8 Complete cargo documentation, logs, and checklists accurately.</p> <p>6.9 Conduct tanker</p>	<p>on of cargo valves, pumps, and IG system controls</p> <ul style="list-style-type: none"> • Gas detection and tank atmosphere testing practice • Role-play communication with terminal during cargo transfer • Emergency spill and fire response simulations 	<ul style="list-style-type: none"> • Cargo system diagrams and checklists • PPE and spill response equipment • Cargo documentation templates and logbooks
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	<p>checklists, and communication with terminal personnel.</p> <p>6.10 Organize crew duties and safety measures during cargo operations.</p> <p>6.11 Plan drills and training related to tanker cargo emergencies.</p> <p>6.12 Investigate and report cargo incidents and recommend corrective actions.</p>			<p>emergency drills as officer in charge.</p> <p>6.10 Evaluate operational performance and carry out post-operation debriefing.</p>		
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General Objective 7.0: Comprehend chemical tanker safety principles, Apply advanced chemical cargo handling procedures, and Evaluate pollution prevention measures specific to chemical tankers.

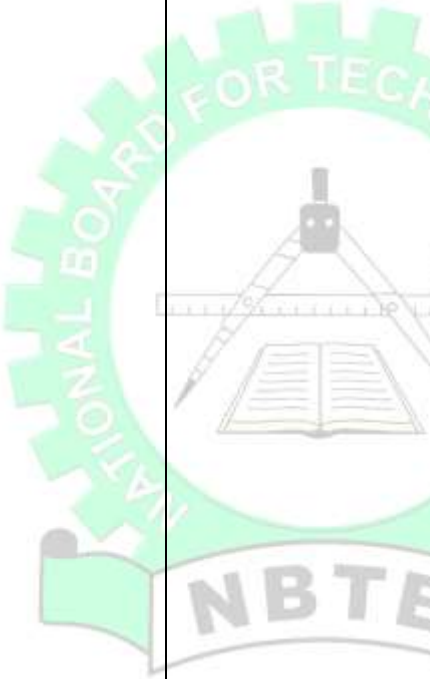
8	<p>7.1 Explain the physical and chemical properties of chemical cargoes and associated hazards (toxicity, reactivity, corrosion).</p> <p>7.2 Evaluate cargo compatibility, segregation, and contamination risks.</p> <p>7.3 Discuss the supervision of loading, discharging, tank cleaning, and ballasting operations</p>	<ul style="list-style-type: none"> Lectures on chemical cargo properties, hazards, and compatibility Case studies of chemical tanker incidents and pollution cases Demonstration of cargo system diagrams and tank arrangements Group discussion on cargo planning and risk assessment 	<ul style="list-style-type: none"> STCW Code A-V/1-1-3 IMO Model Course 1.04 (Advanced Chemical Tanker Cargo Operations) IBC Code, SOLAS & MARPOL regulations Tanker safety guides (ICS/ISGOTT/ ICS Chemical Tanker Guide) 	<p>7.1 Supervise and control chemical cargo loading, discharging, and ballasting operation</p> <p>7.2 Direct operation of cargo pumps, valves, pipelines, heating, and ventilation system conduct gas testing and tank atmosphere monitoring safely.\</p> <p>7.3 Coordinate</p>	<ul style="list-style-type: none"> Simulator or mock cargo control exercises for chemical operations Hands-on demonstration of cargo valves, pumps, and ventilation controls Gas detection and atmosphere 	<ul style="list-style-type: none"> Cargo control simulator or mock-up system Gas detectors and monitoring instruments MSDS, compatibility charts, and cargo checklists PPE and chemical spill response equipment Cargo documentation templates and
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<p>7.4</p> <p>7.5</p> <p>7.6</p> <p>7.7</p> <p>7.8</p> <p>7.9</p> <p>7.10</p>	<p>for chemical cargoes.</p> <p>Explain the operation and safety of cargo pumps, pipelines, valves, heating systems, and ventilation arrangements.</p> <p>Assess risks of fire, explosion, toxicity, and pollution during cargo handling.</p> <p>Explain procedures for tank atmosphere control, gas measurement, and enclosed space precautions.</p> <p>Ensure compliance with MARPOL, SOLAS, IBC Code, and tanker safety regulations.</p> <p>Describe emergency procedures for cargo leaks, spills, toxic exposure, and fire incidents.</p> <p>Evaluate cargo documentation, Material Safety Data Sheets (MSDS), and compatibility charts.</p> <p>Organize crew duties, PPE</p>	<ul style="list-style-type: none"> Review of MSDS, compatibility charts, and regulatory requirements 	<ul style="list-style-type: none"> Cargo system plans and manuals 	<p>communication with terminal staff using cargo checklists and MSDS guidance</p> <p>7.4 Manage tank cleaning, stripping, and gas freeing procedures.</p> <p>7.5 Demonstrate emergency response to cargo leaks, toxic exposure, spills, or fire.</p> <p>7.6 Supervise crew safety and correct use of PPE during cargo handling.</p> <p>7.7 Complete cargo documentation, logs, and compatibility records accurately.</p> <p>7.8 Conduct chemical tanker emergency drills as officer in charge.</p> <p>7.9 Evaluate operational performance and carry out post-operation</p>	<p>testing practice</p> <ul style="list-style-type: none"> Role-play communication with terminal during cargo transfer Emergency spill, toxic exposure, and fire response simulations 	<p>logbooks</p>
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	<p>requirements, and safety measures during cargo operations.</p> <p>7.11 Plan drills and training related to chemical tanker emergencies.</p> <p>7.12 Investigate and report cargo incidents and recommend preventive measures.</p>			debriefing.		
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General Objective 8.0: Identify LG hazards, Operate cargo systems safely, and Assess emergency response procedures for liquefied gas tankers. (Advanced Liquefied Gas (LG) Tanker Cargo Operations)

9	<p>8.1 Explain the physical and chemical properties of liquefied gases and their hazards (cryogenic, flammable, asphyxiant, toxic).</p> <p>8.2 Explain the design and constructional features of the different LNG/LPG tanks.</p> <p>8.3 Evaluate cargo compatibility, segregation, and contamination prevention.</p> <p>8.4 Plan and supervise loading, discharging,</p>	<ul style="list-style-type: none"> Lectures on liquefied gas cargo properties, handling, and hazards Case studies of LNG/LPG incidents and accidents Demonstration of cargo system diagrams, tank arrangements, and control systems Group discussions on cargo planning, risk assessment, and operational decision-making 	<ul style="list-style-type: none"> STCW Code A-V/1-1-4 IMO Model Course 3.21 (Liquefied Gas Tanker Cargo Operations) IGC Code, SOLAS, MARPOL regulations LNG/LPG tanker operation manuals and ISGOTT-style guides Cargo system diagrams, checklists, and 	<p>8.1 Supervise and control LNG/LPG cargo loading, discharging, and transfer operations.</p> <p>8.2 Direct the operation of cargo pumps, compressors, valves, pipelines, and vapour return systems.</p> <p>8.3 Monitor tank pressure, temperature, level, and gas composition during operations.</p> <p>8.4 Apply safety</p>	<ul style="list-style-type: none"> Simulator exercises or mock cargo system training for LNG/LPG operations Supervised handling of valves, pumps, compressors, and pipelines Gas detection and monitoring drills Emergency 	<ul style="list-style-type: none"> Cargo control simulator or mock-up of LNG/LPG system Gas detectors, temperature, and pressure monitoring instruments PPE, cryogenic gloves, face shields, and safety suits Cargo logs, checklists, and emergency response plans Communication equipment for
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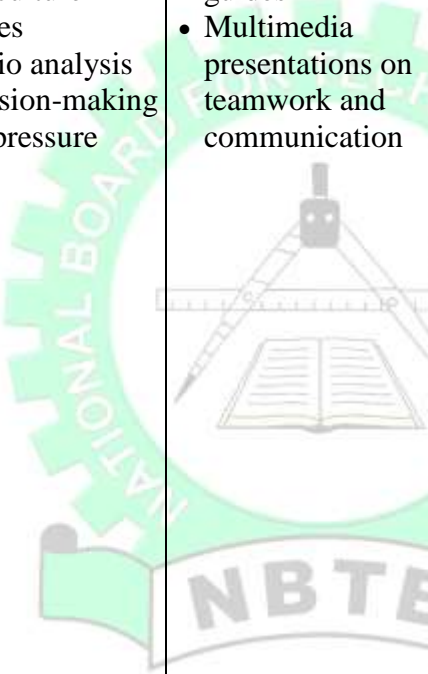
	<p>transfer, and tank cleaning operations.</p> <p>8.5 Explain operation and safety of cargo pumps, pipelines, valves, compressors, and vapour return systems.</p> <p>8.6 Assess risks of fire, explosion, leakage, and environmental pollution during operations.</p> <p>8.7 Describe monitoring and control of tank pressure, temperature, and composition.</p> <p>8.8 Explain procedures for tank venting, inerting, and gas freeing.</p> <p>8.9 Evaluate emergency procedures for gas leaks, spills, fires, or cryogenic injuries.</p> <p>8.10 Ensure compliance with SOLAS, MARPOL, IGC Code, and company safety procedures.</p> <p>8.11 Develop crew training, drills, and contingency planning for</p>	<ul style="list-style-type: none"> Review of regulatory and company manuals, checklists, and contingency plans 	<p>MSDS</p> 	<p>procedures for tank venting, inerting, and gas freeing.</p> <p>8.5 Manage emergency response to leaks, spills, fires, or cryogenic injuries.</p> <p>8.6 Supervise correct use of PPE and safety equipment by crew.</p> <p>8.7 Coordinate communication between bridge, engine room, and terminal staff.</p> <p>8.8 Conduct drills and exercises simulating LNG/LPG cargo emergencies.</p> <p>8.9 Evaluate crew performance and compliance with safety procedures.</p> <p>8.10 Maintain accurate logs, reports, and documentation of cargo operations.</p>	<p>drills: leak, fire, and cryogenic spill scenarios</p> <ul style="list-style-type: none"> Post-operation evaluation, debriefing, and crew performance feedback 	<p>team coordination</p>
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	8.12	LNG/LPG emergencies. Investigate and report cargo incidents, operational deviations, and recommend corrective actions.					
General Objective 9.0: Explain high-voltage safety principles, Demonstrate switching operations, and Apply fault diagnosis at management level. (High Voltage Training (Management Level))							
10	9.1	Explain principles of high-voltage generation, distribution, and protection on board ships.	<ul style="list-style-type: none"> Advanced lectures on shipboard HV systems and protection Study of single-line diagrams and protection layouts Case studies of HV accidents and arc flash incidents Group discussion on HV risk assessment and authorization procedures Demonstration of HV safety documentation and permits 	<ul style="list-style-type: none"> STCW Code A-III/2 IMO/industry HV safety guidance and best practices Ship HV system manuals and single-line diagrams Electrical protection and interlocking diagrams Sample permit-to-work and risk assessment forms 	9.1 Supervise and authorize HV isolation and switching operations safely.	<ul style="list-style-type: none"> Supervised HV switching and isolation exercises on training panels Demonstration of earthing and interlocking procedures Practical fault-finding and testing simulations PPE and insulated tool usage drills Scenario-based HV emergency 	<ul style="list-style-type: none"> HV training panels or simulator boards Insulated tools, earthing rods, and PPE Testing instruments (megger, multimeter, HV tester) Permit-to-work forms and safety checklists Electrical single-line diagrams and manuals
	9.2	Evaluate hazards associated with high-voltage equipment and arc flash risks.			9.2 Direct safe application of earthing and interlocking procedures.		
	9.3	Develop safety procedures and permit-to-work systems for HV operations.			9.3 Conduct risk assessment before HV maintenance or testing.		
	9.4	Explain insulation, earthing, interlocking, and protection systems used in HV installations.			9.4 Supervise testing, fault diagnosis, and monitoring of HV equipment.		
	9.5	Assess risks before authorizing maintenance or fault-			9.5 Ensure correct use of PPE and insulated tools during HV work.		
					9.6 Manage emergency		

	<p>finding on HV systems.</p> <p>9.6 Plan and supervise isolation, switching, and re-energizing procedures.</p> <p>9.7 Interpret HV system drawings, protection schemes, and single-line diagrams.</p> <p>9.8 Explain testing, monitoring, and maintenance requirements of HV equipment.</p> <p>9.9 Ensure compliance with SOLAS and class requirements for HV installations.</p> <p>9.10 Organize crew training and safety drills related to HV hazards.</p> <p>9.11 Investigate and report HV incidents and recommend preventive actions.</p>			<p>response to HV electrical accidents.</p> <p>9.7 Conduct HV safety drills and crew supervision exercises.</p> <p>9.8 Evaluate crew performance and adherence to HV safety procedures.</p> <p>9.9 Complete HV work permits, logs, and safety documentation.</p>	<p>response simulations</p>	
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General Objective 10.0: Analyse human factors affecting maritime operations, Demonstrate leadership and communication skills, and Apply resource management principles (Human Element and Leadership Management (HELM))

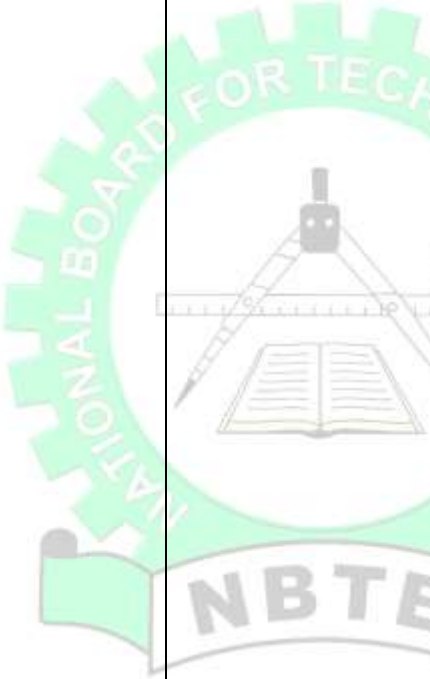
11	<p>10.1 Explain human element factors affecting safety and performance onboard.</p> <p>10.2 Evaluate the impact</p>	<ul style="list-style-type: none"> Lectures on leadership and human element principles Case studies of maritime accidents 	<ul style="list-style-type: none"> STCW Code A-III/2 leadership tables IMO Model Course 7.01 (Leadership & 	<p>10.1 Demonstrate effective leadership during simulated shipboard</p>	<ul style="list-style-type: none"> Role-play leadership and conflict management scenarios Team-based 	<ul style="list-style-type: none"> Simulator facilities or scenario scripts Role-play guides and evaluation checklists
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<p>10.3</p> <p>10.4</p> <p>10.5</p> <p>10.6</p> <p>10.7</p> <p>10.8</p> <p>10.9</p> <p>10.10</p>	<p>of fatigue, stress, and workload on crew efficiency.</p> <p>Describe leadership styles and their application in shipboard management.</p> <p>Assess communication barriers and methods to improve team communication.</p> <p>Explain principles of motivation, discipline, and conflict management.</p> <p>Evaluate decision-making processes in normal and emergency situations.</p> <p>Explain cultural awareness and its effect on teamwork onboard.</p> <p>Describe situational awareness and risk perception in ship operations.</p> <p>Explain the role of safety culture and reporting systems.</p> <p>Plan training,</p>	<p>caused by human error</p> <ul style="list-style-type: none"> Group discussions on leadership challenges at sea Review of STCW leadership requirements and safety culture practices Scenario analysis of decision-making under pressure 	<p>Teamwork)</p> <ul style="list-style-type: none"> Case study materials from maritime incidents Company SMS manuals and safety culture guides Multimedia presentations on teamwork and communication 	<p>operations.</p> <p>10.2 Manage team communication and task allocation in practical scenarios.</p> <p>10.3 Resolve conflicts and disciplinary issues through role-play exercises.</p> <p>10.4 Apply decision-making skills in emergency and routine simulations.</p> <p>10.5 Demonstrate situational awareness and risk assessment in team tasks.</p> <p>10.6 Conduct crew briefings, debriefings, and performance feedback sessions.</p> <p>10.7 Supervise teamwork during drills and operational simulations.</p> <p>10.8 Evaluate team</p>	<p>simulator exercises (engine room/bridge scenarios)</p> <ul style="list-style-type: none"> Supervise group problem-solving tasks Briefing and debriefing practice sessions Performance evaluation and feedback exercises 	<ul style="list-style-type: none"> Communication equipment for simulation Leadership assessment templates and report forms
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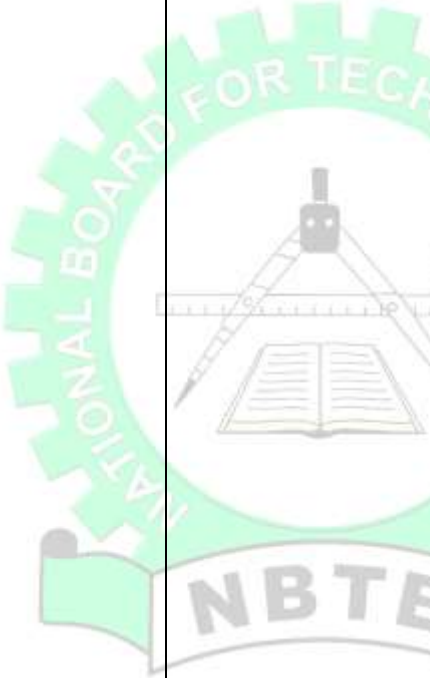
	mentoring, and performance evaluation of crew. 10.11 Ensure compliance with company procedures and international safety standards. 10.12 Investigate human error incidents and recommend preventive measures.			performance and identify areas for improvement. 10.9 Prepare reports on team performance and leadership effectiveness.		
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General Objective 11.0: Plan engine room operations, Coordinate team tasks effectively, and Evaluate decision-making under stress conditions. (Engine Room Resource Management (ERM))

12	<p>11.1 Explain principles of resource management in the engine room.</p> <p>11.2 Evaluate crew competence, roles, and responsibilities for optimal engine room performance.</p> <p>11.3 Plan and organize engine room operations, maintenance, and watchkeeping schedules.</p> <p>11.4 Assess risks associated with human error, fatigue, and communication failures.</p>	<ul style="list-style-type: none"> Lectures on ERM principles and human element factors Case studies of engine room incidents and accidents Group discussion on watchkeeping, resource allocation, and fatigue management Analysis of communication and decision-making processes in the engine room Review of 	<ul style="list-style-type: none"> STCW Code A-III/2 ERM requirements IMO Model Course 7.03 (Engine Room Resource Management) Engine room manuals, SMS, and checklists Case study materials and incident reports Multimedia presentations on ERM principles 	<p>11.1 Supervise and coordinate engine room operations during normal and emergency conditions.</p> <p>11.2 Allocate tasks effectively among engine room personnel based on competence and workload.</p> <p>11.3 Demonstrate effective communication and handover procedures during watch changes.</p>	<ul style="list-style-type: none"> Supervised simulator exercises or live engine room operations Role-play team coordination, task allocation, and emergency response Watchkeeping handover and communication drills Problem-solving 	<ul style="list-style-type: none"> Engine room simulator or mock-up Engine room operational manuals, checklists, and logs Communication tools and alarm panels PPE and safety equipment for supervised drills Evaluation templates and performance checklists
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<p>11.5</p> <p>11.6</p> <p>11.7</p> <p>11.8</p> <p>11.9</p> <p>11.10</p>	<p>Explain effective communication protocols and reporting procedures in engine operations.</p> <p>Describe teamwork, decision-making, and coordination strategies for engine room tasks.</p> <p>Develop contingency plans for engine failures and emergency scenarios.</p> <p>Evaluate safety culture and compliance with company and STCW procedures.</p> <p>Plan training, mentoring, and supervision of engine room personnel.</p> <p>Investigate and report incidents, recommending measures to prevent recurrence.</p>	<p>company SMS, STCW A-III/2, and ERM manuals</p>		<p>11.4 Manage crew performance and maintain operational safety standards.</p> <p>11.5 Apply contingency plans and decision-making during engine failures or emergencies.</p> <p>11.6 Monitor engine room systems and respond appropriately to alarms and faults.</p> <p>11.7 Conduct ERM drills, including teamwork, coordination, and problem-solving exercises.</p> <p>11.8 Evaluate team performance and provide feedback during debriefing.</p> <p>11.9 Maintain accurate logs, reports, and records of engine room</p>	<p>exercises for engine failures</p> <ul style="list-style-type: none"> • Post-drill evaluation and debriefing sessions 	
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operations.						
General Objective 12.0: Operate simulator systems, Demonstrate troubleshooting procedures, and Evaluate performance in simulated emergencies. (Engine Room Simulator Course)						
13	<p>12.1 Explain the purpose, benefits, and capabilities of engine room simulators.</p> <p>12.2 Evaluate scenarios for operational, technical, and emergency decision-making.</p> <p>12.3 Plan engine room operations within simulated scenarios.</p> <p>12.4 Assess risks, crew competence, and system limitations in simulated operations.</p> <p>12.5 Explain communication protocols and reporting procedures for engine room teams.</p> <p>12.6 Describe emergency response procedures for system failures, fires, flooding, and other critical incidents.</p> <p>12.7 Develop contingency plans for operational and technical failures.</p>	<ul style="list-style-type: none"> Lectures on simulator operations and scenario planning Demonstration of simulator interface, alarms, and system monitoring Case studies of engine room incidents and emergency scenarios Group discussion on risk assessment, decision-making, and team coordination Review of STCW A-III/2 requirements and company SMS 	<ul style="list-style-type: none"> STCW Code A-III/2 Engine Room Simulator manuals and guides IMO Model Course 2.07 (Engine Room Simulator) Engine room operational manuals, checklists, and logs Case study materials and multimedia presentations 	<p>12.1 Supervise and command engine room operations in a simulated environment.</p> <p>12.2 Allocate tasks effectively among simulator crew based on competence and scenario requirements.</p> <p>12.3 Demonstrate communication, handover, and reporting procedures in simulated watchkeeping.</p> <p>12.4 Apply decision-making and contingency plans during simulated system failures or emergencies.</p> <p>12.5 Coordinate team performance and safety procedures in</p>	<ul style="list-style-type: none"> Supervised simulator exercises replicating normal and emergency engine room conditions Role-play team coordination, task allocation, and problem-solving Simulation of emergency scenarios (fire, flooding, machinery failure) Watchkeeping and handover drills in the simulator Post-simulation evaluation, 	<ul style="list-style-type: none"> Engine room simulator (full mission or part task) Operational manuals, system diagrams, and logs Communication tools for simulated team coordination PPE for realistic emergency drills Evaluation checklists and debriefing templates

	<p>12.8 Evaluate human element factors affecting simulator operations.</p> <p>12.9 Plan crew training, mentoring, and performance assessment using the simulator.</p> <p>12.10 Investigate and report simulator scenarios to recommend improvements in operations.</p>			<p>the simulator exercises.</p> <p>12.6 Monitor simulated engine systems, alarms, and faults, taking appropriate action.</p> <p>12.7 Conduct simulator drills including fire, flooding, propulsion failure, and electrical faults.</p> <p>12.8 Evaluate crew performance and provide feedback during debriefing sessions.</p> <p>12.9 Maintain accurate records, logs, and reports of simulator exercises.</p>	<p>debriefing, and performance feedback</p>	
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General Objective 13.0: Explain ISM Code principles, Apply compliance oversight, and Prepare management reports for safety audits. (International Safety Management (ISM))

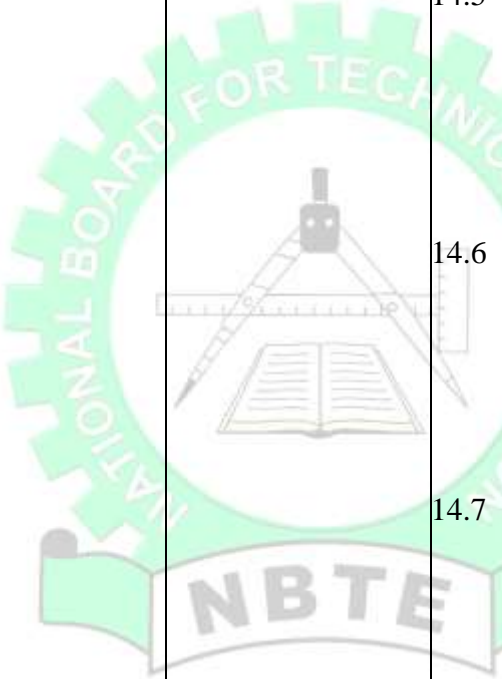
14	<p>13.1 Explain the objectives and structure of the ISM Code and Safety Management System</p>	<ul style="list-style-type: none"> Lectures on ISM Code objectives and framework Case studies of SMS 	<ul style="list-style-type: none"> STCW Code A-III/2 ISM Code (IMO Resolution 	<p>13.1 Implement and supervise SMS procedures onboard effectively.</p>	<ul style="list-style-type: none"> Supervised shipboard safety inspections and risk 	<ul style="list-style-type: none"> Company SMS manuals and checklists Risk assessment
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	<p>(SMS).</p> <p>13.2 Evaluate company SMS policies, procedures, and their application onboard.</p> <p>13.3 Plan and organize implementation of the SMS for shipboard operations.</p> <p>13.4 Assess risks, compliance, and crew adherence to safety procedures.</p> <p>13.5 Explain the reporting and documentation requirements under ISM.</p> <p>13.6 Describe audit procedures, internal safety inspections, and corrective actions.</p> <p>13.7 Evaluate emergency preparedness and response planning within the SMS framework.</p> <p>13.8 Explain the responsibilities of the Safety Officer and Master in ISM compliance.</p> <p>13.9 Develop training and awareness programs</p>	<p>implementation and incident investigations</p> <ul style="list-style-type: none"> • Group discussions on risk assessment and compliance challenges • Demonstration of audit procedures, checklists, and documentation • Review of company SMS manuals and STCW management-level expectations 	<p>A.741(18)) and SOLAS Chapter IX</p> <ul style="list-style-type: none"> • Company SMS manuals and procedures • Incident investigation reports and case studies • Templates for audits, checklists, and safety reports 	<p>13.2 Conduct risk assessments and safety inspections according to SMS procedures.</p> <p>13.3 Manage documentation, non-conformities, and corrective/preventive actions.</p> <p>13.4 Direct crew during drills, emergencies, and routine safety operations.</p> <p>13.5 Coordinate internal audits and evaluate compliance with SMS and ISM Code.</p> <p>13.6 Apply incident investigation procedures and recommend improvements.</p> <p>13.7 Train and mentor crew in safety awareness,</p>	<p>assessment exercises</p> <ul style="list-style-type: none"> • Role-play incident investigation and corrective action procedures • Simulation of emergency drills and safety procedure application • Supervised internal audit exercises and compliance checks • Debriefing and evaluation of crew performance and adherence 	<p>forms and incident report templates</p> <ul style="list-style-type: none"> • Drill equipment and safety devices (fire, lifeboat, lifesaving equipment) • Audit forms, logs, and documentation templates • Multimedia scenarios for incident simulations
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	<p>to promote safety culture onboard.</p> <p>13.10 Investigate and report incidents and non-conformities in line with ISM procedures.</p> <p>13.11 Ensure compliance with international conventions (SOLAS, MARPOL, STCW) via the SMS.</p>			<p>procedures, and best practices.</p> <p>13.8 Monitor adherence to environmental, safety, and operational regulations.</p> <p>13.9 Prepare SMS reports, safety summaries, and audit documentation for submission.</p>		
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General Objective 14.0: Identify ship security threats, Apply ISPS Code procedures, and Demonstrate security drills and threat response strategies. (Ship Security Officer (SSO))

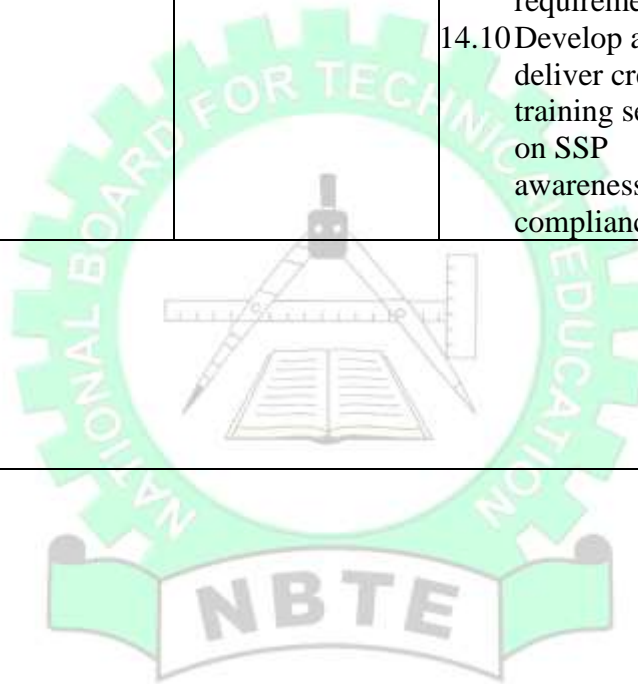
15	<p>14.1 Explain the objectives and requirements of the ISPS Code and ship security plan (SSP).</p> <p>14.2 Evaluate shipboard security risks and vulnerability assessments.</p> <p>14.3 Plan and organize security measures to prevent unauthorized access, sabotage, or terrorism.</p> <p>14.4 Assess security threats under different MARSEC levels.</p>	<ul style="list-style-type: none"> Lectures on ISPS Code, Ship Security Plan (SSP), and security threat management Case studies of maritime security incidents Group discussions on MARSEC levels and implementation of SSP measures Demonstration of SSP application onboard Review of 	<ul style="list-style-type: none"> STCW Code A-III/2 ISPS Code (IMO Resolution A.924(22)) Ship Security Plan (SSP) manuals Company security procedures Incident reports, checklists, and multimedia scenarios 	<p>14.1 Supervise and implement the ship security plan (SSP) effectively onboard.</p> <p>14.2 Conduct risk assessment and vulnerability checks as per SSP guidelines on the ship.</p> <p>14.3 Monitor and control access points, cargo, and personnel in accordance with MARSEC</p>	<ul style="list-style-type: none"> Supervised access control, patrols, and monitoring exercises per SSP Simulated emergency scenarios requiring SSP procedures Hands-on demonstration of security equipment 	<ul style="list-style-type: none"> Ship Security Plan (SSP) manuals and implementation guides Access control devices, CCTV, and alarm systems PPE and communication tools for drills Incident report forms and checklists Simulation props for drills (dummy
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<p>14.5 Explain the responsibilities of the SSO, master, and crew in ship security.</p> <p>14.6 Describe the content, structure, and implementation of the Ship Security Plan (SSP)</p> <p>14.7 Describe procedures for monitoring, controlling, and reporting security incidents.</p> <p>14.8 Evaluate the implementation of security drills and exercises.</p> <p>14.9 Explain communication protocols with port authorities and company security officers.</p> <p>14.10 Develop training programs for crew on security awareness and emergency response.</p> <p>14.11 Investigate and report security breaches, incidents, and non-compliances.</p> <p>14.12 Ensure compliance</p>	<p>reporting procedures, drills, and documentation</p>		<p>levels.</p> <p>14.4 Direct security team during drills, exercises, and emergency situations following the SSP.</p> <p>14.5 Demonstrate proper reporting procedures for security incidents as outlined in the SSP.</p> <p>14.6 Coordinate communication with port and company security officers regarding SSP compliance.</p> <p>14.7 Conduct security drills including simulated attacks, unauthorized boarding, or suspicious activities.</p> <p>14.8 Evaluate crew performance and compliance with SSP and</p>	<p>(locks, CCTV, alarms) per SSP guidelines</p> <ul style="list-style-type: none"> • Role-play incident response and reporting exercises • Post-drill debriefing and evaluation against SSP standards 	<p>intruders, mock threats)</p>
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	with SOLAS, STCW, and company security procedures.			<p>other security procedures.</p> <p>14.9 Maintain accurate logs, reports, and security documentation as per SSP requirements.</p> <p>14.10 Develop and deliver crew training sessions on SSP awareness and compliance.</p>		
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Course assessment

Course work:	10%
Test/Assessment:	10%
Practical:	40%
Examination:	40%
Total:	100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: SHIP AUTOMATION AND CONTROL SYSTEMS	Course Code: MAR 418	Credit Unit: 4	Contact Hours: 4 Hours/Week
			Theoretical: 2 Hours/Week
Year I Semester I	Pre-Requisite		Practical: 2 Hours/Week
<p>GENERAL OBJECTIVES:</p> <p>On completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1.0 Analyze the four different control systems in use; 2.0 Evaluate open and closed loop control systems; 3.0 Analyze control system components and process control; 4.0 Evaluate schematic representation of control signals; 5.0 Analyze transfer functions; 6.0 Evaluate frequency response methods; 7.0 Analyze transducers; 8.0 Evaluate automatic control theory; 9.0 Analyze automatic control for boilers; 10.0 Evaluate automatic control for marine diesel engines; 11.0 Analyze tanker cargo and dynamic positioning systems; 12.0 Manage troubleshooting and restoration of monitoring and control equipment. 			
<p>COMPETENCE:</p> <ul style="list-style-type: none"> • Manage the operation of propulsion plant machinery. • Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery • Manage operation of electrical and electronic control equipment. • Manage troubleshooting, restoration of electrical and electronic control equipment to operating condition • Control trim, stability and stress 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: SHIP AUTOMATION AND CONTROL SYSTEMS		Course Code: MAR 418		Credit Unit: 4	Contact Hours: 4 Hours/Week	
						Theoretical: 2 Hours/Week
Year: II Semester: I		Pre-requisite		Practical: 2 Hours/Week		
General Objective 1.0: Analyze the four different control systems in use						
	THEORETICAL CONTENTS			PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 2	1.1. Describe mechanical, pneumatic, hydraulic, and electronic control systems. 1.2. State which systems are most used in marine environments and why. 1.3. Explain control philosophies for successful automation. 1.4. Evaluate objectives for adopting automation.	<ul style="list-style-type: none"> Lectures with sketches; case studies of automation adoption; guided discussions. 	<ul style="list-style-type: none"> Control engineering texts; multimedia projector. 	1.1 Identify pneumatic, hydraulic, and electronic systems. 1.2 Demonstrate sensors, actuators, valves, and link mechanisms.	<ul style="list-style-type: none"> Supervise lab demonstrations Guide identification exercises. 	<ul style="list-style-type: none"> Control lab equipment; simulators.
General Objective 2.0: Evaluate open and closed loop control systems						
3	2.1 Sketch and explain open/closed loop systems. 2.2 Describe continuous/sequential open loop systems with ship examples.	<ul style="list-style-type: none"> Lectures; MATLAB/SI MULINK demonstrations; guided sketches. 	<ul style="list-style-type: none"> MATLAB/SI MULINK; projector; textbooks. 	2.1 Sketch and test flow rate/direction in loops. 2.2 Demonstrate feedback response.	<ul style="list-style-type: none"> Supervise loop control experiments; guide MATLAB simulations. 	<ul style="list-style-type: none"> Loop control trainer; simulators.

	2.3 Explain on/off and continuous closed loop systems. 2.4 Describe positive and negative feedback.					
General Objective 3.0: Analyze control system components and process control						
4-5	3.1 State components of a control circuit. 3.2 Describe data logger systems. 3.3 Explain parameter sensing instruments. 3.4 Define process control and servo-mechanisms. 3.5 Describe recording/display equipment.	<ul style="list-style-type: none"> Lectures with sketches; case studies; guided problem solving. 	<ul style="list-style-type: none"> Data loggers; oscilloscopes; sensors. 	3.1 Demonstrate use of sensors and loggers. 3.2 Record and interpret process data.	<ul style="list-style-type: none"> Supervise instrumentation exercises, Guide process control practicals. 	<ul style="list-style-type: none"> Lab instruments, transducers.
General Objective 4.0: Evaluate schematic representation of control signals						
6	4.1 Sketch and describe signals in control systems. 4.2 Explain time lag and sensitivity. 4.3 Describe signal conditioning methods.	<ul style="list-style-type: none"> Lectures; guided sketches; mathematical derivations. 	<ul style="list-style-type: none"> Oscilloscopes, signal generators. 	4.1 Generate signals using oscilloscope. 4.2 Derive and calculate signal functions.	<ul style="list-style-type: none"> Supervise signal generation; guide derivations. 	<ul style="list-style-type: none"> Signal generators; lab kits.
General Objective 5.0: Analyze transfer functions						
7-8	5.1 Derive transfer functions for block	<ul style="list-style-type: none"> Lectures; worked examples; 	<ul style="list-style-type: none"> PCs; MATLAB/ SIMULINK; textbooks. 	5.1 Perform input-output	<ul style="list-style-type: none"> Supervise block diagram 	<ul style="list-style-type: none"> MATLAB/ SIMULINK

	<p>diagrams.</p> <p>5.2 Solve system problems using Laplace transforms.</p> <p>5.3 Describe proportional, derivative, and integral control actions.</p> <p>5.4 Explain zero, first, and second order systems.</p>	<p>MATLAB/ SIMULINK exercises.</p>		<p>relationships.</p> <p>5.2 Demonstrate PI/PID controllers.</p>	<p>exercises; guide controller simulations.</p>	<ul style="list-style-type: none"> Control trainer.
General Objective 6.0: Evaluate frequency response methods						
9	<p>6.1 Define frequency response.</p> <p>6.2 Describe transient/steady state response.</p> <p>6.3 Design systems using Nyquist, Bode, Root-Locus plots.</p> <p>6.4 Explain Lisajous figures and input responses.</p>	<ul style="list-style-type: none"> Lectures; case studies; MATLAB demonstrations. 	<ul style="list-style-type: none"> Frequency response trainer; MATLAB/SIMULINK. 	<p>6.1 Demonstrate stability using MATLAB.</p>	<ul style="list-style-type: none"> Supervise MATLAB exercises Guide frequency response tests. 	<ul style="list-style-type: none"> Frequency response trainer; lab kits.
General Objective 7.0: Analyze transducers						
10	<p>7.1 Define transducers with examples.</p> <p>7.2 Explain block diagram of transducer elements.</p> <p>7.3 State characteristics and sensitivity.</p> <p>7.4 Describe electrical, resistance,</p>	<ul style="list-style-type: none"> Lectures; guided sketches; case studies. 	<ul style="list-style-type: none"> Transducer manuals; lab equipment. 	<p>7.1 Identify types of transducers.</p> <p>7.2 Select and apply transducer in experiment.</p>	<ul style="list-style-type: none"> Supervise identification Guide students to perform experiments. 	<ul style="list-style-type: none"> Transducer kits; lab instruments.

	electromagnetic, and mechanical transducers.					
GENERAL OBJECTIVE 8.0: Evaluate automatic control theory						
11	8.1 Describe automatic control systems. 8.2 Sketch closed loop systems. 8.3 Define gain and proportional band. 8.4 Explain effects of derivative/integral actions. 8.5 Describe cascade control.	<ul style="list-style-type: none"> Lectures; case studies; MATLAB simulations. 	<ul style="list-style-type: none"> Feedback trainer; MATLAB/SIMULINK. 	8.1 Perform closed loop control using trainer.	<ul style="list-style-type: none"> Supervise feedback trainer exercises; guide cascade control demonstrations. 	<ul style="list-style-type: none"> Feedback trainer; simulators.
General Objective 9.0: Analyze automatic control for boilers						
12	9.1 Describe boiler water level and steam control. 9.2 Explain sequential burner control. 9.3 Describe steam quality and closed feed systems.	<ul style="list-style-type: none"> Lectures; case studies; ship visit. 	<ul style="list-style-type: none"> Boiler models; simulators. 	9.1 Identify boiler control systems onboard. 9.2 Demonstrate principles of operation.	<ul style="list-style-type: none"> Supervise ship visit; 	<ul style="list-style-type: none"> Boiler trainer; shipboard systems.
General Objective 10.0: Evaluate automatic control for marine diesel engines.						
13	10.1 Sketch mechanical, hydraulic, and electronic governors. 10.2 Describe viscometer systems.	<ul style="list-style-type: none"> Lectures; sketches; case studies; simulator exercises. 	<ul style="list-style-type: none"> Governor models; control system diagrams. 	10.1 Identify governors and control elements. 10.2 Demonstrate viscometer and	<ul style="list-style-type: none"> Supervise identification Supervise simulation exercises. 	<ul style="list-style-type: none"> Engine simulator; governor models.

	<p>10.3 Explain remote starting/control arrangements (ECR/Bridge).</p> <p>10.4 Describe LO and JCW temperature control circuits.</p> <p>10.5 Explain cascade control for JCW</p>			JCW control.		
General Objective 11.0: Analyze tanker cargo automation and dynamic positioning systems						
14	<p>11.1 Describe automatic tank washing and inert gas systems.</p> <p>11.2 Explain tanker loading/discharge automation.</p> <p>11.3 Sketch and describe dynamic positioning systems (DP)</p> <p>11.4 Evaluate DP redundancy, control philosophy, and fault tolerance.</p> <p>11.5 Discuss management responsibilities in DP operation.</p>	<ul style="list-style-type: none"> Lectures; case studies; ship visit; simulator demonstrations. 	<ul style="list-style-type: none"> Tanker cargo system diagrams; DP simulator; IMO manuals. 	<p>11.1 Tanker cargo system diagrams; DP simulator; IMO manuals.</p>	<ul style="list-style-type: none"> Supervise ship visit; guide DP simulator drills; facilitate fault scenario analysis. 	<ul style="list-style-type: none"> DP simulator; tanker cargo trainer; PPE.
General Objective 12.0: Manage troubleshooting and restoration of monitoring and control equipment.						
15	<p>12.1 Identify common faults in automation and monitoring systems.</p>	<ul style="list-style-type: none"> Case-based lectures; scenario analysis; guided 	<ul style="list-style-type: none"> Fault reports; diagnostic guides; IMO/ETB702E 	<p>12.1 Simulate automation faults.</p> <p>12.2 Diagnose failures in monitoring or</p>	<ul style="list-style-type: none"> Supervise fault simulations; guide restoration 	<ul style="list-style-type: none"> Fault simulation kits; diagnostic

	<p>12.2 Analyze causes of sensor, actuator, and signal failures.</p> <p>12.3 Evaluate risks of continued operation under fault conditions.</p> <p>12.4 Approve corrective and contingency actions.</p> <p>12.5 Demonstrate supervisory responsibility in restoring systems to operating condition.</p>	troubleshooting exercises.	references.	<p>control equipment.</p> <p>12.3 Recommend corrective actions and supervise restoration.</p>	drills; facilitate management decision role-plays.	manuals; control lab equipment.
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Course Assessment:

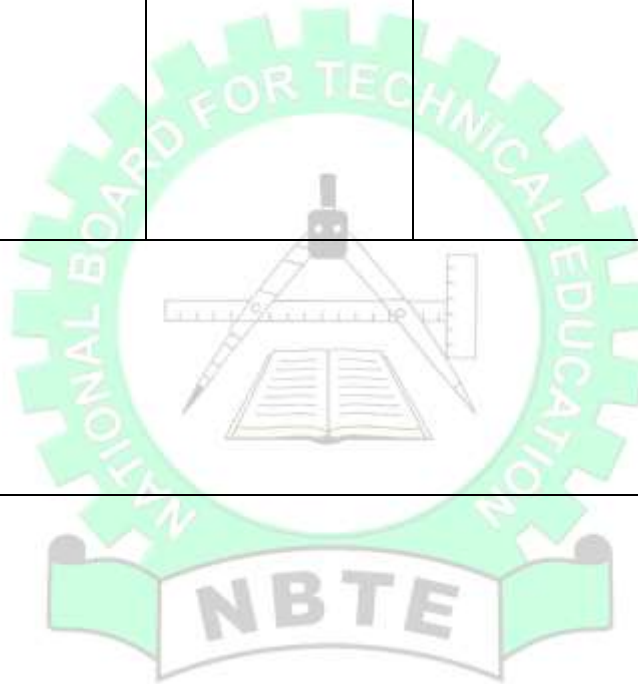
Course work: 10%

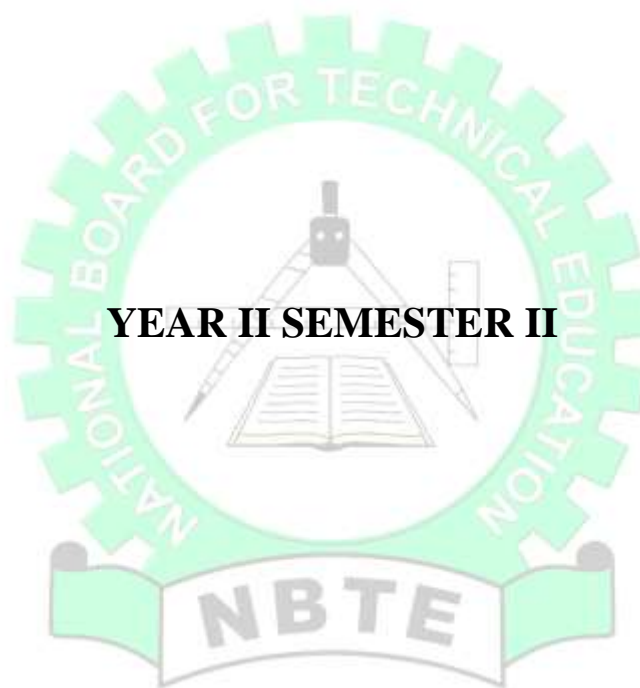
Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%





YEAR II SEMESTER II

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: SHIPBOARD MAINTENANCE MANAGEMENT	Course Code: MAR 421	Credit Unit: 4	Contact Hours: 4hours/ Week
			Theoretical: 2hours / Week
Year: II Semester II	Pre-requisite:		Practical: 2hours / Week
GOAL: This course is designed to equip the students with knowledge and skills to apply management-level competence in planning, supervising, and controlling shipboard maintenance using Planned Maintenance Systems (PMS), integrating classification society rules, statutory survey requirements, and documentation control, and ensuring machinery reliability, safety, and regulatory compliance, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Apply Principles of Planned Maintenance Systems (PMS) Onboard Ships; 2.0 Comprehend how to plan, organize, and control maintenance activities for main and auxiliary machinery onboard ships; 3.0 Integrate maintenance planning with watchkeeping, operational demands, and environmental protection requirements; 4.0 Apply Maintenance Planning Decisions and Management Review on Shipboard Machinery; 5.0 Prepare Maintenance Documentation, Records for Audit Readiness; 6.0 Understand Statutory Surveys and Classification Society Requirements; 7.0 Promote a Culture of Reliability, Safety, Preventive and Corrective maintenance onboard vessel. 			
COMPETENCE			
<ul style="list-style-type: none"> • Manage safe and effective maintenance and repair procedures. • Detect and identify the cause of machinery malfunctions and correct faults. 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: SHIPBOARD MAINTENANCE MANAGEMENT		Course Code: MAR 421	Credit Unit: 4	Contact Hours: 4hours/Week		
				Theoretical: 2hours /Week		
Year: II Semester II		Pre-requisite:		Practical: 2hours/Week		
General Objective 1.0: Apply Principles of Planned Maintenance Systems (PMS) Onboard Ships						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-2	1.1 Explain the objectives and structure of Planned Maintenance Systems of Shipboard Machinery. 1.2 Describe PMS components and scheduling logic. 1.3 Differentiate between preventive, condition-based, and corrective maintenance of Shipboard machinery. 1.4 Evaluate the role of PMS in shipboard machinery reliability and safety. 1.5 Explain management-level	<ul style="list-style-type: none"> Lectures Guided discussions 	<ul style="list-style-type: none"> PMS manuals Maintenance flowcharts Whiteboard, Smartboard, Multimedia Videos 	1.1 Interpret PMS schedules. 1.2 Identify maintenance intervals and task priorities.	<ul style="list-style-type: none"> PMS interpretation exercises Simulate watchkeeping conditions while students plan maintenance tasks. Guide students in conducting risk assessments before maintenance work. Demonstrate how maintenance 	<ul style="list-style-type: none"> Planned Maintenance System (PMS) software or job cards Manufacturer's manuals for main engine and auxiliary machinery Maintenance schedules and checklists Engine room layout drawings and machinery P&IDs Maintenance logbooks and

	understanding of PMS oversight responsibilities.				<p>can be carried out without interrupting engine room operations.</p> <ul style="list-style-type: none"> • Explain management-level understanding of PMS oversight responsibilities. 	<p>record sheets</p> <ul style="list-style-type: none"> • Tool kits and sample spare parts catalogues
General Objective: 2.0: Comprehend how to plan, organize, and control maintenance activities for main and auxiliary machinery onboard ships.						
3-4	<p>2.1 Explain maintenance planning principles for main and auxiliary machinery.</p> <p>2.2 Describe how to prioritize maintenance based on machinery criticality.</p> <p>2.3 Discuss PMS schedules, job cards, and manufacturer’s maintenance instructions.</p> <p>2.4 Identify manpower, tools, and spare</p>	<ul style="list-style-type: none"> • Lecture 2.1-2.5 	<ul style="list-style-type: none"> • Whiteboard, Smartboard, Multimedia, Videos, Company’s manual 	<p>2.1 Prepare a maintenance plan for selected engine room machinery.</p> <p>2.2 Use PMS/job cards to schedule and monitor maintenance tasks.</p> <p>2.3 Allocate manpower and resources for maintenance activities.</p>	<ul style="list-style-type: none"> • PMS interpretation exercises • Simulate watchkeeping conditions while students plan maintenance tasks. • Guide students in conducting risk assessments before maintenance 	<ul style="list-style-type: none"> • Planned Maintenance System (PMS) software or job cards • Manufacturer’s manuals for main engine and auxiliary machinery • Maintenance schedules and checklists • Engine room layout drawings and

	<p>parts required for maintenance tasks.</p> <p>2.5 Explain documentation and control of completed maintenance work.</p>			<p>2.4 Supervise maintenance work to ensure compliance with procedures.</p> <p>2.5 Record completed tasks in maintenance logs and PMS records.</p>	<p>work.</p>	<p>machinery P&IDs</p> <ul style="list-style-type: none"> • Maintenance logbooks and record sheets • Tool kits and sample spare parts catalogues
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General Objective 3.0: Integrate maintenance planning with watchkeeping, operational demands, and environmental protection requirements.

<p>5-6</p>	<p>3.1 Explain how watchkeeping schedules affect maintenance planning.</p> <p>3.2 Identify operational conditions that influence maintenance timing.</p> <p>3.3 Describe environmental risks associated with poor maintenance.</p> <p>3.4 Explain coordination between maintenance tasks and engine room</p>	<ul style="list-style-type: none"> • Lecture 3.1-3.5 	<ul style="list-style-type: none"> • Whiteboard, Smartboard, Multimedia, Videos, Company’s manual • Engine room watchkeeping schedules and logbooks • Risk assessment and permit-to-work forms • MARPOL guidelines related to maintained 	<p>3.1 Adjust maintenance schedules to suit watchkeeping and voyage demands.</p> <p>3.2 Conduct maintenance without disrupting safe engine room operations.</p> <p>3.3 Apply risk assessment before carrying out maintenance</p>	<ul style="list-style-type: none"> • Plan and execute maintenance tasks under simulated watchkeeping conditions. • Conduct risk assessment before performing maintenance on engine room machinery. • Carry out maintenance without 	<ul style="list-style-type: none"> • Engine room watch schedules and logbooks • Permit-to-work forms and risk assessment templates • Operational scenario worksheets (voyage, port, maneuvering conditions) • Pollution prevention equipment
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	<p>operations.</p> <p>3.5 Discuss the importance of pollution prevention equipment maintenance in relation to environmental compliance.</p>		<p>equipment (OWS, STP, Incinerator)</p> <ul style="list-style-type: none"> Operational scenario worksheets (voyage, port stay, maneuvering) SMS procedures for safe maintenance practices 	<p>tasks.</p> <p>3.4 Include pollution prevention equipment in routine maintenance planning.</p> <p>3.5 Maintain proper records during maintenance under operational conditions.</p>	<p>disrupting operational duties in a simulator or mock engine room setup.</p> <ul style="list-style-type: none"> Include pollution prevention equipment (e.g., OWS, STP, incinerator) in maintenance planning and checks. Maintain accurate records of maintenance under operational scenarios. 	<p>models (OWS, Sewage Treatment Plant, Incinerator)</p> <ul style="list-style-type: none"> Safety posters and SMS procedures for maintenance under operational conditions
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General Objective 4.0: Apply Maintenance Planning Decisions and Management Review on Shipboard Machinery.

7-8	<p>4.1 Explain the maintenance performance and system effectiveness.</p> <p>4.2 Discuss approved</p>	<ul style="list-style-type: none"> Review lectures Management-decision workshops 	<ul style="list-style-type: none"> Performance reports Defect logs Whiteboard, Smartboard, Multimedia, 	<p>4.1 Justify maintenance decisions.</p> <p>4.2 Defend compliance-focused</p>	<ul style="list-style-type: none"> Case study evaluation 	<ul style="list-style-type: none"> Performance reports Defect logs Maintenance records
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	<p>maintenance plans and corrective actions on Shipboard machinery.</p> <p>4.3 Discuss balanced operational demands with maintenance requirements.</p> <p>4.4 Apply PMS outcomes into overall plant management.</p> <p>4.5 Discuss sound Management-level judgement in maintenance planning.</p>		<p>Videos, Company's manual</p>	<p>planning.</p> <p>4.3 Evaluate maintenance performance and system effectiveness.</p> <p>4.4 Integrate PMS outcomes into overall plant management.</p> <p>4.5 Demonstrate sound Management-level judgement in maintenance planning.</p>		
General Objective 5.0: Prepare Maintenance Documentation, Records for Audit Readiness						
9-10	<p>5.1 Explain the importance of maintenance documentation and record-keeping.</p> <p>5.2 Discuss maintenance histories and defect reports.</p> <p>5.3 Discuss documentation preparation for</p>	<ul style="list-style-type: none"> • Lectures • Audit-focused workshops 	<ul style="list-style-type: none"> • Maintenance records • Audit reports • Whiteboard, Smartboard, Multimedia, Videos, Company's manual 	<p>5.1 Demonstrate critical review of PMS records.</p> <p>5.2 Propose shipboard maintenance documentation improvements</p> <p>5.3 Demonstrate maintenance documentation</p>	<ul style="list-style-type: none"> • Record-review exercises 	<ul style="list-style-type: none"> • Maintenance records • Audit reports

	<p>audits and inspections.</p> <p>5.4 Identify documentation deficiencies affecting compliance.</p> <p>5.5 Explain shipboard management-level judgement in documentation control.</p>			<p>and record-keeping.</p> <p>5.4 Demonstrate document preparation for shipboard audits and inspections.</p> <p>5.5 Demonstrate management-level judgement in documentation of shipboard control.</p>		
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General Objective: 6.0: Understand Statutory Surveys and Classification Society Requirements

11-12	<p>6.1 Discuss statutory surveys applicable to machinery and systems.</p> <p>6.2 Explain classification society rules and inspection regimes.</p> <p>6.3 Discuss the importance of statutory and class requirements into PMS schedules.</p> <p>6.4 Explain the risks of non-compliance</p>	<ul style="list-style-type: none"> • Lectures • Regulatory case studies 	<ul style="list-style-type: none"> • Class rules extracts • Survey checklists • Whiteboard, Smartboard, Multimedia, Videos, Company’s manual 	<p>6.1 Demonstrate maintenance tasks to match survey requirements.</p> <p>6.2 Guide students through survey documentation and renewal processes.</p> <p>6.3 Demonstrate case studies and real-world scenarios of compliance</p>	<ul style="list-style-type: none"> • Survey-planning exercises • Regulatory case studies 	<ul style="list-style-type: none"> • Copies of statutory certificates (IOPP, ISPP, IAPP, Safety Construction, Safety Equipment, Load line, etc.) • Classification Society survey checklists and guidelines (e.g., ABS, LR,
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	with survey requirements. 6.5 Explain the importance of management decisions related to survey preparation and compliance.			failure and consequences. 6.4 Verify certificates, records, and logbooks required during surveys.		DNV, BV) <ul style="list-style-type: none"> • Engine room logbooks, Oil Record Book, and maintenance records • Case studies of past survey deficiencies and corrective measures
General Objective 7.0: Promote a Culture of Reliability, Safety, Preventive and Corrective maintenance onboard vessels.						
13-15	7.1 Explain the principles of reliability, safety, and preventive maintenance in marine engineering. 7.2 Describe the relationship between preventive maintenance and machinery reliability. 7.3 Identify unsafe maintenance practices and their consequences. 7.4 Explain the role of	<ul style="list-style-type: none"> • Lecture 7.1 – 7.6 	<ul style="list-style-type: none"> • Whiteboard, Smartboard, Multimedia, Videos, SMS Manual and ISM Code guidelines • Case studies on machinery failures and accidents, Manufacturer’s manuals and maintenance guides • Safety posters and 	7.1 Demonstrate SMS and permit-to-work procedures during maintenance tasks. 7.2 Identify and correct unsafe practices during maintenance work. 7.3 Follow preventive maintenance schedules using PMS and job	<ul style="list-style-type: none"> • Supervise students performing maintenance using permit-to-work system. • Observe and correct unsafe practices during workshop sessions. • Guide students in using PMS for preventive maintenance tasks. • Conduct 	<ul style="list-style-type: none"> • PMS software or maintenance job cards • Permit-to-work forms and risk assessment templates • Workshop tools and machinery models • Maintenance logbooks and record sheets • Safety checklists and protective

	<p>SMS, ISM Code, and company procedures in maintenance safety.</p> <p>7.5 Distinguish between preventive and corrective approaches onboard vessels</p> <p>7.6 Describe methods for continuous improvement in maintenance practices onboard vessels.</p>		<p>maintenance checklists</p> <ul style="list-style-type: none"> • Company maintenance and safety procedures 	<p>cards.</p> <p>7.4 Review maintenance records to determine reliability and gaps.</p> <p>7.5 Participate in safety drills and toolbox meetings</p> <p>7.6 Conduct risk assessment and hazard identification onboard</p>	<p>practical reviews of maintenance logs to detect gaps.</p> <ul style="list-style-type: none"> • Lead group exercises on suggesting improvements after tasks. 	<p>equipment (PPE)</p>
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Course Assessment:

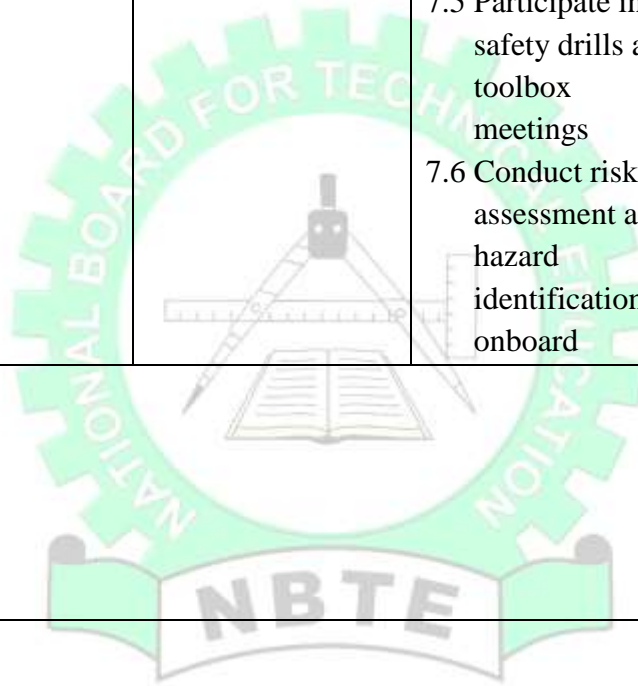
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARINE STRUCTURAL ANALYSIS	Course Code: MAR 422	Credit Unit: 3	Contact Hours: 3hours/ Week
			THEORETICAL: 1hour / Week
Year: II Semester II	Pre-requisite:		Practical: 2hours/Week
<p>GOAL: This course is designed to equip students with the knowledge and skills to analyze, evaluate, and apply structural mechanics principles to marine environments. It focuses on the behavior of ship structures under various loads, the factors affecting strength and stability, bending and deflection theories, energy methods, spring and vibration analysis, corrosion prevention, and survey requirements. Students will develop the ability to plan, supervise, and assess structural integrity of ships at management level, in compliance with STCW Code, Section A-III/2, classification society rules, and statutory requirements, thereby preparing them for effective decision-making in marine engineering practice.</p>			
<p>GENERAL OBJECTIVES:</p> <p>On completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1.0 Analyse forces in ship structures and frameworks; 2.0 Evaluate load-carrying capacity of ship columns and stiffeners; 3.0 Apply bending moment theory to ship beams and hull girder; 4.0 Apply Castigliano’s theorem to marine structures; 5.0 Analyse springs and vibration control in marine applications; 6.0 Evaluate corrosion and structural protection in ships; 7.0 Apply survey and inspection requirements to marine structures. 			
<p>COMPETENCE</p> <ul style="list-style-type: none"> • Apply IMO conventions and STCW Code requirements in structural safety. 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARINE STRUCTURAL ANALYSIS		Course Code: MAR 422	Credit Unit: 3	Contact Hours: 3hours/Week		
				Theoretical: 1hour/Week		
Year: II Semester II		Pre-requisite: -		Practical: 2hours/Week		
General Objective 1.0: Analyze Forces in Ship Structures and Frameworks.						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-2	1.1 Explain statically determinate/ indeterminate ship structures. 1.2 Explain equilibrium of concurrent and coplanar forces in hull members. 1.3 Apply graphical/ analytical methods to determine forces in ship frames and girders.	<ul style="list-style-type: none"> Lecture with sketches. Use PowerPoint slides and Smartboard diagrams. Guided problem-solving. 	<ul style="list-style-type: none"> Whiteboard/ Smartboard. Multimedia projector. Recommended textbooks. 	1.1 Solve stress problems on ship frames using midship section drawings. 1.2 Demonstrate stress distribution with models.	<ul style="list-style-type: none"> Supervise tutorials. Demonstrate with ship structural models. 	<ul style="list-style-type: none"> Ship models. Practical manuals. Logbooks.
General Objective: 2.0: Evaluate Load-Carrying Capacity of Ship Columns and Stiffeners.						
3-4	2.1 Explain effect of shape, length, restraint. 2.2 Discuss eccentric loading in bulkheads/deck supports. 2.3 Calculate safe loads axially/eccentrically.	<ul style="list-style-type: none"> Lecture with sketches. Case studies of stiffener failures. 	<ul style="list-style-type: none"> Smartboard. Multimedia projector. Textbooks. 	2.1 Perform strut testing of ship stiffeners. 2.2 Determine crippling loads for metallic ship	<ul style="list-style-type: none"> Guide lab experiments . Supervise data recording in logbooks. 	<ul style="list-style-type: none"> Strut testing apparatus (Strength of Material laboratory). Lab manuals. Practical logbooks.

				structures.		
General Objective 3.0: Apply Bending Moment Theory to Ship Beams and Hull Girder.						
5-6	<p>3.1 Apply flexure theory to deck beams/hull girder.</p> <p>3.2 Derive shear stress distribution.</p> <p>3.3 Use Macaulay's method for bending moments.</p> <p>3.4 Sketch slope/deflection diagrams.</p>	<ul style="list-style-type: none"> Lecture with Smartboard diagrams. Demonstrate using videos of hogging/sagging. 	<ul style="list-style-type: none"> Whiteboard/ Smartboard. Multimedia projector. Videos of ship stresses. 	<p>3.1 Conduct beam deflection experiments.</p> <p>3.2 Analyze hogging/sagging conditions in ship models.</p>	<ul style="list-style-type: none"> Supervise lab experiments . Guide plotting of deflection diagrams. 	<ul style="list-style-type: none"> Beam deflection apparatus (Strength of Material laboratory). Ship models. Practical manuals.
General Objective 4.0: Apply Castigliano's Theorem to Marine Structures.						
7-8	<p>4.1 Calculate strain energy in bending/twisting.</p> <p>4.2 Prove and apply Castigliano's theorem.</p> <p>4.3 Solve deflection problems in curved ship frames.</p>	<ul style="list-style-type: none"> Lecture with derivations. Guided tutorials. 	<ul style="list-style-type: none"> Smartboard. Multimedia projector. Textbooks. 	<p>4.1 Solve deflection problems using curved frame specimens.</p>	<ul style="list-style-type: none"> Supervise tutorial exercises. Demonstrate with lab specimens. 	<ul style="list-style-type: none"> Curved bar specimens (Strength of Material laboratory). Lab manuals.
General Objective 5.0: Analyze Springs and Vibration Control in Marine Applications.						
9-10	<p>5.1 Describe close-coiled helical springs in marine machinery.</p> <p>5.2 Derive shear stress and angular twist expressions.</p> <p>5.3 Calculate axial deflection.</p> <p>5.4 Relate spring analysis to vibration control (engine mounts, stabilizers).</p>	<ul style="list-style-type: none"> Lecture with Smartboard. Show videos of vibration control systems. 	<ul style="list-style-type: none"> Multimedia projector, Videos, Textbooks. 	<p>5.1 Test springs under axial load.</p> <p>5.2 Demonstrate vibration damping systems in marine machinery.</p>	<ul style="list-style-type: none"> Supervise lab testing. Demonstrate vibration damping. 	<ul style="list-style-type: none"> Spring testing apparatus. Practical manuals.
General Objective 6.0: Evaluate Corrosion and Structural Protection in Ships.						

<p>11-12</p>	<p>6.1 Explain corrosion mechanisms. 6.2 Describe cathodic protection (sacrificial anodes, Impressed Current Cathodic Protection – ICCP). 6.3 Evaluate protective coatings/paint schemes. 6.4 Explain ship corrosion protection by design, focusing on avoiding dissimilar metals, using insulation, and selecting compatible materials, etc.</p>	<ul style="list-style-type: none"> • Lecture with Smartboard diagrams. • Show videos of coating/cathodic protection systems. 	<ul style="list-style-type: none"> • Corrosion diagrams. • Paint samples. • Multimedia projector. 	<p>6.1 Identify corrosion-prone areas on ship models. 6.2 Apply protective coating schemes.</p>	<ul style="list-style-type: none"> • Supervise coating application demo. 	<ul style="list-style-type: none"> • Paints, primers. • Sacrificial anodes. • Practical manuals.
<p>General Objective 7.0: Apply Survey and Inspection Requirements to Marine structures.</p>						
<p>13-15</p>	<p>7.1 Explain classification society survey types 7.2 Describe harmonized survey system and condition assessment scheme (CAS)/ condition assessment programme (CAP) 7.3 Explain items inspected/examined during dry-docking.</p>	<ul style="list-style-type: none"> • Lecture with PowerPoint slides. • Case studies of survey failures. 	<ul style="list-style-type: none"> • Class rules. • IMO conventions. • PowerPoint slides. 	<p>7.1 Conduct mock survey inspection. 7.2 Record findings in survey logbooks.</p>	<ul style="list-style-type: none"> • Supervise mock inspections. • Guide logbook entries. 	<ul style="list-style-type: none"> • Survey checklists. • Practical logbooks. • Dockyard reports.
<p>Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%</p>						

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: DRY DOCKING, SHIP REPAIRS AND REFIT MANAGEMENT	Course Code: MAR 423	Credit Unit: 4	Contact Hours: 4 Hours/ Week
			Theoretical: 2 Hours / Week
Year: II Semester II	Pre-requisite:		Practical: 2 Hours / Week
GOAL: This course is designed to equip the students with knowledge and skills to plan, supervise, and manage dry-docking, ship repair, and refit operations at management level, including specification development, shipyard coordination, cost and time control, quality assurance, and safety oversight, in compliance with STCW Code, Section A-III/2 and applicable statutory and class requirements.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Manage Dry-Dock Planning, Technical Assessment and Repair Specification Development 2.0 Manage Shipyard Coordination, Resource Allocation, Cost Estimation and Time Control 3.0 Manage Quality Assurance (QA), Inspection, Testing and Regulatory Compliance 4.0 Manage Safety, Risk Control, Documentation and Post-Docking Performance Review (PTW) 			
COMPETENCE			
<ul style="list-style-type: none"> • Use Leadership and Managerial Skills • Manage safe and effective maintenance and repair procedures. • Ensure safe working practice. 			



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: DRY DOCKING, SHIP REPAIRS AND REFIT MANAGEMENT		Course Code: MAR 423	Credit Unit: 4	Contact Hours: 4 Hours/ Week		
				Theoretical: 2 Hours / Week		
Year: II Semester: II		Pre-requisite:		Practical: 2 Hours / Week		
General Objective 1.0: Manage Dry-Dock Planning, Technical Assessment and Repair Specification Development						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Explain objectives and phases of dry-docking. 1.2 Assess machinery condition using logs, PMS records and defect reports. 1.3 Identify class and statutory survey requirements for dry-docking. 1.4 Develop detailed repair specifications for main and auxiliary machinery. 1.5 Prepare dry-dock work lists based on priority and machinery condition. 1.6 Justify repair	<ul style="list-style-type: none"> • Explain dry-dock planning process using real ship documents. • Demonstrate how to extract defects from PMS and logbooks. • Guide students in writing repair specifications. • Discuss class/statutory survey items. 	<ul style="list-style-type: none"> • Sample PMS records and logbooks • Dry-dock specification samples • Class survey checklist • Manufacturer manuals • Whiteboard/Project or 	1.1 Develop a complete dry-dock specification from given ship records. 1.2 Prepare a docking work list and priority chart. 1.3 Compile pre-docking document file for class survey.	<ul style="list-style-type: none"> • Provide students with simulated ship defect records. • Supervise students drafting specifications • Review and correct student work. 	<ul style="list-style-type: none"> • Sample defect log sheets • Blank specification templates • Class survey forms

	decisions using technical and operational data. 1.7 Prepare pre-docking documentation and reports.					
General Objective: 2.0: Manage Shipyard Coordination, Resource Allocation, Cost Estimation and Time Control						
4-7	<p>2.1 Explain shipyard organizational structure and communication lines.</p> <p>2.2 Prepare repair schedules using time charts.</p> <p>2.3 Estimate repair cost and manpower requirement.</p> <p>2.4 Explain contractor supervision and progress monitoring techniques.</p> <p>2.5 Describe documentation used in shipyard meetings and reporting.</p> <p>2.6 Apply budgeting and cost control principles in repair work.</p>	<ul style="list-style-type: none"> • Explain yard coordination using case studies. • Demonstrate preparation of Gantt charts. • Discuss cost estimation methods. 	<ul style="list-style-type: none"> • Sample docking schedule • Cost estimate sheets • Progress report templates • Smartboard, Whiteboard, Multimedia 	<p>2.1 Prepare a docking schedule using a time chart.</p> <p>2.2 Prepare a simple repair cost estimate.</p> <p>2.3 Draft a progress monitoring report.</p> <p>2.4 Conduct a mock shipyard coordination meeting.</p>	<ul style="list-style-type: none"> • Assign students group tasks for schedule preparation. • Supervise mock meetings. • Assess student reports. 	<ul style="list-style-type: none"> • Chart papers/PC • Cost templates • Meeting report forms
General Objective 3.0: Manage Quality Assurance (QA), Inspection, Testing and Regulatory Compliance						

<p>8-11</p>	<p>3.1 Explain quality assurance principles in ship repair.</p> <p>3.2 Identify inspection and testing requirements after repairs.</p> <p>3.3 Explain class rules and statutory compliance during repairs.</p> <p>3.4 Describe documentation for inspection and test records.</p> <p>3.5 Explain defect reporting and acceptance criteria.</p>	<ul style="list-style-type: none"> • Discuss QA procedures with examples. • Explain inspection stages during docking. • Demonstrate test record documentation. 	<ul style="list-style-type: none"> • QA manuals • Class rule book extracts • Test record sheets • Smartboard, Whiteboard, Multimedia Videos 	<p>3.1 Prepare inspection checklist for machinery repairs.</p> <p>3.2 Fill test and inspection record sheets.</p> <p>3.3 Evaluate completed repair work using QA checklist.</p>	<ul style="list-style-type: none"> • Provide inspection scenarios. • Supervise students filling QA forms. 	<ul style="list-style-type: none"> • Inspection checklist templates • Test report samples
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General Objective 4.0: Manage Safety, Risk Control, Documentation and Post-Docking Performance Review (PTW)

<p>12-15</p>	<p>4.1 Explain safety hazards associated with dry-dock operations.</p> <p>4.2 Explain risk assessment for repair activities.</p> <p>4.3 Explain permit-to-work system in shipyard environment.</p> <p>4.4 Describe</p>	<ul style="list-style-type: none"> • Discuss real docking accident cases. • Demonstrate risk assessment method. • Explain documentation and reporting procedure. 	<ul style="list-style-type: none"> • Risk assessment forms • Permit-to-work samples • Post-dock report samples 	<p>4.1 Conduct risk assessment for a given repair task.</p> <p>4.2 Prepare a permit-to-work form.</p> <p>4.3 Draft a post-dock performance evaluation report.</p>	<ul style="list-style-type: none"> • Give students repair scenarios. • Supervise completion of safety forms. • Review student reports. 	<ul style="list-style-type: none"> • Risk assessment templates • PTW forms • Defect case studies
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	<p>documentation control during docking.</p> <p>4.5 Explain post-dock performance review and reporting.</p> <p>4.6 Analyze root causes of recurring defects after docking.</p>			<p>4.4 Identify root causes from defect scenarios.</p>		
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Course Assessment:

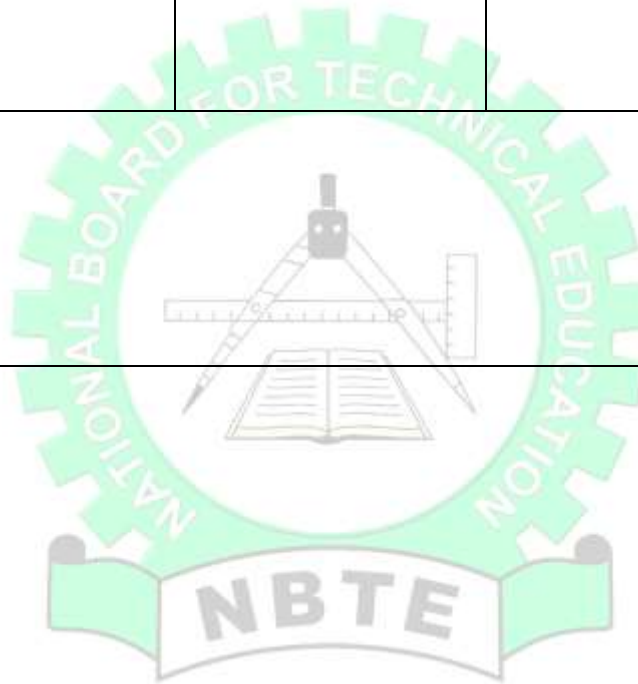
Course work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: ENGINE ROOM RESOURCE MANAGEMENT	Course Code: MAR 424	Credit Unit: 4	Contact Hours: 4 Hours/ Week
			Theoretical: 2 Hours / Week
Year: II Semester II	Pre-requisite:		Practical: 2 Hours / Week
GOAL: This course is designed to equip the students with knowledge and skills to apply leadership and managerial skills within the engine department at management level, effectively supervise engine-room personnel and watchkeeping arrangements, implement Engine-Room Resource Management (ERM) principles, ensure adherence to Standard Operating Procedures (SOPs), and make sound decisions under operational pressure, in accordance with STCW Code, Section A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Apply Leadership Principles and Human-Element Factors in Shipboard Operations; 2.0 Optimize Engine-Room Resource Management (ERM) and Workload Control; 3.0 Enforce Compliance with Safe Operating Procedures (SOP), Watchkeeping Standard and Operational Planning; 4.0 Evaluate Effective Decisions Under Operational Pressure while Exercising Management Responsibility; 5.0 Apply Fundamentals of Engineering Management; 6.0 Evaluate Business Planning, Finance and Strategic Decision-Making; 7.0 Demonstrate Professional Leadership, Ethics and Career Pathways Beyond Shipboard Roles. 			
COMPETENCE			
<ul style="list-style-type: none"> • Apply leadership and managerial skills 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY							
COURSE TITLE: ENGINE RESOURCE MANAGEMENT		Course Code: MAR 424		Credit Unit: 4		Contact Hours: 4 Hours/ Week	
						Theoretical: 2 Hours / Week	
Year: II Semester II		Pre-requisite:				Practical: 2 Hours / Week	
General Objective 1.0: Apply Leadership Principles and Human-Element Factors in Shipboard Operations							
THEORETICAL CONTENTS				PRACTICAL CONTENTS			
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources	
1-2	1.1 Explain leadership styles applicable to shipboard engineering management. 1.2 Describe human-element factors affecting engine-room performance. 1.3 Identify causes of human error and fatigue in marine engine room. 1.4 Discuss the importance of promoting teamwork, motivation, and discipline within the engine department. 1.5 Apply professional leadership conduct expected of senior engineers.	<ul style="list-style-type: none"> Lectures Guided discussions 	<ul style="list-style-type: none"> STCW leadership guidance Human-element case studies Whiteboard, Smartboard, Multimedia Videos 	1.1 Analyze leadership scenarios. 1.2 Identify human-factor risks.	<ul style="list-style-type: none"> Scenario discussions 	<ul style="list-style-type: none"> Simulator Engine room, role-play scripts, Human Element observation checklist etc. 	
General Objective 2.0: Manage and Optimize Engine-Room Resource Management (ERM) and Workload Control							

<p>3-4</p>	<p>2.1 Explain ERM principles and objectives. 2.2 Discuss ERM principles during normal and emergency operations. 2.3 Explain workload, task prioritisation, and resource allocation in machinery space. 2.4 Explain communication coordination between engine room and bridge. 2.5 Discuss ERM error prevention through effective teamwork and situational awareness.</p>	<ul style="list-style-type: none"> Lecture 2.1-2.5 	<ul style="list-style-type: none"> ERM guidelines Watchkeeping plans Whiteboard, Smartboard, Multimedia, Videos 	<p>2.1 Apply effective communication during engine room operations and watchkeeping. 2.2 Demonstrate workload-management strategies. 2.3 Demonstrate leadership and teamwork during maintenance and emergency tasks 2.4 Apply ERM principles during normal and emergency operations.</p>	<ul style="list-style-type: none"> ERM scenario simulations 	<ul style="list-style-type: none"> ERM workshops ERM decision-making flowchart Whiteboard for action mapping
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General Objective 3.0: Supervise and Enforce Compliance with Safe Operating Procedures (SOP), Watchkeeping Standard and Operational Planning

<p>5-6</p>	<p>3.1 Explain SOP and Watchkeeping Management 3.2 Discuss the importance of engine-room watchkeeping arrangements.</p>	<ul style="list-style-type: none"> Lecture 3.1-3. Procedure reviews 	<ul style="list-style-type: none"> SOP manuals Watchkeeping records Whiteboard, Smartboard, Multimedia, 	<p>3.1 Demonstrate SOP and watchkeeping management procedures. 3.2 Supervise engine-room</p>	<ul style="list-style-type: none"> Supervision case exercises 	<ul style="list-style-type: none"> Watchkeeping records Simulator Videos
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	<p>3.3 Discuss the importance of compliance with SOPs and company procedures.</p> <p>3.4 Discuss watchkeeping personnel performance</p> <p>3.5 Discuss in detail, deviation effects on SOP and watchkeeping management procedures</p> <p>3.6 Discuss operational discipline and standards for SOP and watchkeeping management procedures.</p>		<p>Videos</p>	<p>SOP and watchkeeping arrangements.</p> <p>3.3 Evaluate performance of watch keeping personnel.</p> <p>3.4 Demonstrate deviations in SOP and watchkeeping management</p> <p>3.5 Demonstrate corrective actions for SOP and watchkeeping management's deviation</p>		
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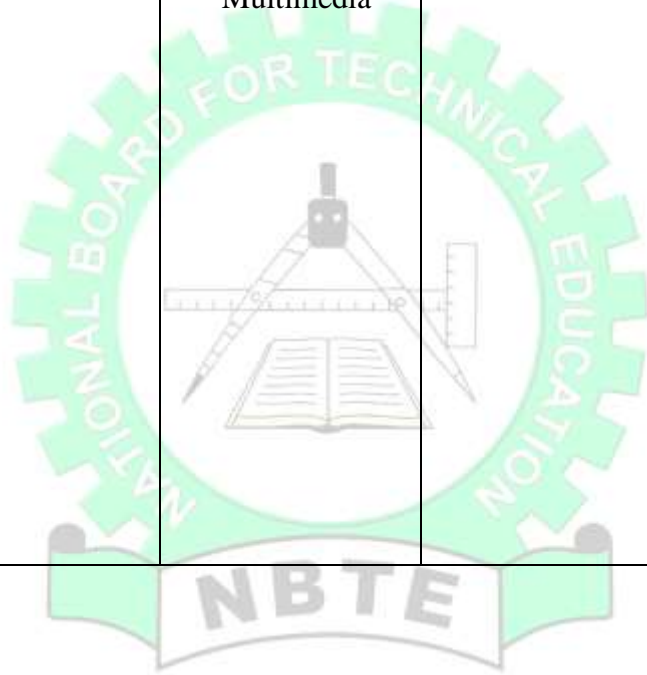
General Objective 4.0: Evaluate and Make Effective Decisions Under Operational Pressure while Exercising Management Responsibility

<p>7-8</p>	<p>4.1 Explain the principles of decision making under emergency and high-stress engine room conditions.</p> <p>4.2 Identify common human factor challenges that impair judgement under</p>	<ul style="list-style-type: none"> • Lecture 4.1-4.6 	<ul style="list-style-type: none"> • Incident reports • Management case studies • Simulator • Smartboard, Whiteboard, 			
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	<p>pressure</p> <p>4.3 Explain balance in safety, operational, and commercial considerations.</p> <p>4.4 Explain consequences of management decisions.</p> <p>4.5 Explain concept of management responsibility and legal implications</p> <p>4.6 Discuss leadership performance and lessons learned in 4.1 to 4.5.</p>		<p>Multimedia, Videos</p>			
General Objective 5.0: Apply Fundamentals of Engineering Management						
9-10	<p>5.1 Explain core principles of engineering management.</p> <p>5.2 Describe management functions: planning, organizing, leading, controlling, etc.</p> <p>5.3 Discuss basic project and operations management concepts.</p> <p>5.4 Discuss organizational structures within maritime and engineering enterprises.</p> <p>5.5 Explain managerial thinking aligned with</p>	<ul style="list-style-type: none"> Lecture 5.1-5.6 Guided discussions 	<ul style="list-style-type: none"> Management texts Engineering case studies Smartboard, Whiteboard, Multimedia 	<p>5.1 Analyse management scenarios.</p> <p>5.2 Propose managerial solutions.</p> <p>5.3 Demonstrate organizational structures within maritime and engineering enterprises.</p> <p>5.4 Demonstrate managerial thinking</p>	<ul style="list-style-type: none"> Guide students to analyse scenarios 	<ul style="list-style-type: none"> Videos

	professional responsibility.			aligned with professional responsibility.		
General Objective 6.0: Formulate and Evaluate Business Planning, Finance and Strategic Decision-Making						
11-12	<p>6.1 Explain basic business and project plans.</p> <p>6.2 Explain fundamental financial concepts (costing, budgeting, profit).</p> <p>6.3 Explain strategic ways of thinking in marine engineering and maritime enterprises.</p> <p>6.4 Discuss investment and operational decisions.</p> <p>6.5 Explain ethical and sustainable business judgement.</p>	<ul style="list-style-type: none"> Lecture 6.1-6.5 	<ul style="list-style-type: none"> Business plan templates Financial examples Smartboard, Whiteboard, Multimedia 	<p>6.1 Draft a basic business or project plan.</p> <p>6.2 Analyse financial concept scenarios.</p> <p>6.3 Demonstrate strategic thinking to engineering and maritime enterprises.</p> <p>6.4 Demonstrate investment and operational decisions.</p> <p>6.5 Demonstrate ethical and sustainable business judgement.</p>	<ul style="list-style-type: none"> Business-planning exercises Guide students to analyze financial concept scenarios 	<ul style="list-style-type: none"> Simulator Case studies Business journals
General Objective Demonstrate Professional Leadership, Ethics and Career Pathways Beyond Shipboard Roles						
13-15	<p>7.1 Discuss leadership and ethical principles in management and</p>	<ul style="list-style-type: none"> Lecture 7.1-7.6 	<ul style="list-style-type: none"> Professional development 			

	<p>entrepreneurship.</p> <p>7.2 Discuss career pathways within and beyond shipboard engineering roles.</p> <p>7.3 Discuss integration of technical expertise with managerial and entrepreneurial competence.</p> <p>7.4 Explain long-term professional development strategies.</p> <p>7.5 Outline the required competences certification and experience for targeted shore-based positions</p> <p>7.6 Discuss entrepreneurial opportunities in the maritime sectors</p>	<ul style="list-style-type: none"> • Career discussions 	<p>resources</p> <ul style="list-style-type: none"> • Group project and presentations • Case studies • Smartboard, Whiteboard, Multimedia 			
<p>Course Assessment: Course work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%</p>						



PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE TITLE: MARITIME LAW AND MARITIME LABOUR CONVENTION	Course Code: MAR 425	Credit Unit: 2	Contact Hours: 2hours/ Week
			Theoretical: 1 hour / Week
Year: II Semester II	Pre-requisite:		Practical: 1 hour / Week
GOAL: This course is designed to equip the students with knowledge and skills to apply maritime law and industrial relations principles at management level within the engine department, manage employment and labour issues fairly and lawfully, ensure compliance with national and international maritime legislation, and exercise sound professional and ethical judgement in accordance with STCW Table A-III/2.			
GENERAL OBJECTIVES:			
On completion of this course, the student will be able to:			
<ol style="list-style-type: none"> 1.0 Identify maritime legal framework and regulatory obligations; 2.0 Understand maritime labour law, employment and welfare; 3.0 Comprehend industrial relations and harmonious working relationships; 4.0 Evaluate discipline, grievance handling and dispute resolution; 5.0 Assess judgement in personnel and compliance matters; 6.0 Prepare compliance oversight and management responsibility; 7.0 Evaluate continuous improvement and lessons learned. 			
COMPETENCE			
<ul style="list-style-type: none"> • Support compliance with labour and maritime regulations 			

PROGRAMME: HIGHER NATIONAL DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE TITLE: MARITIME LAW AND MARITIME LABOUR CONVENTION (MLC)		Course Code: MAR 425		Credit Unit: 2	Contact Hours: 2hours/week	
					Theoretical: 1 hour/week	
Year: II Semester II		Pre-requisites:		Practical: 1 hour/week		
General Objective 1.0: Identify maritime legal framework and regulatory obligations.						
THEORETICAL CONTENTS				PRACTICAL CONTENTS		
Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 3	1.1 Identify sources of maritime law. 1.2 Explain the scope of maritime law affecting marine engineers. 1.3 Interpret Nigerian maritime laws (Merchant Shipping Act, NIMASA Act, Cabotage Act). 1.4 Interpret international conventions (MLC, SOLAS, MARPOL) relevant to shipboard operations.	<ul style="list-style-type: none"> Lectures, guided discussions, group analysis 	<ul style="list-style-type: none"> Statutory instruments, convention extracts, Nigerian statutes, IMO conventions etc. 	1.1 Analyze compliance scenarios 1.2 Identify statutory breaches 1.3 Apply conventions to shipboard operations	<ul style="list-style-type: none"> Case-study discussions Case-study workshop 	<ul style="list-style-type: none"> MLC text, law extracts, Legal case files, IMO manuals
General Objective: 2.0: Understand maritime labour law, employment and welfare.						
4– 6	2.1 Describe crew contracts, rights, and obligations under MLC. 2.2 Analyse employment conditions: hours of work, rest, wages, repatriation.	<ul style="list-style-type: none"> Lectures, contract review, guided discussions, case analysis 	<ul style="list-style-type: none"> Employment contracts, MLC guidance, MLC extracts MLC welfare provisions 	2.1 Draft sample crew agreements Evaluate compliance with crew conditions	<ul style="list-style-type: none"> Practical drafting exercise Scenario-based exercises Case-study 	Crew contract templates Crew welfare records Shipboard welfare manuals

	<p>2.3 Apply welfare and occupational standards onboard (accommodation, food, medical care).</p> <p>2.4 Highlight forms of workplace harassment and bullying onboard.</p> <p>2.5 Explain crew rights and company obligations regarding harassment prevention.</p> <p>2.6 Discuss strategies to prevent and respond to bullying and harassment.</p> <p>2.7 Explain respectful communication and inclusive leadership to promote welfare.</p>			<p>2.2 Recommend welfare-oriented actions</p>	<p>analysis</p>	
<p>General Objective 3.0: Comprehend industrial relations and harmonious working relationships.</p>						
<p>7 – 8</p>	<p>3.1 Discuss principles of industrial relations in the maritime sector.</p> <p>3.2 Discuss strategies for promoting teamwork and harmonious relations.</p> <p>3.3 Demonstrate strategies to prevent and respond to bullying and harassment.</p> <p>3.4 Practice respectful communication and</p>	<ul style="list-style-type: none"> • Lectures, role-play facilitation • Group discussions, leadership training 	<ul style="list-style-type: none"> • Industrial relations codes • HR manuals 	<p>3.1 Resolve simulated labour disputes</p> <p>3.2 Show conflict resolution skills</p>	<ul style="list-style-type: none"> • Role-play exercises • Role-play facilitation 	<ul style="list-style-type: none"> • Company HR procedures • Team-building scenarios

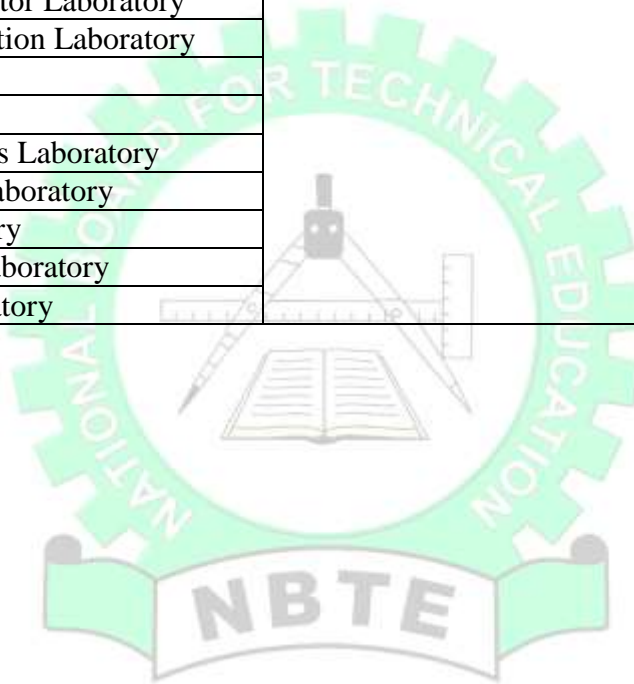
	inclusive leadership.					
General Objective 4.0: Evaluate discipline, grievance handling and dispute resolution.						
9 – 11	<p>4.1 Apply disciplinary procedures fairly and lawfully.</p> <p>4.2 Handle grievances in accordance with company and statutory procedures.</p> <p>4.3 Evaluate dispute resolution methods using leadership and communication skills.</p>	<ul style="list-style-type: none"> Lectures, guided role-play Lectures, case analysis Lectures, group facilitation 	<ul style="list-style-type: none"> Company procedures, disciplinary codes Grievance policies Communication guides 	<p>4.1 Document disciplinary cases.</p> <p>4.2 Analyse grievance cases.</p> <p>4.3 Propose appropriate resolutions</p>	<ul style="list-style-type: none"> Role-play exercises Scenario-based exercises 	<ul style="list-style-type: none"> Case files Company grievance manuals Case studies
General Objective 5.0: Assess judgement in personnel and compliance matters.						
12	<p>5.1 Assess ethical issues in personnel management and compliance oversight.</p> <p>5.2 Assess ethical implications of harassment and discrimination cases.</p> <p>5.3 Recommend actions to support mental health and stress management onboard.</p>	<ul style="list-style-type: none"> Review lectures, group discussions 	<ul style="list-style-type: none"> Compliance reports 	<p>5.1 Evaluate compliance decisions</p>	<ul style="list-style-type: none"> Case review workshops 	<ul style="list-style-type: none"> Case summaries
General Objective 6.0: Prepare compliance oversight and management responsibility.						
13–14	<p>6.1 Supervise compliance with labour and maritime regulations.</p>	<ul style="list-style-type: none"> Lectures, compliance workshops Lectures, 	<ul style="list-style-type: none"> MLC compliance manuals 	<p>6.1 Conduct compliance audits.</p>	<ul style="list-style-type: none"> Workshop exercises Report- 	<ul style="list-style-type: none"> Audit checklists Case files

	6.2 Advise senior management on industrial relations issues. 6.3 Prepare reports relating to labour and legal matters.	group presentations	<ul style="list-style-type: none"> • Management reports 	6.2 Prepare advisory reports	writing exercises	
General Objective 7.0: Evaluate continuous improvement and lessons learned.						
15	7.1 Discuss industrial disputes and compliance failures. 7.2 Propose recommendations for future improvements. 7.3 Review case studies of harassment or bullying disputes. 7.4 Propose improvements for mental health support systems.	<ul style="list-style-type: none"> • Group discussions, case presentations • Review lessons learned from industrial disputes and compliance failures. 	<ul style="list-style-type: none"> • Tribunal reports, dispute records 	7.1 Recommend improvements	<ul style="list-style-type: none"> • Workshop exercises 	<ul style="list-style-type: none"> • Industrial dispute records
ASSESSMENT: Course work: 20% Test/Assignment: 20% Exams: 60% Total: 100%						

LIST OF MINIMUM RESOURCES

PHYSICAL FACILITIES REQUIRED FOR HND MARINE ENGINEERING TECHNOLOGY PROGRAMME

S/N	LABORATORIES	WORKSHOPS	OTHER
1.	Marine Auxiliary Systems Laboratory	Marine Engineering Workshop	Safety and Firefighting Training Yard
2.	Marine Propulsion and Engine Simulator Laboratory		
3.	Naval Architecture and Ship Construction Laboratory		
4.	Electrical and Electronics Laboratory		
5.	Computer and CAD Laboratory		
6.	Thermodynamics and Fluid Mechanics Laboratory		
7.	Materials and Strength of Materials Laboratory		
8.	Control and Instrumentation Laboratory		
9.	Refrigeration and Air Conditioning Laboratory		
10.	Communication and Language Laboratory		



LIST OF REQUIRED TOOLS AND EQUIPMENT

Laboratory/Workshop Type	Category	Specific Tools/Equipment	Recommended Quantity	Notes
1. MARINE ENGINEERING WORKSHOP	Hand Tools	Ball peen hammers	20	Various sizes
		Chisels (flat, cross-cut)	20 sets	Assorted sizes
		Files (flat, round, half-round, triangular)	40 sets	Complete sets
		Hacksaws with blades	20	With spare blades
		Screwdrivers (flat, Phillips, Pozidriv)	40 sets	Insulated handles
		Adjustable spanners	20	6-12 inch range
		Ring spanners set	20 sets	Metric and imperial
		Socket sets	20 sets	¼" and ½" drive
		Pliers (combination, needle-nose, side cutters)	40 sets	3 types minimum
		Vice grips	20	Various sizes
		Punches (centre, pin, drift)	20 sets	Assorted
		Scribers	20	
		Try squares	20	150mm and 300mm
		Marking gauges	20	
		Dividers	20	
		Calipers (inside, outside)	20 sets	
		Tap and die sets	20 sets	Metric and imperial
		Riveting hammers and sets	10 sets	
	Measuring Instruments	Steel rules (150mm, 300mm, 600mm)	40 sets	All three sizes
		Vernier calipers (0.02mm accuracy)	20	Digital preferred
Micrometers (external, internal,		20 sets	0-25mm, 25-	

	depth)		50mm
	Height gauges	10	Digital readout
	Dial indicators with stands	20 sets	0.01mm resolution
	Slip gauge sets	5 sets	Grade 2
	Sine bars	10	100mm and 200mm
	Surface plates (granite)	4	Grade A, 1000x750mm
	Spirit levels (precision)	20	300mm length
	Feeler gauges	20 sets	Metric and imperial
	Thread pitch gauges	20 sets	
	Radius gauges	10 sets	
Machine Tools	Centre lathes (with chucks, faceplates, steadies)	8	Minimum 1m bed
	Drilling machines (bench, pillar, radial)	8	13mm capacity minimum
	Milling machines (vertical/horizontal)	6	
	Shaping machines	4	
	Grinding machines (pedestal, tool & cutter)	4	
	Power hacksaws	4	
	Bending machines	2	Manual or hydraulic
	Shearing machines	2	Bench type
	CNC machines (basic training models)	2	Optional but recommended
	Welding & Fabrication	Arc welding machines (AC/DC)	10
Gas welding sets (oxygen & acetylene cylinders, regulators, torches)		10 sets	Complete sets
TIG welding sets		4	
MIG welding sets		4	

		Welding electrodes (various types/sizes)	Bulk	Yearly supply	
		Welding screens/curtains	10		
		Chipping hammers	20		
		Wire brushes	40		
		Soldering irons/stations	20	40W minimum	
		Brazing equipment	10 sets		
		Plasma cutter (training model)	2	Optional	
	Safety Equipment	Safety goggles/face shields	100	One per student plus spares	
		Welding helmets (auto-darkening)	20		
		Earmuffs/plugs	100		
		Gloves (leather, heat-resistant, rubber)	100 pairs	Various types	
		Aprons/boiler suits	100		
		Safety boots (steel toe)	100 pairs		
		Fire extinguishers (CO ₂ , foam, dry powder)	20	Strategically placed	
		First aid kits	5	Wall mounted	
		Fume extractors	10	Mobile units	
		Safety signage	Complete set	All required signs	
		Non-slip mats	10	For workshop floor	
	Consumables	Cutting fluids/coolants	Bulk	Yearly supply	
		Lubricating oils/grease	Bulk	Yearly supply	
		Emery cloth/sandpaper	Bulk	Various grits	
		Cleaning solvents	Bulk	Yearly supply	
		Marking inks/dyes	Bulk		
		Workshop rags	Bulk		
	2. ELECTRICAL AND ELECTRONICS LABORATORY	Electrical Machines	DC motors/generators (various ratings)	10 sets	0.5-2kW range
			AC motors (single/three-phase)	10 sets	0.5-3HP range
			Transformers (step-up/down)	10 sets	Various ratios

	Alternators	5	Small capacity
	Starters (DOL, star-delta, auto-transformer)	10 sets	
	Motor control panels	10	With protection devices
Measuring Instruments	Digital multimeters	20	Auto-ranging preferred
	Analog multimeters	10	For basic training
	Clamp meters	10	
	Insulation testers (meggers)	10	500V/1000V
	Wattmeters (single/three-phase)	10	
	Energy meters	10	Single phase
	Oscilloscopes (dual trace)	10	50MHz minimum
	Function generators	10	2MHz minimum
	Power supplies (variable AC/DC)	20	Dual output preferred
	Frequency counters	5	
	Phase sequence indicators	10	
Electrical Panels & Components	Distribution boards (single/three-phase)	10	With meters and protection
	Circuit breakers (MCB, MCCB, ELCB)	40 sets	Various ratings
	Relays (overcurrent, under-voltage, time delay)	40 sets	
	Contactors	40	Different sizes
	Switches (toggle, rotary, push-button)	100	Various types
	Fuses and fuse carriers	100 sets	
	Terminal blocks	200	
	Wiring cables (various sizes/colors)	Bulk	Yearly supply
	Conduit and trunking	Bulk	PVC and metal
Electronics Kits	Breadboards	40	830 tie points

		Resistors, capacitors, inductors (assorted)	Bulk	Complete range
		Diodes, transistors, LEDs	Bulk	Various types
		Integrated circuits (op-amps, timers, regulators)	Bulk	Common types
		Soldering stations with vacuum pumps	20	Temperature controlled
		PCB etching kits	10	Complete sets
	Safety Equipment	Insulated tools	40 sets	Screwdrivers, pliers
		Rubber mats	20	For floor
		Warning signs	Complete set	
		Emergency stop buttons	10	Wall mounted
	3. COMPUTER AND CAD LABORATORY	Hardware	Desktop computers (minimum i5, 8GB RAM, dedicated graphics)	40
A3/A4 printers			4	Networked
Plotters			2	A1 size
Scanners			4	
Projectors with screens			2	Ceiling mounted
Network switches/routers			4	24-port minimum
Uninterruptible power supplies			10	For computers and servers
Software		Windows/Linux OS	40 licenses	
		AutoCAD/Autodesk Inventor	40 licenses	Educational version
		SolidWorks/CATIA	40 licenses	Educational version
		Microsoft Office	40 licenses	
		Programming IDEs (Python, C++)	40 licenses	
		Marine simulation software	5 licenses	Optional
Furniture & Accessories	Computer tables/chairs	40 sets	Ergonomic	
	Drawing tables with parallel motion	20	For manual drafting	

		T-squares, set squares, French curves	40 sets	
		Drawing boards	20	A2 size
		Scales (metric/imperial)	40 sets	
		Compasses, dividers	40 sets	
		Drawing instrument sets	40	Complete sets
4. THERMODYNAMICS AND FLUID MECHANICS LABORATORY	Thermodynamics Equipment	Fire-tube boiler model	2	Working models
		Water-tube boiler model	2	Working models
		Steam engine demonstration unit	2	
		Bomb calorimeter	2	
		Constant pressure calorimeter	4	
		Heat exchanger models (shell & tube, plate)	4 sets	
		Refrigeration test rig	4	
		Air compressor test rig	4	
		Psychrometers	10	Sling type
	Fluid Mechanics Equipment	Hydraulic benches	8	With accessories
		Centrifugal pump test rig	4	
		Reciprocating pump test rig	4	
		Pelton wheel turbine	2	
		Francis turbine model	2	
		Kaplan turbine model	2	
		Orifice/venturi flow meters	8 sets	
		Pipe friction apparatus	4	
		Bernoulli's theorem apparatus	4	
		Metacentric height apparatus	4	
	Measuring Instruments	Reynolds apparatus	4	
		U-tube/inclined manometers	20	
		Pitot-static tubes	10	
		Pressure gauges (Bourdon tube)	40	Various ranges
Temperature sensors (RTD, thermocouple)		40	With indicators	
		Flow meters (rotameter, electromagnetic)	20	

5. MATERIALS AND STRENGTH OF MATERIALS LABORATORY	Testing Machines	Tachometers (digital/contact)	10	
		Universal testing machine (100kN capacity)	2	Computerized preferred
		Impact testing machine (Izod/Charpy)	2	
		Hardness testers (Brinell, Rockwell, Vickers)	4 sets	
		Torsion testing machine	2	
		Fatigue testing machine	1	Optional
	Creep testing apparatus	2		
	Metallurgy Equipment	Metallurgical microscopes (with cameras)	4	1000x magnification
		Sample cutting machines	2	
		Mounting presses	2	
		Grinding/polishing machines	4	
		Etching equipment	4 sets	
		Muffle furnaces	2	Up to 1200°C
		Jominy end-quench apparatus	2	
	Measuring Instruments	Extensometers	10	
		Strain gauges with data acquisition	10 sets	
		Dial gauges (0.01mm accuracy)	20	
		Vernier height gauges	10	
Surface roughness tester		2		
6. MARINE AUXILIARY SYSTEMS LABORATORY	Pumps	Centrifugal pumps (single/multi-stage)	8	Various sizes
		Reciprocating pumps	4	
		Gear pumps	4	
		Screw pumps	2	
		Diaphragm pumps	2	
	Compressors	Reciprocating air compressors	4	
		Rotary screw compressors	2	
	Heat Exchangers	Shell and tube heat exchangers	4	
		Plate heat exchangers	4	
		Finned tube heat exchangers	2	

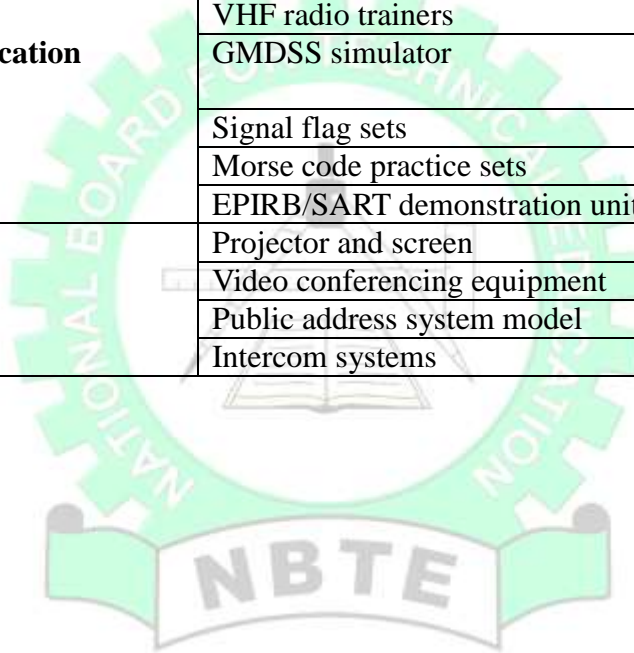
	Valves (working models)	Gate, globe, check valves	20 sets	Various sizes
		Butterfly, ball, diaphragm valves	20 sets	
		Safety/relief valves	10	
		Control valves (pneumatic/electric)	10	
	Piping Systems	Pipe sections (steel, copper, PVC)	Bulk	Various diameters
		Flanges, gaskets, fittings	Bulk	Assorted
		Pipe bending/threading tools	8 sets	
		Pipe support systems	8 sets	
	Other Equipment	Oil-water separator model	2	
		Incinerator model	2	
		Sewage treatment plant model	2	
		Fresh water generator model	2	
	7. MARINE PROPULSION AND ENGINE SIMULATION LABORATORY	Engine Models	Cutaway 2-stroke diesel engine	2
Cutaway 4-stroke diesel engine			2	Large size for clarity
Working diesel engine test bed (50-100HP)			2	Fully instrumented
Gas turbine model			1	
Steering gear model			2	
Propeller models (FPP, CPP)			4 sets	
Simulators		Engine-room simulator (full mission or part task)	4 consoles	20 terminals total
		Propulsion plant simulator	2 consoles	
		Bridge-engine room communication system	2 sets	
Special Tools		Cylinder liner pulling tools	4 sets	
		Valve grinding tools	8 sets	
		Torque wrenches (various ranges)	10 sets	
		Bearing pullers	8 sets	
		Hydraulic jacking equipment	4 sets	
Measuring Instruments		Compression pressure gauge	10	
		Peak pressure indicator	4	

		Fuel injection pressure tester	10	
		Exhaust gas analyzer	2	
		Vibration analyzer (basic)	2	
8. NAVAL ARCHITECTURE AND SHIP CONSTRUCTION LABORATORY	Models & Demonstrators	Ship hull form models (various types)	10	Different ship types
		Stability demonstrator (free surface effect)	4	
		Load line mark model	4	
		Ship construction sectional model	4	Showing framing, plating
		Welded joint samples (butt, fillet, lap)	20 sets	Polished and etched
		Corrosion protection samples	20 sets	
	Drawing & Design	Ship curves (French curves)	40 sets	
		Naval architectural scales	40	
		Stability calculation software	20 licenses	
		Hull form design software (basic)	20 licenses	
	Testing Equipment	Inclining experiment apparatus	4	Laboratory scale
		Draft measuring system model	4	
		Tank testing small models	2	Optional
9. SAFETY AND FIREFIGHTING TRAINING YARD	Firefighting Equipment	Fire extinguishers (water, foam, CO ₂ , dry powder)	40	All types, refillable
		Fire hoses (various diameters) with nozzles	20 sets	20m length each
		Fire hydrants and monitors	4	Training type
		Fire suits (proximity, entry)	20 sets	
		Breathing apparatus (SCBA)	20 sets	With spare cylinders
		Fire blankets	20	
		Hose reels and cabinets	10	
	Life-Saving Equipment	Life jackets (inflatable/inherent buoyancy)	100	Various types
		Life rafts (inflatable, demonstration model)	4	10-person capacity

		Lifebuys with lights/smoke	20	
		First aid kits (comprehensive)	10	Wall mounted
		Stretchers (Neil Robertson, standard)	10	
		Survival suits	20	
	Training Aids	Fire simulators (liquid, electrical, gas)	4 sets	
		Smoke generating machines	2	
		Training pool (for survival drills)	1	Minimum 10x5x2m
		Oil spill containment boom/kit	4 sets	
		Abandon ship drill equipment	4 sets	
	Safety Equipment	Emergency showers/eye wash stations	4	
		Gas detectors (O ₂ , H ₂ S, combustible)	10	Portable
		Safety harnesses/lifelines	20 sets	
		Warning signs/barricade tapes	Bulk	
		Hearing protection test equipment	2	
10. CONTROL AND INSTRUMENTATION LABORATORY	Control Systems	PLC trainers (Siemens, Allen-Bradley, etc.)	10	With programming software
		PID controllers (single/loop)	10	
		Process control trainers (level, temperature, flow, pressure)	8	
		DCS simulator (distributed control system)	2	With multiple stations
		SCADA system workstation	4	
	Instrumentation	Temperature sensors (RTD, thermocouple, thermistor)	40 sets	With transmitters
		Pressure transmitters (absolute, gauge, differential)	40 sets	Various ranges
		Level sensors (float, capacitive, ultrasonic)	20 sets	
		Flow meters (orifice, turbine, magnetic)	20 sets	

		Control valves (pneumatic/electrical actuators)	20		
		Positioners and I/P converters	20		
	Calibration Equipment	Dead weight tester	2		
		Temperature calibration bath	2		
		Multifunction calibrator	4		
		Pressure/vacuum pump	4		
	Monitoring Systems	Alarm annunciator panel	4		
		Data loggers	10		
		Chart recorders (circular/strip)	10		
		Mimic diagrams	4	Engine room layout	
	11. REFRIGERATION AND AIR CONDITIONING LABORATORY	Systems	Domestic refrigerator (cutaway)	4	
			Commercial refrigeration system	2	
Ice plant model			2		
Window AC unit (working/demonstration)			4		
Split AC system			4		
Central AC model (with ducting)			2		
Chiller system model			2		
Cold room/storage model			2		
Tools		Refrigeration manifold gauge sets	20	For R134a, R22, R404a	
		Vacuum pumps	10	Dual stage	
		Charging hoses and cylinders	10 sets		
		Leak detectors (electronic, soap solution)	20		
		Tube cutters, flaring tools, swaging tools	20 sets		
	Brazing/soldering equipment	10 sets			
	Recovery/recycling machines	4			
Measuring Instruments	Digital thermometers/hygrometers	20			
	Psychrometric charts/sling psychrometer	20			

		Pressure-temperature charts	20	For common refrigerants
		Ammeters/voltmeters for compressor circuits	20	
12. COMMUNICATION AND LANGUAGE LABORATORY	Language Lab	Computerized language lab consoles	40	1:2 student ratio
		Headsets with microphones	80	One per student
		Language learning software	40 licenses	
		Interactive whiteboard	2	
		Audio-visual recording equipment	4 sets	
	Maritime Communication	VHF radio trainers	10	
		GMDSS simulator	4 consoles	Optional but recommended
		Signal flag sets	10	Complete sets
		Morse code practice sets	10	
		EPIRB/SART demonstration units	4	Non-transmitting
	General	Projector and screen	4	
		Video conferencing equipment	2	
		Public address system model	2	
Intercom systems		4		



LIST OF WORKSHOP PARTICIPANTS

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