

NATIONAL BOARD FOR TECHNICAL EDUCATION

CURRICULUM AND COURSE SPECIFICATIONS

FOR

NATIONAL INNOVATION DIPLOMA (NID)

IN

MARINE ENGINEERING TECHNOLOGY

February 2009

Plot B Bida Road, P. M. B. 2239, Kaduna, Nigeria.

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GENERAL INFORMATION FOR NATIONAL INOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

1.0 Programme Nomenclature

National Innovation Diploma (NID) in Marine Engineering Technology

2.0 Goal and Objectives

Goal: The programme is intended to impart theoretical knowledge and practical skills to students on engineering design, planning, management, operation and maintenance of Marine Engineering systems and equipment suitable for an innovative technician.

Objectives: A graduate of NID in Marine Engineering Technology should be able to:

- i. Identify and select simple hand and machine tools for marine engineering operations.
- ii. Carryout simple repair and maintenance operations in marine vessels.
- ii. Communicate their knowledge of techniques and processes in the course of discharging their duties.
- iii. Draw up simple routine maintenance plans
- iv. Draw and interpret engineering drawings related to marine systems.
- v. Perform simple joining and welding operations in marine systems.
- vi. Promote a capacity to solve specified technical design problems
- vii. Apply management principles in organising/supervising groups and in the arrangement of sequence of activities.
- viii. Acquire and apply basic entrepreneurial skills.

ix. Apply adequate Information Technology and Drafting skills.

3.0 **Entry requirements for National Innovation Diploma in Marine Engineering Technology**

The general entry requirements for the NID programme are:

- i. Post Secondary School Leavers with 5 Credit level passes in SSCE or equivalent in Physics, Chemistry, Mathematics, English Language and any other science or technical subjects , who are desirous of acquiring relevant employable skills.
- ii. Unemployed or under-employed graduates looking for requisite employable skills.
- iii. Employed graduates who desire relevant or additional working skills.
- iv. Those out of school for a long time, in line with Government desire for open access to re-skilling and up-skilling of the nations workforce as part of Life Long Learning (LLL).
- v. Post NVC Final (articulation from the VEIs).

4.0 **CURRICULUM**

4.1 The curriculum of NID in Computer Software Engineering programme consists of four main components. These are:-

- i) General courses
- ii) Foundation courses
- iii) Professional/Core courses
- iv) Supervised Industrial Attachment.

4.2 **The General Studies** component shall include courses in English Language and Communication Entrepreneurship

4.3 **Foundation Courses** include courses in Mathematics, Computing and Science.

4.4 **Professional Courses** are courses, which give the student the theory and practical skills he needs to practice his field of calling at the technical/technologists level.

4.5 **SIWES:** The students on this NID Marine Engineering Technology programme will be expected to undergo a compulsory industrial training in the relevant area for three months after the first year, and one year after the second year. During the SIWES, it is expected that the student should be supervised by an industry based marine engineering personnel and a school based training officer who will regularly visit the student's place of industrial training. The 3-month program shall be graded as a 3-credit unit course taking into consideration the comments/report of the industry based personnel on the student, on the spot observation of the student in the industry and the student's final report of experience gained during the industrial training which is submitted at the end of the 3-month training.

The grading of the student's industrial training could be carried out as follows:

Student's report	-	50%
Industry based Engineering personnel's report/comment	-	40%
School based supervisor's observation	-	10%
T O T A L	-	100%

It is mandatory that any institution running the NID Marine Engineering should have a written Memorandum Of Understanding (MOU) with at least one industry for the purposes of Students Industrial Work Experience Scheme (SIWES) or industrial training. This is to avoid a situation where a student will not get industrial placement for IT during vacations. The period of the SIWES could be within a session i.e. between the first and second semesters or at the end of a session.

During accreditation visits, the Board will require evidence of MOU with at least one industry (for the purposes of SIWES) as a basis for accrediting the NID Marine engineering programme.

5.0 CURRICULUM STRUCTURE

5.1 NID in Marine Engineering Technology programme

The structure of the programme is made up of four semesters of classroom, laboratory, workshop and practical activities in the institution – and a period at least 3 months of supervised industrial attachment. Each semester shall have 17 weeks duration made up as follows:-

15 contact weeks of learning and practical applications

2 weeks for examinations and registration.

CURRICULUM TABLE FOR NID MARINE ENGINEERING TECHNOLOGY

FIRST SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
GNS 101	Use of English	2	-	-	2	2	
MRN 101	French I	2	-	-	2	2	
MTH101	General Mathematics I	2	-	-	2	2	
COM 101	Computer Appreciation and Application	1	-	3	4	4	
MEC 101	Technical Drawing	-	-	3	3	3	
IEE 101	Electrical Engineering Science	2	-	2	4	4	
MEC 103	Mechanical Engineering Science	2	-	2	4	4	
MEC 105	Workshop Technology I	-	-	4	4	4	
IME 101	Arc Welding	-	-	4	4	4	
IME 103	Marine Pollution	1	-	1	2	2	
	Total	12	-	19	31	31	

SECOND SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
GNS 102	Communication Skills	2	-	-	2	2	
MRN 102	French II	2	-	-	2	2	
MTH 102	Calculus	2	-	-	2	2	
MEC 102	Assembly and Development Drawing	-	-	3	3	3	
IEE 102	Electrical Engineering Technology	1	-	3	4	4	
MEC 104	Thermodynamics	2	-	2	4	4	
MEC 106	Engineering Materials	1	-	2	3	3	
IME 102	Ship Familiarisation and Seamanship	1	-	3	4	4	
MEC 108	Workshop Technology II	-	-	4	3	3	
IME 104	Gas Welding	-	-	4	3	3	
	Total	11	-	21	30	30	

THIRD SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
GNS 201	Entrepreneurship Development I	2	-	-	2	2	
MRN 203	French III	2	-	-	2	2	
MTH 201	Trigonometry and Analytical Geometry	2	-	-	2	2	
IME 201	AUTOCAD I	-	-	3	3	3	
MEC 201	Engineering Measurement	1	-	2	3	3	
MEC 203	Strength of Materials	2	-	2	4	4	
MEC 205	Fluid Mechanics	2	-	2	4	4	
IME 203	Naval Architecture	1	-	2	3	3	
IME 205	Marine Engines	1	-	3	4	4	
IME 207	Fire Prevention, Protection and Fighting	1	-	2	3	3	
IME 209	SIWES-3 Months	-	-	3	3	3	
	Total	16		19	33	33	

FOURTH SEMESTER

COURSE CODE	COURSE TITLE	L	T	P	CU	CH	Prerequisite
GNS 202	Entrepreneurship Development II	1	-	1	2	2	
IME 202	AUTOCAD II	-	-	3	3	3	
IME 204	Marine Refrigeration and Air-conditioning	1	-	3	4	4	
IME 206	Marine Plant Services and Maintenance	1	-	3	4	4	
IME 208	Marine Auxiliary Machinery	2	-	2	4	4	
IME 210	Ship Yard Technology	1	-	3	4	4	
IME 216	Final Year Project	-	-	6	6	6	
	Total	6	-	21	27	27	

FIRST SEMESTER COURSES

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Use of English

COURSE CODE: GNS 101

CONTACT HOURS: 2 – 0 – 0

GOAL: To Acquire Knowledge and Skills in Communication

COURSE SPECIFICATION: THEORETICAL CONTENT

PRACTICAL CONTENT

1 General Objective 1: Develop Appropriate Study Skills Using English Language

General Objective 1: Develop Appropriate Study Skills Using English Language

Week	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-2	1.1 Explain the principles of good note taking and making techniques in English.	Explain the necessity for acquiring good note-making techniques in English.	Flip charts, Felt pen, Textbooks, Workbooks, Close-circuit TV, Model notes Library, Dictionary, reference books, etc Class handouts	1.1 Demonstrate good note-taking skill in English.	Provide assignments on note taking.	Flip charts, Felt pen, Textbooks, Workbooks, Library, Internet Sections of Library, Internet, Newspapers, Textbooks, Magazine, Selected Novels
	1.2 Explain the method of note taking/making English.	Show methods of note-taking/making in English.		1.2 List methods of note-taking/making in English.	Provide sources of information on note-taking/making.	
	1.3 Identify sources of library information.	Expose students to sources of library information in English.		1.3 Classify sources of library information.	Refer students to sources of library information.	
	1.4 Identify information in the sources listed in 1.3.	Discuss with students how to locate the sources listed in 1.3.		1.4 Locate information in the courses listed in 1.3.	Guide students in locating the sources listed in 1.3.	
	1.5 Identify good reading habits in English.	Discuss the principles of good reading habits.		1.5 Apply good reading habits	Set tasks and supervise activities	

2	General Objective 2: Know the nature of language and the basic rules of grammar.			General Objective 2: Know the nature of language and the basic rules of grammar.		
3-6	<p>2.1 List the characteristics of language.</p> <p>2.2 Describe the four language skills – speaking, listening, writing, & reading.</p> <p>2.3 Explain the functions of language.</p> <p>2.4 List the uses of English Language in Nigeria.</p> <p>2.5 Identify grammar and parts of speech.</p>	<p>Explain the concept of Language</p> <p>Textbooks</p> <p>Discuss the four language skills.</p> <p>Explain the functions of language.</p> <p>Explain the uses of English Language in Nigeria e.g. as a language of Research, government, business, etc.</p> <p>Explain grammar and parts of speech.</p>	<p>Textbooks</p> <p>Handouts Textbooks</p> <p>Handouts</p> <p>Resource persons from government, business, research, etc</p> <p>Demonstration tapes.</p> <p>Class handouts</p> <p>Examples</p> <p>Handouts</p>	<p>2.1 Apply the four language skills in communication.</p> <p>2.2 Apply the functions in groups.</p> <p>2.3 Play roles as researchers, government officials, business, etc.</p> <p>2.4 Carry out on the assigned exercises.</p> <p>2.5 Correct common errors in the use of parts of speech.</p> <p>2.6 Construct sentences with correct syntactic arrangement and punctuation.</p> <p>2.7 Construct sentences to illustrate idioms, figures of speech and affixes.</p>	<p>Supervise the students' activities.</p> <p>Supervise the students' activities.</p> <p>Evaluate students' activities.</p> <p>Provide exercise as parts of speech.</p> <p>Provide passages containing common errors in parts of speech.</p> <p>Set activities and provide feedback</p> <p>Set activities and provide feedback</p>	<p>Audio tapes, Radio</p> <p>Video recorder,</p> <p>CD-ROM</p> <p>Audio tapes, Radio</p> <p>Video recorder,</p> <p>CD-ROM</p> <p>Textbooks</p> <p>Workbooks and related materials.</p>

	<p>2.6 Explain the use of part of speech in sentences.</p> <p>2.7 Identify common errors in the use of parts of speech.</p> <p>2.8 Explain correct synthetic arrangement and punctuation marks.</p> <p>2.9 Describe idioms, figures of speech, and offices.</p>	<p>Analyse the use of parts of speech in sentences.</p> <p>Explain what constitute errors in the use of parts of speech.</p> <p>Demonstrate to students correct synthetics arrangement and punctuation marks.</p> <p>Explain idioms, figures of speech and affixes.</p>				
3	General Objective 3.0: Appreciate Literacy Works In English.			General Objective 3.0: Appreciate Literacy Works In English.		
7-8	<p>3.1 Explain the meaning and stages of development of literature.</p> <p>3.2 Classify the literary game.</p>	<p>Define and trace the development of literature.</p> <p>Different between the literacy genres.</p>	<p>Literary materials.</p> <p>Handouts</p> <p>Classical and modern literary works.</p>	<p>3.1 Analyse the characteristics of different literacy genres.</p>	<p>Supervise the student's activity.</p>	<p>Class handouts</p> <p>Selected literary examples</p>
	<p>3.3 Explain the terminology and functions of literature.</p>	<p>Explain the terminology and functions of literature such prose and fiction in terms of e.g. plot,</p>	<p>As in 5.2 above</p>	<p>6.0 Differentiate among the following fiction, prose, plot, setting characterisation etc.</p>	<p>Evaluate student's activity.</p>	<p>Role playing of the characters.</p>

		setting, characterisation, etc.				
4	General Objective 4.0: Understand the concept of communication.			General Objective 4.0: Understand the concept of communication.		
9-10	<p>4.1 Define and outline the process of communication.</p> <p>4.2 List the purpose of communication.</p> <p>4.3 Differentiate between communication and language.</p>	<p>Define and analyse the process of communication.</p> <p>Analyse the purposes of communication</p> <p>Explain the relationship between communication and language.</p>	Textbooks, Charts, etc.	4.1 Identify barriers to effective communication at various levels.	Evaluate students work.	Handouts
	<p>4.4 Explain the impact of interference on communication at various levels.</p> <p>4.5 Explain code mixing, code switching, and dissonance in communication.</p>	<p>Explain the impact of interference on communication at various levels e.g. phonological, syntactic, etc.</p> <p>Explain code mixing code switching and dissonance in communication.</p>	<p>Telephone receivers, Radio, Television, etc.</p> <p>Class handouts</p>	4.1 Identify impact of interference in communication	<p>Moderate the student's discussion.</p> <p>Role plays</p>	<p>Telephone receivers, Radio, Television, etc.</p> <p>Class handouts</p>

5	General Objective 5.0: Know to make oral and written presentations.			General Objective 5.0: Know to make oral and written presentations.		
11-13	<p>5.1 List the organs and functions of speech.</p> <p>5.2 List the phonemes of English.</p>	<p>Label and describe the functions of the organs of speech.</p> <p>Explain the phonemes of English.</p>	<p>Class handouts</p> <p>Recommended Text books</p>	<p>5.1 Label organs of speech.</p> <p>5.2 Classify functions of organs of speech.</p> <p>5.3 Produce correctly each of the phonemes enumerated by the teacher.</p>	<p>Guide the students.</p> <p>Guide the students.</p>	<p>Handouts</p> <p>Oral and written speeches.</p>
	<p>5.4 Explain the different sound contrast as demonstrated by the teacher.</p> <p>5.5 Note the principles of effective speaking.</p>	<p>Distinguish between the different sound contrasts in the consonantal and vowel systems of English Language through correct pronunciation.</p> <p>Explain principles of effective speaking viz, correct use of stress, rhythm, and intonation pattern.</p>	<p>Sound tracks e.g. video, audio, etc</p> <p>Handouts</p>	<p>5.4 Pronounce the different sound contrasts in English Language.</p> <p>5.5 Make short speeches e.g. welcome address, stories, vote of thanks, etc.</p> <p>5.6 Write formal and informal letters, memos and notices.</p>	<p>Evaluate students work.</p> <p>Illustrate techniques of effective speaking.</p> <p>Evaluate students' work.</p>	<p>Sound tracks e.g. video, audio, etc</p> <p>Models of formal and informal letters, memo, notices, etc.</p>
	<p>5.7 List the various types of correspondence.</p>	<p>Explain and illustrate the various types of correspondence, e.g. letter, memo, notices, etc.</p>	<p>Models of formal and informal letters, memo, notices, etc.</p>			

6	General Objective 6.0: Know the rules of comprehension and interpretation.			General Objective 6: Know the rules of comprehension and interpretation.		
14-15	6.1 Recognise the idea in a given passage as distinct from details.	Explain the concept of main idea and differentiate it from details.	Selected passages from relevant texts.	6.1 Identify main idea in a given passage. 6.2 Distinguish between main idea and details.	Group work. Guide students in their work.	Selected passages Handouts
	6.3 Identify the use of main idea in anticipating details. 6.4 Identify the use of context clues in comprehension.	Explain the use of main idea in anticipating specific details. Explain how to use context clues such as definitions, restatements, and examples to aid comprehension.	Selected passages from relevant texts.	6.3 Predict specific details from main idea. 6.4 Draw conclusions from available information.	Evaluate students work. Guide and evaluate students work.	Selected passages Handouts

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: General Mathematics I			COURSE CODE: MTH 101		CONTACT HOURS: 2-0-0	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand laws of indices and their applications in simplifying algebra expressions					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Define index 1.2 Establish the laws of indices 1.3 Solve simple problems using the laws of indices.	Explain in details the laws of indices using solved examples.	Chalkboard, chalk, Textbooks, Calculators, lesson plan etc.			
General Objective 2.0: Understand Theory of logarithms, surds and their applications in manipulating expression						
2-3	2.1 Define logarithm 2.2 Establish the four basic laws of logarithm 2.3 Solve simple logarithm problem 2.4 Define natural logarithm and common logarithm.	Explain in details logarithm and its laws using solved examples. Ask the students to solve logarithmic and surd related problems	Chalkboard, Textbooks, Calculators, lesson notes.			

	<p>2.5 Define characteristic and mantissa</p> <p>2.6 Read the logarithmic table for given numbers</p> <p>2.7 Simplify numerical expressions using log tables e.g.</p> <p>e.g. $18 D = 3\%4JPC^2 \wedge M^B$, find D when J = 0935,</p> <p>e.g. $\theta = 35, P = 1.6$</p> <p>$10^6, C = 55, M = 0$ $0025. \pi = 3.142$</p> <p>2.8 Apply logarithm in solving non-linear equations.</p> <p>e.g. $y = ax^n$; $\log y - \log a + n \log x$; $y = bc^x = \log y = \log b + x \log c$; $Y = a + bx^n$ B Log (Y B D) = Log b +</p>					
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	nlog x., 2.9 Define surds 2.10 Reduce a surd into its simplest form 2.11 Solve simple problems on surds					
General Objective 3.0: Understand Principles underlying the construction of Charts and graphs						
4	3.1 Construct graphs of functions fractions such as $Y = ax + b, n = 1, 2$ $Y = CST (a+x)$ $Y = ax^k$, including cases of asymptotes 3.2 Apply knowledge from 3.1 in determination as laws from experimental data.	Illustrate with examples the construction of charts and graphs. Ask the students to draw graphs	Chalkboard, Textbooks, Calculators, lesson notes.			
General Objective 4.0: Know the different methods of solving quadratic equations						
5	4.1 Solve quadratic equations by factorization 4.2 Solve quadratic equations by method of	Illustrate with detailed examples the various method of solving quadratic equations Ask the students to solve	Chalkboard, Textbooks, Calculators			

	<p>completing squares.</p> <p>4.3 Solve quadratic equations by formula</p> <p>4.4 Determine the roots.</p> <p>4.5 Form equations whose roots are given in different methods.</p>	quadratic equations				
General Objective 5.0: Understand Permutations and Combinations						
5	<p>5.1 Define permutation</p> <p>5.2 State examples of permutations</p> <p>5.3 Define combination</p> <p>5.4 State examples of combination</p> <p>5.5 Establish the theorem $nPr = \frac{n!}{(n-r)!}$ giving examples e.g. number of ways of collecting two out of 8 balls</p>	<p>Explain in details the formulation and combination, solve examples to illustrate them.</p> <p>Give exercises on permutation and combination to them</p>	Chalkboard, Textbooks, Calculators			

General Objective 6.0: Understand the concept of set theory						
6 – 7	6.1	Establish ${}^nC_r = {}^nC_n$ B r.	Illustrate with solved examples the concept of set theory. Give exercises on set theory to the students	Chalkboard, Textbooks, Calculators, lesson notes.		
	6.2	Define sets, subsets, and null sets				
	6.3	Define union, inter-section and completion of sets				
	6.4	Draw Venn diagrams to demonstrate the concepts in 6.1 B 6.3 above.				
	6.5	Calculate the size or number of elements in a given set.				
General Objective 7.0: Understand the properties of arithmetic and geometric progressions						
8 - 9	7.1	Define an Arithmetic progression (A.P.)	Describe in details with examples the meaning and properties of arithmetic progression. Ask the students to apply Arithmetic progression to solve problems. Illustrate with solved	Chalkboard, Textbooks, Calculators		
	7.2	Obtain the formula for nth term and the first n terms of an A.P.				
	7.3	Give examples of				

	<p>the above e.g. find the 20th term of the series e.g. $2 + 4 + 6 + Y \dots$. Find also the series of the first 20 terms.</p>	<p>examples the meaning and properties of geometric progression.</p> <p>Assess the students.</p>				
7.4	Define a geometric progression (G.P.)					
7.5	Obtain the formula for the nth term and the first n terms of a geometric series.					
7.6	State examples of 7.5 above e.g. given the sequences $1/3, 1, 3, Y$ find the 20 th term and hence the sum of the 1 st 20 terms.					
7.7	Define Arithmetic Mean (AM) and Geometric Mean (G.M.)					
7.8	Define convergence of series.					

	7.9	Define divergence of series.					
General Objective 8.0: Understand the binomial theorem and its application in the expansion of expressions and in approximations.							
10 - 11	8.1	Explain the method of mathematical induction	State the importance and application of the theorem				
	8.2	State and prove the binomial theorem for a positive integral index.	Explain in details the principles of binomial theorem and mathematical induction				
	8.3	Expand expressions of the forms $(x + y)^2$, $(x^2 + y^2)^s$ applying binominal theorem	Solve problem relating to binomial theorems and mathematical inductions. Assess the students.				
	8.4	Find the coefficient of a particular term in the expansion of simple binomial expressions.	Explain the need for a rational index in binomial theorem.				
	8.5	Find the middle term in the expansion of binomial	Solve problems relating to rational index in binomial theorem. Assess the students.				

	<p>expression</p> <p>8.6 State the binomial theorem for a rational index.</p> <p>8.7 Expand expressions of the form: $(1 + x)^{-1}$, $(1 + x)^2$, $(1 + x)^{-a}$ applying binomial theorem</p> <p>8.8 Expand and approximate expressions of the type $(1.001)^n$, $(0.998)^n$, $(1 + x)^2$, $(1 + x)^a$ to a stated degree of accuracy applying scalar expressions.</p>					
General Objectives 9.0: Understand the basic concepts and manipulation of vectors and their applications to the solutions of engineering problems						
12 - 13	<p>9.1 State the definitions and representations of vectors.</p> <p>9.2 Define a position</p>	<p>Illustrate in details the basic concepts and manipulation of vectors with examples.</p>				

	vector.				
9.3	Define unit vector	Apply the techniques of vectors to solve various problems			
9.4	Explain scalar multiple of a vector				
9.5	List the characteristics of parallel vectors	Solved problems involving addition and subtraction of vectors.			
9.6	Identify quantities that may be classified as vector e.g. displacement velocity, acceleration, force etc.				
9.7	Compute the modulus of any given vector up to 2 and 3 dimensions.				
9.8	State the parallelogram law in solving problems including addition and subtraction of vectors				
9.9	Apply the parallelogram law in solving problems including addition and subtraction of				

	<p>vectors.</p> <p>9.10 Explain the concept of components of a vector and the meaning of orthogonal components.</p> <p>9.11 Resolve a vector into its orthogonal components.</p> <p>9.12 List characteristics of coplanar localized vectors.</p> <p>9.13 Define the resultant or composition of coplanar vectors.</p>	<p>Explain the steps to resolve a vector into its orthogonal components.</p>				
	<p>9.14 Compute the resultant of coplanar forces acting at a point using algebraic and graphical methods.</p> <p>9.15 Apply the techniques of resolution and resultant to the solution of problems involving coplanar forces.</p>	<p>Explain the meaning of resultant of coplanar forces.</p> <p>Solve problems using algebraic and graphical methods.</p>	<p>Recommended textbooks, chalkboard, chalk, lesson notes etc.</p>			

	9.16	Apply vectoral techniques in solving problems involving relative velocity.	<p>Explain in details:</p> <p>i) Scalar product of two vectors.</p> <p>ii) Vector product of two vectors.</p> <p>Solve problems relating to scalar and vector products of vectors.</p> <p>Assess the students</p>				
	9.17	State the scalar product of two vectors.					
	9.18	Compute the scalar product of given vectors.					
	9.19	Define the cross product of the vector product or two vectors.					
	9.20	Calculate the direction ratios of given vectors.					
	9.21	Calculate the angle between two vectors using the scalar product.					

General Objective 10.0 Know the concept and solve linear simultaneous equation with two unknown variables

14	10.1	Explain the concept of equation, i.e. $A = B$ where A and B are expressions.	<p>Illustrate with solved examples the concept of linear simultaneous equations with two unknown variables.</p>	<p>Chalkboard, chalk Textbooks, Lesson notes</p>			
	10.2	List different types					

	of equations:- Linear, quadratic, cubic, etc.	Ask the student to solve various equations as indicated in section 10	etc.			
10.3	State examples of linear simultaneous equations with two unknowns and simultaneous equations with at least one quadratic equation.	Solve simultaneous equations involving a linear equation and a quadratic equation using algebraic and graphical methods.				
10.4	Apply algebraic and graphical methods in solving two simultaneous equations involving a linear equation and a quadratic equation.					
10.5	Apply the algebraic and graphical methods in solving two simultaneous quadratic equations.	Do the same for two simultaneous quadratic equations.				
10.6	Define a determinant of n^{th} order.					
10.7	Apply determinants of order 2 and 3 in solving simultaneous linear					

	equations.					
	General Objective 11.0 Understand the concept of trigonometric functions and apply them in solving problems.					
15	<p>11.1 Define the basic trigonometric ratios, sine, cosine and tangent of an angle.</p> <p>11.2 Derive the other trigonometric ratios; cosecant, secant and cotangent using the basic trigonometric ratios in 11.1 above.</p> <p>11.3 Derive identities involving the trigonometric ratios of the form; $\text{Cos}^2 \theta + \text{Sin}^2 \theta = 1$, $\text{Sec}^2 \theta = 1 + \tan^2 \theta$, etc.</p> <p>11.4 Derive the compound angle formulae for $\sin (A+B)$, $\text{Cos} (A+B)$ and $\text{Tan} (A+B)$.</p>	<p>Define and Derive the trigonometric ratios and identities.</p> <p>Illustrate with good examples the activities listed in 11.1 to 11.4.</p> <p>Assess the students.</p>	<p>Chalkboard, chalk</p> <p>Textbooks, Lesson notes etc.</p>			

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Computer Appreciation and Application			COURSE CODE: COM 101		CONTACT HOURS: 1-0-3	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand the basic components of the computer and how it has evolved over the years			General Objective 1.0: Understand the basic components of the computer and how it has evolved over the years		
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 Give a brief history of computer development 1.2 State the uses of computer and understand the impact of the PC on computer technology 1.3 Differentiate between hardware and software 1.4 Explain the input-process-output algorithm with the following in mind: 1. Central processor 2. Input Mechanism 3. Output Mechanism	Relate the present idea of computer to other equipment and items that assess man to perform tasks faster. Trace the historical evolution of Computers Assess the impact of computers to every day living Conduct the students through the various parts of the computer and how data is managed by the various parts in the system	Maximum of 4 students to a Computer system, Maximum of 4 computers to a printer except when a Network is in use Papers and computer accessories, Magic Board, Multimedia projector system.	1.1 Identify different types of computers that have evolved over the years. 1.2 Identify software packages such as System Software (MS DOS windows, etc) and Application software such as MS. Word, Excel, Access etc.	Demonstrate activities 1.1 to 1.2 for the students.	Personal Computers, Printers, with relevant soft wares.

	General Objective 2.0: Know how data is stored and applications of various operating systems			General Objective 2.0: Identify storage devices		
3 - 4	<p>2.1 Explain the application of the following:</p> <p>a. RAM b. ROM c. Fixed discs d. Removable</p> <p>2.2 Describe the concept of an operating system</p> <p>i. PC-DOS/MS DOS ii. Windows iii. Linux iv. Unix</p>	<p>Explain the need for data storage</p> <p>Explain the concept of an operating system</p>	<p>Recommended textbooks, chalkboard, lesson notes etc.</p>	<p>2.1 Identify various devices used in data storage such as RAM, ROM, Flash drive, CDs, etc.</p>	<p>Dismantle a computer system and show the students the RAM Card, Hard disk and processors.</p>	<p>Personal computers with accessories and relevant software.</p>
	General Objective 3.0: Understand the operation of Windows operating system and application			General Objective 3.0: Understand the operation of Windows operating system and application		
5 – 10	<p>3.1 Access computers correctly through Windows Operation system.</p> <p>3.2 Explain the steps for opening and closing windows.</p> <p>3.3 Explain the application of program Manager.</p> <p>3.4 State the uses and application of the various windows bars.</p>	<p>Discuss the advantage of Windows Operating System.</p> <p>Explain the Windows Menu and tools. Each student must be given an opportunity to start a computer, open/close the window operating system, understand the program manager and</p>	<p>Recommended textbooks, chalkboard, chalk, lesson notes etc.</p>	<p>3.1 Identify the main components of windows operating system.</p> <p>3.2 Demonstrate the use of windows for specific jobs.</p>	<p>Illustrate activities 3.1 to 3.2</p> <p>Assess the students.</p>	<p>Personal computers with accessories and relevant software.</p>

	<p>3.5 Explain how to move from one window to another and how to operate them concurrently.</p> <p>3.5 Explain file management and how to manage files.</p> <p>3.6 Describe the step in creating files and folders.</p> <p>3.7 Explain file manipulation (moving copying saving deleting etc).</p> <p>3.8 State the use of Print Manager.</p> <p>3.9 Explain the concept of the following software package</p> <ul style="list-style-type: none"> • MS Office • Lotus Smart suite • MS Encarta 	<p>move around in the windows environment.</p> <ul style="list-style-type: none"> • Explain the process of creating a file, manipulating the file and use of the print manager. • Assess the student Load MS Office with the student and explain the various packages that make up MS office. Load MS Encarta and discuss its use with the student. • Assess the student 				
	General Objective 4.0: Understand file Management and application of software packages – MS Word					
11 - 15				<p>4.1 Demonstrate ability in the use of a word processing packages such as MS Word or Word Perfect and covering the following:</p> <p>4.2. Entering text</p>	<p>Demonstrate the installation of MS Word</p> <p>Identify the different features of the software</p> <p>Ask students to type</p>	<ul style="list-style-type: none"> • Maximum of 4 students to a Computer system, Maximum of 4

				<p>4.3. Formatting text (boldening,, font size, italicizing, etc)</p> <p>4.4. Creating and saving text files</p> <p>4.5. Importing objects</p> <p>4.6. Spelling and grammar checking</p> <p>4.7 Creating and manipulating tables, text boxes equations</p> <p>4.8 Printing and file export</p>	<p>a short document and save it.</p> <p>Ask students to edit a document and carry out a spell check</p> <p>Demonstrate the use of tables</p>	<p>computers to a printer except when a Network is in use</p> <p>Papers and computer accessories</p> <p>, Magic Board, Multimedia projector system.</p>
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Electrical Engineering Science			COURSE CODE: IEE 101		CONTACT HOURS: 2-0-2	
Course Specification: Theoretical and Practical Contents						
WEEK	General Objective 1.0: Understand the basic concept of electric current flow.					
1	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-2	1.1 Define an atom. 1.2 Explain the structure and composition of an atom 1.3 Differentiate between conductors, insulators and semi-conductors. 1.4 Explain the concepts of current and electron flow 1.5 Define electric current, potential difference, electromotive force (e.m.f) and resistance, state their units and symbols. 1.6 State multiples and sub-multiples of Electric quantities; (e.g. Mega 10^6 , kilo- 10^3 , etc)	Draw atomic structure to explain to the student its composition. Explain the electron mobility Draw the atomic structure to explain the unique differences in their structure. Explain with the aid of diagrams how the current & electron flow. Write down the formulae and symbols for current flow, p.d. or e.m.f., resistance. Explain them to the students. Explain quantities of electricity and their units.	Chalk Board, Chalk, Recommended textbook, Charts, writing materials, calculator.			
2	General Objective 2.0: Understand simple DC circuits			General Objective 2.0: Understand simple DC circuits		

3 - 5	<p>2.1 Define DC current.</p> <p>2.2 State the analogy between current flow and water flow.</p> <p>2.3 Describe basic D.C. circuits</p> <p>2.4 Explain Ohm's law.</p> <p>2.5 Solve problems using Ohm's law.</p> <p>2.6 Define resistivity and conductivity of a conductor.</p> <p>2.7 State the relationship between resistance of a conductor, its resistivity, length and area.</p> <p>2.8 Differentiate between series and parallel circuits.</p> <p>2.9 Solve problems involving resistivity and conductivity.</p> <p>2.10 Deduce the equivalent resistance of series and parallel circuits.</p>	<p>State the definition of current.</p> <p>Explain how flow of current is similar to the flow of water.</p> <p>Draw the basic d.c circuit with source.</p> <p>Explain the flow of current.</p> <p>Use diagrams to explain Ohms law.</p> <p>Give some circuit with resistive components.</p> <p>Explain how to obtain resistivity and conductivity from the formula $R = \rho l/a$.</p> <p>Draw the circuit diagrams for series and parallel connections. Explain the differences between the Kirchhoff's laws and superposition principles. Give examples.</p>	Chalk Board, Chalk, Recommended textbook, Charts, writing materials, calculator.	<p>2.1 Conduct an experiment to demonstrate DC flow in the laboratory.</p> <p>2.2 Verify by experiment the Ohm's law.</p> <p>2.3 Verify by experiment the Kirchhoff's laws.</p>	Demonstrate for the students to learn and allow them to practice.	Potentiometers, resistors etc.
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<p>6 - 7</p>	<p>2.12 Explain Kirchhoff's laws.</p> <p>2.14 Explain the Superposition Principles.</p> <p>2.15 Solve problems involving series and parallel circuits using Kirchhoff's laws and superposition principles.</p> <p>2.16 Define temperature coefficient of resistance.</p> <p>2.17 Use the expression for resistance at temperature T (k) and to calculate change in resistance.</p> <p>2.18 See from 2.17 the change in resistance due to change in temperature.</p> <p>2.19 Solve problems involving effect of temperature on resistance.</p>	<p>Explain the relationship between the temperature and resistance of a wire.</p> <p>Show how to calculate a change in resistance when the temp changes. Explain why there is a temperature change when the current flows through a wire.</p> <p>Show a typical graph of resistance against temperature. Solve problems.</p>				
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3	General Objective 3.0: Understand various types of energy and their inter-relationships					
8-10	3.1 Explain various types of energy. 3.2 Explain the relationship between electrical, mechanical and thermal energy. 3.3 State 5.1 units of various types of energy in 3.2 3.4 State Joule's law. 3.5 Solve problems involving Joule's law.	Explain the sources of various energy generations. Show how they are related to electrical energy. Explain their units. Solve problems.	Chalk Board, Chalk, Recommended textbook, Charts, writing materials, calculator.			
4	General Objective 4.0: Understand the concept of electrostatics, electric charge and capacitance of capacitors.			General Objective 4.0: Understand the concept of electrostatics, electric charge and capacitance of capacitors.		
11-12	4.1 Explain electric charge. 4.2 State its unit. 4.3 State Coulomb's law. 4.4 Solve problems involving coulomb's law. 4.5 Define electric field strength, electric flux density, permittivity, and relative permittivity, and field intensity, potential and electric flux. 4.6 Solve problems involving the terms in 4.5. 4.7 Define capacitance. 4.8 Derive an expression for the capacitance of parallel plate capacitors	Explain sources of electric charges and electrostatic charges.	Chalk Board, Chalk, Recommended textbook, Charts, writing materials, calculator.	4.1 Conduct experiment on charging and discharging capacitor.	Demonstrate for the students to learn and ask them to practice till they become competent	Capacitors, DC Power Supply, Voltmeter, Ammeter, Stop Watch, Connecting Cables.

	in terms of area, the distance between plates and permittivity of the dielectric.					
15	<p>4.9 Derive an expression for the capacitance of parallel plate capacitors in terms of area, the distance between plates and permittivity of the dielectric.</p> <p>4.10 Derive an expression for the capacitance of a capacitor with composite dielectrics.</p> <p>4.11 Derive an expression for the voltage distribution between series connected capacitors.</p> <p>4.12 Deduce an expression for the equivalent capacitance for capacitors connected in series and in parallel.</p> <p>4.13 Derive an expression for the energy stored in a capacitor.</p> <p>4.14 Solve problems involving 4.8 to 4.12.</p>	<p>Explain the mathematical formula for the electric charge, electrostatic charges.</p> <p>Treat energy store in capacitor.</p>				

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Technical Drawing			COURSE CODE: MEC 101		CONTACT HOURS: 0-0-3	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know different drawing instruments, equipment and materials used in technical drawing.			General Objective 1.0: Know different drawing instruments, equipment and materials used in technical drawing.		
1	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 – 3	<p>1.1 State the different types of drawing instruments, equipment and materials.</p> <p>1.2 Outline the uses of the various instruments, equipment and materials.</p> <p>1.3 State the precautions necessary to preserve items 1.1 above.</p>	<p>Explain in details the features of drawing instruments and precautions to be observed while using them</p>	<p>Black board ruler (1m) Black board Tee-Square Black board compass Blackboard protector Adjustable set-square 60 set square 45 set square French curve set Templates Duster Chalk Complete drawing table</p>	<p>1.1 Identify the different types of drawing instruments, equipment and materials.</p> <p>1.2 Use each of the items in 1.1 above.</p> <p>1.3 Maintain the various instruments and equipment.</p>	<p>Guide the students to identify, use and maintain all the drawing instruments, equipment and materials:</p> <p>a. Drawing set b. T-Square c. Drawing board d. Set squares e. Types of pencils (H to B), etc.</p>	<p>Black board ruler (1m) Black board Tee-Square Black board compass Blackboard protector Adjustable set-square 60 set square 45 set square French curve set Templates Duster Chalk Complete drawing table</p>

2	General Objective 2.0: Know Graphical Communication.					
4 - 5	<p>2.1 Explain graphics and the different types of graphic presentation.</p> <p>2.2 Illustrate the various conventions present in graphical productions of construction lines, finished lines, hidden and overhead details projections, centre lines, break lines, dimensioning of plane, elevation and sections of objects.</p> <p>2.3 Layout of drawing sheets with the following (a) Margins (b) Title block etc.</p> <p>2.4 State the various standards of drawing sheets.</p> <p>2.5 Print letters and figures of various</p>	<p>Demonstrate activities 2.1 to 2.6 for the students to learn and allow them to practise.</p> <p>Assess the students' graded assignments</p>	<p>Recommended textbooks, chalkboard, chalk, lesson note etc.</p>			

	forms and characters. 2.6 Illustrate conventional signs, symbols and appropriate lettering characters.					
3	General Objective 3.0: Know the construction of simple geometrical figures and shapes.			General Objective 3.0: Know the construction of simple geometrical figures and shapes.		
6 - 7	<p>3.1 Explain the purpose of geometrical construction in drawing parallel.</p> <p>3.2 Define a circle.</p> <p>3.3 Explain the properties of a circle, e.g. radius, diameter, normal, tangent, circumference etc.</p> <p>3.4 Define a circle.</p> <p>3.5 Explain the properties of a circle, e.g. radius, diameter, normal, tangent, circumference etc.</p> <p>3.6 Define an ellipse.</p> <p>3.7 Explain the following</p>	<p>Explain in detail details the process of construction simple geometrical figures and shapes.</p> <p>Guide the students to construct regular polygon such as pentagon, hexagon, heptagon, etc using different methods.</p>	<p>Recommended textbooks, chalkboard, chalk, Drawing instruments.</p>	<p>3.1 Construct parallel and perpendicular lines.</p> <p>3.2 Construct and bisect lines, angles and areas.</p> <p>3.3 Divide a straight line into given number of equal parts.</p> <p>3.4 Identify polygons (regular or irregular)</p> <p>3.5 Construct regular polygons with N sides in a given circle, given (a) distance across flats (b) distance across corners.</p> <p>3.6 Carry out simple geometrical</p>	<p>Demonstrate activities 3.1 to 3.8 and allow the students to practice until they became competent.</p> <p>Assess the students.</p>	<p>Drawing instruments and other accessories.</p>

	<p>draughting techniques (a) Projection method (b) Measurement method (c) Transposition method.</p>			<p>constructions on circles e.g. (a) diameter of a circle of a given circumference. (b) the circumference to a circle of a given diameter</p> <p>(c) a circle to pass through 3 points (d) a circle to pass through 2 points and touch a given line (e) a circle to touch a given smaller circle and a given line (f) tangents to points (g) an arc of radius tangent to two lines at an angle to less than and more than 90 (h) an are externally tangent to two circles (i) inscribing and circumscribing circles at various.</p> <p>3.7 Construct plane scales and diagonal scales, using appropriate instruments.</p> <p>3.8 Construct ellipse by using (a) trammel method (b) concentric circle method.</p>		
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4	General Objective 4.0: Know Isometric and Oblique Projections			General Objective 4.0: Know Isometric and Oblique Projections		
8 – 9	4.1 Explain isometric and oblique projections	Ask students to differentiate between Isometric and oblique projections and assess	Recommended textbooks. Chalkboard, dust, chalk, lecture notes, drawing sets	4.1 Draw a square in isometric and oblique forms. 4.2 Draw a circle in Isometric and oblique forms 4.3 Draw an ellipse in Isometric and oblique forms. 4.4 Draw a polygon with a minimum of eight sides in Isometric and oblique forms 4.5 Dimension holes, circles, arcs and angles correctly on isometric and oblique. 4.6 Use appropriate convention symbols and abbreviations.	Ask students to construct a square and circle in isometric and oblique projections and assess. Ask students to draw a polygon in isometric and oblique projections and assess. Ask students to construct and dimension holes circles, arcs and angles in isometric and oblique projection and label with appropriate conventional symbols and abbreviations and assess	Drawing instruments and accessories.
5	General Objective 5.0: Know single orthographic projections			General Objective 5.0: Know single orthographic projections		
	5.1 Explain the principle of orthographic	Ask students to differentiate between		5.1 Project views of three-dimensional objects	Ask students to construct	

11 - 12	<p>projection.</p> <p>5.2 Illustrate the principle planes of projection (a) Vertical plane (b) Horizontal plane.</p> <p>5.3 Explain why the first and third angles are used and the second and fourth angles not used.</p>	<p>first and third angle orthographic projection and assess.</p> <p>Ask students to explain the vertical and horizontal planes in orthographic projection and assess</p>		<p>on to the basic planes of projection in both first and third angle to obtain (a) the front view or elevation (b) the top view or plan.</p>	<p>orthographic projections of simple objects in first and third angle orthographic projections and assess</p>	
6	General Objective 6.0: Understand the intersections of regular solids			General Objective 6.0: Understand the intersections of regular solids		
13 - 15	6.1 Explain interpretation or intersections of solids	Ask students to give examples of intersection of solids	Recommended textbooks. Chalkboard, dust, chalk, lecture notes, drawing sets	6.1 Draw the lines of intersections of the following regular solids and planes in both first and third angles. a. Two square-prisms meeting at right angles. b. Two dissimilar square prisms meeting at an angle. c. Two dissimilar square prisms meeting to an angle	Ask students to construct: Two square-prisms meeting at right angles a. Two dissimilar square prisms meeting at “ b. Two dissimilar square prisms meeting 60 c. An hexagonal prism meeting a square prism	Drawing instruments and accessories.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Mechanical Engineering Science	COURSE CODE: MEC 103	CONTACT HOURS: 2-0-2
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Course Specification: Theoretical & Practical Content

WEEK	General Objective 1.0: Know the basic principles of statics	General Objective 1.0: Know the basic principles of statics
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1	Theoretical Content	Practical Content
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	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
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1 - 2	1.1 Define a Scalar quantity	Explain in details the basic principles of statics and the concepts of particles and rigid bodies.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc	1.1 Locate the centre of gravity of plane areas.	Demonstrate activities 1.1 and 1.2 for the students to learn and ask them to carry out all the activities.	Graph Sheets, Drawing instruments, etc.
	1.2 Define vector quantity			1.2 Determine graphically the centre of gravity of plane areas and solid bodies		
	1.3 Distinguish between 1.1 and 1.2.					
	1.4 Give examples in 1.1 and 1.2.					
	1.5 Explain the concept of particles and rigid body					

2	General Objective 2.0: Understand motion of bodies.					
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3	2.1 Define motion	Explain with detailed notes motion of bodies. Solve problems involving motion.	Recommended textbook, chalkboard, duster, chalk, lesson notes, etc.			
	2.2 State types of motion					
	2.3 Give practical examples of types of					

	motion.					
3	General Objective 3.0: Know the concept of distance, displacement, speed, velocity and acceleration					
4	<p>3.1 Define scalar and vector quantities.</p> <p>3.2 Define distance, displacement, speed, velocity and acceleration.</p> <p>3.3 Explain the quantities defined above and classify them as scalar and vector quantities.</p> <p>3.4 State the SI units of the quantities.</p> <p>3.5 Solve problems relating to the quantities in 3.2 above.</p>	Describe with solved examples the concept of distance, displacement, speed, velocity and acceleration	Recommended textbooks, chalkboard, chalk Dusters, lesson notes etc.			
4	General Objective 4.0: Understand the concept and effect of force and its moments			General Objective 4.0: Understand the concept and effect of force and its moments		
5-7	<p>4.1 Define force.</p> <p>4.2 Describe the conditions for the equilibrium of coplanar forces.</p> <p>4.3 State the principles of parallelogram of forces.</p> <p>4.4 Explain how to construct</p>	<p>Explain in details the concept and effects of forces and their moments.</p> <p>Guide the students to solve problems relating to forces and its moments.</p>	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.	<p>4.1 Construct parallelogram of force.</p> <p>4.2 Draw triangle of forces</p> <p>4.3 Draw polygon of forces.</p> <p>4.4 Verify Lami's theorem using a force board.</p> <p>4.5 Verify the parallelogram law of</p>	Demonstrate activities 4.1 to 4.5 for the students to learn and ask them to carry out all the activities	Drawing materials/instruments

	<p>parallelogram of forces.</p> <p>4.5 Calculate the resultant of a system of two forces.</p> <p>4.6 State the principle of triangle of forces.</p> <p>4.7 Resolve forces into components.</p> <p>4.8 Resolve a force into force and couple.</p> <p>4.9 Define moment of a force.</p> <p>4.10 State the principles of moments.</p> <p>4.11 Solve problems related to 4.1 to 4.11 above.</p>	Assess students' graded assignment		forces		
5	General Objective 5.0: Understand the effect of friction and the law governing it			General Objective 5.0: Understand the effect of friction and the law governing it		
8	<p>5.1 Define friction.</p> <p>5.2 State advantages and disadvantages of friction.</p> <p>5.3 Define coefficient of</p>	<p>Explain in details the principles and effects of friction and the law governing it.</p> <p>Guide the students to solve problems relating</p>	<p>Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.</p>	<p>5.1 Determine the co-efficient of friction by means of an inclined plane.</p>	<p>Demonstrate activity 5.1 for the students to learn and ask them to carry out the activity</p>	<p>Specimens of masses, inclined plain set-up. Protractor, etc.</p>

	friction. 5.4 Define limiting angle of friction. 5.5 Define angle of repose. 5.6 Solve problems related to 5.1 to 5.5	to friction.				
6	General Objective 6.0: Know the forces in simple frames and structures			General Objective 6.0: Know the forces in simple frames and structures		
9	6.1 Explain forces in the members (including Trusses) using free Body Diagram. 6.2 State the general conditions for equilibrium. 6.3 Solve problems involving supported beams and cantilevers.	Explain in details the features and concepts of forces in simple frames and structures	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.	6.1 Apply BOW's notation for graphical analysis of simple frame structures. 6.2 Determine the nature of the forces acting on each member of simple frame.	Demonstrate the experiments in 6.1 and 6.2 for the students to learn and ask them to carry out the experiments	Specimens of forces acting on members of simple frames.
7	General Objective 7.0: Understand the concept of torque, work, energy and power.					
10	7.1 Define the following terms: Torque, Work, Energy, Power.	Explain in details the concept of torque, work, energy and power.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.			

	<p>7.2 State the unit of measurement of the terms above.</p> <p>7.3 State types of energy to include Kinetic and Potential Energy.</p> <p>7.4 State the law of conservation of energy.</p> <p>7.5 Solve problems involving torque, work, energy and power.</p>					
8	General Objective 8.0: Understand the concept of simple machines			General Objective 8.0: Understand the concept of simple machines		
11-12	<p>8.1 State and explain the classification of simple machines such as levers, pulleys, etc.</p> <p>8.2 Describe the functions of load and effort.</p> <p>8.3 Define Mechanical Advantage, Efficiency and Velocity ratios of different classes of</p>	<p>Explain in details the concept of simple machines with examples and relevant notes.</p> <p>Assess the students.</p>	<p>Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.</p>	<p>8.1 Identify simple machines in the laboratory.</p> <p>8.2 Demonstrate the operation of simple machines.</p>	<p>Show the students simple machines and demonstrate their operations in the laboratory and in the field.</p>	<p>Levers, Pulleys, etc.</p>

	<p>simple machines.</p> <p>8.4 Relate the terms defined above mathematically.</p> <p>8.5 Solve problems relating to terms defined in 8.3 above.</p>					
9	General Objective 9.0: Understand the concept of direct stress and strain			General Objective 9.0: Understand the concept of direct stress and strain		
13	<p>9.1 Define direct stress and strain.</p> <p>9.2 State Hook's law.</p> <p>9.3 Explain the following parameters:</p> <p>Modulus of Elasticity</p> <p>Elastic limit</p> <p>UTS</p> <p>Yield Stress</p> <p>Shear Stress</p> <p>Safety factor</p> <p>9.4 Draw a diagram to illustrate the parameters in 9.3</p>	<p>Explain in details the concept of direct stress and strain with diagrams, examples and adequate notes.</p>	<p>Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.</p>	<p>9.1 Conduct an experiment to verify Hook's law.</p> <p>9.2 Conduct an experiment to demonstrate all the parameters in 9.3 in the theory.</p>	<p>Demonstrate for the students to learn and allow them to practise</p>	<p>Clamps, springs, samples of loads</p>

	above. 9.5 Solve problems relating to 9.1 to 9.3 above					
10	General Objective 10.0: Know the concept of hydrostatics			General Objective 10.0: Know the concept of hydrostatics		
14	10.1 Define the term 'Hydrostatics'. 10.2 State Archimedes Principle. 10.3 Define density and relative density of a fluid, volume and weight of floating bodies. 10.4 State and explain the factors necessary for floating bodies to be in equilibrium. 10.5 Explain the variation of fluid pressure with depth and total force due to liquid pressure on immersed plane surface – horizontal or vertical. 10.6 Solve problems	Explain in details with appropriate diagrams and notes the concepts of hydrostatics.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.	10.1 Conduct experiment to illustrate Archimedes Principles.	Demonstrate for students to learn and allow them to practice.	Water trough, string, samples of weight, etc.

	relating to 10.2 to 10.5 above.					
11	General Objective 11.0: Understand the stability principles of floating vessels.			General Objective 11.0: Understand the stability principles of floating vessels.		
15	<p>11.1 Define and explain with the aid of diagram: centre of buoyancy, centre of gravity meta centre of a floating vessel.</p> <p>11.2 Describe with the aid of diagram how the parameters described above can be applied to achieve stability of a floating vessel (Box shape only).</p> <p>11.3 Solve problems relating to 11.1 to 11.2 above.</p>	Explain in details with diagrams and adequate notes the stability principles of floating vessels.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.	11.1 Conduct an experiment to demonstrate the stability of floating vessels	Show how the experiment is performed for the students to learn and allow them to practice.	Hydraulic bench, v-bottom and flat bottom objects, strings, etc.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Workshop Technology I			COURSE CODE: MEC 105		CONTACT HOURS: 0-0-4	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know workshop safety rules and regulations and understand the meaning and the purpose of workshop					
1	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 State safety precautions 1.2 Explain protective wears 1.3 List all safety rules and regulation. 1.4 Define workshop. 1.5 State types of workshop and operations carried out in each workshop.	Explain in details safety rules and regulations in workshop practice.	Chalkboard, Textbooks, Charts, etc	1.1 Observe safety precautions. 1.2 Operate safety equipment e.g. fire extinguishers, safety water hose etc. 1.3 Use protective wears. 1.4 Observe all safety rules and regulations	Demonstrate activities 1.1 to 1.4 for the students to learn and ask them to carry out all the activities	Fire extinguishers, Water hoses, Sand buckets, Safety charts, etc.

2				General Objective 2.0 Know how to use and maintain various bench tools.		
3				<p>2.1 Use marking-out tools on the bench correctly.</p> <p>2.2 Produce simple objects using bench/hand tools such as files, chisels, scribers, scrapers, saws, etc.</p> <p>2.3 Maintain files, dividers, saws, gauges try squares, bevel edge square etc.</p>	<p>Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to carry out all the activities</p>	<p>Micrometer Screw</p> <p>Gauge, Vernier Calipers, Steel rule,</p>
3				General Objective 3.0 Demonstrate skills in the use of simple measuring and testing instruments.		
4 - 5				<p>3.1 Perform simple measuring exercises using steel rules, vernier calipers and micrometers.</p> <p>3.2 Use dial indicators to</p> <p>(i) set up jobs on the lathe</p> <p>(ii) test roundness etc.</p>	<p>Demonstrate activities 3.1 to 3.5 for the students to learn and ask them to carry out all the activities</p>	<p>spirit level, surface roughness tester, (portable type) SURF TEST 4 90° angle gauge, straight edge, vernier, protractor, sine bar,</p>

				<p>3.3 Carry out exercises involving flatness and squareness.</p> <p>3.4 Perform taper measurement on jobs using vernier calipers, protractor and sine bars.</p> <p>3.5 Inspect jobs using simple comparators to test straightness and surface finish.</p>		<p>set of standard slip gauges, marking out table, bench, comparator, 0-100 mm S-d Test mandrels.</p>
4	General Objective 4.0: Know and demonstrate skills in drilling operations			General Objective 4.0: Know and demonstrate skills in drilling operations		
6	<p>4.1 Discuss the nomenclature of a twist drill.</p> <p>4.2 Discuss the formulae for calculation of speed of various sizes of drills:</p> $n = [v \times 1000] / [1 \times d]$ <p>Where n = no. of rev/min d = dia of drill in mm v = cutting speed</p>	<p>Explain in details the features and processes of drilling operations.</p> <p>Guide the students to calculate the speed of various sizes of drills.</p>	<p>Chalkboard, Textbooks, Charts, etc</p>	<p>4.1 Carryout simple drilling operation on a work piece.</p>	<p>Demonstrate activities 4.1 for the students to learn and ask them to carry out all the activities</p>	<p>Drilling machines, drill bits.</p>
5	General Objective 5.0: Know and demonstrate skills in tapping and metal joining operations			General Objective 5.0: Know and demonstrate skills in tapping and metal joining operations		

7	<p>5.1 State the correct tapping drill size.</p> <p>5.2 Explain how to tap a drilled hole.</p> <p>5.3 Explain the processes of fabrication of metal container by knock-up joining.</p> <p>5.4 Explain soft soldering process.</p>	<p>Explain in details the principles of tapping and metal joining operations.</p> <p>Guide the students to calculate the tapping drill size for v-threads.</p>	<p>Recommended textbook, Lecture notes, Chalkboard, Chalk ,Duster, etc</p>	<p>5.1 Carryout simple tapping operation on a drilled hole in a work piece.</p> <p>5.2 Join metal container by using knock-up joining.</p> <p>5.3 Join metal container by grooving technique.</p> <p>5.4 Carryout soft soldering process.</p>	<p>Demonstrate activities 5.1 to 5.4 for the students to learn and ask them to carry out all the activities.</p> <p>Assess the students.</p>	<p>Drilling Machines, Assorted taps, Soft Soldering Equipment, OXY-acetylene gas welding set, Manual rolling machine, Guillotine, shear ing machine, Assorted cutting snips, Bending machine.</p>
6	General Objective 6.0: Know the various wood working tools and operations			General Objective 6.0: Know the various wood working tools and operations		
8 - 12	<p>6.1 Know and state the applications of the following:</p> <p>a. Geometric/marking out tools e.g. try square, dividers and gauges</p> <p>b. Planning tools e.g. Jack, smooth, try planes, spoke shaves, etc.</p> <p>c. Cutting tools e.g. saws chisels, knives, boring tools.</p> <p>d. Impelling tools e.g. hammer and mallets.</p> <p>e. Pneumatic tools.</p>	<p>Explain in details the features and operations of various wood working tools.</p>	<p>Recommended textbook, Lecture notes, Chalkboard, Chalk ,Duster, etc</p>	<p>6.1 Operate different types of drilling machine</p> <p>6.2 Carry out drilling operations such as counter-boring and counter-sinking</p> <p>6.3 Grind drill bits accurately</p> <p>6.4 Select correct drilling speeds</p>	<p>Demonstrate activities 6.1 to 6.4 for the students to learn and ask them to carry out all the activities</p>	<p>Radial drilling machine, Bench drilling machine, Pillar drilling machine, Column type drilling machine.</p>

	<p>6.2 Describe portable electric hand tools in wood work, e.g. portable saw, portable planer, portable drill, portable sander and jig saw.</p> <p>6.3 Explain the operations of the tools in 6.1</p> <p>6.4 List basic wood working machine's such as:</p> <ul style="list-style-type: none"> a. Surface planning and thickening machine. b. Circular sawing machine. c. Morticing machine d. Drilling machine. e. Single ended tenon machine. f. Band sawing machines and safety precaution in their operations 					
7						General Objective 7.0: Demonstrate skills in reaming operations

13 - 15				<p>7.1 Carry out reaming operations</p> <ul style="list-style-type: none"> i. on the bench ii. on drilling/lathe <p>7.2 Select correct speeds for reaming small and large holes.</p>	<p>Demonstrate activities 5.1 to 5.2 for the students to learn and ask them to carry out all the activities</p>	<p>Hand reamers, Machine reamers, Tap wrenches, Jacob's chuck and key, Medium size Lathe, Reduction sleeves, Radial drilling machine, and Pillar drilling machine</p>
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Arc Welding	COURSE CODE: IME 101	CONTACT HOURS: 0-0-4
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Course Specification: Theoretical and Practical Contents

WEEK	General Objective 1.0: Understand safety precautions related to Arc Welding			General Objective 1.0: Apply safety precautions related to Arc Welding		
1	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 List and explain the hazards related to metal arc welding, e.g. a. arc eye b. burning c. radiation d. electric shock e. toxic fumes, etc	Explain the hazard related to metal arc welding as listed in 1.1 • Discuss how these listed hazards can be avoided • Give detailed notes	Chalkboard, Chalk, Duster, Recommended textbooks, Lecture notes, Charts.	1.1 Select, use and care for protective wears required while carrying out metal arc welding operations, e.g. a. head and face shields b. hand gloves c. apron d. Eye goggles e. boots and leggings, etc. 1.2 Observe appropriate safety precautions while carrying out: a. arc welding in confined spaces b. Arc welding of empty vessels or	Show the students various protective wears and how to use them.	PPE, Safety Charts, etc.

				drums that had contained inflammable or toxic materials c. Arc welding near inflammable materials		
2	General Objective 2.0: Understand the construction, features and working principles of arc welding machines and accessories			General Objective 2.0: Understand the construction, features and working principles of arc welding machines and accessories		
3 - 5	<p>2.1 Differentiate between A.C and D.C arc welding machine.</p> <p>2.2 Explain the working principles of A.C. and D.C. welding machines.</p> <p>2.3 List and state the functions of the welding accessories, e.g. 1. welding load 2. earth load 3. electrode holder 4. chipping hammer 5. wire brush, etc.</p> <p>2.4 State the advantages and disadvantages of</p>	<p>Explain the differences between A.C. and D.C. arc welding machines</p> <p>State the working principles of A.C. and D.C. welding machines</p> <ul style="list-style-type: none"> • Explain the function of welding accessories as listed in 2.3 	<p>Chalkboard, Chalk, Duster, Recommended textbooks, Lecture notes, Charts.</p>	<p>1.1 Set and use the A.C. and D.C. welding machines for specified voltage/amperage operation, observing safety precaution.</p> <p>1.2 Select electrode materials according to parent system.</p> <p>1.3 Strike metal arc and maintain the arc.</p> <p>1.4 Carry out with proficiency the following arc welding techniques/ operations: a. weaving</p>	<p>Show students the different features in the construction of the arc welding machine</p> <p>Demonstrate the use of A.C. and D.C. machines for specified voltage and amperage observing safety precautions.</p> <ul style="list-style-type: none"> • Demonstrate how to strike and maintain the arc • Ask students to practice striking metal arc and maintaining the arc 	<p>A.C. and D.C. arc welding machines and accessories.</p>

	<p>A.C. and D.C. welding systems.</p> <p>2.5 Explain the following processes of electrode manufacture:</p> <p>a. solid extrusion process b. extruded with re-enforcing coating c. dipped process.</p> <p>2.6 Describe with sketches the material composition of different types of electrodes.</p> <p>2.7 State the conventional electrode classification system.</p>			<p>b. laying of multi-runs, etc.</p> <p>Note: Safety regulations and requirements must be observed.</p>	<p>• Demonstrate with proficiency the following arc welding techniques/operations:</p> <p>i. weaving ii. laying of multi-runs etc observing safety regulations as required</p>	
3	General Objective 3.0: Make different types of arc welded joints in all positions			General Objective 3.0: Make different types of arc welded joints in all positions		
	3.1 Describe with sketches the application of the following joints in	Explain in details with appropriate diagrams and notes joints in metal fabrication.	Chalkboard, Chalk,	3.1 Prepare edges for welding the following joints:	Demonstrate activities 3.1 to 3.8 for students to learn and allow them to practice till	Arc welding machines and accessories.

6 – 8	<p>metal fabrication:</p> <p>a. square butt b. single vee c. double vee d. single U Fillet e. open corner, etc.</p> <p>3.2 State and explain the factors that govern the selection of joints to be used for a project e.g.</p> <p>a. type of metal b. thickness of metal c. shape of plate d. position of joint</p> <p>3.3 Interpret the various arc welding symbols and conventions used in engineering working drawings</p>		<p>Duster, Recommended textbooks, Lecture notes, Charts.</p>	<p>a. square butt b. single vee c. double vee d. single U e. double U f. open corner</p> <p>3.2 Weld the prepared joints in (3.1) above in flat positions observing necessary safety precautions.</p> <p>3.3 Prepare metal surfaces for:</p> <p>a. multi-run welds b. weaving welds</p> <p>3.4 Make multi-run welds</p> <p>3.5 Make weaving welds</p> <p>3.6 Weld joints in the following positions:</p> <p>a. vertical position b. horizontal position c. overhead position</p> <p>3.7 Weld pipes and flanges in various fixed positions.</p> <p>3.8 Weld pipes and</p>	they become competent	
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				flanges in rotated position		
4	General Objective 4.0: Build up worn metallic shafts; air surfaces using metal arc welding			General Objective 4.0: Build up worn metallic shafts; air surfaces using metal arc welding		
9 - 10	4.1 Discuss the properties of given worn metallic parts to be restored by arc welding.	Describe the composition of a given worn metal shafts or parts e.g. gear teeth that can be restored by arc welding • State the properties of given worn metal parts to be restored by arc welding.	Chalkboard, Chalk, Duster, Recommended textbooks, Lecture notes, Charts.	4.1 Identify the composition of given worn metallic shafts or other worn metallic parts. e.g. gear teeth that can be restored by arc welding. 4.2 Build-up given worn metallic parts to specification using appropriate techniques including controls against distortion.	• Demonstrate the building up of worn metal parts to specification, using appropriate techniques and control against distortion	Arc welding machines and accessories.
5	General Objective 5.0: Cut Metals to Various Specifications Using Metal Arc Cutting Process.			General Objective 5.0: Cut Metals to Various Specifications Using Metal Arc Cutting Process.		
11 - 12	5.1 Explain the principles and application of the following arc cutting methods in metal	Explain the principles and application of the following arc cutting methods in metal	Chalkboard, Chalk, Duster,	5.1 Identify arc cutting electrodes and state their compositions and uses. 5.2 Cut metals with facility using the different	Demonstrate the cutting of metals using the different cutting method	Arc welding machines and accessories.

	fabrication: a. air arc method b. carbon arc method c. oxy arc method	fabrication: i. air arc method ii. carbon arc method and iii. oxy arc method Explain arc cutting electrode stating their composition and uses.	Recommended textbooks, Lecture notes, Charts.	cutting methods named in 5.1 above.	named in 5.1 above.	
	General Objective 6.0: Know various arc welding defects and rectify them			General Objective 6.0: Know various arc welding defects and rectify them		
13 - 15	6.1 Describe major defects in arc welded joints including undercut; lack of fusion (side, root, inter-run); porosity; slag inclusion (oxide entrenchment); unequal leg length (uneven alignment); and lack of reinforcement. 6.2 Explain how the weld defects in 6.1 above can be avoided.	Explain major defects in arc welded joint as in 6.1 Show students samples of these defects Explain how weld defects in 6.1 above can be avoided.	Chalkboard, Chalk, Duster, Recommended textbooks, Lecture notes, Charts.	6.1 Apply the following tests to detect defects in arc welded joints: a. non-destructive tests such as visual inspection, x-ray test, gamma ray test, ultrasonic test, magnetic track detector, dye penetrant; b. destructive tests such as bend test, macro and micro examinations sulphur print, izod and fatigue. 6.2 Rectify welded	Demonstrate the application of the following test to detect defects in arc welded joints as shown in 6.3 (a-b) Test, evaluate the students in the production process	Arc welding machines and accessories.

				<p>joint defects named in 6.1 above.</p> <p>6.3 Produce project involving the application of:</p> <ul style="list-style-type: none">a. General safety precautionb. Using both AC and DC machinesc. Ferrous and non-ferrous metalsd. Different type of joints in all positions and defects, etc		
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PROGRAMME :NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Marine Pollution			COURSE CODE: IME 103		CONTACT HOURS: 1-0-1	
GOAL: To acquire knowledge and skills in marine pollution						
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand the term pollutant			General Objective 1.0: Understand the effect of pollutants on living matter		
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Explain the full meaning of marine pollution 1.2 List sources of marine pollution.	Explain pollution and pollutant. Describe types of pollutants	Chalkboard Lecture notes Textbooks Etc.	1.1 Appreciate dangers of pollutants	Collect sample of pollutant (e.g. crude oil) & demonstrate in front of students the action of crude oil on marine biota	Beakers and pollutants
	General Objective 2.0: Know tankers and sources of oil			General Objective 2.0: Identify crude oil reserve points and tanker models		
2-3	2.1 List important areas in the world where crude oil is found in commercial quantities. 2.2 Explain the types and uses of oil Tankers	Explain areas of the world with commercial reserves of oil Identify an discuss various types of tankers	Lecture notes Charts Models etc.	2.1 Identify major oil producers and differentiate types of tankers	Use world map to indicate areas around the world where crude oil is found in commercial quantities Use models or profile drawings of the various types of	WORLD MAP Profile drawings or models of different types of Tankers.

					Tankers.	
	General Objective 3.0: Know sources of oil pollution					
4-6	<p>3.1 Trace the historical background of pollution by Neolithic man.</p> <p>3.2 Trace the history of oil</p> <p>3.3 Discuss the effects of industrialization on pollution</p> <p>3.4 Mention other sources of pollution</p>	<p>Discuss the history of pollution</p> <p>Explain the history of oil as a source of energy</p> <p>Explain how the industrial revolution encouraged oil pollution</p> <p>Mention major maritime accidents</p> <p>List other sources of oil pollution e.g. drilling spillage; gaseous discharges; operational discharges from tankers; bilge discharges; spills caused by marine accidents, collisions, groundings etc.</p>	<p>Chalkboard</p> <p>Textbooks</p> <p>Maps</p> <p>Large photographs of marine accident scenes</p>			
	General Objective 4.0: Know the effects of marine pollution					
7-8	<p>4.1 State the effects of oil pollution on marine, shore life and vegetation.</p> <p>4.2 Explain risk to man from the consumption of oil derived carcinogens (PNAH).</p> <p>4.3 Describe substances</p>	<p>Demonstrate effects with chemical formulae</p>	<p>Photographs of polluted beaches and marine biota</p> <p>Shipboard Medical Book</p>			

	that are emitted into the air from the use of fuel oil. 4.4 Explain why oil pollution is a fire and explosion risk.					
General Objective 5.0: Know prevention of oil spills from ships						
9	5.1 Describe various pollution control methods 5.2 Explain how good communication can help to reduce spillage	Sketch a hose and a loading arm of a tanker List the precautions to be observed when bunkering.	Photographs of oil booms skimmers etc.			
General Objective 6.0: Know rules relating to pumping systems						
10-11	6.1 List international conventions on marine Pollution (ICMP) 6.2 List the rules relating to pumping systems	List the rules relating to pumping systems onboard ships especially tankers Sketch, label and describe the various pumping equipment	Chalkboard IMO books on Conventions			
General Objective 7.0: Know equipment for marine pollution and prevention						
12-13	7.1 Describe oily water separator. 7.2 Describe oil content monitoring device	Sketch and describe oily water separator, oil content monitoring device and incinerator	Chalk Board Photographs Models			

	<p>7.3 Describe an incinerator</p> <p>7.4 Describe main and bilge injection valves.</p> <p>7.5 Describe Marine sewage treatment system.</p>	<p>Explain water Ballast systems, oil tanks pumping system</p> <p>Sketch main and bilge injection valves and marine sewage treatment system</p> <p>Describe effects of microbes in ballast systems</p>				
<p>General Objective 8.0: Know other sources and prevention of marine pollution</p>						
14-15	<p>8.1 Describe the effects of poor combustion on marine pollution</p> <p>8.2 Describe an engine exhaust scrubber</p> <p>8.3 Highlight ballasts system convention</p> <p>8.4 Describe the effects of sewage and garbage as marine pollutants</p>	<p>Use chemical equations and photographs to demonstrate the effects of: poor combustion, sewage, garbage and poor ballasts systems.</p>	<p>Photographs</p> <p>Chalkboard</p>			

SECOND SEMESTER COURSES

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

Course: Communication skills

Course Code: GNS 102

Contact Hours: 2 – 0 – 0

Goal: To acquire knowledge and skills in communication

COURSE SPECIFICATION: THEORETICAL CONTENT

PRACTICAL CONTENT

General Objective 1: Develop appropriate study skills using English language

General Objective 1: Develop appropriate study skills using English language

Week	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
1	1.1 Explain the concepts of phrase and clause.	Define the terms phrase and clause and explain their various types.	Relevant textbooks.	<ul style="list-style-type: none"> Identify structural and functional phrases and clauses. 	Guide students in the identification.	Relevant textbooks.
2	1.2 Explain the definition of the sentence.	Define the sentence and remind the various types.	Relevant textbooks.	<ul style="list-style-type: none"> Identify structural and functional sentences. 	Guide the students in the process.	Relevant textbooks.
Week	General Objective 2: Know how to write good essays, reports, and articles.			General Objective 2: Know how to write good essays, reports, and articles.		
3	2.1 List the different types of essay and identify the features of each type.	List and explain the different types, and features of essay.	Model essays, literature, etc Handouts	<ul style="list-style-type: none"> Generate relevant information on a given topic. Draw up a good outline. Write a good essay on a given topic. 	Assign topics and evaluate students’ work.	Handouts
4	2.2 Describe a report; its types, uses and	Define a report and list types. Enumerate uses	Model of good reports.	<ul style="list-style-type: none"> Write a report. 	Evaluate the report.	Handouts

	Characteristics	and characteristics of a good report.				
5	2.3 Identify the techniques for writing articles.	Explain techniques for writing articles.	Model essays and articles. Handouts	<ul style="list-style-type: none"> • Write good articles for publication. 	Evaluate and analyze published essays.	Newspapers Journals Magazines
Week	General Objective 3: Comprehend the difference between denotative and connotative use of words.			General Objective 3: Comprehend the difference between denotative and connotative use of words.		
6	3.1 Explain the term denotation.	Explain the term denotation.	Relevant textbooks.	<ul style="list-style-type: none"> • Identify words used denotatively. • Apply words denotatively. 	Compare denotative and connotative usage in group of synonyms e.g. woman, lady, female, client, customer, patient, fear, terror, dread, etc.	Relevant textbooks.
7	3.2 Explain the term connotative.	Explain the term connotation.	Relevant textbooks.	<ul style="list-style-type: none"> • Identify words used connotatively. • Apply words connotatively. 	Guide students and evaluate their work.	Relevant textbooks, Handouts
Week	General Objective 4: Understand the techniques of comprehension and summary writing.					
8	4.1 Give contextual explanations to statement to a text. 4.2 Describe summary writing types and steps in writing them.	Explain the techniques answering questions on comprehension at a higher level of difficulty. Explain and illustrate summary writing, types, and steps in writing	Relevant textbooks.	<ul style="list-style-type: none"> • Write comprehension passages at a higher level of difficulty. • Write, within a specified length, a good summary of a given passage. 	Guide and grade students work.	Relevant textbooks.

		them.				
9	4.3 Identify colloquialism, slangs and jargons.	Explain and illustrate colloquialisms, slangs and jargons.	Relevant textbooks.	<ul style="list-style-type: none"> State appropriate use of jargons. 	Guide students.	Relevant textbooks.
Week	General Objective 5: Understand registers.			General Objective 5: Understand registers.		
10	5.1 Understand registers.	Explain registers and factors influencing them viz field, mode, and tenor.	Passages from source books.	<ul style="list-style-type: none"> Identify items of register in a given passage. List items of register in a given passage. 	Guide and evaluate students' work.	Textbooks, workbooks.
Week	General Objective 6: Understand the principles of correspondence.			General Objective 6: Understand the principles of correspondence.		
11 – 15	6.1 Recognise the different types of business letters. 6.2 Apply suitable language for business letters.	Describe and illustrate the different types of business letters e.g. applications, enquiry, invitation, complaints, etc and their replies. Explain suitable language for specific types of business letter.	Model business letters. Handouts	<ul style="list-style-type: none"> Write business letters. Write business letters. 	Guide and grade students' work.	Handouts Example of generic business letters

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

Course: Calculus

Course code: MTH 102

Contact Hours: 2 – 0 – 0

GOAL: To acquaint Students with knowledge of differentiation and integration and their applications

Course specification: Theoretical Content

Practical Content

General Objective 1: Understand the basic concepts of differential calculus and their application in solving engineering problems.

Week	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1-4	1.1 Define limits with examples. 1.2 State and prove basic theorems on limits. 1.3 Prove that $\lim_{\Phi \rightarrow 0} \sin \Phi / \Phi = 1$, $\lim_{\Phi \rightarrow 0} \tan \Phi / \Phi = 1$ as $\Phi \rightarrow 0$. 1.4 Define differentiation as an incremental notation or a function. 1.5 Differentiate a function from first principles 1.6 Prove the formulae for derivative of functions, Function of a function, products, and quotient of functions.	Explain with detailed notes and solve examples the concept of differential calculus. Teachers are to give and solve simple engineering and technological problems.	Chalkboard, textbooks, lecture notes, chalk, calculator.			

	<p>1.7 Differentiate simple algebraic, trigonometric, logarithmic, exponential, hyperbolic parametric, inverse and implicit functions.</p> <p>1.8 Derive second derivative of a function.</p> <p>1.9 Apply differentiation to simple engineering and technological problems.</p> <p>1.10 Explain the rate of change of a function</p> <p>1.11 Explain the condition for turning point of a function.</p> <p>1.12 Distinguish between maximum and minimum value of a function.</p> <p>1.13 Sketch the graph of a function showing its maximum and minimum points and points of reflexion.</p> <p>1.14 Estimate error quantities from the</p>	<p>- Derive an expression for derivative of functions, function of a function, products and quotient of functions.</p> <p>- Solve problems relating to differentiation of simple algebraic, trigonometric, logarithmic, exponential, hyperbolic, parametric, and inverse and implicit functions.</p> <p>Explain the concept of turning point of a function, maximum and minimum value of function.</p> <p>Illustrate with graph a function showing its maximum and minimum points.</p>				
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	<p>small increment of a function.</p> <p>1.15 Determine the tangent to a curve.</p> <p>1.16 Determine the normal to a curve.</p>					
Week	General Objective 2: Know integration as the reverse of differentiation and its application to engineering problems					
5 – 8	<p>2.1 Define integration as the reverse of differentiation.</p> <p>2.2 Explain integration as a limit of summation of a function.</p> <p>2.3 Distinguish between indefinite and definite integrals.</p> <p>2.4 Determine the indefinite and definite integrals.</p> <p>2.5 Determine the definite integral of a function.</p> <p>2.6 Integrate algebraic, logarithmic, trigonometric and exponential simple functions.</p> <p>2.7 List possible methods of integration.</p> <p>2.8 Integrate algebraic and trigonometric functions by substitution method.</p>	<p>Illustrate with examples the principles of integration.</p> <p>Ask students to apply integral calculus to simple function</p> <p>Solve problems involving algebraic, logarithmic, trigonometric and exponentials functions.</p>	<p>Chalkboard, textbooks, lecture notes, chalk, calculator.</p>			

<p>2.9 Integrate trigonometric and exponential functions by parts.</p> <p>2.10 Integrate algebraic functions by partial fraction.</p> <p>2.11 Integrate trigonometric and logarithmic functions applying reduction formula.</p> <p>2.12 State standard forms of some basic integrals.</p> <p>2.13 Calculate length of arc, area under a curve, area between two curves, volume of revolution, centre of gravity, centre of surface area, second moment and moment of inertia.</p> <p>2.14 Define Trapezoidal and Simpson's rule as methods of approximating areas under given curves.</p> <p>2.15 Find approximate area under a curve applying Trapezoidal method.</p> <p>2.16 Find approximate area under a curve applying Simpson's rule.</p> <p>2.17 Compare result obtained from Trapezoidal and Simpson's rules with the</p>		<p>Explain in details with notes and solved example.</p>				
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	results by direct integration. 2.18 Apply integration to kinematics.					
Week	General Objective 3: Understand first order homogenous linear ordinary equations with constant coefficients as applied to simple engineering problems					
9 – 12	<p>3.1 Define first order differential equation</p> <p>3.2 List order, degree, general solution, boundary or initial conditions and particular solution of differential equations.</p> <p>3.3 List examples of various types of first order differential equations.</p> <p>3.4 Define first order homogenous differential equations</p> <p>3.5 List the methods of solving differential equations by separable variables.</p> <p>3.6 Identify differential equations reducible to the homogenous form.</p> <p>3.7 Explain exact differential equations.</p> <p>3.8 Solve exact differential equations, e.g. (a) Show that $(3x^2 + y \cos x) dx + (\sin x - 4y^3) dy = 0$ is an exact</p>	<p>Illustrate with examples the concept of 1st order differential equations.</p> <p>Ask students to apply differential equation to solve engineering problems.</p> <p>Explain the procedures of solving exact</p>	<p>Chalkboard, textbooks, lecture notes, chalk, calculator.</p>			

	<p>differential equation. (b) Find its general solution.</p> <p>3.9 Define integrating factors.</p> <p>3.10 Determine the solution of differential equations using integrating factors.</p> <p>3.11 Define linear differential equations of the first order.</p>	<p>differential equations.</p> <p>Describe the importance of integrating factors and give the solution of differential equation using integrating factors.</p>				
Week	General Objective 4: Understand the basic concepts of partial differentiation and apply same to engineering problems					
13 – 15	<p>4.1 Define partial differentiation</p> <p>4.2 List and explain the uses of partial derivatives.</p> <p>4.3 Solve problems on partial differentiation. e.g. $f(x, y) = x^2 + y^2 = 2xy$ find dy/dx, dx/dy</p> <p>4.4 Apply partial differentiation to engineering problems.</p>	<p>Explain in details the concept of partial differentiation.</p> <p>Solve problems on partial differential.</p> <p>Solve problems on partial differentiation and apply same to engineering problems.</p>	<p>Chalkboard, textbooks, lecture notes, chalk, calculator.</p>			

				<p>hyperbola using</p> <p>(a) Rectangular method</p> <p>(b) Ordinate method</p> <p>(c) tangent method</p> <p>(d) offset method.</p> <p>1.6 Locate the directrix and focus of a given parabolic curve.</p> <p>1.7 Construct a curve of a parabolic form through two given points.</p> <p>1.8 Define involute to a square, circle, cycloid and Archimedean spiral.</p> <p>1.9 Describe the various types of link mechanisms.</p> <p>1.10 Plot the locus of point e.g. (a) mechanism with a link constrained to pass through a fixed point (mechanism with</p>	<p>Drawing Table</p> <p>Adjustable Set square</p> <p>45° Set square</p> <p>60° Set square</p> <p>Pencil</p> <p>Desk Sharpener</p> <p>French curve set</p> <p>Drawing instrument set</p>
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				<p>the end of the link constrained to move in a horizontal link (c) three links mechanism (d) linkages of a mechanically operated lever system mechanism of a printing press (f) mechanism of a pair of secateurs.</p>		
2				General Objective 2.0: Understand orthographic projections		
6-10				<p>2.1 Identify the third plane (the auxiliary or side vertical plane) of projection. 2.2 Project on it the end view of a three dimensional object. 2.3 Sketch from an object (with changer, round hole, stepped, block, etc) the plane and elevations and draw the view in first and third angle orthographic Projections. 2.4 Draw plan, elevations and sections of simple object such as hollow sand crate block. 2.5 Explain the properties of a point, a line and plane</p>	<p>Demonstrate activities 2.1 to 2.9 for the student to learn and allow them to practice till they became competent.</p>	<p>Black board ruler Blackboard Tee Square Blackboard Set Squares 45°, 60° Black board Compass Black board Protractor Adjustable set square 45° Set Square 60° Set square Drawing Table Pencil Desk Sharper</p>

				<p>in space.</p> <p>2.6 Locate given point, lines and planes in space on the projection planes.</p> <p>2.7 Determine the true length of a line in space using (a) auxiliary method (b) rotational Method.</p> <p>2.8 State Practical application's of the methods in 2.7 above.</p> <p>2.9 Apply successive auxiliary projections to determine the true position of a point to both horizontal and vertical planes the true horizontal and vertical planes the true shape of a plane inclined to both horizontal and vertical planes the shortest distance between the two lines: The angle of inclination of a line inclined to two given planes</p>	Assess the student.	<p>Drawing Instrument Set</p> <p>Drawing Table</p> <p>Adjustable Set square</p> <p>45° Set square</p> <p>60° Set square</p> <p>Pencil</p> <p>Desk Sharpener</p> <p>French curve set</p> <p>Drawing instrument set</p>
3	General Objective 3.0: Understand the developments and intersections of regular solids and planes			General Objective 3.0: Understand the developments and intersections of regular solids and planes		

11-15	<p>3.1 Define developments</p> <p>3.2 State the features of Developments</p>	<p>Explain in details the development and intersections of regular solids and planes.</p>	<p>Recommended textbooks, chalkboard, chalk, lesson notes.</p>	<p>3.1 Develop pattern of regular solids such as truncated prism, prism, circular cylinder, truncated cylinder, frustum of a pyramid, truncated cone, etc</p> <p>3.2 Draw the lines of intersections of the following regular solids and plane in both first and third angles</p> <p>i) a cylinder meeting a square pyramid at right angle</p> <p>ii) a cylinder meeting a cone, the cone at an angle</p> <p>iii) a cylinder meeting a cone, the cone enveloping the cylinder</p> <p>iv) a cylinder and a cone, the cylinder enveloping the cone</p> <p>v) A Square prism meeting a rectangular plane at an angle</p> <p>vi) A square prism meeting an ellipse at an angle</p>	<p>Demonstrate activities 3.1 to 3.7 for the students to learn and allow them to practice until they became competent.</p> <p>Assess the students.</p>	<p>Black board ruler Blackboard Tee Square Blackboard Set Squares 45°, 60° Black board Compass Black board Protractor Adjustable set square 45° Set Square 60° Set square Drawing Table Pencil Desk Sharpener Drawing Instrument Set Drawing Table Adjustable Set square 45° Set square 60° Set square Pencil Desk Sharpener French curve set Drawing instrument set</p>
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				<p>vii) A square prism meeting a circle at an angle</p> <p>iii) A cylinder meeting a pentagon at an angle</p> <p>ix) a cylinder meeting an ellipse at an angle</p> <p>x) a cone meeting an ellipse at an angle</p> <p>xi) a circle cutting through a pyramid at an angle</p> <p>xii) an ellipse being enveloped by a pyramid at an angle, e.t.c.</p> <p>3.4 Draw the patterns (developments) of the regular solids and planes in 3.3a-3.3e above.</p> <p>3.5 Draw the patterns (developments) of the regular solids and planes in 3.3f-3.3i</p> <p>3.6 Draw the patterns (development of the regular solids and planes in 3.3j-3.3 m</p> <p>3.7 Make models of the patterns referred to in 3.3a - 3.3e</p>		
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Electrical Technology	COURSE CODE: IEE 102	CONTACT HOURS: 1-0-3
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Course Specification: Theoretical & Practical Content

WEEK	General Objective 1.0: Understand the principle of operation of D.C Machines.			General Objective 1.0: Understand the construction of D.C Machines.		
1	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Describe, with the aid of a labelled diagram, the construction of a DC motor. 1.2 State materials used in the construction of various parts DC machines. 1.3 State the functions of armature windings and field windings. 1.4 Show the student a typical lap & wave winding of a DC machine. 1.5 Differentiate between lap and wave windings. 1.6 Draw diagrams of lap	The teacher should give the detail construction of d.c machines. Ask the students to solve problems on d.c machines. Explain the conditions for parallel operation of D.C machines. Discuss different types of starters and their applications.	Chalk, board, textbooks, writing materials, calculators.	1.1 Identify the main components of a DC motor. 1.2 Identify the location of the windings and major sources of faults in DC motor.	Show the student a DC motor and dismantle the motor for the students to see all components and sources of faults.	Tool box, DC motor, charts, etc.

	<p>and wave windings.</p> <p>1.7 Derive emf equation of dc machine.</p> <p>1.8 Solve problems involving 1.4 and 1.6.</p> <p>1.9 State factors that affect the emf equations.</p> <p>1.10 Derive the equation $V = E + I_a R_a$ (for a motor) Or $E = V + IR$ (for a generator).</p> <p>1.11 Explain, with the aid of developed diagram, armature reaction and methods of minimising it.</p> <p>1.12 Stop circuit representations of dc machines and calculate current and voltage drop.</p> <p>1.13 Explain concept of back emf.</p> <p>1.14 Explain the need for Starters for a dc motor.</p> <p>1.15 Describe different Starters for dc motors.</p>					
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	<p>1.16 Derive the condition for maximum efficiency of dc machine.</p> <p>1.17 State conditions for parallel operation of dc machines.</p> <p>1.18 Solve problems involving 1.1 to 1.17</p>					
2	General Objective 2.0: Understand basic principles of a transformer and application.			General Objective 2.0: Understand basic principles of a transformer and application.		
4-5	<p>2.1 Describe with labeled diagrams the construction and principles of operation of single-phase transformer.</p> <p>2.2 List different types of cores used in transformer construction.</p> <p>2.3 Explain with the aid of phasor diagrams the action of a transformer on load and on no-load.</p> <p>2.4 Derive transformation</p>	<p>The teacher should ensure that the construction and operation of transformer is illustrated with diagrams.</p> <p>Explain in details with diagram the principles of operation transformer and its application.</p> <p>Ask the students to solve problems associated with single phase and three phase transformers</p>	<p>Chalkboard, chalk, recommended textbooks, lesson notes.</p>	<p>2.1 Perform experiment on open circuit characteristics of a single-phase transformer.</p> <p>2.2 Perform experiment on open circuit characteristics of three-phase transformer.</p> <p>2.3 Carryout experiment on close circuit characteristics of a single-phase transformer.</p> <p>2.4 Perform experiment on</p>	<p>Teacher should assist the students when carrying out experiment</p>	<p>Transformers (single and three phase), a.c machines, starters, voltmeter, ammeter, tachometer, phase sequence meter, practical manual practical logbook</p>

	<p>equations of a transformer.</p> <p>2.5 Draw an equivalent circuit for a transformer.</p> <p>2.6 Describe with the aid of an equivalent circuit, a practical transformer.</p> <p>2.7 Determine the equivalent circuit of a transformer with parameters referred to the primary or secondary.</p> <p>2.8 List standard terminal markings for a single, 2-phase, and 3-phase transformers as governed by BS171.</p> <p>2.9 Define efficiency of transformers.</p> <p>2.10 Calculate efficiency of a transformer.</p> <p>2.11 Derive the expression for maximum efficiency of a transformer (Single and 3-phase).</p>			<p>close circuit characteristics of three-phase transformer.</p> <p>2.5 Perform experiment on identifying polarity of a 3-phase transformer</p>		
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3	General Objective 3.0: Understand Construction, principle of operation and application of a.c machines.			General Objective 3.0: Understand Construction, principle of operation and application of a.c machines.		
6-7	<p>3.1 Discuss how rotating field are produced and how polyphase machines are constructed (use diagrams).</p> <p>3.2 Differentiate between synchronous and induction machines.</p> <p>3.3 Describe the component parts of a 3-phase Induction motor (Squirrel cage and wound type).</p> <p>3.4 Explain the principles of operation of Induction machine.</p> <p>3.5 Define synchronous speed and slip.</p> <p>3.6 Solve problems relating to 3.4 and 3.5.</p> <p>3.7 List the component parts of an Alternator.</p> <p>3.8 Derive the e.m.f</p>	<p>The teacher should discuss the principles of operation of induction and synchronous machine.</p> <p>Give simple problems involving a.c machines.</p> <p>Discuss the essential features of induction motor.</p> <p>Explain the operational principle of alternator.</p> <p>Give assignments to students and assess them.</p>	<p>Chalk, board, textbooks, writing materials, lecture note, calculator</p>	<p>3.1 Perform experiments on open and close circuit characteristics of a single induction motor.</p> <p>3.2 Carryout experiments on open and close circuit characteristics of a three-phase induction motion.</p> <p>3.3 Carryout experiment on open circuit characteristics of an alternator/a.c</p>	<p>Teacher should assist the students when carrying out experiment</p>	<p>Transformers (single and three phase), a.c machines, starters, voltmeter, ammeter, tachometer, phase sequence meter, practical manual practical logbook</p>

	<p>equations of an Alternator.</p> <p>3.9 Explain the principle of operation of a single phase induction motor.</p> <p>3.10 Calculate efficiency of an Induction motor.</p> <p>3.11 Derive an expression for maximum efficiency of an Induction motor.</p> <p>3.12 Explain various applications of an Induction machine.</p> <p>3.13 Solve simple problems involving ac machines.</p> <p>3.14 Explain the various types of enclosures and cooling arrangements of electrical machines (dc motors and ac motors).</p>					
4				General Objective 4.0: Understand the basic knowledge and skill in electrical installation		

8				<p>4.1 Identify electrical/electronic graphical symbols:</p> <ul style="list-style-type: none"> a. Resistor b. Capacitor c. Inductor d. Diodes e. Thyristor f. Diac g. Triac h. Operational Amplifier i. Logic gates j. Linear IC k. Power Switches l. Sockets m. Isolator Switch n. Breakers o. Motors p. Fans q. ELCB. <p>4.2 Draw symbols in 1.1 above using appropriate instruments.</p>	<p>The teacher should show and draw electrical/electronic graphical symbols to the students</p>	<p>Charts showing graphical symbols must be available in the laboratory</p>
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5	General Objective 5.0: Know how to produce schematic and wiring drawing.			General Objective 5.0: Know how to produce schematic and wiring drawing.		
9-10	<p>5.1 Explain schematic and wiring diagram.</p> <p>5.2 State the merits and demerits of schematic diagrams.</p> <p>5.3 Explain wiring diagram.</p> <p>5.4 State the merits and demerits of wiring diagrams.</p> <p>5.5 Explain methods of preventing hazards.</p> <p>5.6 Define earth continuity conductor, earth electrode, consumer's earth terminal.</p> <p>5.7 Explain the necessity for earthing and state the relevant regulations concerning earthing.</p> <p>5.8 Explain the protection of an installation by fuse and by ELCB.</p> <p>5.9 Distinguish between solid earthing practice and earth leakage circuit breaker protection.</p> <p>5.10 State a number of</p>	<p>The teacher should draft various schematic diagram for electrical/electronic circuits and panel to the students.</p> <p>Teacher to draft various wiring diagrams to students</p>	<p>Drawing Instrument and drawing boards.</p> <p>Typical samples of architectural drawings</p>	<p>5.1 Draw electrical/electronic graphical symbols.</p>	<p>Illustrate electrical/electronic symbols.</p> <p>The teacher should give assignments to students and assess them.</p>	<p>Graphical symbol, charts, drawing sets and materials</p>

	<p>problems associated with earth leakage circuit breakers.</p> <p>5.11 Describe how the human body can become part of an electric circuit.</p> <p>5.12 Explain how to prevent electric shock</p> <p>5.13 Explain methods of treating electric shock.</p> <p>5.14 Explain artificial respiration</p> <p>a) mouth resuscitation</p> <p>b) revised Holger Nelson resuscitation</p> <p>c) external cardio compression/cardio-pulmonary resuscitation.</p>					
6	General Objective 6.0: Understand how to produce sectional and architectural drawings			General Objective 6.0: Understand how to produce sectional and architectural drawings		
11	<p>6.1 Explain architectural drawings and symbols.</p> <p>6.2 Interpret architectural drawings</p>	<p>Teacher to draft architectural drawings of simple building e.g. 3-bedroom flat</p>	<p>Recommended textbooks, chalkboard, chalk, lesson notes etc.</p>	<p>6.1 Draft various electrical/electronic schematic diagrams.</p> <p>6.2 Draft various electrical installation/wiring diagrams.</p> <p>6.3 Draft architectural drawings of simple buildings e.g. 3-</p>	<p>Demonstrate activities 6.1 to 6.7 for the students to learn and ask them to perform them.</p> <p>The teacher should give assignments to students and assess</p>	<p>Graphical symbol, charts, drawing sets and materials</p>

				bedroom flat etc. 6.4 Produce elevation drawings for architectural drawings. 6.5 Draft electrical services for a residential building e.g. 3-bedroom flat. 6.6 Draft electrical supply for a 3-bedroom building. 6.7 Draw the installation diagram for a single phase and three-phase energy meters in domestic and commercial/industrial premises.	them.	
7	General Objective 7.0: Know the importance of Cables in Electrical Installations			General Objective 7.0: Know the importance of Cables in Electrical Installations		
12-13	7.1 Define the following diversity factor ambient temperature, class of excess current protection, and disposition of cable. 7.2 Explain the use of relevant IEE tables for cable selection. 7.3 Apply 4.1 and 4.2 for close selection. 7.4 Design an external supply system for a 3-bedroom building.	The teacher should show to the student various cable sizes used in wiring and services building. Draw typical electrical supply systems for building.	Recommended textbook, chalkboard, chalk, lesson notes.	7.1 Demonstrate various types of joints using PVC and flexible cables	Illustrate with diagrams various types of joints in PVC and flexible cable. The teacher should give assignments to students and assess them.	Graphical symbol, charts, drawing sets and materials

	<p>7.5 Draft electrical services for a simple 3-bedroom building.</p> <p>7.6 Calculate the total load current for a final sub circuit in the building.</p> <p>7.7 List the main types of insulating and conducting materials.</p> <p>7.8 Distinguish between conductors and insulators.</p> <p>7.9 Describe, with the aid of sketches, the construction of different types of cables.</p> <p>7.10 State the advantages and disadvantages when using:</p> <ul style="list-style-type: none"> a. PVE - Insulated, PVC - sheathed cables. b. Mineral - Insulated metal - sheathed cables c. Armoured PVC - insulated, PVC - sheathed cables d. Steel and PVC conducts e. Steel and PVC trunking. f. Flexible cabled and cord etc. <p>7.11 Explain the general I.E.E. Regulation related to cables and their uses.</p>					
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	7.12 Identify the cable colour coding, commonly used in Nigeria.					
8	General Objective 8.0: Understand the estimating procedures for electrical installations			General Objective 8.0: Understand the estimating procedures for electrical installations		
14	8.1 Produce item quantities from drawings. 8.2 Estimate cost of materials	Explain in details the procedure in 8.1 and 8.2	Recommended textbook, chalkboard, chalk, lesson notes.	8.1 Prepare Bills of Engineering Measurements and Materials for an electrical installation	Show students how to prepare bills of quantities. The teacher should give assignments to students and assess them.	Samples of bills of quantities.
9	General Objective 9.0 Understand installation of various electrical/electronic systems.			General Objective 9.0 Understand installation of various electrical/electronic systems.		
15	9.1 Explain the Installation of Public address system. 9.2 Explain the Installation of television system. 9.3 Explain the computer system. 9.4 Explain the Electrical services of residential and commercial/industrial premises 9.5 Explain the single phase and three-phase	The teacher should illustrate the installation of the system with appropriate diagram and procedure.	Recommended textbooks, chalkboard, chalk, lesson notes.	9.1 Carry out installation of a typical electrical/electronic circuit system	Demonstrate for the students to learn and allow them to practice. The teacher should give assignments to students and assess	Toolbox, cables and electrical fittings.

	energy meters in domestic and commercial/industrial premises.				them.	
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Thermodynamics			COURSE CODE: MEC 104		CONTACT HOURS: 2-0-2	
Course Specification:						
WEEK	General Objective 1.0: Know the concept of temperature and the principles of empirical thermometry.					
1	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 3	TEMPERATURE AND TEMPERATURE MEASUREMENT 1.1 Define temperature 1.2 State the units of measurement 1.3 State the Zeroth Law of Thermodynamics 1.4 Define thermometric substances 1.5 Solve simple problems on determination of temperatures when the thermometric property values at certain fixed points are given and a scale of temperature is	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, thermometers, thermocouple.			

	prescribed.					
2	General Objective 2.0: Understand thermal energy			General Objective 2.0: Determine specific heat capacities of substances.		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
4-6	THERMAL ENERGY 2.1 Define Thermal Energy 2.2 Solve problems associated with mass, specific heat capacity and temperature change 2.3 Differentiate between sensible heat and latent heat 2.4 Solve simple problems related to specific latent heat	Explain in details with aid of diagrams and adequate notes. Solve problems related mass, specific heat, temperature, sensible heat and latent heat.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	2.1 Determine experimentally, specific heat capacities of solids, liquids and gases.	Carry out the experiment in 2.1 and ask students to do the same.	Substances: solid, liquid and gas. Thermometer, Bunsen Burner, calorimeter stirrer, Tripod etc.
3	General Objective 3.0: Understand heat transfer					
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
	HEAT TRANSFER 3.1 Explain the modes of heat transfer e.g. conduction, convection	Explain in details with aid of diagrams and	Chalkboard, Chalk, Recommended			

7 - 9	<p>and radiation</p> <p>3.2 Explain how heat (transfer) can be reduced by:</p> <p>i) use of thermal insulation</p> <p>ii) shiny (reflecting) surfaces</p> <p>3.3 State Fourier's Law</p> <p>3.4 Define thermal conductivity</p> <p>3.5 Define thermal resistance</p> <p>3.6 show the analogy between thermal and electrical conduction</p> <p>3.7 Use Fourier's Law to solve simple problems in thermal conduction through composite (walls) or slabs.</p> <p>3.8 Solve simple problems on heat transfer by convection from flat surfaces.</p>	adequate notes.	Textbooks, Charts, Lesson plan, etc			
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4	General Objective 4.0: Understand work transfer					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
10 - 12	<p>WORK TRANSFER</p> <p>4.1 explain the basic concepts of systems and surroundings, boundary, control volume, property state, process equilibrium</p> <p>4.2 give the thermodynamic definition of work transfer</p> <p>4.3 calculate the work transfer by expansion of a gas in a piston-cylinder system</p> <p>4.4 solve simple problems relating to work transfer e.g. power transmission via a rotating shaft.</p>	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			
	General Objective 5.0: Know the first law of thermodynamics as a statement of the principles of conservation of energy					

	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
13 - 15	<p>THE FIRST LAW OF THERMODYNAMICS</p> <p>5.1 State the thermodynamic relationship between heat transfer (Q) work transfer (W) and the related changes in the properties.</p> <p>5.2 Express the principle of conservation of energy in thermodynamic systems.</p> <p>5.3 Derive the energy equation for a system</p> <p>5.4 Solve problems related to 5.1 – 5.3</p>	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Engineering Materials			COURSE CODE: MEC 106		CONTACT HOURS: 1-0-2	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand engineering materials and their properties			General Objective 1.0: Determine the mechanical properties of materials.		
1	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 3	1.1 State types of engineering materials 1.2 Define principal mechanical properties: stress, strain, elastic modulus, yield strength, ductility, elongation, reduction of area, hardness and toughness. 1.3 State the role of each property in 1.2 above in engineering application of materials. 1.4 Define thermal expansion, heat capacity and thermal conductivity of material. 1.5 State the relevance of 1.4 above in engineering	Explain engineering materials and their properties. Explain the determination of properties. State the mathematical expressions, relating the properties to determinable quantities. State problems associated with the properties above. Give exercises	Sample of Engineering Materials (Plastics, Wood, Metal, Concrete, etc.).	1.1 Show the determination of mechanical properties of materials in the laboratory.	Determine experimentally: stress, elastic modulus, hardness etc.	Universal tensile testing machine, brinell, Vickers, young's modulus apparatus, strain gauges etc.

	<p>applications.</p> <p>1.6 Describe the determination of variables in 1.2 and 1.4 above.</p> <p>1.7 Define electrical conductivity, resistivity and polarisation of engineering materials.</p> <p>1.8 State the relationship between electrical conductivity and temperature, strain, composition and thermal conductivity.</p> <p>1.9 Describe the determination of electrical conductivity and resistivity for engineering materials.</p> <p>1.10 Solve mathematical problems associated with properties in 1.2, 1.4 and 1.7.</p>					
2	General Objective 2.0: Know the structure and energy of atoms.					
4 - 5	<p>2.1 Describe electronic structure of atoms.</p> <p>2.2 Give an expression of the relationship between energy possessed by a photon and its</p>	<p>Illustrate the electronic configuration of atoms and rotation of sub-shells in K,L,M,N,and O shells. Use the related law to explain energy distribution and electron</p>	<p>Structural Model of Atoms.</p>			

	<p>wavelength.</p> <p>2.3 Explain electron notation using S,P,D sub-shell of K,L,M,N,O shells of an atom.</p> <p>2.4 Explain energy distributions and electron excitations in atoms.</p> <p>2.5 Solve mathematical problems associated with 2.2 and 2.4 above</p>	<p>excitation in atoms.</p> <p>Solve mathematical problems based on energy expressions.</p> <p>Give exercises.</p>				
3	General Objective 3.0: Understand atomic bonding and coordination.					
6 - 7	<p>3.1 State the four general types of inter-atomic bonds in materials.</p> <p>3.2 Explain the occurrence of inter-atomic bonds in materials.</p> <p>3.3 Explain the expression showing the relationship between energy change of two approaching ions and their inter-ionic distance and electronic charges.</p> <p>3.4 Define coordination number and ionic radius.</p> <p>3.5 Relate coordination number with radii</p>	<p>Explain the different types of bonds and how they result.</p> <p>Give expressions indicating relationship between ions, distance and electronic charges.</p> <p>Relate coordination number to radii ratios and their effect on bonding.</p>				

	<p>ratios.</p> <p>3.6 State how 3.5 affect ionic and/or covalent bonding.</p> <p>3.7 Explain the terms: poly-atomic ions and free-radicals.</p> <p>State the effect of 3.7 in engineering materials properties.</p>					
4	General Objective 4.0: Understand crystalline geometry					
8	<p>4.1 Define a phase, crystalline solids, short and long range orders.</p> <p>4.2 Give examples of each 4.1 above.</p> <p>4.3 Describe the close-packed crystals (hcp, fcc) and body centred cubic (bcc) crystals with examples.</p> <p>4.4 Describe the structure of ionic and molecular crystals. Give examples of 4.4 above.</p>	<p>Explain crystalline structures in solids. Mention phase, short and long range orders. Explain ionic and molecular structures and polymorphism. Give examples of metals with those structures i.e.: b.c.c., f.c.c. & h.c.p.</p>				
5	General Objective 5.0: Understand crystalline phases.					
9 - 10	<p>5.1 Explain the Bravais lattices.</p> <p>5.2 Give example of crystal structures belonging to a given Bravais lattice.</p>	<p>Discuss Bravais lattices. Give examples of crystallographic structures for particular lattices. State types of symmetry,</p>	<p>Models of B.C.C., F.C.C. & H.C.P. Structures</p>			

	<p>5.3 Describe types of symmetry possible within a lattice.</p> <p>5.4 Determine the Bravais lattice of NaCl, CsCl.</p> <p>5.5 Explain the lattice directions with reference to:</p> <ul style="list-style-type: none"> i vector relationship, ii lattice vectors, iii angles between directions (cubic crystals), iv family of directions, <p>5.6 Explain lattice planes with reference to Miller indices.</p> <p>5.7 Describe Miller – Bravais indices (hexagonal crystals) with reference to:</p> <ul style="list-style-type: none"> i. intersection of planes, ii. direction within a plane. <p>5.8 Define diffraction in crystals.</p> <p>5.9 State the Bragg’s law.</p> <p>5.10 Describe diffraction patterns, diffraction lines and second – order diffraction in crystals.</p> <p>Perform calculations based on 5.9 above.</p>	<p>lattice direction noting vector relationship, vectors, angles between directions and family of directions.</p> <p>Explain Muller indices with emphasis on directions and plane of intercessions.</p> <p>Explain diffraction.</p> <p>State Bragg’s law and diffraction pattern and orders.</p> <p>State mathematical relationship.</p> <p>Solve calculations.</p>				
6	General Objective 6.0: Know structural disorders in materials					

11 - 12	<p>6.1 Explain imperfections in crystals.</p> <p>6.2 State the relevance of 6.1 in the properties of engineering materials.</p> <p>6.3 Categorise imperfections into point defects, dislocation (linear defects) and boundaries (two-dimensional discontinuities).</p> <p>6.4 Explain each of the imperfections in 6.3 above and their micro-structural consequences.</p> <p>6.5 Perform calculations based on 6.3 above; e.g. energy of dislocations, grain boundary area & energies, and grain size.</p> <p>6.6 Describe the three-dimensional defects in amorphous or non-crystalline solids and their effects.</p>	<p>Illustrate crystalline imperfections i.e. point defects, dislocation and grain boundaries. Explain their micro structural consequences. Derive expressions for dislocation and grain boundary energy and size. Explain defects in non-crystalline solids. Solve problems.</p>	Model of Crystalline Arrangement with Defects.			
7	General Objective 7.0: Understand molecular phases.					
13 - 15	<p>7.1 Define micro and macro-molecules.</p> <p>7.2 Give examples of each in 7.1 above.</p> <p>7.3 Determine by</p>	<p>Illustrate micro and macro molecular phenomenon i.e. weight and length of polymer molecules, folded chains</p>				

	<p>calculations molecular weights and length of polymer molecules.</p> <p>7.4 Explain the terms “micelles” and “folded chains” in polymer crystallisations.</p> <p>7.5 Describe molecular variations with reference to side radicals, steric hindrance, stereo isomers and branching.</p> <p>7.6 Define unsaturated polymers, cis and trans-isomers and cross-linking.</p> <p>7.7 Give examples of the terms in 7.6 above.</p> <p>7.8 state the effects of 7.6 on the physical property of polymer materials.</p>	<p>and crystallisation.</p> <p>Explain molecular variation with examples of side radicals, steric hindrance, stereo-isomers and branching.</p> <p>Give examples of unsaturated polymers, cis and trans-isomers and cross linking</p>				
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Ship Familiarisation and Seamanship			COURSE CODE: IME 102		CONTACT HOURS: 1-0-3	
Course Specification: Theoretical and Practical Contents						
WEEK	General Objective 1.0: Know various parts of a ship			General Objective 1.0: Draw ship profile.		
	Theoretical Content			Practical Content		
1	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 Name parts of the hull structure of a ship. 1.2 Name parts of a ship, the different types of deck e.g. foc'sle poop deck, weather deck twin deck, monkey Island. 1.3 Sketch the profile of a ship and label it.	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	1.1 Understand ship profile.	Give individual drawing assignment on ship's profile.	Drawing board, Pencil, Eraser, Drawing set.
2	General Objective 2.0: Know the names of all major deck machinery.					
3 - 4	2.1 Identify and list the various deck machinery on board a merchant ship (cargo ship and tankers). 2.2 Explain cargo handling systems for cargo ships and for tankers. 2.3 Explain cargo protection arrangements for	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			

	cargo ships and for tankers. 2.4 State the location of fire fighting equipment for cargo ships and for tankers.					
3	General Objective 3.0: Understand rigging		General Objective 3.0: Understand the operations of life boats.			
5	3.1 Describe rigging as applicable to shipping.	Explain rigging. Describe methods of rigging.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	3.1 Operate life-boats and crafts. 3.2 Start and stop life boat engines. 3.3 Steer life boats and crafts. 3.4 Lower, raise, secure and anchor life boats. 3.5 Swim and float at sea. 3.6 Demonstrate rigging.	Perform 3.1 – 3.6 and ask the students to do the same.	Ropes, mallet spikes, life boat, crafts.
4	General Objectives: 4.0: Know merchant ship departmental organisation.					
6 - 7	4.1 List the main departments of a merchant ship 4.2 Draw organogram of the ship department. 4.3 State the duties of all officers and ratings of a merchant ship.	Explain 4.1 – 4.3 in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			

5	General Objective: 5.0: Understand various aspects of sea life			General Objective 5.0: Know the equipment used for predicting bad weather at sea.		
8 - 9	<p>5.1 Explain the need for discipline at sea.</p> <p>5.2 Explain the necessity for self reliance, reliability and loyalty in the performance of assigned duties.</p> <p>5.3 List the equipment used for predicting bad weather at sea.</p> <p>5.4 Describe the process of occurrence of a storm.</p>	<p>Explain in details with aid of diagrams and adequate notes.</p>	<p>Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc</p>	<p>5.1 Identify equipment used for predicting bad weather.</p>	<p>5.1 Perform experiment to determine weather trend.</p>	<p>Barometer, Wind vane, Radar</p>
6	General Objective: 6.0: Know navigational systems and aids.			General Objective 6.0: Understand how to fix ship's position		
10 - 11	<p>6.1 Explain the use of navigational aids such as lights, radar, direction finder, magnetic compass, and echo sounder.</p> <p>6.2 Explain the basic methods of locating a Ship's position.</p>	<p>Explain in details with aid of diagrams and adequate notes.</p>	<p>Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc</p>	<p>6.1 Show the positions of lights, radar, direction finder, magnetic compass and echo sounder.</p> <p>6.2 Measure and plot ship's position on the map.</p>	<p>Demonstrate to students the activities of plotting ship's positions.</p>	<p>Chart, Map, Pencil, Ruler etc.</p>
7	General Objective: 7.0: know the functions of national and international maritime organisations					
	<p>7.1 State the functions of the National Maritime Authority of Nigeria and the</p>	<p>Explain in details with aid of diagrams and adequate notes.</p>	<p>Chalkboard, Chalk, Recommended</p>			

12 - 15	<p>Government Inspectorate of Shipping (Federal Ministry of Transport.)</p> <p>7.2 State the functions of the International Maritime Organisation (IMO).</p> <p>7.3 State the functions of Classification Societies.</p> <p>7.4 State the functions of United Nations Conference on Trade and development (UNCTAD).</p>		Textbooks, Charts, Lesson plan, etc			
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Workshop Technology II	COURSE CODE: MEC 108	CONTACT HOURS: 0-0-4
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Course Specification: Theoretical and Practical Contents

WEEK	General Objective 1.0: Understand the importance of heat processes					
	Theoretical Content			Practical Content		
1	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 2	1.1 Distinguish between hand forging and drop forging.	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	1.1 Identify the tools used for heat processes. 1.2 Carry out forging, soldering and brazing operations and observe safety rules. 1.3 Perform the following operations: upsetting, drawing down, bending, punching, drifting and stamping and observe safety rules.	Demonstrate for the students to learn and allow them to practice till they become competent	Furnace, Blower, hammer, Tangs, sample material Quenching bath etc.
2	General Objective 2.0: Know the properties and functions of steel tools			General Objective 2.0: Understand heat treatment processes		
	2.1 Define steel tools. 2.2 Distinguish among types of steel tools. 2.3 Explain the metallurgical	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts,	2.1 Demonstrate heat treatment processes e.g. case hardening, annealing,	Demonstrate the processes in 2.1 and ask students to do	

3 - 4	properties of tool steels. 2.4 Describe the following heat treatment processes – case hardening, annealing normalizing and tempering.		Lesson plan, etc	tempering etc.	the same.	
3	General Objective 3.0: Understand the various metal cutting processes of metals observing safety precautions			General Objective 3.0: Practise metal cutting.		
5 - 6	3.1 Enumerate the various cutting methods and the safety precautions e.g. use of hacksaw, use electric hacksaw, flame cutting, oxy-arc and gorging, guillotine, chisel, and hand snips.	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	3.1 Carry out flame cutting, oxy-arc and gorging operations and observe safety precautions. 3.2 Carry out cutting by hacksaw and by mechanical hacksaw (power).	Demonstrate for the students to learn and allow them to practice till they become competent	Welding set, Welding machine, hacksaws, guillotine and hand tools.
4	General Objective 4.0: Know various types of lathes and their functions			General Objective 4.0: Practise mechanical cutting using lathes.		
7 - 9	4.1 List the various types of lathe (such as capstan lathe, turret lathe, center lathe,) and their accessories. 4.2 Describe the features of the various types, of lathe machines. 4.3 Define feed and cutting speed as applied to machine	Explain in details with aid of diagrams and adequate notes. Explain in detail the	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	4.1 Select and use the appropriate cutting tools for efficient machining of various metals and observe safety rules. 4.2 Use job pieces to perform various lathe operations. 4.3 Identify any attachment	Demonstrate for the students to learn and allow them to practice till they become competent	Lathe machines, cutting tools, measuring tools, cutting fluids, work pieces, goggles, and hand gloves.

	tool work e.g., material to be cut, use of coolant and type of finish.	feed and cutting speed of machine tool work.		necessary for 4.1. 4.4 Carry out the following operations on the lathe and observe safety rules: taper turning, step screw cutting, multi-start square thread cutting, etc.		
5	General Objective 5.0: Understand the features, functions and uses of milling machines			General Objective 5.0: Demonstrate milling operations		
10-12	<p>5.1 Describe the main features of milling machines.</p> <p>5.2 Outline the safety and operational precautions to be observed when milling.</p> <p>5.3 Describe straddle and gang milling operations.</p> <p>5.4 Describe the various features of the tool and cutter grinder.</p> <p>5.5 List and state the uses of different types of milling cutters (arbor cutters, plain cutters, shank cutters and mills, T-slot side and mill cutter).</p> <p>5.6 Describe the features and working principles</p>	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	<p>5.1 Perform the mounting of cutters on the milling machine.</p> <p>5.2 Assemble a work piece and cutter holding device and attachment on a milling machine.</p> <p>5.3 Identify cutters according to materials to be milled and type of milling operations with the safety precautions.</p> <p>5.4 Determine cutting speeds and feeds for a given milling work.</p> <p>5.5 Perform the up and down milling operations.</p>	Demonstrate for the students to learn and allow them to practice till they become competent	Milling Machines, cutting fluids, milling cutters, work pieces, goggles, aprons/overalls, gloves, safety shoes, tool and cutter grinder

	of the dividing head.			5.6 Carry out various indexing methods on a miller, e.g., direct, simple, differential, angular indexing.		
6	General Objective 6.0: Understand the features and functions of shaping machines			General Objective 6.0: Demonstrate activities on shaping machines.		
13 - 14	6.1 Describe the main features of shaping machines. 6.2 List the advantages of a swan-necked tool on a shaping machine.	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	6.1 Identify appropriate shaping tools for different surface forms. 6.2 Perform the setting up of work piece on the shaping machine. 6.3 Perform the adjusting of the length and position of the stroke of the shaping machine. 6.4 Carry out the setting of a clapper box for a given operation. 6.5 Carry out slotting, surface planing, and keyway cutting on a shaping machine.	Demonstrate for the students to learn and allow them to practice till they become competent	Shaping machine, shaping tools, work pieces, cutting fluids goggles, gloves, apron/overalls and safety shoes, parallels.
7	General Objectives 7.0: Understand the features and functions of a grinding machine.			General Objective 7.0: Practise activities on the grinding machine.		

15	7.1 Describe the main features of grinding machine.		Chalkboard, recommended texts, charts, etc.	<p>7.1 Identify the main features of grinding machines in 7.1.</p> <p>7.2 Carry out the grinding of job pieces on the machine and observe safety rules.</p> <p>7.3 Identify the wheels for grinding different types of materials.</p> <p>7.4 Perform the following operations.</p> <ul style="list-style-type: none"> - surface grinding - taper grinding - tool and cutter grinding - centre-less grinding - gauge grinding - Wheel testing and mounting - Wheel balancing and alignment - Wheel dressing and truing. 	Demonstrate for the students to learn and allow them to practice till they become competent	Pedestal grinding machine, goggles, hand gloves, aprons, safety shoes, cylindrical grinding machine, and surface grinders.
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Gas Welding	COURSE CODE: IME 104	CONTACT HOURS: 0-0-4
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Course Specification: Theoretical and practical

WEEK	General Objective 1.0: Understand general safety in gas welding
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Theoretical Content: Understand safety in handling gas cylinders	Practical Content: Understand safety in gas welding.
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1	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
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1 - 2	1.0 Explain the safe ways of handling gas cylinders.	Explain safe handling of gas cylinders in the workshop. Explain safe transportation of gas cylinders.	Chalkboard, relevant textbook, charts, Trolleys etc, motor vehicle.	1.1 Carry, transport and store full and empty gas cylinders safely using appropriate equipment. 1.2 Observe appropriate safety precautions while carrying out the following: a. Gas welding operations on containers which have been emptied of chemicals, inflammable or explosive liquids. b. Gas welding near containers with inflammable materials, e.g. petrol tank; and c. Gas welding in	Demonstrate for the students to learn and allow them to practice till they become competent.	
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				<p>confined spaces.</p> <p>1.3 Select, use and care for protective wears for carrying out gas welding operations. E.g.</p> <p>a. welding goggles b. Welding shields c. gloves d. boots etc.</p>		
2	General Objective 2.0: Know and apply successfully various gas welding Processes.			General Objective 2.0: Demonstrate Gas welding process.		
3 - 5	<p>2.1 Differentiate between the following types of generators, stating their merits and demerits</p> <p>a. water-to-carbide generator b. carbide-to-carbide generator</p> <p>2.2 Distinguish between high and low pressure systems of welding</p> <p>2.3 State the composition of calcium carbide.</p> <p>2.4 Differentiate between welding and cutting</p>	<p>Explain in details with aid of diagrams and adequate notes.</p>	<p>Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc</p>	<p>2.1 Identify the following gas welding equipment, describing their features, functions, applications and care:</p> <p>a. generators b. regulators c. blow pipes d. nozzles e. hoses f. gas cylinders and their colours g. economizers h. check valves.</p>	<p>Demonstrate for the students to learn and allow them to practice till they become competent.</p>	

	<p>torches.</p> <p>2.5 State the instances of the application/uses of the type of flames named in 2.4 above</p>			<p>2.2 Identify the main parts of the generator e.g. hydraulic back pressure valve purifiers, carbide trays etc.</p> <p>2.3 Generate acetylene using calcium carbide guiding against danger of over-charge.</p> <p>2.4 Identify types of welding rods stating their properties, compositions, and uses.</p> <p>2.5 Identify the following flames and describe how they are derived in the oxy-acetylene welding processes:</p> <ul style="list-style-type: none"> a. oxidizing flame b. carbonizing flame c. neutral flame <p>2.6 Light the welding torch and adjust the</p>		
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				<p>flame to each of the types named in 2.9 above.</p> <p>2.7 Prepare plate surfaces and run beads:</p> <ul style="list-style-type: none"> a. without filler rods b. with filler rods <p>2.8 Make neat labelled sketches indicating the conventional symbols for the welding joints. E.g.:</p> <ul style="list-style-type: none"> a. butt joint b. fillet joint c. lap joint <p>2.9 Prepare plate surfaces for the following welding joints and tack weld:</p> <ul style="list-style-type: none"> a. butt joint b. fillet joint c. lap joint <p>2.10 Weld metals together in down-hand or flat</p>		
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				<p>position</p> <p>2.11 State the functions of backing bars and strips.</p> <p>2.12 Apply backing bars and strips according to instructions on the side of a weld to control penetration.</p>		
3	General Objective 3.0: Understand and weld together different types of non-ferrous and ferrous metals			General Objective 3.0: Demonstrate welding processes on ferrous metals		
6 - 8	<p>3.1 Describe the general characteristics of materials used in fabrication engineering including simple consideration of physical properties such as:</p> <p>a. strength b. ductility c. malleability d. hardness e. tenacity f. fusion</p>	<p>Explain in details with aid of diagrams and adequate notes.</p>	<p>Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc</p>	<p>3.1 Identify the following types of non-ferrous and ferrous metals</p> <p>Non-ferrous</p> <p>a.copper b. aluminium c. brass d. bronze e. tin f. zinc g. lead h. iconel</p>	<p>Demonstrate for the students to learn and allow them to practice till they become competent.</p>	

	<p>g. distortion</p> <p>h. toughness and resistance to impact in relation to uses and common manufacturing processes, and weldability of materials.</p> <p>3.3 State the common fabrication engineering uses of cast iron, mild steel, high yield steel, cast steel, austenite stainless steel, copper and common copper alloys, aluminium and common aluminium alloys.</p> <p>3.4 State the properties and composition of fluxes used for welding non-ferrous metals.</p> <p>3.5 Enumerate two functions of fluxes in the welding of non-ferrous metals.</p>			<p>and monel</p> <p>Ferrous</p> <p>a. wrought iron</p> <p>b. mild steel</p> <p>c. stainless steel</p> <p>d. cast iron</p> <p>and state their composition</p> <p>3.2 Prepare and weld non-ferrous metals using appropriate fluxes.</p> <p>3.3 Identify cast iron in terms of:</p> <p>a. types</p> <p>b. composition</p> <p>c. properties</p> <p>3.4 Prepare cast iron for welding by:</p> <p>a. chamfering or bevelling of edges to specification</p> <p>b. pre-heating to specification</p>		
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				<p>3.5 Identify fusion weld of cast iron components.</p> <p>3.6 Identify suitable flux for bronze welding and state its composition.</p> <p>3.7 Prepare bronze to specifications.</p> <p>3.8 Weld bronze to specifications.</p> <p>3.9 Identify reasons for post-heating of bronze welds</p>		
4	General Objective 4.0: Understand and demonstrate welding of stainless steel and dissimilar metals			General Objective 4.0: Demonstrate welding operation on stainless and dissimilar metals.		
9 - 10	<p>4.1 Explain the principles of the following welding processes:</p> <p>a. cladding b. stellite c. hard surfacing d. brazing</p> <p>4.2 Identify and state the type, composition and properties of common stainless steels used in</p>	<p>Explain in details with aid of diagrams and adequate notes.</p>	<p>Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc</p>	<p>4.1 Prepare stainless steel components for welding</p> <p>4.2 Weld stainless steel using appropriate welding rods and techniques and observing safety practice.</p> <p>4.3 Apply appropriate treatment to the</p>	<p>Demonstrate for the students to learn and allow them to practice till they become competent</p>	<p>Stainless steel components of dissimilar metals, welding sets, safety equipment etc.</p>

	metal work. 4.3 Explain the effect of welding together two different metals.			welded joint e.g. washing in soapy water, brushing off flux residue, etc. to avoid weld decay 4.4 Identify dissimilar metals such as: a. copper and brass b. steel and cast-iron c. aluminium and steel, etc. 4.5 Prepare and weld dissimilar metals using correct techniques and observing the correct safety practice 4.6 Identify the effect of dilution in welding		
5	General Objective 5.0: Understand the process of building up worn metallic shafts or surfaces			General Objective 5.0: Know the composition of worn metallic shaft.		
11 - 13	5.1 Discuss the properties of the metal used for given worn metallic shafts.	Explain in details with aid of diagrams and adequate notes.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	5.1 Identify the composition of a given worn metallic shaft. 5.2 Build up given worn metallic surfaces to	Demonstrate to students to learn and allow them to practice till they become competent	

				specifications using suitable filler rods and applying the correct technique/sequence of operation		
6	General Objective 6.0: Know the various welding defects and rectify them					
14 -15	<p>6.1 Describe the following defects in gas welded joints:</p> <p>a. undercut b. lack of fusion (side, root, inter-run) c. porosity d. slag inclusion e. unequal leg length (uneven alignment) f. lack of reinforcement</p>	<p>Explain in details with aid of diagrams and adequate notes.</p>	<p>Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc</p>	<p>6.1 Apply the following tests to detect defects in welded joints:</p> <p>a. Destructive test such as bend test, macro and micro examination sulphur prints, mick and tee fillet test</p> <p>6.2 Rectify welded joints defects enumerated in 5.1 above</p> <p>6.3 Produce project involving the fabrication of:</p> <p>a. General safety precaution b. Ferrous and non-ferrous metal welding c. Various joints defect and their rectification</p>	<p>Demonstrate for the students to learn and allow them to practise till they become competent</p>	

	<p>6.2 State how the weld defects in (6.1) above can be avoided in oxy-acetylene welding.</p> <p>6.3 Explain the following test to be avoided in detecting defect in welded joint</p> <p>a. Non-destructive test such as visual inspection, x-ray test, gamma ray test, ultrasonic tests.</p>					
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THIRD SEMESTER COURSES

3	<p>2.1 Historical perspective.</p> <p>2.2 Trace the origin of entrepreneurship.</p> <p>2.3 Explain organizational structure.</p> <p>2.4 Explain the role of an entrepreneur.</p> <p>2.5 Explain the reasons for business failure.</p>	Trace the historical evolution of business enterprise citing example Highlight the reasons for their failure/success.	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			
General Objective 3.0: Know how to plan a business enterprise/project.						
4 - 5	<p>3.1 Define the concepts: planning, business enterprise and project.</p> <p>3.2 Explain the importance of planning to a business enterprise.</p> <p>3.3 Analyse the skills and Techniques of starting and managing small business successfully.</p> <p>3.4 Prepare and present project proposal.</p> <p>3.5 Manage a small business profitably.</p>	<ul style="list-style-type: none"> • Lecture and illustrate with examples. • Highlight to the students the initial problems likely to be faced. • Invite a successful entrepreneur to deliver lecture to the students. 	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			
General Objective 4.0: Know how to operate simple stock keeping records			General Objective 4.0: Know how to operate simple stock keeping records.			
	4.1 Ordering spare parts/materials	Lecture and demonstrate to students how to write	Store or any storage facility	4.1 Practise record	Demonstrate to students how to write receipts	Sample receipts and

6 - 7	4.2 Receipt of parts/materials 4.3 Storage of parts/materials. 4.4 Issue of parts/materials	receipt and keep records of ordering, storage and issue materials.	Record note-books.	keeping for stocks.	and keep records of ordering, storage and issue materials	inventory records.
General Objective 5.0: Know how to prepare and operate cash flow on spreadsheets						
8	5.1 Need for different records (capital, revenue, credit transaction, tax) 5.2 Formatting spread sheet 5.3 Operating spreadsheet	<ul style="list-style-type: none"> Lecture and demonstrate for the students to appreciate Give practical exercise to students. 	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			
General Objective 6.0: Understand employment issues						
9 - 10	6.1 Define the terms: education, training and development. 6.2 Restate education, training and development to employment. 6.3 Distinguish between skills and employment. 6.4 Explain the role of the private sector in employment generation. 6.5 Identify the forms and informal sectors. 6.6 Explain the issues of: (i) Rural youth and employment (ii) Urban youth and employment.					

	General Objective 7.0: Understand the Nigerian Legal System					
11	7.1 Explain the nature of law. 7.2 Analyse the sources of Nigerian laws. 7.3 Evaluate the characteristics of Nigerian Legal System.		Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			
	General Objective 8.0: Comprehend the nature of contract and tort					
12 - 13	8.1 Define contract. 8.2 Explain types of contracts 8.3 State the basic requirements for a valid contract. 8.4 Analyse contractual terms. 8.5 Examine vitiating terms. 8.6 Explain breach of contract and remedies. 8.7 Define Tort. 8.8 Explain types of Tort. 8.9 Discuss tortuous liabilities and remedies.		Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			
	General Objective 9.0: Understand Agency and Partnership					
14 - 15	9.1 Define agency 9.2 Explain creation of Agency 9.3 Explain authority of the agent. 9.4 Analyze the rights and duties of principal		Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson			

	agent and third parties. 9.5 Explain termination of agency and remedies. 9.6 Define partnership. 9.7 Examine creation of partnership. 9.8 Explain relations of partners to one another and to persons dealing with them. 9.9 Analyze dissolution of partnership and remedies.		plan, etc			
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Trigonometry and Analytical Geometry			COURSE CODE: MTH 201		CONTACT HOURS: 2-0-0	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand the manipulation of trigonometric equations			General Objective 1.0: Build confidence in students through solving problems.		
	Theoretical Content				Practical Content	
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1 - 4	1.1 Convert sums and differences of trigonometric ratios to products: $\sin A + \sin B = 2 \sin \frac{A+B}{2} \cos \frac{A-B}{2}$ $\cos A + \cos B = 2 \cos \frac{A+B}{2} \cos \frac{A-B}{2}$ 1.2 Prove the sine and cosine formulae of triangles 1.3 Solve triangles using the sine and cosine formulae e.g.:- The sides a,b,c, of a triangle are 4cm, 5cm, and 6cm respectively. Find the angles. 1.4 Calculate angles of	Illustrate with good examples activities in 1.1 to 1.10 and ask the students to solve problems on them. Assess the student	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc	1.1 Illustrate by solving some examples.	Provide assignments to student in 1.1-1.10 Assess the student.	Chalk board, chalk, Recommended text books, charts.

	<p>elevation and depression using trigonometric ratios e.g.:- From the top of a tree 120m high an observer sees a boat 560m away. Calculate the angle of depression.</p> <p>1.5 Compute bearings, heights and distances of inaccessible objects and projections, e.g. B A man walks 3km due N, and the 3km N.52° W. How far is the of his starting point? What is his bearing from his original position.</p> <p>1.6 Derive half angle formulae fro sin, cos and tan.</p> <p>1.7 Define inverse circular function.</p> <p>1.8 Explain inverse circular functions graphically.</p> <p>1.9 Solve problems involving 1.8 and e.g.:- Draw the graph of $1/(\cos 2\theta)$ Taking values from 0° to 90° inclusive.</p> <p>1.10 Apply the concepts in 1.8 above to three dimensional problems.</p>					
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General Objective 2.0: Understand the concept of mensuration and its application to engineering problems						
5 - 7	2.1	Explain circular measure	Illustrate with good examples activities in 2.1 – 2.5	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc		
	2.2	State the relation between radians and degrees				
	2.3	Prove the formulae for arc length and area of a sector.	Solve various examples.			
	2.4	Identify segment and chord of a circle.	Illustrate to students how to use Simpson's rule and mid-ordinate rule to solve in 2.7 – 2.8			
	2.5	Determine the area of a segment and the chord of length of a given circle.				
	2.6	Calculate the surface areas and volumes of simple shapes such as cylinder, sphere and cone. E.g. A solid sphere has radius 8cm. Calculate its volume.				
	2.7	Determine the areas and volumes of irregular shapes applying Simpsons rule.				
	2.8	Apply mid-ordinate rule to determine the areas and volumes applying mid-ordinate rule.				
General Objective 3.0: Understand the concept of analytical geometry and their applications						

8 - 11	<p>3.1 Explain two dimensional coordinate systems: Cartesian and Polar-coordinate systems.</p> <p>3.2 Explain plotting and sketching of graphs with respect to the two coordinate systems.</p> <p>3.3 Relate Cartesian coordinate to polar coordinates.</p> <p>3.4 Explain the slope of a line in relation to the above concepts in 3.3. above.</p> <p>3.5 Explain the intercept of a line.</p> <p>3.6 Derive the formula for the gradient of a line passing through two points.</p> <p>3.7 Derive the equation of a straight line, given the gradient and the co-ordinates of a point.</p> <p>3.8 Reduce a given linear equation to the intercept form.</p>	<p>Illustrate the activities in 3.1 to 3.20 With good examples and ask the students to solve problems on them.</p>	<p>Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc</p>			
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	$x/a + y/b = 1$				
3.9	Determine the coordinates of the point of intersection of two straight lines.				
3.10	Define locus				
3.11	Derive the slope-intercept form of the equation of a straight line: $y = mx+c.$				
3.12	Derive the point B slope form of the equation of a straight line: $y - y_1 = m(x - x_1)$				
3.13	Derive the double B point form of the equations of the straight line: $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$				
3.14	Derive the perpendicular form of the equation of a straight line				
3.15	Solve examples of 3.11 to 3.14 above.				
3.16	Find the angle (Q) between two lines whose slopes,				

	<p>(m1, and m2) are Known: $Q = \tan (m_2 B m_1) / 1 + m_1 m_2$</p> <p>3.17 Determine the conditions for two lines to be parallel and to be perpendicular.</p> <p>3.18 Derive the expression for the perpendicular distance from a point to a line.</p> <p>3.19 Draw a circle.</p> <p>3.20 Derive the equation of a circle with center at the origin and radius r.</p> <p>3.21 Derive the equation of a circle with center outside the origin.</p> <p>3.22 State general equation of a circle.</p> <p>3.23 Determine the coordinates of the center of a circle from a given equation of a circle.</p> <p>3.24 Draw orthogonal circles.</p> <p>3.25 Find the equations of the tangent and the normal at a point circle.</p> <p>3.26 List illustrative examples of each of 3.20 -3.25 above</p>					
<p>General Objective 4.0: Understand the concept of parabola and related shapes.</p>						

12 - 15	<p>4.1 Define a Parabola</p> <p>4.2 Derive the standard equation of a Parabola $y^2 = 4ax$</p> <p>4.3 State the properties of the parabola</p> <p>4.4 Define the focal chord, axis and lotus rectum of a parabola</p> <p>4.5 Determine the equation of the tangent and normal from a given point to the parabola.</p> <p>4.6 Solve problems on parabola e.g. Write down the equation of the parabola and state its vertex if the focus B is (2,0) and the directrix $x = -2$.</p> <p>4.7 Define ellipse</p> <p>4.8 Derive the equation of an ellipse $x^2/a^2 + y^2/b^2 = 1$</p> <p>4.9 State the properties of an ellipse</p> <p>4.10 Determine the equation of the tangent and the normal to an ellipse from a given point.</p> <p>4.11 Define focal chord and axes of ellipse.</p> <p>4.12 Solve problems on ellipses e.g. Find the</p>	<ul style="list-style-type: none"> • Illustrate the activities in 3.21 to and ask the students to solve problems on them. 	Chalkboard, Chalk, Recommended Textbooks, Charts, Lesson plan, etc			
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	length of the axes and the eccentricity for the ellipse: $4x^2 + 9y^2 = 36$					
4.13	Define the Hyperbola					
4.14	Derive the equation of the Hyperbola					
4.15	Identify the properties of the Hyperbola.					
4.16	Define asymptotes, chord, tangent and normal to a hyperbola.					
4.17	Solve problems on hyperbola e.g. Find the foci and directrices for hyperbola: $x^2/16 - y^2/9 = 1$					
4.18	Explain rectangular hyperbola					
4.19	Determine tangent and normal to the rectangular hyperbola.					

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: AUTOCAD I			Course Code: COM 102		Contact Hours: 1-0-3 Hrs/Wk	
Course Specification: Theoretical Contents				Practical Content:		
	General Objective 1.0: Understand the use of computer in the design and drafting process.		General Objective 1.0: Make students proficient in AUTOCAD activities.			
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1 - 3	1.1 State the advantages and disadvantages of computer in the design process. 1.2 Explain the links between CAD and CAM. 1.3 Understand the principles of operation capabilities and system requirements of AutoCAD. 1.4 Identify the main parts of the screen of Auto CAD or later version. 1.5 Explain the functions of the above. 1.6 Understand and use the different input methods: keyboards, mouse,	<ul style="list-style-type: none"> • Explain advantages and disadvantages of computer in the design process. • Explain the links between CAD and CAM. • Show the students the main parts of the screen of Auto CAD 14. • Explain the function of the above. • Ask the students to explain and use the different input methods. • Ask students to explain differences between Cartesian and polar coordinates systems. • Ask students to demonstrate the above options on the 	Computer System. 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitizer to 2 students. Manuals, Recommended Textbooks. Plotters in a Network 1 Digitizer to 2 students.	1.1 Install the AutoCAD Software correctly. 1.2 Demonstrate the uses of HELP Menu in solving problems when using the package. 1.3 Use the OSNAP facility to select options. 1.4 Use layer control to change the layers in a drawing. 1.5 Use Cartesian and Polar coordinates to draw lines. 1.6 Prepare and change the size of the drawing field. 1.7 Show how to save	<ul style="list-style-type: none"> • Provide the students the AutoCAD CDROM for the installation. 	A Computer System, 1 large format Printer or plotter and 1 Digitizer to 2 Students.

	digitisers, and scanners. 1.7 List the different coordinate systems.	computer screen. <ul style="list-style-type: none"> • Ask students to construct lines at set lengths and angles using above coordinate systems. • Ask students to use snap points to construct lines. • Ask students to explain the use of snap points and ortho-commands. • Assess the students. 		drawings on demand and also how to set up the auto-save features.		
General Objective 2.0: Understand how to construct simple geometric shapes.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
4	2.1 Know how to hatch the shapes drawn and change the hatch pattern and scale. 2.2 Explain how to draw circles, ellipse and arcs to given dimensions. 2.3 Explain how to construct polygons and squares to given dimensions. 2.4 Produce a simple drawing – Drawing 1.	<ul style="list-style-type: none"> • Ask the students to hatch the shapes drawn. • Ask the students to change the hatch pattern and scale. • Ask the students to draw circles, ellipse and arc to given dimensions. 	<ul style="list-style-type: none"> • Complete Computer Sets • 1 Computer to 2 Students • 1 Large Format Printer or • Plotters in a Network • 1 Digitizer to 2 students. 	2.1 Produce a simple drawing.	<ul style="list-style-type: none"> • Ask the students to construct polygons and squares to a given dimensions. 	<ul style="list-style-type: none"> • A computer system • 1 computer to 2 students, • 1 large format printer or plotter in a network, • 1 Digitizer to 2 students.

General Objective 3.0: Understand the different edit boxes.						
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
5	<p>3.1 Explain the different edit boxes, how to use them and their attributes.</p> <p>3.2 Explain how to select the shapes using edit boxes.</p> <p>3.3 Explain how to use the offset command.</p>	<ul style="list-style-type: none"> Ask students to explain the different edit boxes. Ask students to use them. Ask students to explain their attributes. Ask students to draw both polar and rectangular arrays using array command. Ask students to draw using the offset command. 	<ul style="list-style-type: none"> Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitizers to 2 students. 	<p>3.1 Use array command to draw both polar and rectangular arrays.</p>		
General Objective 4.0: Understand how to use edit commands.				General Objective:4.0: Assure competence in editing procedures with MS-Word and AUTOCAD		
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
6	<p>4.1 Explain how to use edit commands.</p> <p>4.1 Demonstrate how to move objects accurately; using both snap commands and coordinates.</p> <p>4.2 Demonstrate how to copy objects from one position</p>	<ul style="list-style-type: none"> Demonstrate the installation of MD Word Identify the different features of the software. Ask students to type a short document and save it. Ask student to 	<ul style="list-style-type: none"> Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or 	<p>4.1 Demonstrate how to move objects accurately; using both snap commands and coordinates.</p> <p>4.2 Demonstrate how to copy objects from</p>	<p>Demonstrate the installation of MD Word</p> <p>Identify the different features of the software.</p> <p>Ask students to type a short document and save it.</p>	

	<p>to another accurately using snap and coordinate entry.</p> <p>4.4 Demonstrate how to erase object.</p> <p>4.5 Demonstrate how to trip objects.</p> <p>4.4 Demonstrate how to fillet and chamfer angles.</p>	<p>edit a document and carry out a spell check.</p> <ul style="list-style-type: none"> • Demonstrate the use of tables. 	<ul style="list-style-type: none"> • Plotters in a Network • 1 Digitizers to 2 students. 	<p>one position to another accurately using snap and coordinate entry.</p> <p>4.3 Demonstrate how to erase object.</p> <p>4.4 Demonstrate how to trip objects.</p>	<p>Ask student to edit a document and carry out a spell check. Demonstrate the use of tables.</p>	
	General Objective 5.0: Understand how to create layers			General Objective: Ability to create layers.		
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
7-8	<p>5.1 Demonstrate how to create layers.</p> <p>5.2 Demonstrate how to change colour of layers.</p> <p>5.3 Demonstrate how to change the line types of a layer.</p> <p>5.4 Demonstrate how to move objects from one layer to another.</p> <p>5.5 Demonstrate how to switch layers on and off.</p> <p>5.6 Understand the use of layers and how they help in the construction and</p>	<ul style="list-style-type: none"> • Ask students to create layers. • Ask students to change colour of layers. • Ask students to change the line type of a layer. • Ask students to move objects form one layer to another. • Ask students to switch layers on an off. • Ask students to use layers to construct drawings. 	<p>A Computer System</p> <p>1 Computer to 2 Students</p> <p>1 Large Format Printer or</p> <p>Plotters in a Network</p> <p>1 Digitiser to 2 students.</p>	<p>5.1 Demonstrate how to create layers.</p> <p>5.2 Demonstrate how to change colour of layers.</p> <p>5.3 Demonstrate how to change the line types of a layer.</p> <p>5.4 Demonstrate how to move objects from one layer to another.</p> <p>5.5 Demonstrate how to switch layers on and off.</p> <p>5.6 Understand the use of layers and how they help in</p>	<ul style="list-style-type: none"> • Ask students to create layers. • Ask students to change colour of layers. • Ask students to change the line type of a layer. • Ask students to move objects form one layer to another. • Ask students to switch layers on an off. • Ask students to use layers to construct drawings. 	<p>A Computer System</p> <p>1 Computer to 2 Students</p> <p>1 Large Format Printer or</p> <p>Plotter in a Network</p> <p>1 Digitiser to 2 students.</p>

	understanding of a draw.			the construction and understanding of a draw.		
	General Objective 6.0: Understand how to create linear and aligned dimensions.			General Objective 6.0: Actively create linear and aligned dimensions		
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
9-10	6.1 Explain how to create linear and aligned dimensions. 6.2 Understand how to create angular dimensions. 6.3 Demonstrate how to add tolerances to dimension. 6.4 Demonstrate how to create leader lines. 6.5 Demonstrate how to add single line and multiple line texts to drawings. 6.5 Demonstrate how to edit dimensions and text.		<ul style="list-style-type: none"> Sets of Personal Computers Recommended Textbooks Manuals etc. 	6.1 Demonstrate how to add to tolerances to dimension. 6.2 Demonstrate how to create leader lines. 6.3 Demonstrate how to add single line and multiple line texts to drawings. 6.4 Demonstrate how to edit dimensions and text.		<ul style="list-style-type: none"> A computer system 1 computer to 2 students, 1 large format printer or plotters in a network, 1 Digitizers to 2 students.
				General Objective 7.0: Produce a fully dimensional drawing of a component		
WEEK	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources

11 - 14				<p>7.1 Create the title block for a drawing and write letters and numbers on drawings</p> <p>7.2 Draw circles be able to erase parts lines or circles.</p>	<ul style="list-style-type: none"> • Ask each student to carry out his/her own drawing. 	A Computer System.
				<p>7.3 Produce a simple drawing with correct details in terms of title block etc.</p> <p>7.4 Select parts of a drawing in order to do further work.</p> <p>7.5 Move, copy and rotate drawing parts.</p> <p>7.6 Produce a full drawing with title blocks from a real engineered object.</p> <p>7.7 Show all the views</p>	<ul style="list-style-type: none"> • Let each student carry out his/her own drawings. • Ask each student to carry out his/her own drawing. • Ask each student to carry out a drawing that is specific to his/her department. • Assess the students • Grade each student's drawing 	<ul style="list-style-type: none"> • 1 Computer to 2 Students • 1 Large Format Printer or • Plotters in a Network • 1 Digitizer to 2 students.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: ENGINEERING MEASUREMENT			Course Code: MEC 201		Contact Hours 1-0-2	
Course Specification: Theoretical Content				Practical Content		
Week	General Objective 1.0: Know measurement fundamentals.					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1-2	1.1 Describe workshop Standards of length. 1.2 List the sub-divisions of standards of length. 1.3 Discuss the sub-divisions in 1.2.	Explain in details the concepts and fundamentals of measurement.	Recommended textbooks, charts, Chalkboard, chalk, etc.			
Week	General Objective 2.0: Understand and identify sources of errors in measurement.			General Objective 2.0: Analyze objectively sources of errors		
	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
3-4	2.1 Describe the types of errors commonly found in engineering measurement. 2.2 Explain sources of errors in measurement such as equipment errors, operational interference,	Explain in details the types, sources and means of overcoming errors.	Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.	2.1 Identify sources of errors in measurement such as equipment errors, operational interference, and installation errors, and ways of eliminating them.	Demonstrate the activity in 2.1 and ask the students to identify the sources of error and suggest ways of overcoming them. • Assess students'	Comparator, Limit gauges, steel rule, Dynamometers, Thermometer, etc.

	and installation errors. 2.3 Explain means of overcoming errors in 2.1 above. 2.4 Describe drunken threads.				reports.	
General Objective 3.0: Understand and identify the parts of simple measuring instruments.				General Objective 3.0: Be adept at naming and using measuring instruments.		
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
5-7	3.1 Explain the principles of construction and operation of the following (a) dynamometer (b) bourdon tube manometers (c) thermometer, pyrometer, thermocouple etc. 3.2 State the precautions to be observed when using the measuring instruments in 3.1 above. 3.3 Differentiate between direct measurement and	Explain in details the features, operations and principles of construction of simple measuring instruments. Assess the students' graded assignments.	Chalk Chalkboard, Recommended textbooks, etc.	3.1 Identify the following: (a) Dynamometer (b) Bourdon tube Manometers (c) thermometer, (d) pyrometer, (e) thermocouple. 3.2 Determine forces acting on a cutting tool using dynamometer. 3.3 Determine the pressure in a vessel using the bourdon tube	Illustrate the activities in 3.1 to 3.6 and ask the students to carry out all the activities observing safety precautions.	Dynamometer, Bourdon tube, Manometers, Thermometer, Pyrometer, Thermocouple, etc

	measurement by comparison			manometer. 3.4 Determine the temperature in a cutting zone using a thermocouple. 3.5 Determine the speed of a grinding wheel using a tachometer. 3.6 Determine the flow of liquid in an orifice using a flow meter.		
	General Objective 4.0: Understand and demonstrate skills in limit gauge measurement and design.			General Objective 4.0: Practise calibration and gauging.		
Week	Specific Learning Outcome:	Teachers Activities	Resources	Specific Learning Outcome:	Teachers Activities	Resources
8-10	4.1 Explain the concept of calibration. 4.2 Describe the principles of calibrating (i) pressure gauges (ii) thermometers (iii) flow meters. 4.3 State the precautions to be observed during calibration of measuring instruments. 4.4 Define maximum and minimum metal limits.	Explain in detail the concept of calibration and limit gauging. Illustrate the precautions to be observed during calibration. Assess the students' graded assignments.	Recommended textbooks, charts, Chalkboard, chalk, Lecture notes, etc.	4.1 Calibrate pressure gauges, thermometer, etc. 4.2 Demonstrate the precautions to be observed during calibration. 4.3 Identify materials for gauges and its heat treatment. 4.4 Compare gauging with direct measurement.	Demonstrate the activities in 4.1 to 4.5 for students to learn and ask the students to carry out the activities. Assess students' reports	Gauge apparatus and calibration kits

	<p>4.5 Describe the limits of gauging.</p> <p>4.6 State Taylor’s principle of gauging.</p> <p>4.7 Give examples of principle of gauging.</p>			4.5 Design a gauge.		
General Objective 5.0: Know the use of strain gauges, load cells and piezoelectric devices.				General Objective 5.0: Demonstrate skills in the use of strain gauges, load cells and piezoelectric devices		
Week	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
11-12	<p>5.1 Describe various forms of strain gauges for measuring strains in radial, axial and biaxial directions.</p> <p>5.2 Describe load cells and piezoelectric devices in measurement.</p> <p>5.3 Discuss the effect of heat and other environmental factors in the use of strain gauges.</p>	<p>Explain in details the principle of operation and application of strain gauges. Assess the students.</p>	<p>Recommended textbooks, charts, lecture notes, Chalkboard, chalk, etc,</p>	<p>5.1 Identify the following:</p> <p>a. Strain gauges</p> <p>b. Load cells</p> <p>c. Piezoelectric devices</p> <p>5.2 Make measurement with strain gauges and compare with other gauges.</p> <p>5.3 Make measurements with load cells,</p>	<p>Demonstrate the activities in 5.1 to 5.3 for students to learn and ask the students to carry out the activities.</p> <p>Assess students’ reports</p>	<p>Strain gauges, load cells, piezoelectric devices, etc.</p>

				piezoelectric devices and compare with strain gauge measurements in terms of accuracy.		
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Strength of Materials			COURSE CODE: MEC 203		CONTACT HOURS: 2-0-2	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Understand the concept of stress, strain, Hook's law, and elastic constant (E, G, K)			General Objective 1.0: Acquire skills in stress, strain experiments.		
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Define stress and strain 1.2 State Hook's law	Explain stress strain and Hook's law	Chalk –board, chalk Recommended text books.	1.1 Perform an experiment to demonstrate strain with -Extensometer - Electrical Resistance strain Gauges	Demonstrate how to perform strain experiment with the instruments mentioned in 1.1	Extensometer, Electrical Resistance strain gauges.
	General Objective 2.0: Understand the relationship between the elastic constants, the concept of strain energy and stresses in composite bars			General Objective 2.0: Carry out stated strength tests		
2	2.1 Describe the relationship between the elastic constant E, G, and K. 2.2 Explain the concept of	Explain the relationship of elastic constant, strain energy and composite bars.	Chalk Board, Chalk, Recommended text books	2.1 Carry out the following test - Tensile test - Compression test - Hardness test - Impact test	Perform the experiment for students to demonstrate the four tests as in 2.1	Compression and tensile testing M/C Universal hardness testing M/C (brinell ,

	strain energy. 2.3 Evaluate stress in composite bars					Vickers)
	General Objective 3.0: Understand the concept of compatibility equation, the concept of stress-strain relationship in 2-dimensions			General Objective 3.0: Understand stress – strain relationship.		
3	3.1 Explain the compatibility equation. 3.2 Define stress and strain relationship in 2-dimensions	Solve examples of equation	Chalk board, chalk, duster	3.1 Carryout an experiment to determine stress – strain relationship	Perform the experiment in 3.1 and ask the students to do same	Strain gauges, portable strain meter etc.
	General Objective 4.0: Understand the type of stresses and strains developed in thick walled pressure vessels and cylinder					
4	4.1 Evaluate principal stresses, strain and planes. 4.2 Find principal stresses using the mohr's circles.	Explain Principal stresses,, strains and planes and mohr,s circles.	Recommended text books chalkboard, chalk			
	General Objective 5.0: Understand the construction of shearing force and bending moment diagrams and the computation of shearing force and bending Moment					
5	5.1 Derive the types of stress in pressurized cylinder shells. 5.2 Compare Hoop and	Explain stress in pressurized shells, hoop and longitudinal stress as in 5.1 -5.2	Chalk board, chalk, recommended text books.	5.1 Perform experiment to demonstrate universal cantilever	Demonstrate the experiment as in 5.1 and ask students to do the same	Universal cantilever apparatus

	longitudinal stresses					
	General Objective 6.0: Understand the theory of bending					
6	6.1 Derive the stress in thin spherical shells. 6.2 Analyze the dimensional changes caused by internal pressure	Explain stress in thin spherical shells and analyze dimensional changes in internal pressure	Chalk board, chalk, Recommended text books	6.1 Carryout experiment to test for strength of Beams. 6.2 Carry out experiment to test for strength of Thin and thick cylinder.	Demonstrate the experiment to test for strength of beams. Ask the students to do same.	Tensile testing M/C, Beam Apparatus.
	General Objectives 7.0: Understand the theory of torsion					
7	7.1 Distinguish between Thick and thin cylinders. 7.2 Illustrate stress variations over the cross-section of the cylinder	Explain the difference illustrate and explain stress variations	Chalk –board chalk, Recommended textbooks	7.1 Test for torsional stress/strain of cylindrical bar.	Demonstrate strain/stress of cylindrical bar.	
	General Objective 8.0: Understand the use of portable strain meter and universal cantilever apparatus.					
8	8.1 Describe the longitudinal, radial and circumferential stresses and strains for a thick cylinder. 8.2 Explain the relationship between stress and strain values in thin					

	cylinders with those of thick cylinder					
	General Objective 9.0: Understand the use of thin cylinder apparatus of thick cylinder apparatus					
9	<p>9.1 Construct shearing force and bending moment diagrams.</p> <p>9.2 Solve problems on bending stresses.</p> <p>9.3 Calculate polar moment of area.</p> <p>9.4 Relate Shear strain to the angle of twist.</p> <p>9.5 Derive the torsion equation</p> <p>9.6 Calculate torsional strain energy.</p> <p>9.7 Carryout revisions.</p>					

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Fluid Mechanics	COURSE CODE: MEC 205	CONTACT HOURS: 2-0-2
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Course Specification: Theoretical & Practical Content

WEEK	General Objective 1.0: Understand the working principles and the use of different types of fluid flow measuring devices			General Objective 1.0: Carryout experiment on fluid flow		
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1-3	1.1 Explain the need for fluid flow measurement (Review). 1.2 Explain stagnation point, stagnation pressure and dynamic pressure in a fluid. 1.3 Define the coefficients of velocity contraction and discharge. 1.4 Describe a flow nozzle. 1.5 Obtain an expression for the actual and ideal discharges through a flow nozzle. 1.6 Define a notch.	Explain 1.1-1.10 with examples	Hydraulic bench with accessories.	1.1 Determine the coefficient of orifice and venturimeter experimentally and solve problems related to them. 1.2 Carry out experiments to measure fluid flow using rectangular and v-notches.	Perform the experiment to student	Hydraulic bench with accessories.

	<p>1.7 Describe rectangular and V-notches.</p> <p>1.8 Describe a weir and determine its coefficient of discharge</p> <p>1.9 Explain the use of notches and determine their coefficient of discharge.</p> <p>1.10 Describe a suppressed weir.</p>					
<p>General Objective 2.0: Know the different types of flow in pipes and the parameters governing them</p>						
4	<p>2.1 Derive an expression for the head loss due to friction.</p> <p>2.2 Explain the graph of Vs/Re for pipe flows.</p> <p>2.3 Solve problems related to 2.1- 2.2 above</p>	<p>Derive the expression in 2.1</p> <p>Solve problems related to 2.2-2.3 and ask students to do the same</p>	<p>Chalk board</p> <p>Charts</p> <p>Textbooks</p>			
<p>General Objective 3.0: Understand Channel Flow</p>						
5	<p>3.1 Define an open channel flow.</p> <p>3.2 Identify the instances</p>	<p>Explain open channel</p> <p>Give examples of open</p>	<p>Chalk board</p> <p>Charts</p>			

	<p>where open channel flow exists.</p> <p>3.3 Explain the terms, 'wetted perimeter' (p) and 'hydraulic mean depth (m)</p>	<p>channel</p> <p>Explain the terms in 3.3</p>	<p>Textbooks</p>			
<p>General Objective 4.0: Understand the principles in Channel Flow</p>						
6	<p>4.1 Develop Chazi formula for a rectangular open channel.</p> <p>4.2 State the formula for flow in channels.</p> <p>4.3 Determine the head loss due to friction in an open channel flow</p>	<p>Develop Chazi formula for a rectangular open channel and use it to solve problems</p> <p>Give students problems on Chazi formula</p>	<p>Chalk board</p> <p>Charts</p> <p>Textbooks</p>			
<p>General Objective 5.0: Understand the different types of flow in open channel s.</p>						
7	<p>5.1 Derive the expression for the friction factor.</p> <p>5.2 Solve simple problems related to 5.1 above.</p> <p>5.3 Determine the Reynolds number in a pipe flow.</p> <p>5.4 Calculate the friction loss along pipes.</p>	<p>Derive the expression for the friction factor and use it to solve problems</p> <p>Determine Reynold's number.</p> <p>Ask students to calculate friction loss as in 5.4</p>	<p>Chalk board</p> <p>Charts</p> <p>Textbooks</p>			

	General Objective 6.0: Know the working principles of positive displacement and rotor-dynamic machines and their relative uses.					
8-9	<p>6.1 Classify hydraulic machines as positive displacement and rotor-dynamic give examples of each.6.2 Give at least 3</p> <p>6.2 Describe the main parts of positive displacement and rotor-dynamic machines.</p> <p>6.3 Explain the working principles of positive displacement and rotor-dynamic machines.</p>	<p>Classify and give examples of the machines in 6.1</p> <p>Ask students to describe the parts of positive displacement and rotor-dynamic machines</p> <p>Explain 6.3 and ask students to do same.</p>	<p>Pumps</p> <p>Chalk board</p> <p>Charts</p> <p>Textbooks</p>			
	General Objectives 7.0: Understand the principles in reciprocating Pumps					
10	<p>7.1 Enumerate the merits and demerits of each type of machines.</p> <p>7.2 Draw the essential parts of a reciprocating pump and explain its working principles.</p> <p>7.3 Draw the P-V diagram for a reciprocating</p>	<p>Draw the essential parts of a reciprocating pump</p> <p>explain the working principles of reciprocating pump.</p> <p>Guide students to do 7.3-7.4 and use the expressions to solve problems</p>	<p>Pumps</p> <p>Chalk board</p> <p>Charts</p> <p>Textbooks</p>			

	<p>pump for a complete working cycle.</p> <p>7.4 Derive an expression for the discharge from reciprocating pump.</p>					
	General Objective 8.0: Know the working principles of positive displacement and rotordynamic machines and their relative uses.			General Objective 9.0: Carryout experiments on pump characteristics		
11	<p>8.1 Distinguish between single acting, double acting single cylinder and multi-cylinder pumps</p> <p>8.2 Define the terms coefficient of discharge and percentage slip.</p> <p>8.3 Draw the essential parts of a centrifugal pump and explain its working principles</p>	Explain 8.1-8.3 and ask students to do same	<p>Pumps</p> <p>Chalk board</p> <p>Charts</p> <p>Textbooks</p>			
	General Objective 9.0: Know the working principles of Pumps			General Objective 9.0: Carry out experiments on pump characteristics		
12-13	<p>9.1 Discuss the various types of centrifugal pumps.</p> <p>9.2 Draw the velocity triangles for the inlet and outlet sides of the</p>	Carry out the exercises in 9.1-9.7 and guide students to do same	<p>Pump</p> <p>Charts</p> <p>Textbooks</p> <p>Etc.</p>	<p>9.1 Conduct load tests on reciprocating Pump and analyse the results.</p> <p>9.2 Conduct load tests on centrifugal Pump and</p>	Guide the students to carry out the experiments in 9.1-9.3	<p>Different kinds of pumps</p> <p>Pelton and Francis Wheels</p>

	<p>impeller .</p> <p>9.3 Explain the terms absolute velocity and relative velocity.</p> <p>9.4 Develop an expression for the pump work power</p> <p>9.5 Explain the working principles of impulse and reaction turbines</p> <p>9.6 Describe the pelton wheel and explain its working principles</p> <p>9.7 Draw the velocity triangles and derive an expression for the power of pelton wheel</p>			<p>analyse the results.</p> <p>9.3 Carryout load test on Pelton and Francis Wheels and analyse the results.</p>		
	<p>General Objective 10.0: Know the working principles of positive displacement and rotordynamic machines and their relative uses.</p>					
14-15	<p>10.1 Draw the velocity triangles and derive an expression for the power developed by a reaction wheel</p> <p>10.2 Define unit speed, unit discharge, unit power and specific</p>	<p>Carry out the exercises in 10.1-10.4 and ask the students to do same</p>	<p>Pump</p> <p>Charts</p> <p>Textbooks</p> <p>Etc.</p>			

	<p>speed of hydraulic machines.</p> <p>10.3 Solve problems related to 10.2 above.</p> <p>10.4 Explain the following phenomena in fluid flow, Pressure surge, water hammer, cavitations.</p>					
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Naval Architecture			COURSE CODE: IME 203		CONTACT HOURS: 1-0-2	
Course Specification: Theoretical & Practical Content						
WEEK	General Objective 1.0: Know ship types and their respective functions.					
1						
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Name the various types of merchant ships. 1.2 State the difference between a merchant ship and a naval ship. 1.3 State the functions of a merchant ship and a naval ship. 1.4 Sketch the layout of 3 types of merchant ships.	Explain the distinguishing features of merchant and naval ships. Sketch the layouts and explain the functions of each type.	Chalk board, charts, drawing sets.			
1	General Objectives: 2.0: Know shipbuilding terms					
2	2.1 Define the various terms used in ship building. 2.2 State the various terms used in shipbuilding calculation.	Explain as in 2.1 – 2.2 and give students assignments.	Chalkboard, charts Handbooks etc.			

3	General Objectives: 3.0: Perform ship calculations					
3-4	3.1 Calculate the areas and volumes of various shapes of an object. 3.2 Calculate the areas of ship sections and wetted surface areas using trapezoidal and Simpson's rules 3.3 Calculate moments of area and centroid by Simpson's rule 3.4 Calculate form coefficients for ship sections.	Explain 3.1 – 3.4	Chalkboard, charts, drawing sets, French curves.			
4	General Objectives: 4.0: Know elements of ship stability			General Objectives: 4.0: Carryout experiments on stability		
5-6	4.1 Define ship stability 4.2 Explain state of equilibrium: positive neutral and negative 4.3 Explain stability terms and criteria 4.4 Explain transverse and longitudinal stability 4.5 Determine center of gravity and metacentric height by including experiment. 4.6 Determine the effect of shifting and changes of cargo on stability. 4.7 Describe stability of a ship under damage condition.	Explain 4.1 – 4.10	Lecture notes, texts, handbooks etc.	Conduct experiments on wave forms and equilibrium.	Divide students into groups and supervise their experiments.	Weir tank, water, full complement if wave measuring instruments.

	<p>4.8 Determine stability during small and big angle of heel</p> <p>4.9 Describe loss of buoyancy using added weight methods.</p> <p>4.10 Describe free surface effect as it affects ship stability.</p>					
5	General Objectives: 5.0: Know elements of ship motion					
7-8	<p>5.1 State the effect of waves on the motion of a ship.</p> <p>5.2 Define rolling, heaving, pitching, trimming, Swaying, yawing, sagging, hogging and pounding of a ship.</p> <p>5.3 State the method of reduction of rolling of a ship</p>	<p>Explain the concepts in 5.1 – 5.3</p>				
6	General Objectives: 6.0: Know ship structures		General Objectives: 6.0: Know ship structures			

9-11	6.1 Outline types of ship structures 6.2 Determine load acting on ship structures 6.3 Explain the function of ship structural components 6.4 Determine wave loading, weight distribution, loading, shearing force and bending moments. 6.5 State the method of constructing single and double bottom ship 6.6 Describe the framing system 6.7 Describe the construction of the bow and stern of a ship.	Explain 6.1 – 6.7	Chalkboard etc.	6.1 Conduct listing experiments.	Give and supervise students' experiments.	Weir tank.
7	General Objectives: 7.0: Know elements of ship resistance.			General Objectives: 7.0: Know elements of ship resistance.		
12	7.1 State types of resistance. 7.2 Carry out various methods of resistance calculations. 7.3 Use the procedures for the experiments on resistance of ships using models.	Explain and calculate Resistance.		Carryout experiment on Resistance of ships using models.	Give and supervise students' experiments.	Weir tank, Relevant models.
8	General Objectives: 8.0: Know the functions of a propeller and					

	rudder					
13-14	8.1 Define the various dimensions of a propeller. 8.2 Explain the action of a marine propeller. 8.3 Differentiate between fixed pitch propeller and controllable pitch propeller. 8.4 State the used of a rudder. 8.5 Stated the types of rudders in use. 8.6 Calculate the force on a rudder					
	General Objectives: 9.0: Understand national and international regulations					
15	9.1 Outline the principles of IMO regulations on load line, safety of life at sea and pollution. 9.2 Outline the classification of the society's rules and regulations.					

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Marine Engines	COURSE CODE: IME 205	CONTACT HOURS: 1-0-3
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Course Specification: Theoretical & Practical Content

WEEK	General Objective: 1.0 Know the theoretical basis of heat engines					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
1-3	1.1 Explain the thermodynamics properties of fluids. 1.2 Define the term “reversibility “of a heat engine. 1.3 Explain Carnot cycle’s efficiency and its principle. 1.4 State the second law of thermodynamics. 1.5 Solve problems on entropy. 1.6 Distinguish between theoretical (ideal) and actual cycles. 1.7 Solve problems on cycle efficiency and work ratio. 1.8 By means of diagrams and worked examples, distinguish among the Otto, Diesel, Dual (mixed), Rankine and Joule cycles. 1.9 Calculate efficiencies, BHP, IHP.	Explain the concept in 1.1-1.9				

	General Objectives: 2.0: Understand the concept of propulsion engines					
4	2.1 List the types of marine propulsion engines. 2.2 Identify the differences between internal combustion engines and external combustion engines.	Explain the concepts in 2.1 – 2.2				
	General Objectives: 3.0: Understand the construction and operating principles of internal combustion engines			General Objectives: 3.0: Understand the construction and operating principles of internal combustion engines		
5-9	3.1 Distinguish between four and two stroke cycles. 3.2 Discuss scavenging and supercharging. 3.3 Distinguish between a supercharger and a scavenge blower. 3.4 State the types and functions of superchargers. 3.5 Explain the constructional details and design considerations of I.C.E's i.e. bed plates, a-frame, tie rods, crankshafts, main bearings cylinder liner, cylinder head, piston rod, crosshead, connecting rod inlet and exhaust valves,	Explain and calculate as appropriate the concepts in 3.1 – 3.17		3.1 Identify the components of, and the operation of the following fuel\injection systems: fuel pumps (jerk, common rail, electronic injection); fuel injections. 3.2 Carry out the timing of an injection pump from the first principles.	Ask students to identify the components in 3.1 and explain their operation. Perform timing of an injection pump and guide students to do the same.	Sample components injection pump timing apparatus etc.

	<p>fuel camshaft, gear drive, chain drive, motion couplings.</p> <p>3.6 Describe the procedure of phasing and calibrating of an injection pump.</p> <p>3.7 Discuss the modes of engine lubrication systems and measures directed at ensuring efficient lubrication, viz: lubricating systems (liner, crosshead, and bearings), boundary and full-flow lubrication lubricating oil tests on board and recommended valves.</p> <p>3.8 Explain the cooling of pistons, cylinder heads and liners.</p> <p>3.9 Identify coolant converging mechanisms and systems.</p> <p>3.10 Discuss the relative merits of coolants.</p> <p>3.11 Explain engine starting and manoeuvring systems, i.e. engine starting by manual, battery, air or hydraulic manoeuvring systems safety devices in starting systems.</p> <p>3.12 Interpret indicator diagrams.</p> <p>3.13 Explain fault detection power balancing, heat balance.</p> <p>3.14 Explain ignition delay, delay period, after-</p>					
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	<p>burning, turbulence, atomization, and penetration.</p> <p>3.15 Describe the influence of octane and cetane numbers and the addition of additives on engine components.</p> <p>3.16 Identify and explain fuel oil purification methods.</p> <p>3.17 Calculate fuel consumption.</p>					
General Objectives: 4.0: Understanding the operating principle of steam boilers, steam turbines, and steam reciprocating engines						
10-13	<p>4.1 Describe a boiler.</p> <p>4.2 Differentiate between a smoke-tube and a water-tube boiler.</p> <p>4.3 Explain the principles of operation of water-tube boiler.</p> <p>4.4 Explain the functions of the following components: water drum, steam drum, fire row tubes and down comers economizers, super heater furnace boiler feet.</p> <p>4.5 Classify various types of turbine.</p> <p>4.6 Sketch the layout and explain the principles of operation of impulse and reaction turbines.</p> <p>4.7 Sketch the layout and explain the principles of operation of gas turbine plant.</p>	<p>Sketch and explain the concepts in 4.1 – 4.8</p>				

	4.8 Explain the principle of operation of a steam reciprocating engine.					
	General Objectives: 5.0: Understand propulsion systems					
14-15	<p>5.1 List the various components of transmission system.</p> <p>5.2 Identify the functions of the components of the transmission systems.</p> <p>5.3 Sketch a line diagram of the fuel oil system.</p> <p>5.4 Trace and sketch the lubricating oil system</p> <p>5.5 Explain the closed-feed cooling water system.</p> <p>5.6 Sketch the air and hydraulic starting System</p>	List and explain the concepts in 5.1 - 5.				

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE SPECIFICATION: FIRE PREVENTION, PROTECTION AND FIGHTING				COURSE CODE:IME 207		CONTACT HOURS: 1-0-2
GOAL: To acquire knowledge in Fire Protection						
COURSE SPECIFICATION: THEORETICAL CONTENT				PRACTICAL CONTENT		
GENERAL OBJECTIVE: 1.0: Understand the Chemistry of Fire.				GENERAL OBJECTIVE: 1.0: Identify and operate fire detectors		
WEEK	SPECIFIC LEARNING OUTCOMES	TEACHER ACTIVITIES	LEARNING RESOURCE	SPECIFIC LEARNING OUTCOMES	TEACHER ACTIVITIES	LEARNING RESOURCES
1-2	<p>1.1 Describe the theory and philosophy of combustion.</p> <p>1.2 Describe the causes of fire.</p> <p>1.3 Describe the processes of extinction</p>	<p>Define fire.</p> <p>Explain how fire occurs.</p> <p>Explain sources of ignition and the combustion process.</p> <p>List and explain methods of fire extinction.</p> <p>Explain explosive limit and range.</p>	<p>Chalkboard, charts, Audio Visuals etc.</p>	<p>1.1 Identify and operate various types of fire detectors, explosimeter, IR detectors.</p>	<p>Organise Fire drills.</p> <p>Make students identify various detectors and explosimeter and test them.</p>	<p>Flame and smoke detectors.</p> <p>Explosimeter.</p> <p>Fire extinguishers</p> <p>Fire tender and hoses.</p>

	GENERAL OBJECTIVES: 2.0: Know fuel and classes of fire.			GENERAL OBJECTIVES: 2.0: Determine characteristics of fuel.		
3-4	2.1 Describe fuel and types. 2.2 Describe classes of fire and extinction principles.	Define fuel. Explain types of fuel. Ask students to explain fuel and give examples. Discuss classes of fire. Explain all the practical methods of fire fighting in the Marine Industry.	Chalkboard, Audio Visuals, Charts etc.	2.1 Determine characteristics of fuel.	Carry out experiment to determine flash Points, fire points, smoke point freezing point, calorific values API gravity.	Fuel, Calorimeter, Bunsen burner etc.
	GENERAL OBJECTIVES: 3.0: Understand the principles of fire extinguishers.					
5-6	3.1 Describe fire fighting techniques. 3.2 Give reasons for spread of fire.	Describe fire extinguishers. Mention different types of fire extinguishers and their uses.	Fire extinguishers.			
	GENERAL OBJECTIVES: 4.0: Know the basic procedures for fire prevention.					
	4.1 Describe ways of preventing fire.	Explain the	Chalkboard,			

7-9	<p>4.2 Describe fire prevention action.</p> <p>4.3 Determine fire risk of work area.</p> <p>4.4 Explain fire safe and fire resistant materials hot-air, toxic fumes and gaseous smoke.</p> <p>4.5 Describe the necessity for fire fighting equipments.</p>	<p>objectives and various ways of preventing fire.</p> <p>Evaluate fire risk of work area (high, normal or low)</p> <p>Enumerate fire safe and fire resistant materials of heat, fire and other substances.</p> <p>Explain the fundamental needs of fire drills.</p>	Audio Visuals etc.			
GENERAL OBJECTIVES: 5.0: Know evacuation Procedures at emergencies.						
10-12	<p>5.1 Describe evacuation procedures.</p> <p>5.2 Highlight benefits of evacuation drills.</p> <p>5.3 Discuss the physiological effect of fire, heat.</p>	<p>Explain fire emergency procedures.</p> <p>Enumerate and demonstrate the physiological effects.</p>	Fire drills, chalkboard, Visual aids, Water hoses, hydrants etc.			
GENERAL OBJECTIVES: 6.0: Know how to service and maintain fire equipment.			GENERAL OBJECTIVES: 6.0: Know how to service and maintain fire equipment.			
13-15	6.1 Describe the terms, servicing and maintenance of fire equipment.	Explain and demonstrate the procedures of	Chalkboard, fire equipment e.g.	6.1 Carry out the procedures of servicing fire	Practise, demonstrate and supervise students	Visual Aids, extinguishers etc.

	<p>6.2 Describe the procedures for servicing fire fighting equipments.</p> <p>6.3 Describe how frequent fire equipments are serviced and maintained.</p>	servicing and maintaining fire equipment.	extinguisher.	equipments.	closely while servicing fire equipment.	
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FOURTH SEMESTER COURSES

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: Entrepreneurship Development II	COURSE CODE: GNS 202	CONTACT HOURS: 1-0-1
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Course Specification: Theoretical and Practical Contents

WEEK	General Objective 1.0: Understand Financial Management					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
	1.1 Define financial management 1.2 Explain sources and types of finding 1.3 Define the concepts of cost, price, revenue, profit and break-even point. 1.4 Explain financial statements e.g budgeting, balance sheet, profit and loss accounts, and cash flow budget. 1.5 Apply financial statements in business management.	Explain in details the concept of financial Management with appropriate notes.	Recommended textbook, Chalkboard, Chalk, Duster, Lesson notes, etc.			

General Objective 2.0: Know how to prepare simple accounts.						
				2.1 Dealing with assets 2.2 Preparing profit and loss statement. 2.3 Preparing balance sheet.	Demonstrate the procedures involved in preparing balance sheet.	Ledger book and other materials used in preparing balance sheet
General Objective 3.0: Know simple cost preparation						
3.1 Determining labour costs. 3.2 Determining direct machine cost. 3.3 Determine Overheads: labour, machine, and general	Explain in details the concept of cost preparation with appropriate notes.	Recommended textbook, Chalkboard, Chalk, Duster, Lesson notes, etc.				
General Objective 4.0: Know product and job costing						
				4.1 Identify major elements of product costing 4.2 Carry out product costing 4.3 Identify major elements of job costing 4.4 Carryout job costing 4.5 Identify major elements of project costing 4.6 Carryout project costing	Demonstrate activities 4.1 to 4.6 for the students to learn and ask to do them.	Writing and computational materials

General Objective 5.0: Understand the Laws relating to formation of Companies of Companies						
5.1 Identify the fundamental concepts in company law.	Explain in details the features of laws relating to formation of companies with appropriate notes.	Recommended textbook, Chalkboard, Chalk, Duster, Lesson notes, etc.				
5.2 Explain memorandum and Articles of Association.						
5.3 Explain promoters, promotion and the prospectus.						
5.4 Distinguish between shares and debentures.						
5.5 Analyse the functions and powers of Directors, Secretaries and Auditors.						
5.1 Explain liquidation of companies.						
General Objective 6.0: Comprehend Labour and Industrial Law						
6.1 Analyse the laws relating to employer – employee relationship	Explain in details the concept of labour and industrial laws with appropriate notes.	Recommended textbook, Chalkboard, Chalk, Duster, Lesson notes, etc.				
6.2 Explain industrial safety laws.						
6.3 Examine water and public health laws.						
6.4 Evaluate land acquisition.						
General Objective 7.0: Understand Copyright and patent laws						

	<p>7.1 Explain copyrights</p> <p>7.2 Explain patent.</p> <p>7.3 Explain rights and liabilities under the copyrights and patent laws.</p> <p>7.4 Evaluate breach and remedies.</p>					
General Objective 8.0: Comprehend the nature of sale of goods						
	<p>8.1 Define contract of sale of goods</p> <p>8.2 Distinguish sale of goods from other contracts e.g. lease, hire purchase and works and materials.</p> <p>8.3 Explain duties of the parties.</p> <p>8.4 Explain passing of properties and titles.</p> <p>8.5 Examine breach and remedies.</p>	<p>Explain in details the nature of sale of goods with appropriate notes.</p>	<p>Recommended textbook, Chalkboard, Chalk, Duster, Lesson notes, etc.</p>			

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: AUTOCAD II	COURSE CODE: IME 202	CONTACT HOURS: 1-0-3
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Course Specification: Theoretical & Practical Content

WEEK	General Objective 1.0: Understand fundamentals of (3D) drawings.					
	Theoretical Content			Practical Content		
	Specific Learning Outcomes	Teacher's Activities	Resources	Specific Learning Outcomes	Teacher's Activities	Resources
1	1.1 Differentiate between 2D and 3D drawings.	Explain the difference between 2D and 3D drawings.	Computer Relevant software.	1.1 Use solid commands to do the following: <ul style="list-style-type: none"> • Intersect: Defines a new solid object based on the common volume between selected solids. • Union: Defines a new solid that consists of common and uncommon volume between selected solids. • Subtract: Select two set of solids. A single solid based on the removal of the second set from the first one will be created. 	Practise intersects, union and ask students to do same.	Computer system latest AUTOCAD software.

	General Objective 2.0: Draw isometric view of a complex 3D mechanical part.					
2-3				<p>2.1 Divide the complex object to several smaller parts, then draw each part individually and then assemble those using Boolean operations.</p> <p>2.2 Draw each part separately.</p> <p>2.3 Use region command and convert the a part e.g triangle to a region.</p> <p>2.4 Extrude the generated region and enter the value of the appropriate dimensions.</p> <p>2.5 Use Rotate 3D command to rotate parts of the object to correct position</p> <p>2.6 Use solids toolbar to draw parts involving plates, with correct dimensions according to</p>	<p>Illustrate activities 2.1 to 2.10 using a complex mechanical part such a 3D pipe clamp and flange.</p>	<p>Computer relevant software.</p>

				<p>the current UCS.</p> <p>2.7 Use move command to place and relocate the plates to form the desired shape.</p> <p>2.8 Use Subtract command to draw any hollow cylinder in the object and relocate it to its appropriate position.</p> <p>2.9 Union all the parts.</p> <p>2.10 Use shade command to give your model an clear display</p>		
				General Objective 3.0: Demonstrate skills in rendering and orbiting of 3D mechanical part		
4				<p>3.1 Carryout the following on the part produced in 2.0 above :</p> <ul style="list-style-type: none"> i. Rendering ii. Photoreal iii. Photoraytrace iv. Orbit. 	Demonstrate rendering, photoreal, photoraytrace and orbit.	Computer Relevant soft ware.
	General Objective 4.0: Understand 3D ISO-Metric threads			General Objective 4.0: Know how to draw 3D isometric threads.		

5	4.1 State and explain the features of Iso-metric threads such as: Major diameter, minor diameter, pitch, crest, root, etc.			4.1 Draw the basic conventions in the representation of Screw Threads. 4.2 Represent ISO Metric screw threads on drawings		
6	General Objective 5.0: Know how to draw an assembly of two valves coupling with - nut, bolt and washer.			Draw an assembly of two valves coupling		
				5.1 Use M20 for the Hex Nut & bolt to draw an assembly of two valves coupling also add suitable washers and spring washers.	Carry out 5.1 and ask students to do same.	Computer Relevant software.
	General Objective 6.0: Understand Conventions and Symbols			General Objective 6.0: Understand Conventions and Symbols of mechanical parts.		
7-8	6.1 Explains symbols and abbreviations commonly used in engineering drawings. 6.2 State and explain Mechanical parts abbreviations & symbols 6.4 State and explain various machine parts abbreviations and symbols	Explain the symbols, abbreviations and standards used in engineering drawings, mechanical parts, machine parts etc as in 6.1 – 6.5	Charts, Relevant textbooks etc.	6.1 Draw the various mechanical parts symbols used in AUTOCAD such as internal and external threads (details), screw thread, thread inserts, splined shafts, serrated shaft, etc. 6.2 Draw various machine parts symbols such as straight knurling,	Demonstrate the drawing of mechanical parts symbols, machine parts symbols, and standard symbols as in 6.1-6.3 Ask the students to practice the exercises above.	Computer, Relevant software.

	6.5 Enumerate and explain standard abbreviations and symbols such as interrupted views, cylindrical compression spring, cylindrical tension spring.			diamond knurling, square on shaft, hole on circular pitch, bearings, etc. 6.3 Draw standard symbols such as interrupted views, cylindrical compression spring, cylindrical tension spring.		
	General Objective 7.0 Know how to produce working drawing of an engineering system			General Objective 7.0: Drawing of an engineering system		
9	7.1 Define working drawing. 7.2 State and explain types of working drawing to include assembly and detail drawings. 7.3 Enumerate and explain the steps involved in producing assembly drawing to include: 1- Study the application of the machine or structure 2- Try to match the dimensions and understand the	Explain working drawing. Explain types of working drawing e.g. assembly and detailed drawings. Explain the steps involved in producing assembly drawing as in 7.3	Chalkboard, charts, Relevant texts.	7.1 Draw an engineering system to illustrate working drawing which may include – assembly and detailed drawings. 7.2 Draw an engineering system to illustrate assembly drawing which may include – Outline assembly - General assembly, - Sub Assembly - Exploded Assembly	Ask students to practice assembly and detailed drawing. Ask students to practice outline assembly, general assembly, sub assembly and exploded assembly.	Computer, Relevant software.

	<p>relationship between parts.</p> <ul style="list-style-type: none">3- Study carefully the assembly guide given to identify the relationship between parts, in case no assembly guide is given try to draw one to help you in your assembly.4- Select the suitable scale for the entire assembly drawing.5- Draw the main part and make sure that all parts are correctly assembled.6- Prepare the title block7- Label each component by leader and line and number it8- Add overall dimensions necessary for workshop production					
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	General Objective 8.0: Understand the Rules and Features of Assembly Drawing		General Objective 8.0: Produce assembly drawings			
10	8.1 Describe the main rules and features of assembly drawing to include: - Layout - Parts list - Dimension	Describe the rules and features of assembly drawing and ask students to do same, taking into consideration the layout, parts list and dimension		8.1 Produce the layout, parts list and dimensions of the assembly drawings of 7.0 above.	Demonstrate 8.1 and ask students to practice same	Computer, Relevant software.
			General Objective 9.0: Produce drawing of PIN JOINT ASSEMBLY			
11				9.1 Make PIN JOINT ASSEMBLY drawing using scale 1:1 and first angle of projection. 9.2 Draw the following: 1- Complete sectional front view with all parts correctly assembled 2- Add title block and parts list. 3- Add main dimensions	Ask students to practice 9.1-9.2	Computer, Relevant software.
			General Objective 10.0: Know how to produce assembly drawing of SCREW JACK ASSEMBLY			

12				<p>10.1 Make SCREW JACK ASSEMBLY drawing using scale 1:1 and first angle of projection.</p> <p>10.2 Draw the following:</p> <ol style="list-style-type: none"> 1- Complete sectional front view with all parts correctly assembled 2- Add title block and parts list. 3- Add main dimension 	Ask students to practice 10.1-10.2	Computer, Relevant software.
				General Objective 11.0: Draw PULLEY BRACKET ASSEMBLY		
13				<p>11.1 Make PULLEY BRACKET ASSEMBLY drawing using scale 1:1 and first angle of projection.</p> <p>11.2 Draw the following:</p> <ol style="list-style-type: none"> 1- Complete sectional front view with all parts correctly assembled 2- Use design center library to obtain the required Hexagon 	Demonstrate 11.1-11.2 and ask students to practice same	Computer, Relevant software.

				<p>Nut.</p> <p>3- Add title block and parts list.</p> <p>4- Add main dimensions.</p>		
				General Objective 12.0: Know how to produce assembly drawing of CLAMP ASSEMBLY		
14				<p>12.1 Draw and show parts of a CLAMP using scale 1:1 and first angle of projection.</p> <p>12.2 Draw the following:</p> <p>1- Complete sectional front View with all parts correctly assembled.</p> <p>2- Side View without hidden lines</p> <p>3- Use Design center library to obtain the required Hexagon Nut</p> <p>4- Add Title block and parts list</p> <p>5- Add main dimensions</p>	Demonstrate 12.1-12.2 and ask students to do same	Computer, Relevant software.
	General Objective 13.0: Understand Engineering Drawing Analysis			Analyse Engineering Drawing		
	13.1 Explain the purpose of engineering drawing	Explain and describe as in		13.1 Analyse the detailed drawing of the following engineering	Demonstrate 13.1 and ask students to do	Computer, Relevant

15	analysis. 13.2 Describe contents and elements of the engineering parts and objects drawn.	13.1-13.2		component: - Pin joint Assembly - Screw Jack assembly - Pulley Bracket Assembly - C Clamp Assembly	same	software.
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Marine Refrigeration and Air Conditioning			COURSE CODE: IME 204		CONTACT HOURS: 1 – 0 – 3	
GOAL: To acquire basic knowledge and skills in Refrigeration and Air Conditioning.						
COURSE SPECIFICATION: THEORETICAL CONTENT				PRACTICAL CONTENT		
GENERAL OBJECTIVE 1.0: Understand the basic principles of refrigeration.				Identify the components of a refrigerator		
Week	Specific Learning Outcomes	Teacher’s Activities	Resources	Specific Learning Outcomes	Teacher’s Activities	Resources
1-2	1.1 Describe reversed carnot cycle 1.2 Identify the component parts of a refrigeration system 1.3 Describe the functions of each component 1.4 Explain the basic concepts of refrigeration 1.5 Define the terms: (1) Refrigerating effect (2) Coefficient of performance (3) Dew point, Dry bulb and Wet bulb temperatures, Specific humidity and Relative humidity. 1.6 Describe the functions of each component	Ask students to: explain the reversed carnot cycle, explain the basic concepts of refrigerator, Define the terms in 1.5 Describe the functions of each component and ask students to do same.	Relevant textbooks, Lecture notes, Chalkboard, Chalk.	1.1 Identify component parts of refrigeration system.	Demonstrate the activities in 1.1 and ask the students to perform the same.	Refrigerator

2	General Objective 2.0: Know the basic tools and equipment used in refrigeration practice			General Objective 2.0: Use the basic refrigeration tools to perform operations		
3	<p>2.1 Identify the equipment used in refrigeration workshop e.g manifold gauge, leak detecting instruments, etc.</p> <p>2.2 Identify vapour absorption system and its requirements</p>		<p>Hand cutting tools, Flaring tools, Gas welding equipment, manifold gauge, leak detecting instruments, etc.</p>	<p>2.2 Perform cutting, flaring bending and joining of tubes using appropriate tools and equipment.</p>	<p>Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to practice</p>	<p>Hand cutting tools, Flaring tools, Gas welding equipment, manifold gauge, leak detecting instruments, etc.</p>
3	General Objective 3.0: Understand the various types of practical refrigeration cycles			General Objective 3.0: Identify component parts and working of refrigeration system		
4-5	<p>3.1 List the various types of refrigeration cycles e.g vapour compression, absorption etc.</p> <p>3.2 Describe the cycles in 3.1</p> <p>3.3 Describe the functions of the basic components of the refrigeration cycles mentioned above</p>	<p>List the various types of refrigeration cycles.</p>	<p>Relevant textbooks, Lecture notes, Chalkboard, Charts etc.</p>	<p>3.1 Sketch and describe the functions of the basic components of refrigeration system</p>	<p>Identify the basic components of refrigeration system</p> <p>Describe the functions of the basic components of the refrigeration cycles mentioned</p>	<p>Chalkboard, Charts etc.</p>

					above and ask the student to do same	
4	General Objective 4.0: Understand the properties of refrigerants			General Objective 4.0: Demonstrate refrigeration cycles and properties of refrigerants		
6-7	<p>4.1 Define refrigerant.</p> <p>4.2 List common refrigerants.</p> <p>4.3 State the applications of refrigerants in 3.2.</p> <p>4.4 State the properties of a refrigerant.</p> <p>4.5 Explain the differences between primary and secondary refrigerants.</p> <p>4.6 Describe the pressure temperature relationships of common refrigerants.</p> <p>4.7 Describe the effects of refrigerants on piping materials.</p> <p>4.8 State the safety precautions in the storage of refrigerants.</p> <p>4.9 Explain the suitability of each refrigerant for application in (I) domestic refrigerator</p>	<p>Ask students to:</p> <ul style="list-style-type: none"> - Define refrigerant - List common refrigerants - State the application of listed refrigerant - State properties of refrigerant - Explain the difference between primary and secondary refrigerant - Describe the effects of refrigerant on piping materials - The merits of each refrigerant for particular applications. - List refrigerant absorbent pairs used in vapour absorption systems. - Explain the relationship of common refrigerant - Assess the students 	<p>Recommended textbooks, Lecture notes, Chalkboard, Chart.</p>	<p>4.1 Identify various refrigerant and its applications.</p> <p>4.2 Use refrigeration and air condition demonstration unit to illustrate the effect of: (i) pressure on temperature (ii) cooling water rate on condenser and evaporator temperatures.</p> <p>4.3 Observe safety precaution in the workshop and in the storage of refrigerants</p>	<p>Demonstrate the activities in 4.1 to 4.3 for the students to learn and ask the students to practice. Assess the students</p>	<p>Refrigerants, Refrigeration/Air conditioning demonstration unit</p>

	(ii) cold room for food preservation (iii) air conditioning unit. (iv) the refrigerant /absorbent combinations in the vapour absorption system 4.10 Explain the effects of CFCs and HCFCs on global warming and ozone depletion					
5	General Objective 5.0: Know the reasons for and the methods of lubrication in refrigeration			General Objective 5.0: Demonstrate skills in lubrication of refrigerator		
8	5.1 List the required properties of compressor oil. 5.2 Explain the term pouring point, close point and dielectric strength for lubricants. 5.3 Describe methods of lubrication and the mechanism of oil pumps	Ask student to: - List required properties of compressor oil - Explain the terms as applied to lubrication - Describe lubrication methods in refrigeration systems.	Relevant textbooks, Lecture notes, Chalkboard	5.1 Identify the lubrication points in a refrigerator. 5.2 Carry out lubrication operation in a refrigerator using appropriate equipment e.g oil pumps.	Demonstrate the activities in 5.1 and 5.2 for the students to learn and allow the students to practice.	Lubricants, Oil pumps Refrigerator, etc
6	General Objective 6.0: Know the procedure for recharging refrigeration circuit			General Objective 6.0: Demonstrate the procedures of recharging refrigeration circuit		

<p>9-10</p>	<p>6.1 Describe safe methods of transferring refrigerants to service cylinders.</p> <p>6.2 Describe correct storage conditions</p> <p>6.3 Describe correct charging methods, identifying when liquid charging is permissible and when vapour charging is advisable</p> <p>6.4 State the circumstances when (i) toxic products may be produced (ii) there is the risk of an explosion.</p>	<p>Ask students to: Describe safe methods of handling refrigerants Explain when liquid charging is required Explain when vapour charging is required Explain the service cylinder positions in both charging techniques</p>	<p>Halide torch, Manifold gauge, Hoses, connector, vacuum pump, Hand tools, etc</p>	<p>6.1 Conduct leakage detection tests.</p> <p>6.2 Purge, charge and re-charge domestic refrigeration and window air-conditioning units.</p> <p>6.3 Dismantle, service and assemble a refrigerator.</p>	<p>Ask students to: Describe safe methods of handling refrigerants Explain when liquid charging is required Explain when vapour charging is required Explain the service cylinder positions in both charging techniques</p>	<p>Halide torch, Manifold gauge, Hoses, connector, vacuum pump, Hand tools, etc</p>
<p>7</p>	<p>General Objective 7.0: Know the various applications of refrigeration</p>					
<p>11-12</p>	<p>7.1 Explain the use of a refrigerating unit in an air-conditioning system.</p> <p>7.2 List examples of other common refrigeration systems for industrial applications.</p> <p>7.3 Describe a typical layout for cold rooms</p>	<p>Ask student to:</p> <ul style="list-style-type: none"> - Explain the use of refrigeration in Air-conditioning - List common refrigeration systems that have industrial application - Sketch a layout for cold room 	<p>Relevant textbooks, Lecture notes, Chalkboard</p>			

	7.4 List the safety requirements for industrial ammonia plants	- Explain safety needs for industrial ammonia plants. - Assess the students				
8	General Objective 8.0: Know the function of an air-conditioning system for a building			General Objective 8.0: Demonstrate skills in the overhaul of an - air conditioner		
13-15	<p>8.1 Define the term air-conditioning.</p> <p>8.2 List the reasons why air-condition may be provided in a building.</p> <p>8.3 Differentiate between comfort and industrial air-conditioning system.</p> <p>8.4 Distinguish between package, unit and central air-conditioning systems.</p> <p>8.5 Sketch the cycle and list the main components of a unit air-condition</p> <p>8.6 Sketch the equipment used in an air-conditioning system e.g. cooler, batteries, humidifier, fan etc.</p> <p>8.7 State the functions of</p>	<p>Ask students to</p> <ul style="list-style-type: none"> - Define air-conditioning - State reasons for providing air-conditioning in buildings. - Explain the difference between air-conditioning for comfort and air conditioning for industrial purpose. - Explain the difference between package unit air conditioner and central air-conditioning system. - Make a sketch of package air-conditioning unit and indicate the components by proper labeling 	<p>Relevant textbooks, Lecture notes, Chalkboard</p>	<p>8.1 Dismantle, service and reassemble a window type air-conditioner.</p> <p>8.2 Dismantle, service, reassemble and test a compressor unit of an air-conditioner.</p>	<p>Design more practice work for students from 8.1 to 8.10 of the theoretical objective section and ask them to do same.</p>	<p>Complete tool box, Test equipment etc.</p>

	<p>each item of equipment named in 8.6.</p> <p>8.8 Describe typical layouts of central air-conditioning central air-conditioning system.</p> <p>8.9 Explain the source of various load imposed on the air-conditioning plant like solar heat gain, filtration etc.</p> <p>8.10 List the techniques by which some of the loads imposed on air-conditioning plant may be reduced.</p>	<ul style="list-style-type: none"> - Make sketches of the different components - Explain the functions of each component listed - Make a sketch of the layout of a central air condition system - List the sources of cooling load - Explain some of the ways by which heat gains may be reduced 				
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: MARINE PLANT SERVICES AND MAINTENANCE			COURSE CODE: IME 206		CONTACT HOURS: 1 – 0 – 3	
GOAL: TO INTRODUCE PLANT SERVICES AND MAINTENANCE SKILLS TO THE STUDENT						
COURSE SPECIFICATION: THEORETICAL CONTENT				PRACTICAL CONTENT		
GENERAL OBJECTIVE 1.0: Know the need for and types of plant maintenance.				GENERAL OBJECTIVE 1.0: Carry out maintenance operations on a typical machinery		
Week	Specific Learning Outcomes	Teacher's activities	Learning Resources	Specific Learning Outcomes	Teacher's activities	Learning Resources
1	1.1 Define: breakdown maintenance, routine checks, planned maintenance and preventive maintenance. 1.2 State the importance of the use of machinery manufacturers' manual in plant maintenance.	Discuss 1.1 and 1.2	Relevant textbooks, Lecture notes, Chalkboard. A typical machinery manufacturer's manual	1.1 Practice routine checks, preventive maintenance and planned maintenance of typical machinery.	Guide the students to carry out routine checks, preventive and planned maintenance on typical marine machinery.	A typical machinery manufacturer's manual
2	General Objective: 2.0: Know the components of a marine diesel engine			General Objective: 2.0: Describe the components of a marine diesel engine		
2	2.1 Identify the major components of a marine diesel engine.	Illustrate with a large diagram visit to engine plants	Writing material, drawings and photographs. Samples of engine components.	2.1 Illustrate marine diesel components	Identify the components of a marine diesel engine and ask the students to do same. Ask the students to	Charts, sample parts etc.

					describe the functions of the identified components.	
3				General Objectives: 3.0: Understand marine plant faults diagnosis and corrective actions		
3				3.1 Outline common faults 3.2 Explain the causes of the faults in 3.1 above	Diagnose faults in marine plants using relevant tools and equipment	Chalkboard, Charts, tools, equipment etc.
4	General Objectives: 4.0: Understand the routine maintenance procedure of a marine diesel engine			General objectives: 4.0: Demonstrate the routine maintenance procedure of a marine diesel engine		
4-5	4.1 State the maintenance procedure for each of the following marine engine component: main bearing, piston and rings, fuel injectors, fuel pumps, heat exchangers and filters. 4.2 Explain the procedure for calibration of fuel pumps 4.3 Explain shipboard tests for contamination of lubricating oil 4.4 List the causes and prevention of crankcase explosions and scavenge fires	State and explain 4.1 to 4.4	Recommended textbooks, Lecture notes, Chalkboard, Chart.	4.1 Bleed the fuel system of the engine 4.2 Check fuel system of the engine for any malfunction. 4.3 Carry out emergency stopping procedure of the engine. 4.4 Service a turbo charger 4.5 Replace worn piston and rings 4.6 Check tappet clearances 4.7 Grind poppet valves 4.8 Assemble poppet valves and time them 4.9 Clean fouled coolers 4.10 Sketch indicator diagrams and identify possible	Demonstrate the activities in 4.1 to 4.14 for the students to learn and ask the students to practise. Assess the students	Marine system components, Tools, Equipment, Charts, etc.

6	General Objectives: 6.0: Know the correct procedure for overhauling the compressor			General Objectives: 6.0: Demonstrate the correct procedure for overhauling the compressor 4.11 Check cylinder bore with 4.12 Check crankshaft		
	6.1 Describe the precise order for dismantling the compressor	Describe the processes in 6.1 and 6.2	Samples of compressor valves, inter coolers,	6.1 Reassemble valves, inter-coolers and the after coolers. 4.13 Explain common faults of governors. 4.14 Time the fuel pumps 6.2 Over-haul big end and		Samples of compressor valves, inter coolers,
5 10	General objectives: 5.0: Know the correct procedure for preparing a boiler and its mountings for survey			General objectives: 5.0: Demonstrate the correct procedure for maintenance of a boiler emphasizing the need to		
6-9	5.1 Describe the blow down process of a boiler 6.3 6.4 State the common faults in boiler water cooled compressor valves and inter coolers 5.2 Explain how boiler water is tested 5.3 Describe the fuel line arrangement of the burner and also explain the operation of the remote control for shutting down the burner in an emergency 5.4 Explain how boiler valve seats are grounded	• Ask student to: Describe, explain and state the processes in 5.1 to 5.7	Relevant textbooks, bearings notes, Chalkboard compressor.	5.1 Open up, clean both water and gas of a boiler in passages in shaft volume and determine compression ratio of a compressor, economizers, super heaters, and 6.3 Check chamber and furnace Demonstrate 6.1 to 6.3 and ask the students to do 5.2 Dismantle, clean and prepare boiler mountings for survey	Demonstrate, explain and have students perform activities in 5.1 – 5.2. Conduct visit to ships and operate systems there	Sample boiler burners, sample boiler gauge glasses, boiler water test kits, sample boiler safety valve. Demonstration compressor.
7	General Objectives: 7.0: Know the correct procedure for preparing the air vessel and valves for survey			General Objectives: 7.0: Demonstrate the correct procedure for preparing the air vessel and valves for survey paying special attention to		
11-12	7.1 List the type of tools used for cleaning the internal system, e.g., nozzle, electrodes and filter. 5.6 State the method of cleaning the internal system, e.g., nozzle, electrodes and filter. 7.2 State safety precautions necessary for servicing pressurized vessels 5.7 Explain how to test alarm system. 7.3 State the importance of the air vessel relief valve,	Explain and have students perform tasks in 7.1, 7.3. Visit a sea-going ship Explain air vessel, internal coating and maintenance.	Typical air vessel with fittings	7.1 Fill the air vessel and safety valves, and gauge check for leaks and stress the importance of regular operation of the drain cock.	Demonstrate 7.1 and have students do the same. Lead students on excursion to a sea-going ship.	Typical air vessel with fittings e.g. compressed air bottles

	<p>fusible plug, manhole mud doors; also state the need for regular inspection of these fittings.</p> <p>7.4 State the importance of the internal coating in air vessel and the need for the regular maintenance of this coating.</p>					
8	General Objectives: 8.0: Understand the steering gear system			General Objectives: 8.0: Carry out checks on steering gear system		
13	8.1 Explain actions required on total failure of the telemeter system	Explain and illustrate with sketches and have Cadet perform tasks in 8.1 – 8.2 Visit to a ship.	Staring gear model and printed diagrams.	8.1 Carry out tests and checks on steering gear system prior to sailing.	Demonstrate 8.1 and have students to do same	Staring gear model and printed diagrams.
9	General Objectives: 9.0: Understand the specific faults which occurs in pumps and how to rectify them			General Objectives: 9.0: Understand the specific faults which occurs in pumps and how to rectify them		
14-15	<p>9.1 Explain how to service a reciprocating pump.</p> <p>9.2 Explain how to service a centrifugal pump</p> <p>9.3 Explain how to service a gear pump.</p> <p>9.4 Explain how to service a screw pump</p>	Explain 9.1 – 9.4 in details with drawings	Reciprocating pump centrifugal pump, gear pump and screw pump, tool box, chalk board and charts.	<p>9.1 Understand pump trouble shooting</p> <p>9.2 Demonstrate the servicing of various pumps</p> <p>9.3 Demonstrate the repairs of simple faults in a pump</p>	Demonstrate simple repair techniques and ask students to do the same	Reciprocating pump centrifugal pump, gear pump and screw pump, tool box, chalk board and charts.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY

COURSE: MARINE AUXILLIARY MACHINERY

COURSE CODE: IME 208

CONTACT HOURS: 2 – 0 – 2

GOAL: To introduce the student to the construction and operation of marine auxiliary machinery

COURSE SPECIFICATION: THEORETICAL CONTENT

PRACTICAL CONTENT

GENERAL OBJECTIVE 1: Know different kinds of marine pumps.

Week	Specific Learning Outcomes	Teacher’s activities	Learning Resources	Specific Learning Outcomes	Teacher’s activities	Learning Resources
1	1.1 Classify the marine pumps (e.g. positive displacement and rotodynamic pumps and give examples of each class with their general characteristics). 1.2 Describe the construction and operation of a centrifugal pump. 1.3 Describe a submersible centrifugal pump.	Explain, distinguish and classify items 1.1 – 1.3 and have student dismantle and assemble various pumps.	Centrifugal pumps, reciprocating pump, screw pump, gear pump.	1.1 Calculate performance characteristics of centrifugal pump	1.1 Calculate performance characteristics of centrifugal pump (e.g. suction head, flow rate and efficiency) using graphs	Centrifugal pump, reciprocating pump, screw pump, gear pump.
2	General objective: 2.0: Understand the principles of heat exchangers			General objective: 2.0: Practice flow regulation in heat exchangers		
2-3	2.1 Classify and explain the principles of heat exchangers 2.2 Describe different types of heat exchangers 2.3 Explain flow principles of heat exchangers 2.4 State how the flow can be	Explain with sketch 2.1 – 2.4 and have students do same	Heat exchanger, chalkboard, charts etc.	2.1 Sketch and describe flow principles of heat exchangers. 2.2 Demonstrate flow regulation in heat exchangers	2.1 Ask students to describe flow principles with necessary sketches 2.2 Demonstrate flow regulation and	Heat exchanger, tool box, chalkboard, charts etc.

	regulated.				ask students to do the same	
3	General objective: 3.0: Know	different kinds of compressor		General objective: 3.0: Know	different kinds of compressor	
4	3.1 Classify the marine compressors (e.g. reciprocating rotary and centrifugal, low pressure and high pressure. 3.2 Explain the stages of compression (e.g. two and three stages). 3.3 Explain the essence of pressure relief valves, effect of leaking valves and automatic drain system. 3.4 Explain the terms intercoolers and after-cooler in relation to air compressors.	Explain with sketches and have students practice same	Teaching Aids	3.1 Carry out simple calculations based on an air-compressor (e.g. clearance volumes, swept volume, volumetric efficiency). 3.2 Describe and demonstrate methods of compressor drives 3.3 Illustrate how air receiving vessels are connected to a compressor.	Demonstrate 3.1 and 3.3 and ask students to do the same.	Teaching Aids Tool box
4	General objectives: 4.0: Know	steam condensers and the different kinds of boilers		General objectives: 4.0: Know	steam condensers and the different kinds of boilers	
5-6	4.1 Describe the working principles of steam condensers 4.2 Describe the characteristics of a condenser 4.3 Classify steam boilers. 4.4 Enumerate the rules and regulations governing installation and operation of steam boilers.	Describe and classify 4.1-4.4	Teaching Aids	4.1 Demonstrate the regulations of a condenser 4.2 Describe the layout of a steam boiler. 4.3 Describe the construction of the water tube boiler, and fire tube boiler. 4.4 Describe the methods of supplying feed water to a boiler. 4.5 Describe the methods of firing a boiler 4.6 Describe the methods of	Show practically and theoretically 4.1-4.5 and ask students to practice same	Condenser, boiler, tool box, charts etc.

				governing boilers.		
5	General objectives: 5.0: Understand the domestic water system			General objectives: 5.0: Understand the domestic water system		
7-8	<p>5.1 Explain the uses and effect of misuse of fresh water onboard a ship</p> <p>5.2 Mention some fresh water storage facilities on board a ship</p> <p>5.3 Explain the sanitary system</p> <p>5.4 Enumerate the various uses of salt water onboard a ship.</p> <p>5.5 Explain the usefulness of a distilling plant on board a ship</p> <p>5.6 List all types of distilling plants employed in the marine service</p> <p>5.7 List the various parts of a distilling plant</p> <p>5.8 Distinguish between evaporator type and vapour compression type of distilling plants</p> <p>5.9 State the functions of the heating coil in the evaporator shell distiller.</p> <p>5.10 List all the causes of priming in the evaporator shell</p>	Explain with sketches and have students practice same	Teaching Aids and samples	<p>5.1 With diagrams, describe the layout of domestic water system in a ship.</p> <p>5.2 Describe the procedure for testing salinity of fresh water.</p> <p>5.3 Describe a vacuum system on board</p> <p>5.4 Describe how the brine density is controlled in a distiller</p> <p>5.5 Describe the periodic maintenance carried out on distillers.</p>	Demonstrate 5.1-5.5 and ask students to do same	Teaching Aids and samples

8	General objectives 8.0: Understand the steering gear system			General objectives 8.0: Understand the steering gear system		
11-12	8.1 Classify the steering gear system (e.g. mechanical, hydraulic, electron-hydraulic, electrical). 8.2 Discuss the rules governing steering gears. 8.3 List the various parts of	Classify, discuss, list, state and explain 8.1-8.6 with necessary sketches and examples.	Relevant textbook, chalkboard, Visit ship etc.	8.1 Describe the steering gear system 8.2 Describe steering gear control system, e.g., telemeters, receiver rams, steering pumps, transmitter, follow-on	Describe 8.1- 8.3 and show the students how to do same	Charts, Visit ship, etc.
6	General objectives 6.0: Know different kinds of ejectors			General objectives 6.0: Know different kinds of ejectors		
9	6.1 State the working principle of the fire ring 8.4 State the function of the fire ring 6.2 Trace the fire ring main hunting board of a steering gear. 6.3 Explain the basic principles of steam ejectors 8.5 Explain the term creep test and how the test is carried out. 6.4 Outline the different kinds of ejectors 8.6 Explain the meaning of secondary steering position, local control and emergency steering.	Explain with sketches and have students practice same	Teaching Aids	8.3 Describe types and arrangements of rudders in connection with a steering gear		
7	General objectives 7.0: Know different kinds of valves and cocks			General objectives 7.0: Know different kinds of valves and cocks		
9	General objectives 9.0: Understand capstan, windlass and winches.			General objectives 9.0: Understand capstan, windlass and winches.		
19	9.1 State the primary function of a capstan. 7.1 Classify types of valves (e.g non-return, gate valve, safety valve relief valve and screw lift valve). 9.2 State the primary function of a windlass 9.3 Distinguish between a windlass and a capstan 7.2 Explain the construction of various types of valves 9.4 List out the security arrangement of the capstan, anchors and exhaust valves 7.3 Explain the functions of cables 7.4 Explain the construction of a cock 9.5 Enumerate the use of winches	Explain with adequate examples 9.1-9.5	Relevant textbook, chalkboard, Visit ship etc.	7.1 Illustrate the maintenance of valves	Show how valves can be maintained and ask students to do same.	Teaching aid

10	General objectives: 10.0: Understand power generating machinery			General objectives: 10.0: Understand power generating machinery		
14	10.1 Define power generation. 10.2 State the two traditional power distribution techniques employed on board marine ships. 10.3 Distinguish between alternating and direct current supply 10.4 State the mode of supplying power to the main control switchboard. 10.5 Explain the three modes of power distribution on board a ship	Explain and have students practice same Ship visit	Teaching aid, ship visit	10.1 Illustrate the technique of running generators in parallel 10.2 Demonstrate how to put a generator on-load and off-load	Demonstrate and have student practice same.	Teaching aid, ship visit, toolbox etc.
11	General objectives 11.0: Understand bunkering system			General objectives 11.0: Understand bunkering system		
15	11.1 Define the term “bunkering” 11.2 Explain the preparation for bunkering. 11.3 Explain the methods of bunkering 11.4 State the precautions while bunkering.	Explain 11.1-11.4 with relevant sketches and examples	Ship visit, teaching aid, chalkboard etc.	11.1 Demonstrate the precautions while bunkering.	Demonstrate bunkering precautions and have students do the same	Teaching Aids

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY						
COURSE: Ship Yard Technology			COURSE CODE: IME 210		CONTACT HOURS: 1 – 0 – 3	
GOAL: To enable the students acquire knowledge in ship yard technology						
COURSE SPECIFICATION: THEORETICAL CONTENT				PRACTICAL CONTENT		
General Objective 1.0: Know the Scope of a Modern Shipyard				General Objective 1.0: Understand the plan and layout of a modern ship yard		
Week	Specific Learning Outcomes	Teacher's activities	Learning Resources	Specific Learning Outcomes	Teacher's activities	Learning Resources
1-2	MODERN SHIPYARD 1.1 Describe types of shipyards 1.2 Describe and give examples of modern shipyard workshops 1.3 Explain the functions of a ship drawing office 1.4 Describe steel ordering and storage procedure	Explain with sketches and have students practice same	Visit shipyard (Shipbuilding), Drawing equipment, charts etc.	1.1 Draw general plan of shipyards 1.2 Describe the layout of shipyard and working areas	Draw general plan of shipyard and ask students to do same Ask students to describe the layout and working areas of the shipyard drawn above	Visit shipyard (Shipbuilding), Drawing equipment, charts etc.
2	General objective: 2.0: Understand ship building materials					
3	2.1 Describe the production of various types of steel for ship hull 2.2 Describe casting and forging process of materials 2.3 Describe the composition of various	Explain 2.1-2.3 with samples of materials	Teaching Aids samples of materials			

	aluminium alloys					
3	General objectives: 3.0: Know hull processing and fabrication method			General objectives: 3.0: Know hull processing and fabrication method		
4-5	3.1 Give the general introduction of hull fabrication 3.2 Describe the functions of hull processing shop 3.3 Explain the unit fabrication 3.4 Explain the sub-assembly pre-fabrication	Explain 3.1-3.4 with samples of materials	Teaching Aids Samples of materials	3.1 Carryout unit erections.	Demonstrate unit erections and ask students to do same.	Chalkboard, teaching aid etc.
4	General objectives: 4.0: Know the methods of joining structural parts of a ship			General objectives: 4.0: Know the methods of joining structural parts of a ship		
6	4.1 Sketch and describe transverses and longitudinal framing 4.2 Describe shell plating, bulk heads bow and stern structures, flat and bar keel and superstructures 4.3 Describe methods of joining structural parts of ship	Explain 4.1-4.3 with adequate sketches and samples	Samples for demonstrations. Teaching Aids.	4.1 Perform welding and riveting operations in ship-building and observe safety precautions.	4.1 Demonstrate welding and riveting and ask students to do same 4.2 Observe safety during the exercises in 4.1 above	Samples for demonstrations, teaching Aids, welding equipment, toolbox etc.
5	General Objectives: 5.0: Know the methods of material preparation and corrosion prevention			General Objectives: 5.0: Know the methods of material preparation and corrosion prevention		
7-8	5.1 Describe surface preparation and painting technique for steel vessels. 5.2 Explain the sand blasting technique in detail 5.3 List types of marine	Explain 5.1-5.5 with sketches and samples	Shipyard visit	5.1 Practice surface preparation and painting technique for steel vessels.	Ask students to practise surface preparation and painting technique for steel vessels.	Teaching Aids and samples of paint

	<p>paints</p> <p>5.4 Explain the general principle of corrosion</p> <p>5.5 Describe the cathodic method of preventing marine corrosion</p>					
6	General Objectives: 6.0: Know piping systems and method of installing machinery					
9-11	<p>6.1 Describe the general layout of deck machinery</p> <p>6.2 List the criteria used in location of deck machinery</p> <p>6.3 List the criteria for location of main propulsion unit and auxiliary machines.</p> <p>6.4 Explain with sketches shafting arrangement of a ship</p> <p>6.5 Sketch the pipe layout system for sea water system.</p>	<p>Explain 6.1-6.5 with sketches and have students practice same</p>	<p>Teaching Aids</p>			
7	General Objectives: 7.0: Know inspection, launching, and sea trial procedures for vessels			General Objectives: 7.0: Know inspection, launching, and sea trial procedures for vessels		
12-13	<p>7.1 Outline the procedure of opening machinery for inspection by classification societies</p> <p>7.2 Outline necessary preparation for dry-docking of a vessel.</p> <p>7.3 Outline the general services for a ship during</p>	<p>Explain 7.1-7.5 with sketches</p>	<p>Teaching aid, yard visit etc.</p>	<p>7.1 Prepare for dry-docking of a vessel.</p> <p>7.2 Rehearse the general services for a ship during dry docking</p> <p>7.3 Practice giving information required for sea trial.</p> <p>7.4 Prepare for the launching of a new ship</p>	<p>Prepare, rehearse and practice 7.1-7.4 and have students do the same</p>	<p>Relevant texts, teaching aid, shipyard visit etc.</p>

	<p>dry docking</p> <p>7.4 List the information required for sea trial.</p> <p>7.5 Outline necessary preparation for the launching of a new ship</p>					
8	General Objectives: 8.0: Understand general safety precautions in shipyards			General Objectives: 8.0: Understand general safety precautions in shipyards		
14-15	<p>8.1 List all fire fighting applications in a shipyard</p> <p>8.2 Enumerate the precautions necessary to avoid electrical fire in welding workshop.</p> <p>8.3 List precautions necessary during welding</p> <p>8.4 List sources of hazards in a wood workshop such as:</p> <ul style="list-style-type: none"> - handling and using hand tools, power tools and machines - stepping on or striking obstruction left on the floor or bench; - lifting, moving and storing materials; using inflammable liquids; - inhaling vapour or fumes <p>8.5 Identify how accident can occur through the various items in 8.4.</p> <p>8.6 Explain how accident</p>	<p>Explain 8.1-8.2 with sketches</p>	<p>Relevant textbook, chalkboard, Visit ship etc.</p>	<p>8.1 Observe shop safety and safe working conditions</p> <p>8.2 Apply the safety rules relating to:</p> <ul style="list-style-type: none"> - clothing and health hazards - workshop hygiene - movements and other behaviour of workers in a workshop - material handling - tooling handling, storage and uses - machine operation - fire prevention. 	<p>Demonstrate 8.1-8.2 and show the students how to do same.</p>	<p>Charts, Visit ship, welding equipment, toolbox, clothing etc.</p>

	<p>listed in 8.5 can be prevented.</p> <p>8.7 Name safety wears and equipment essential in a wood/welding workshop and their application in working situations: shoes, non-flowing gowns, eye goggles, fire extinguishers, sand and water buckets.</p>					
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PROGRAMME: NATIONAL INNOVATION DIPLOMA IN MARINE ENGINEERING TECHNOLOGY			
COURSE: FINAL YEAR PROJECT		Course Code: IME 216	Contact Hours: 0-0-6
Course Specification: Practical Content			
WEEK	General Objective: 1.0: This module is intended to allow each student to work independently on a project and to inculcate in the students, the ability to integrate all the objectives learnt during his/her course of study and to utilize the acquired skill in finding solutions to problems relating to his/her profession and the maritime industry as a whole.		
1-15	SUGGESTED PROJECT TOPICS 1. Condition monitoring as a maintenance tool e.g. vibration measurements, temperature monitoring, pressure monitoring, etc. 2. Repair/Maintenance of: - Diesel Engines - Centrifugal pumps -Air compressors - Refrigeration & Air conditioning Plants -Sewage Plants - Main Switchboard -Alternators/Generators -Emergency Lighting - Steering Gear -Domestic Hydrophor Plant - Fresh Water Generators	Guide in selection of project and supervise throughout the duration of project work	Materials/Systems for projects.

Assessment

Oral Defence: 15%-By a Panel,

Written Report: 85% - By Project Supervisor.

LIST OF MINIMUM EQUIPMENT FOR NID MARINE ENGINEERING TECHNOLOGY PROGRAMME FOR 30 STUDENTS

WORKSHOPS

MACHINE SHOP

1.	Centre lathe with the swing of 330 and length of bed 1500mm with complete accessories	4
2.	Universal milling machine complete with accessories	2
3.	Radial drilling machine complete with accessories (optional)	2
4.	Universal engraving machine complete with accessories	2
5.	Sensitive drilling machine	2
6.	Power hacksaw	2
7.	Shaping machine with accessories	2
8.	Micrometers outside 0.25mm 25-50mm 50-75mm and sets of Inside micrometers	20 each
9.	Depth gauge	10
10.	Steel rule 300mm	20
11.	Calipers (inside and outside)	20 each
12.	Vee block with clamps	4
13.	Scribing block	4
14.	Surface plate	3
15.	Grease gun	4
16.	Fire extinguisher, water and sand buckets	4 each

FITTING SHOP

Work benches for 30 students

Bench vices 30

Pillar drilling machine 2

Marking out table 1

Power hacksaw 1

Flat rough file (300mm) 30

Round rough file (300mm) 30

Square rough file (300mm) 30

Flat smooth file 250mm) 30

Half round rough file (150mm) 30

Triangular rough file (150mm) 30

Try-square 30

Dividers 30

Steel rule 30

Wallets of warding file 10 sets

Scribers 16

Vee block and clamp 2

Scribing block 2

Centre punches	30
Cold chisels (set)	10 sets
Scrapers (set)	5
Guilotine	2
Vernier Caliper	10
Hacksaw frame	30
Stock and dies (set) metric	3 sets
Taps and wrenches (set) metric	3 set
Hand drill	2
Centre drills	Lot
Tap extractor (set)	2 sets
Screw extractor (set)	4
Screw gauges (assorted)	2 sets
Screw driver (set)	4 sets
Hammers (assorted weight)	30
Wire brush	5
Micrometer (assorted)	5
Fire extinguisher, water and sand buckets	4 each
Feeler gauges	10
Goggles	30 pairs

WELDING AND FABRICATION SHOP

1	Welding transformer	2
2	MIG and MAG welding set	4
3	TIG Welding set	2
4	Acetylene gas cylinder	8
5	Oxygen gas cylinder	8
6	Welding table (gas)	5
7	Welding table (arc)	5
8	Protection screen for five booths for both arc and gas	10
9	Grinding machine (pedestal type)	2
10	Bench vice	6
11	Anvil and stand	4
12	Electrode holder	8
13	Clamp	8
14	Welding chipping hammer	6
15	Wire brush	6
16	Welding shield	6
17	Gloves	20
18	Gas bottle keys	6
19	Welding and cutting burner set	4
20	Gas cylinder truck	4
21	Flash gas lighter	4
22	Brazing rods	4 packets
23	Soldering flux	6 tins
24	Blow lamps	5
25	Goggles	10

26	Steel rule	10
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ENGINE REPAIR SHOP

1	Engine diagnostic equipment	1
2	Hydraulic jack	1
3	Hydraulic press (100 tonne)	1
4	Brake testing equipment with control panel	1
5	Sensitive drilling machine	2
6	Valve grinder	1
7	Workshop service compressor	1
8	Work benches	4
9	Bench vices	6
10	Injector pump test bench	1
11	Universal battery charger	1
12	Engine mounting stand	3
13	Hydro-meters	5
14	Trolley Jacks	2
15	Complete mechanics tool kit	10
16	Electric hand drill	2
17	Breast drill (manual	2

18	Airline pressure gauge	4
19	Tachometer	2
20	Smoke meter	2
21	Lubrication equipment	1
22	Portable crane	1
23	Components of pumps	
24	Components of compressors	
25	Valve refacer	2
26	Diesel fuel pump test stand	1
27	Chain wrench (for removing oil filter)	2
28	Battery cell tester	2
29	Piston ring removal	2
30	Pullers (Various sizes)	6
31	Grease gun	6
32	Cylinder ridge removal	6
33	Engine sump drainer	2
34	Two (2) stroke diesel engine	
35	4 (four) cylinder petrol engine	
36	4 (four) cylinder petrol engine	
37	Clutch testing machine	

38	Spanners (assorted types and sizes)	
39	Transparent engines, gear boxes (for demonstration)	1
40	Vibration meter	1
41	Fuel consumption measuring system	1
42	Fire extinguishers, water and sand buckets	
V	Training Boat	
	All facilities required for the operation of a vessel that can accommodate 20 (twenty) students	

FOUNDRY/HEAT TREATMENT/FORGE WORKSHOP

1	Black smith forges	1
2	Anvil and stand	2
3	Tongs (assorted)	5 each
4	Swage block	2
5	Leg vice	2
6	Black smith hand hammer (various sizes)	6 each
7	Sledge hammer	4
8	Flatters	6
9	Hardles	6
10	Hot chisels	6
11	Cold chisels	6

12	Fullers	6
13	Top and bottom swage (various sizes)	6 each
14	Heat treatment furnace	1
15	Electric furnace with control	1
16	Quenching bath	2
17	Thermocouples	2
18	Pickup tongs (assorted)	10
19	Combined portable thermocouple pyrometer	1
20	Hammers (assorted)	6 each
21	Wire brush	2
22	Pedestal grinder	2
23	Hacksaw frame and blades	10
24	Eye Goggles	10
25	Face shield	10
26	Heat resistant gloves	10 pairs
27	Knee leggings (foundry)	10 pairs
28	Leather apron	10 pairs
29	Safety boots (fire resistant)	10
30	Moulding bench	10
31	Bottom board	20

31	Moulding flask	20
32	Moulding sand shovel	20
33	Watering can	5
34	Wheel-barrow	4
35	Rammers (various types)	20
36	Moulding trowels (various sizes)	20
37	Strike-off-bars	20
38	Gate cutter or spoon	20
39	Sprue pins	20
40	Vent rods	20
41	Bellows	10
42	Lifters	10
43	Bold sponges	10
44	Draw pins	100
45	Bench vice	12
46	Hand vice	6
47	Cutting pliers	6
48	Combination pliers	20
49	Half round bastard file	20
50	Flat file second cut	20

51	Triangular file	20
52	Round file	20
53	Sand mixing machine	1
54	Moulding machine	5
55	Continuous mixer machine dispenser	1
56	Core boxes	10
57	G. Clamps	20
58	Core driver	1

DRAWING STUDIO

1	Drawing table complete with drafting machine/stood	20
2	Drawing set complete with pens for ink work	20
3	45o set squares	20
4	60o set squares	20
5	Blue printing machine	1
6	Adjustable set squares	4
7	Desk sharpener	20
8	Triangular scale rule (30mm)	20
9	Flat scale rule (300mm)	4

10	Blackboard ruler (1m)	4
11	Blackboard Tee squares	4
12	Blackboard set square (45o 60o)	4 each
13	Blackboard compasses	4
14	Blackboard protractor	4
15	French curve set	4
16	Letter stencils (full alphabet, plus S) height 3mm, 6mm	10
17	Number stencil (0-9 inclusive) height 3mm, 6mm	10

LABORATORIES

MECHANICS OF MACHINES

1	Screw Jack	1
2	Oldham coupling	1
3	Four bar chain mechanism	1
4	Whitworth quick return mechanism	1
5	Slider crank mechanism	1
6	Hooks joint	1
7	Geneva stop	1
8	Conservation of angular momentum	1
9	Dead weight tester	1

10	Forces on beam apparatus	1
11	Simple moment beam	1
12	Comprehensive fly wheel apparatus	1
13	Bourdon tube pressure gauge	1
14	Torsion of bar apparatus	1
15	Spring balance	1
16	Gearing system apparatus	1
17	Compression apparatus	1
18	Strut apparatus	1
19	Wheel and axle set	1
20	Centrifugal/centripetal apparatus	1
21	Polygon of force apparatus	1
22	Balancing of rotation masses	1
23	Static and dynamic balance apparatus	1
24	Governor apparatus	1
25	Efficiency of screw threads	1
26	Plate clutch friction apparatus	1
27	Friction on inclined plane apparatus	1
28	Sound friction apparatus	1
29	Extension and compression of springs apparatus	1

30	Universal cantilever apparatus	1
31	Gyroscope apparatus	1
32	Angular acceleration	1
33	Centripetal force apparatus	1
34	Whirling of shaft apparatus	1
35	Crank and connecting rod apparatus	1
36	Rope, belt and coil friction apparatus	1
37	Universal vibration apparatus	1
38	Cam and cam follower mechanism	1
39	Differential gear assembly	1
40	Fire extinguishers sand and water buckets	4

STRENGTH OF MATERIALS

1	Compression and tensile testing machine (140 tons)	1
2	Universal hardness testing machine (brinell, vickers)	1
3	Fatigue testing machine	1
4	Thick cylinder apparatus	1
5	Thin cylinder apparatus	1
6	Strutting apparatus	1
7	Torsion testing machine	1
8	Creep measuring apparatus	1

9	Universal cantilever apparatus	1
10	Portable strain meter	1
11	Beam apparatus	1
12	Shearing force apparatus	1
13	Bending moment apparatus	1
14	Cyroscope apparatus	1
15	Polygon and force apparatus	1
16	Young's modulus apparatus	1
17	Tensometer	1
18	Strain gauges	1
19	Closed coil spring apparatus	1
20	Leaf spring testing machine	1
21	Floor mounted tensile compressive testing machine with accessories	1
22	X-Y recorder for tensile testers	1
23	Table top tensometer with accessories	1
24	Macro hardness testing machine (brinell, Vickers, Rockwell)	1
25	Impact testers (izod, charpy)	1
26	Micro hardness testing machine	1
27	Strain measuring bridge	1
28	Creep testing machine/furnace	1

29	Steel rule (1/2m)	5
30	Inside caliper	5
31	Outside caliper	5
32	Set of open ended spanner	2
33	Set of ring spanner	2
34	Allen keys	2 sets
35	Screw driver	3
36	Universal measuring microscope	1
37	Tool maker's microscope	1
38	Horizontal comparator	1
39	Vertical comparator	1
40	Surface finish measuring instrument Tally surf	1
41	Roundness measuring instrument Tally round	1
42	Universal gear measuring machines OR	1
43	Involute gear measuring machine OR	1
44	Double flank gear testing machine or	1
45	Universal pitch measuring machine	1
46	Measuring projector	1
47	Bench testing centres	1
48	Optical dividing head (vertical and horizontal)	1

49	Auto collimator or	1
50	Clinometer	1
51	Angle dekkor	1
52	Height setting micrometer	1
53	Angle gauge	1
54	Slip gauge and holder	2 sets
55	Vernier protractor	2
56	Sine bars with centers	2
57	Block level	4
58	Measuring ball	2 sets
59	Measuring cylinder	sets
60	Vee block (various sizes)	3
61	Optical flats	2 sets
62	Magnetic vee block	4
63	Surface texture comparative standards	2 sets
64	Staight edge	6
65	Outside micrometer (0-25mm; 25-50mm; 50-75mm; 75-100mm; 100-200mm; 200-300mm, 300-400mm)	4 each
66	Gear tooth vernier caliper	3
67	Vernier height gauge (75mm-100mm)	4

68	Vernier caliper	20
69	Depth gauge micrometer	4
70	Thread micrometer	2
71	Screw pitch gauge	4
72	Inside micrometer	3
73	Angle plate	3
74	Surface plate	3
75	Marking out table	1
76	Parallel strips	6
77	Limit gauge for hole, shaft and thread	6 each
78	Engraver	1
79	Bevel protractor	3
80	Combination set	2
81	Profile measuring projector	1
82	Floating carriage micrometer	1
83	Dial gauge stand (magnetic)	3
84	Measuring wires	2
85	Dial indicator	3
86	Radius gauge	4
87	Standard ring gauge	2

88	Engineer's square	4
89	Feeler guage	2
90	Fire extinguishers, water and sand buckets	

FLUID MECHANICS/HYDRAULICS/HYDRODYNAMICS

1	Turbine set (pelTon, francis pump, or Kaplan)	1
2	Hydraulics Bench with accessories for various experiments in fluid flow measurements	1
3	Weir tank	1
4	Friction loss in pipes	1
5	Bernulli apparatus	1
6	Floating body apparatus	1
7	Losses in fitting and pipe bending apparatus	1
8	Universal pump testing unit	1
9	Centrifugal pump set	1
10	Reciprocating pump set	1
11	Manometer	1
12	Rotameter	1
13	Laminar flow apparatus	1
14	Pilot static tube	1

15	Free and force vortices apparatus	1
16	Parallel series centrifugal pump set	1
17	Universal radial flow apparatus	1
18	Water meter	2
19	Hot wire anaemometer	2
20	Pelton wheel apparatus	1
21	Towing tank	1
22	Ships model	1
23	Propeller and Rudders (used ones)	1

THERMODYNAMIC/HEAT ENGINES

1	Water- heater/stirrer unit with bath	1
2	Uncalibrated mercury in glass thermometer 10° to 110 °c	20
3	Resistance thermometer	1
4	Bench mounted aircooled 4 stroke diesel engine rig including dynamometer and instrumentation	1
5	Boyle gas calorimeter	1
6	Orsat gas calorimeter	1
7	Tachometer	2
8	Stroboscope	1

9	Air compressor test set	1
10	Thermal conductivity apparatus	1
11	Marcet boiler	1
12	Steam boiler plant (laboratory type)	1
13	Mechanical equivalent of heat apparatus	1
14	High pressure vapour unit	1
15	Vapour density apparatus	1
16	Pressure cooker	1
17	Stirling heat pump	1
18	Falling ball viscometer	1
19	Rotary viscometer	1
20	Gas laws apparatus	1
21	Single or two stage air compressor	1
22	Refrigeration demonstration unit	1
23	Air conditioning laboratory unit	1
24	Speedomax recorder	1
25	Thermal anemometer	1
26	Electric anemometer	1
27	Pyrometer, infrared, non-contact digital infratrace	1
28	Combined separating and throttling calorimeter	1

29	Air thermometer constant value	1
30	Piston pump test set	1
31	Gear pump test set	1
32	Fan test set	1
33	Surge in pipe apparatus	1
34	Heat transfer apparatus-parallel, counter flow	1
35	Smoke tunnel	1
36	Air flow measurement demonstration apparatus	1
37	Sensor dial thermometer set	4
38	Experimental heat pump and air cooler	1
39	Refrigeration cycle apparatus	1
40	Barometer	2
41	Reverse cycle refrigeration and air conditioning training unit	1
42	Vapour unit compression refrigeration unit	1
43	Bench top water cooling tower	1
44	Domestic deep-freezer	1
45	Complete set of manifold with gauges and lines	1
46	Semi hermetic compressor	1
47	Condensing unit (air cooled) with open type compressor	1
48	Vacuum pump	3

49	Graduated charging cylinder	2
50	Electronic leak detector	2
51	Amprobe	2
52	Thermostatic expansion valve	20
53	Automatic expansion valve	20
54	Time switches	20
55	Blower	20
56	Fan motor	10
57	Fan blade	15
58	Sectioned compressor	1
59	Environmental control apparatus	1
60	System analyzer	6
61	Sectioned component	2
62	Oil pump	2
63	Evaporator fan motor	10
64	Evaporator fan blade	5
65	Motor run capacitor	15
66	Motor capacitor	15
67	Fan capacitor	15
68	Condenser fan motor and blade	10

69	Electric relay	20
70	Electric overload	20
71	Flaring tool box	20
72	Refrigeration socket set	4
73	Refrigerant expansion	1
74	Multi purpose air duct	1
75	Sound level indicator	1
76	Fire extinguisher, sand and water buckets	1

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LIST OF PARTICIPANTS

S/N	NAME	ADDRESS
1.	Engr. E. S. Ukpabio	Star Maritime Academy, Lagos
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