

Course Curriculum

of the

Department of Naval Architecture & Marine Engineering

Sonargaon University

Developed by:

Department of Naval Architecture & Marine Engineering
Bangladesh University of Engineering & Technology (BUET)
Dhaka-1000, Bangladesh

Team members:

1. Prof. Md. Sadiqul Baree _____
2. Prof. M. Rafiqul Islam _____
3. Prof. Md. Shahjada Tarafder (Team Leader) _____
4. Prof. Nayeb Md. Golam Zakaria _____
5. Dr. Md. Mashiur Rahaman _____

Chapter 1: Rules and Regulations of the course system

1.1 Number of Semesters in a Year

There will be three semesters (Semester 1, Semester 2 & Semester 3) in an academic year.

1.2 Duration of Semesters

The duration of a semester will be 15 (fifteen) weeks as the following composition.

Classes	13 weeks
Recess before Term Final Examination	1 week
Term Final Examination	1 week
Total	15 weeks

1.3 Course Pattern and Credit Structure

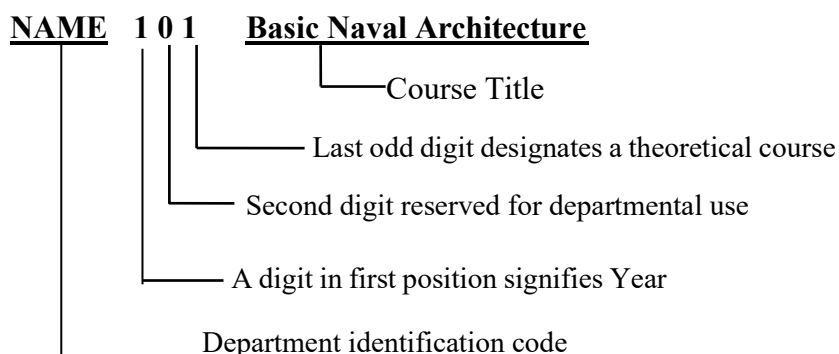
The entire undergraduate program is covered through a set of theoretical and laboratory/ Sessional and Field visit.

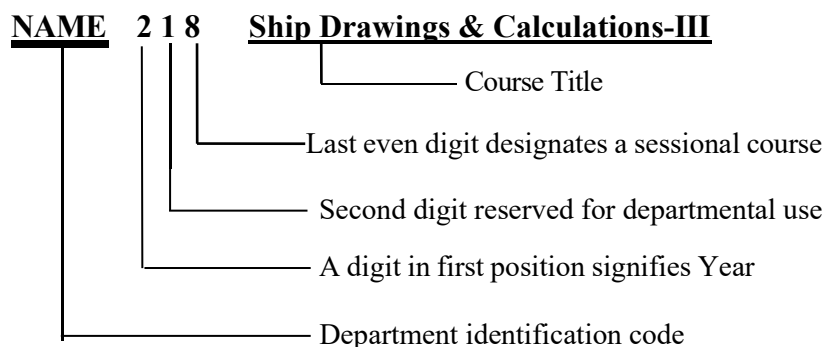
1.4 Course Designation and Numbering System

Each course is designated by a three to four letter word identifying the departmental courses following by a three-digit number with the following criteria:

- (a) The first digit will correspond to the year in which the course is normally taken.
- (b) The second digit will be reserved for departmental use.
- (c) The last digit will usually be odd for theoretical and even for laboratory or sessional courses.

The course designation system is illustrated by two examples.





1.5 Assignment of Credits

- (i) Theoretical Courses: One lecture hour per week per semester will be equivalent to one credit hour.
- (ii) Laboratory/ Sessional/ Design/Field visit: Credits for laboratory/ Sessional or design courses will be half of the class hours per week per semester.

Credit hours are also assigned to thesis work taken by students.

1.6 The Grading System

Letter grades and corresponding grade points will be awarded in accordance with provisions shown below.

Numerical grade	Letter Grade	Grade Point
80% or above	A ⁺ (A plus)	4.00
75% to less than 80%	A (A regular)	3.75
70% to less than 75%	A ⁻ (A minus)	3.50
65% to less than 70%	B ⁺ (B plus)	3.25
60% to less than 65%	B(B regular)	3.00
55% to less than 60%	B ⁻ (B minus)	2.75
50% to less than 55%	C ⁺ (C plus)	2.50
45% to less than 50%	C (C regular)	2.25
40% to less than 45%	D	2.00
less than 40%	F	0
Continuation (for project & thesis / design courses)	X	--

1.7 Distribution of Marks

Items	Theoretical (%)	Sessional (%)
Class Participation/Attendance	10	20
Assignment (s), Class Test (s) and Report(s)	30	50
Final Examination (Theory courses) /Final Quiz (Sessional courses)	60	30
Total	100	100

The semester final examination for each subject will be of 3 hours duration.

Basis of awarding marks for class participation / attendance will be as follows:

Attendance	Marks
90% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
65% to less than 70%	5
60% to less than 65%	4
less than 60%	0

The number of class tests of a course shall be $n+1$, where n is the number of credit hours of the course. Evaluation of the performance in class tests will be on the basis of the best n class tests. The scheme of continuous assessment that a teacher proposes to follow for a course will be announced on the first day of classes.

1.8 Earned Credits

The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained 'F' grade will not be counted towards his/her earned credits.

A student who obtains 'F' grade in a any course in any term will have to repeat the course. 'F' grade will not be counted for GPA calculation but will stay permanently on the Grade Sheet and Transcript. When a student will repeat a course in which he / she previously obtained 'F' grade, he/she will not be eligible to get a grade better than 'B' in such a course.

If a student obtains a grade lower than 'B' in a course, he/she will be allowed to repeat the course only once for the purpose of grade improvement by forgoing his/her earlier grade, but he/she will not be eligible to get a grade better than 'B' in such a course. A student will be permitted to repeat for grade improvement purposes a maximum of four courses.

1.9 Calculation of GPA

Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes five courses in a term having credits of C_1, C_2, C_3, C_4 , and C_5 and his grade points in these courses are G_1, G_2, G_3, G_4 , and G_5 , respectively then

$$GPA = \frac{\sum C_i G_i}{\sum C_i}$$

A Numerical Example

Suppose a student has completed five courses in a term and obtained the following grades:

Course	Credits	Grade	Grade Points
NAME 117	3	A	4.00
NAME 219	3	B	3.00
NAME 329	3	A	3.75
MATH 205	2	B	3.25
HUM 203	1	A	3.50

Then his GPA for the term will be computed as follows:

$$GPA = \frac{3 \times 4.0 + 3 \times 3.0 + 3 \times 3.75 + 2 \times 3.25 + 1 \times 3.5}{3 + 3 + 3 + 2 + 1} = 3.52$$

1.10 Student Classification

For a number of reasons it is necessary to have a definite system by which to classify students as First Year/Freshman, Second Year/Sophomore, Third Year/Junior and Fourth Year/Senior. Students can be classified according to the number of credit hours earned towards a degree. The following classification can be applied to the students

Year	Earned Credit
First Year	0 to 31
Second Year	>31 to 62
Third Year	>62 to 93
Fourth Year	>93

1.11 Exemption of Courses

Diploma students (from public/private institute) may be granted exemption of a maximum of 12 (twelve) credit hours in related theoretical course(s) in which he/she secured at least 60% marks individually.

1.12 Evaluation of Thesis

Thesis work must be supervised by the Faculty member (full-time) of a recognized university having doctoral degree. No Faculty member will be allowed to supervise more than 5 (five) students for a particular academic year.

1.13 Teaching Methodology

Theoretical courses: classroom lectures, class test (s) and /or assignments (individual/group)
Sessional courses: classroom instructions, assignments (individual/group) and /or quiz(s)

1.14 Teaching Aids:

Theory courses:	White board, Over Head Projector, Multimedia and Flip Chart
Sessional courses:	Experimental equipments/software/videos/field visits, White board, Over Head Projector and Multimedia

Chapter 2: Undergraduate Courses

2.1 Introduction

Course schedule for the undergraduate students of the Department of Naval Architecture & Marine Engineering is given below.

Summary of Course Curriculum

	Total	Departmental
Theoretical courses	36	24
Sessional courses	27	20
Theory (Credit hours/Contact hours)	114/114	80/80
Sessional (Credit hours/Contact hours)	40.5/81	33/66
Total Credit hours	154.5	
Total Contact hours	195	

Distribution of credit hours for different categories of courses

Category of Courses	Credit hours
Basic science courses	21
Social sciences courses	8
Allied engineering courses	12.5
Core courses	113
Total	154.5

2.2 Course content

Semester 1			
Course No.	Course Title	Contact hours	Credit hours
NAME 101	Basic Naval Architecture	3	3
NAME 160	Basic Engineering Drawings	3	1.5
NAME 100	Basic Computer Aided Drawing	3	1.5
Phy 101	Structure of Matter, Electricity, Magnetism and Modern Physics	3	3
Phy 102	Physics Sessional	3	1.5
Math 101	Calculus	4	4
Total		19	14.5

Semester 2			
Course No.	Course Title	Contact hours	Credit hours
Chem 101	Chemistry	3	3
Chem 102	Chemistry Sessional	3	1.5
Hum 101	English	2	2
NAME 161	Marine Engineering-I	3	3
NAME 162	Marine Engineering-I Sessional	3	1.5
NAME 108	Ship Drawings & Calculations-I	3	1.5
Total		17	12.5

Semester 3			
Course No.	Course Title	Contact hours	Credit hours
EEE 101	Electrical Engineering Principles	2	2
EEE 102	Electrical Engineering Principles Sessional	1.5	0.75
Hum 103	Economics	2	2
NAME 103	Fluid Mechanics	3	3
NAME 104	Fluid Mechanics Sessional	3	1.5
Shop 106	Machine Shop and Welding Shop Sessional	3	1.5
Total		14.5	10.75

Semester 4			
Course No.	Course Title	Contact hours	Credit hours
NAME 201	Hydrostatic and Stability of Ships	3	3
Math 201	Vector Analysis, Differential Equation and Partial Differential Equation	4	4
NAME 203	Mechanics of Structures	3	3
NAME 204	Mechanics of Structures Sessional	3	1.5
NAME 208	Ship Drawings & Calculations-II	3	1.5
Total		16	13

Semester 5			
Course No.	Course Title	Contact hours	Credit hours
EEE 201	Electrical and Electronic Engineering for Marine Engineers	3	3
EEE 202	Electrical and Electronic Engineering for Marine Engineers Sessional	1.5	0.75
NAME 261	Marine Engineering-II	4	4
Hum 201	Sociology	2	2
NAME 218	Ship Drawings & Calculations-III	3	1.5
Total		13.5	11.25

Semester 6			
Course No.	Course Title	Contact hours	Credit hours
Math 203	Statistics , Fourier Analysis and Matrices, Laplace Transformations	4	4
MET 201	Shipbuilding Materials	3	3
MET 202	Shipbuilding Materials Sessional	3	1.5
NAME 205	Marine Hydrodynamics	4	4
NAME 206	Marine Hydrodynamics Sessional	3	1.5
Total		17	14

Semester 7			
Course No.	Course Title	Contact hours	Credit hours
NAME 301	Shipbuilding Technology-I	3	3
NAME 305	Principles of Ship Design	3	3
NAME 318	Computer Programming in Ship Design-I	3	1.5
NAME 309	Resistance & Propulsion of Ships	4	4
NAME 310	Resistance & Propulsion of Ships Sessional	3	1.5
Total		16	13

Semester 8			
Course No.	Course Title	Contact hours	Credit hours
NAME 361	Heat Transfer	3	3
NAME 303	Shipbuilding Technology-II	3	3
NAME 315	Numerical Methods for Engineers	4	4
NAME 328	Computer Programming in Ship Design-II	3	1.5
NAME 312	Shipyard Training-I (3 weeks)	3	1.5
Total		16	13

Semester 9			
Course No.	Course Title	Contact hours	Credit hours
NAME 307	Maneuvering & Control of ships	3	3
NAME 363	Theory of Machines	3	3
Hum 301	Principles of Accounting	2	2
NAME 308	Ship Drawings & Calculations-IV	3	1.5
NAME 314	Shipyard Training-II (3 weeks)	3	1.5
Total		14	11

Semester 10			
Course No.	Course Title	Contact hours	Credit hours
NAME 400	Projects & Thesis	3	1.5
NAME 405	Computational Fluid Dynamics	4	4
NAME 401	Ship Structures	3	3
NAME 402	Ship Structures Sessional	3	1.5
NAME 409	Dynamics of Marine Vehicles	4	4
Total		17	14

Semester 11			
Course No.	Course Title	Contact hours	Credit hours
NAME 400	Projects & Thesis	3	1.5
NAME 461	Marine Engineering-III	4	4
NAME 462	Marine Engineering-III Sessional	3	1.5
NAME 419	Ship Hull Vibration	3	3
NAME 411	Shipyards Management	3	3
NAME 410	Dynamics of Marine Vehicles Sessional	3	1.5
Total		19	14.5

Semester 12			
Course No.	Course Title	Contact hours	Credit hours
NAME 400	Project & Thesis	6	3
NAME 403	Finite Element Method in Ship Structures	4	4
NAME 407	Engineering Economics in Ship Design	3	3
NAME 413	Navigation and Shipping Laws	3	3
Total		16	13

2.3 Detail outline of the courses

2.3.1 Core courses

Course No./Title	NAME 100 / Basic Computer Aided Drawing
Credit hours/	1.50
Contact hours	3 hrs./wk.

Course content

Getting Started with AutoCAD. Basic Drawing & Editing Commands. Drawing Precision in AutoCAD. Making Changes in Your Drawing. Organizing Your Drawing with Layers. Advanced Object Types. Getting Information from Your Drawing. Advanced Editing Commands. Inserting Blocks. Setting Up a Layout. Printing Your Drawing. Text, Hatching, Adding Dimensions. Working Effectively with AutoCAD. Accurate Positioning. Parametric Drawing. Working with Blocks. Creating Templates. Annotation Styles. Advanced Layouts. External References.

Advanced Text Objects. Working with Tables. Dynamic Blocks. Attributes, Output and Publishing. Other Tools for Collaboration. Online Collaboration and 2D Automation. Introduction to Sheet Sets. Publishing and Customizing Sheet Sets. Managing Layers. CAD Standards. System Setup. Introduction to Customization. Customizing the User Interface. Macros and Custom Routines.

3D Foundations. Simple Solids. Creating Solids & Surfaces from 2D Objects. Modifying in 3D Space. Advanced Solid Editing. Additional Editing Tools. Refining the View. Visualization. Working Drawings from 3D Models. Working with the User Coordinate System.

Course outcome

At the end of the course, students will be able to:

1. understand the fundamental of AutoCAD
2. apply knowledge for development of engineering drawings using computers

Reference

1. Introduction to AutoCAD 2013: 2D and 3D Design, Alf Yarwood, Routledge, 2012

Course No./Title	NAME 101 / Basic Naval Architecture
Credit hours	3.00
Contact hours	3 hrs./wk.

Course content Naval Architecture and its scope. Ship definitions and nomenclature. Ship geometry and lines. Ship types and offshore vehicles. Numerical integration: calculation of area, volume, moment, displacements, center of buoyancy, center of gravity, moment of inertia etc. Approximate formulae and rules. Light weight & deadweight. Capacity & Tonnage measurements. Initial stability of ships. Metacentric diagram.

Course outcome By the end of the course, students will be able to:

1. understand the basics of ships geometry and stability
2. apply basic numerical integration methods in ship calculations.

Reference

1. Theoretical Naval Architecture, Edward Lewis Attwood, BiblioBazaar, 2009
2. Introduction to Naval Architecture, E. C. Tupper, Butterworth-Heinemann, 2013

Course No./Title	NAME 103 / Fluid Mechanics
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Fluid properties. Fluid statics and kinematics. Continuity, energy and momentum principles. Energy and hydraulic grade-lines. Laminar and turbulent flows. Introduction to boundary layers, drags, and wakes, friction and flow through pipes. Impact of jets. Dimensional analysis. Principles of similitude and model testing. Aerofoil and its application. Hydraulic machines: reciprocating and centrifugal pumps. Cavitations.

Course outcome By the end of the course, students will be able to:

1. acquire knowledge of fluid properties, flows and equations
2. understand fluid phenomena
3. apply the knowledge of fluid flow phenomena in pipes, aerofoil's, hydraulic machineries etc.

Reference

1. Fluid Mechanics Fundamentals and Applications, Yunus Cengel & John Cimbala, McGraw-Hill Science/Engineering/Math; 3 edition, January 30, 2013
2. Fluid Mechanics with Engineering Application, Robert L. Daugherty, Joseph B. Franzini, E. John Finnemore, McGraw-Hill Book Company, 1989

Course No./Title	NAME 104 / Fluid Mechanics Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Experiments based on NAME 103

Course outcome By the end of the course, students will be able to:

1. understand fluid phenomena
2. apply the knowledge of fluid flow phenomena in pipes, aerofoil's, hydraulic machineries etc.

Reference

1. Fluid Mechanics Fundamentals and Applications, Yunus Cengel & John Cimbala, McGraw-Hill Science/Engineering/Math; 3 edition, January 30, 2013

Course No./Title	NAME 108 / Ship Drawings & Calculations-I
Credit hours	1.50
Contact hours	3 hrs./wk.

Course content Preparation of general arrangement (GA) plan. Lines plan. Offset table and Bonjean curves.

Course outcome By the end of the course, students will be able to:

1. understand the basics of ships geometry and stability
2. prepare basic general arrangements and lines drawings of ships.

Reference

1. Introduction to Naval Architecture, E. C. Tupper, Butterworth-Heinemann, 2013
2. Ship Knowledge 2011: Design, Construction and Operation, Klaas Van Dokkum, Dokmar Maritime Publishers, 7th edition, 2011
3. Ship Design and Performance for Masters and Mates, Bryan Barrass, Butterworth-Heinemann, 2004

Course No./Title	NAME 160 / Basic Engineering Drawings
Credit hours	1.50
Contact hours	3 hrs./wk.

Course content Introduction, Instruments and their uses. First and third angle projections. Orthographic drawings. Isometric views. Missing lines and views. Sectional views and conventional practices. Auxiliary views.

Course outcome At the end of the course, students will be able to:

1. understand the fundamental of engineering drawings
2. apply knowledge for development of engineering drawings

Reference

1. Engineering Graphics: First Angle Projection, K. L. Narayana & P Kannaiah, Tata McGraw-Hill Publishing Company Ltd., India

Course No./Title	NAME 161 / Marine Engineering -I
Credit hours	3.00
Contact hours	3 hrs./wk.
Course content	Fundamental concepts of thermodynamics: it's laws and their corollaries. Non flow process and flow processes. Thermodynamic cycles and processes. Properties of pure substances. Mixture of gas and vapor. Internal combustion engines: Petrol engines, Diesel engines and Gas turbines with their cycles and accessories. Steam generation units with accessories and mountings. Steam turbines.
Course outcome	At the end of the course, students will be able to: 1. gain knowledge of thermodynamics of pure substances 2. identify different engine types 3. understand the principles of internal combustion engines and turbines
Reference	1. Applied Thermodynamics, Vasandani V.P and Kumar D.S., India 2. Engineering Thermodynamics, C P Arora, Tata McGraw Hill, India

Course No./Title	NAME 162 / Marine Engineering-I Sessional
Credit hours	1.50
Contact hours	3 hrs./wk.
Course content	Sessional based on NAME 161
Course outcome	At the end of the course, students will be able to: 1. gain knowledge of thermodynamics of pure substances 2. identify different engine types 3. understand the principles of internal combustion engines and turbines
Reference	1. Applied Thermodynamics, Vasandani V.P and Kumar D.S., India 2. Engineering Thermodynamics, C P Arora, Tata McGraw Hill, India

Course No./Title	NAME 201 / Hydrostatic and Stability of Ships
Credit hours	3.00
Contact hours	3hrs.wk.
Prerequisite	NAME 101

Course content Large angle stability. Inclining experiments. Heeling trials and still tests. Effects of freely suspended weight and free liquid surface. Trim and hydrostatic calculations. Stability curves and their applications. Influence of ship form on stability. Stability of completely submerged bodies. Dynamic stability. Damage stability: flooding and collision. Stability criteria. Freeboard calculations. Launching calculations.

Course outcome By the end of the course, students will be able to:

1. comprehend the hydrostatic and stability of ships
2. apply knowledge for evaluation of ship's stability and trim
3. analyze ship's stability in damaged conditions
4. determine the layout of slipway during launching

Reference

1. Ship Hydrostatics and Stability, Adrian Biran, Butterworth-Heinemann; 1 edition, 2003
2. Ship Stability for Masters and Mates, Bryan Barrass & Capt D R Derrett, Butterworth-Heinemann, 2012

Course No./Title	NAME 203 / Mechanics of Structures
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Introduction. Mechanical properties of materials. Uni-axial stress and strain. Bending of beams. Two-dimensional stresses and strains: Mohr's circle, membrane stresses in shell-pressure vessels. Combined direct and bending stresses. Strength of welded and riveted joints. Design of columns.

Simple torsion. Deflection of statically determinate beams. Thick cylinders and rotating discs. Theories of failure.

Course outcome By the end of the course, students will be able to:

1. understand stress, strain , bending and deflection of columns and beams
2. design simple beams , columns and shafts

Reference

1. Elements of Mechanics of Materials/Strength of materials, Gerner A Olsen, Prentice-Hall, 1981

Course No./Title	NAME 204 / Mechanics of Structures Sessional
Credit hours	1.50
Contact hours	3hrs./wk.
Course content	Tension, direct shear, hardness and impact tests of steel specimen. Slender column test for different end loading conditions. Static bending test. Performance test of welded and riveted joints.
Course outcome	By the end of the course, students will be able to: 1. determine stress, strain , bending and deflection of columns and beams 2. evaluate the strength of welded and riveted joints
Reference	1. Elements of Mechanics of Materials/Strength of materials, Gerner A Olsen, Prentice-Hall, 1981

Course No./Title	NAME 205 / Marine Hydrodynamics
Credit hours	4.00
Contact hours	4hrs./wk.
Prerequisite	NAME 103
Course content	Flow of an ideal fluid: equation of continuity, streamlines, streak lines and path lines. Two-dimensional flow patterns. Rotational and irrotational flows. Vorticity. Velocity potential functions. Stream functions. Euler's equation of motion. Bernoulli's equation. Velocity and pressure distribution. Uniform flow. Irrotational vortex. Circulation. Source, sink and doublet. Flow past a half body, cylinder and rankine body. Virtual mass and Magnus effect. Conformal transformation: analytic functions, singularities, Cauchy-Riemann equations, complex potential, application of conformal transformation to some flow cases, Joukowski's hypothesis, lift of an infinite aerofoil. Theorems of Green, Stokes, Cauchy and Blasius and their application to some hydrodynamic problems. Flow of a real fluid: Navier-Stokes equations, displacement, momentum and energy thickness of the boundary layer, and characteristics of flow around a ship hull.
Course outcome	By the end of the course, students will be able to: 1. acquire knowledge of various fluid flows and equations 2. understand fluid phenomena 3. apply the knowledge of fluid flow phenomena in conformal transformation
Reference	1. Applied Hydrodynamics, H.R. Valentine, Newnes-Butterworth; July 1969

Course No./Title	NAME 206 / Marine Hydrodynamics Sessional
Credit hours	1.50
Contact hours	3hrs./wk.
Prerequisite	NAME 104

Course content Experiments based on NAME 205

Course outcome By the end of the course, students will be able to:

1. identify various fluid flows patterns
2. measure the natural frequency of oscillations of waves, drag on various bodies

Reference 1. Applied Hydrodynamics, H.R. Valentine, Newnes-Butterworth; July 1969

Course No./Title	NAME 208 / Ship Drawings & Calculations-II
Credit hours	1.50
Contact hours	3hrs./wk.
Prerequisite	NAME 108

Course content Hull form design. Hydrostatic calculation. Stability and cross curves. Checking compliance with standard stability criteria. Trim calculations.

Course outcome By the end of the course, students will be able to:

1. apply knowledge for evaluation of ship's hydrostatic, stability and trim
2. analyze ship's stability

Reference 1. Basic Naval Architecture, Kenneth C. Barnaby, Hutchinson & Co. Ltd, 1967
2. Ship Hydrostatics and Stability, Adrian Biran, Butterworth-Heinemann; 1 edition, 2003
3. Ship Stability for Masters and Mates, Bryan Barrass & Capt D R Derrett, Butterworth-Heinemann, 2012

Course No./Title	NAME 218 / Ship Drawings & Calculations-III
Credit hours	1.50
Contact hours	3hrs./wk.
Prerequisite	NAME 108, NAME 208

Course content Scantling of structural members. Mid-ship section, longitudinal construction and shell expansion drawings. Capacity plan.

Course outcome By the end of the course, students will be able to:

1. evaluate strength of ship's structural members
2. formulate material distribution (plates/angles) on ship's hull surface

Reference 1. Rule books of different classification societies: ABS, GL & NKK, DNV, BV
2. Elements of Ship Design, R. Munro-Smith, Intl Specialized Book Service Inc (July 1976)

Course No./Title	NAME 261 / Marine Engineering-II
Credit hours	4.00
Contact hours	4hrs./wk.
Prerequisite	NAME 161

Course content Performance study of internal combustion engines. Fuels and combustion. Internal combustion engine systems: introduction, fuel oil, injection, intake, exhaust etc. Engine components: crankshaft, bearings, connecting rod, piston, liner, ring, thrust bearing etc. Marine fuel: types, grading, testing, treatment methods, blending, catalytic cracking etc. HSD, IFO and heavy fuel engines. Gas turbines. Nuclear power plants. Introduction to combustion chamber: open and divided, combustion chamber in marine diesel engines. Turbo-charging: thermodynamics, principle, types and design limitations. Vessel types and engine choice.

Course outcome At the end of the course, students will be able to:

1. acquire knowledge of IC engine components
2. understand the principles of marine engines and fuels

Reference

1. Marine Internal Combustion Engines, A.B.Kane, Shroff Publishers & Distributors Pvt. Ltd., 2003.
2. Engineering Fundamentals of the Internal Combustion Engine, W.W.Pulknabeck, Prentice Hall, 2003

Course No./Title	NAME 301 / Shipbuilding Technology-I
Credit hours	3.00,
Contact hours	3hrs./wk.

Course content Development of ship welding. Different types of welding and their equipment. Welding principle, types of power sources and their characteristics. Welding methods: MMAW, GMAW, SAW, Electro-slag welding, TIG. Types of welding joints. Welding symbols. Welding sequence in shipbuilding, Common defects in ship welding: welding distortion monitoring and control, inspection and testing of welded specimen. Non destructive testing. Methods and principles of cutting, cutting equipment. Steel surface preparation, shot blasting, acid pickling, etc.

Course outcome By the end of the course, students will be able to:

1. explain types of welding, welding joints and defects in welding
2. know the equipment used for welding
3. apply methods for testing welding specimen and steel surface preparation

Reference

1. Welding and Welding Technology, Richard L. Little, McGraw-Hill Inc.,US; 1ST edition, 1973
2. Welding Science and Technology, Ibrahim Khan, New Age International Pvt Ltd Publishers, 2009

Course No./Title	NAME 303 / Shipbuilding Technology-II
Credit hours	3.00
Contact hours	3hrs./wk.
Prerequisite	NAME 301

Course content Development of ship structure. Details of structural member: structural discontinuity, stress concentration, remedial measures. Cathodic protection, surface preparation and painting. Shipyard facilities: various shops and production facilities and their layout. Process of ship construction. Numerical control. Boat building by materials other than steel. Introduction to the rules of Classification Societies.

Course outcome By the end of the course, students will be able to:

1. explain types of stresses and discontinuities in ship's structural members
2. apply knowledge for process of ship construction and shipyard layout

Reference

1. Merchant Ship Construction, D.A. Taylor, Institute of Marine Engineers, 1998
2. Ship Construction, David J Eyres, Butterworth-Heinemann, 2007
3. Ship Construction Sketches and Notes, John F Kemp & Peter Young, Routledge, 1997
4. Merchant Ship Construction, H. J. Pursey, Sheridan House Inc, 1983

Course No./Title	NAME 305 / Principles of Ship Design
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Introduction. General design characteristics. Determination of principal parameters and dimensions. Mass equation and estimation of masses and capacities. Body plan design. Choice of form and modification to form. General arrangement and layout of the ship. Strength, powering, maneuvering, sea-keeping and safety. Computer Aided Design (CAD).

Course outcome By the end of the course, students will be able to:

1. develop basic design of ships

Reference

1. Introduction to Naval Architecture, E. C. Tupper, Butterworth-Heinemann, 2013
2. Ship Design and Performance for Masters and Mates, Bryan Barrass, Butterworth-Heinemann, 2004
3. Practical Ship Design, D.G.M. Watson, Elsevier

Course No./Title	NAME 307 / Maneuvering & Control of Ships
Credit hours	4.00
Contact hours	4hrs./wk.

Course content Maneuvering equations of motions and hydrodynamic derivatives. Different types of ship maneuvering. Various motion stability. Determination of hydrodynamic derivatives: rotating arm test, planer motion mechanism test. Controls fixed straight line stability. Full scale trails. Estimating turning circle parameters. Rudder design.

Course outcome By the end of the course, students will be able to:

1. understand various motion stability relating to ship maneuvering
2. evaluate ship's straight line stability
3. design control surfaces

Reference

1. Principles of Naval Architecture: Volume III Motions in Waves and Controllability, Edward V. Lewis, Society of Naval Architects, 1990
2. The Dynamics of Marine Craft: Maneuvering and Seakeeping, Edward M. Lewandowski, World Scientific Pub Co Inc, 2003

Course No./Title	NAME 308 / Ship Drawings & Calculations-IV
Credit hours	1.50
Contact hours	3hrs./wk.
Prerequisite	NAME 108, NAME 208 & NAME 218

Course content Rudder design and drawing. Steering arrangement. Shafting and propeller arrangement. Propeller drawing. Main engine foundation.

Course outcome By the end of the course, students will be able to:

1. develop the design and drawing of rudder, propeller, shafting and stern gear arrangement.

Reference

1. Theoretical Naval Architecture, Edward Lewis Attwood, BiblioBazaar, 2009
2. Introduction to Naval Architecture, E. C. Tupper, Butterworth-Heinemann, 2013

Course No./Title	NAME 309 / Resistance and Propulsion of Ships
Credit hours	4.00
Contact hours	4hrs./wk.

Course content Phenomena resisting the motion of ships. Resistance due to friction, wave making, form, appendage, wind and waves, squat, blockage and shallow water effects. Estimation of powering using methodical series and statistical methods. Advantageous effects of hull form changes- bulbous bows. Asymmetric sterns and optimum trim for ships in ballast.

Screw propeller geometry. Momentum and blade element theories. Propellers in open water, propeller coefficients and design charts. Hull propeller interaction- wake, thrust deduction and relative rotative efficiency. Propeller cavitations. Propeller blade strength. Screw design according to circulation theory for uniform and non-uniform wake. Speed trials and service performance analysis.

Course outcome By the end of the course, students will be able to:

1. gain knowledge of resistance and propulsion of ships
2. determine power and apply different theories for design of ship hull and propeller.

Reference

1. Basic ship Propulsion, Ghose, J. P. & Gokarn, R. P., Allied Publishers India, 2004
2. Ship Resistance and Propulsion, Molland, A. F., Turnock, S. R. & Hudson, Cambridge University Press, New York, 2001

Course No./Title	NAME 310 / Resistance and Propulsion of Ships Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Sessional based on NAME 309

Course outcome By the end of the course, students will be able to:

1. gain knowledge of resistance and propulsion of ships
2. determine power and apply different theories for design of ship hull and propeller.

Reference

1. Basic ship Propulsion, Ghose, J. P. & Gokarn, R. P., Allied Publishers India, 2004
2. Ship Resistance and Propulsion, Molland, A. F., Turnock, S. R. & Hudson, Cambridge University Press, New York, 2001

Course No./Title	NAME 312 / Shipyard Training-I
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Ship design: basic design, estimation, hull design, piping and equipment design, shell expansion, detailed construction drawings. Ship construction: mould loft, gas cutting, CNC cutting, welding, fabrication, sub-assembly, assembly, field assembly, erection, launching, outfitting, delivery trial. Diesel engine workshop practice.

Course outcome By the end of the course, students will be able to:

1. gain practical knowledge in ship design and construction

Reference

1. Merchant Ship Construction, D.A. Taylor, Institute of Marine Engineers, 1998
2. Ship Construction, David J Eyres, Butterworth-Heinemann, 2007
3. Ship Construction Sketches and Notes, John F Kemp & Peter Young, Routledge, 1997
4. Merchant Ship Construction, H. J. Pursey, Sheridan House Inc, 1983

Course No./Title	NAME 314 / Shipyard Training-II
Credit hours	1.50
Contact hours	3 hrs./wk.
Prerequisite	NAME 312

Course content Ship design: basic design, estimation, hull design, piping and equipment design, shell expansion, detailed construction drawings. Ship construction: mould loft, gas cutting, CNC cutting, welding, fabrication, sub-assembly, assembly, field assembly, erection, launching, outfitting, delivery trial. Diesel engine workshop practice.

Course outcome By the end of the course, students will be able to:

1. Gain practical knowledge in ship design and construction

Reference

1. Merchant Ship Construction, D.A. Taylor, Institute of Marine Engineers, 1998
2. Ship Construction, David J Eyres, Butterworth-Heinemann, 2007
3. Ship Construction Sketches and Notes, John F Kemp & Peter Young, Routledge, 1997
4. Merchant Ship Construction, H. J. Pursey, Sheridan House Inc, 1983

Course No./Title	NAME 315 / Numerical Methods for Engineers
Credit hour	4.00
Contact hours	4hrs./wk.
Course content	Interpolation: Polynomial interpolation, Cubic spline interpolation, B-spline interpolation. Curve fitting: Fitting linear equation, Fitting transcendental equation, Fitting polynomial equation, Multi linear regression. Solution of nonlinear equations: The Bisection method, False position method, Newton-Raphson method, Secant method. Solution of simultaneous linear equation: Guassian elimination with pivoting, Matrix inversion, LU decomposition method, Iterative methods- Jacobi iteration & Gauss-Seidel iteration. Numerical differentiation & integration: Numerical differentiation, Errors in numerical differentiation, The cubic spline method, Romber integration, Guassian quadrature. Solution of ordinary differential equation: The Taylor's series method, Euler's method, Runge-Kutta method.
Course outcome	By the end of the course, students will be able to: 1. gain knowledge of different numerical methods for solving linear and non-linear problems 2. apply the knowledge in Naval Architectural problems
Reference	1. Numerical Methods, E. Balagurusamy, Mc-Graw Hill Education, India, 199 2. Numerical Methods, S. Balachandra Rao & C. K. Shanta, Universities Press (India) Private Limited, 2004.

Course No./Title	NAME 318 / Computer Programming in Ship Design-I
Credit hours	1.50
Contact hours	3hrs./wk.
Course content	Introduction to programming languages. FORTRAN 77 and FORTRAN 90: variables, statements, format directed input and output, nesting, arrays and pointers, subprograms and modules, graphics programming, using library functions, dynamic link library (DLL), dynamic memory allocation, creating multi-thread application, debugging. Computer applications to naval architecture problems especially hydrostatic calculations of marine vehicles.
Course outcome	By the end of the course, students will be able to: 1. apply the FORTRAN programming language in ship design calculation.
Reference	1. Fortran 95/2003 for Scientists and Engineers, Chapman, Mc-Graw Hill Company, USA, 2007

Course No./Title	NAME 328 / Computer Programming in Ship Design-II
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Introduction to C and C++ programming languages. C and C++ fundamentals , data types and expressions. Operators. Libraries. Statements. Arrays and strings. Functions. Function overloading. Control statements. Pointers. Input and output systems. Object oriented programming (OOP). Application to the computations of stability, trim and structural strength of marine vehicles.

Course outcome By the end of the course, students will be able to:

1. apply C and C++ programming language in ship design calculation.

Reference 1. Object-Oriented Programming in C++, Lafore R., Sams Publishing, USA, 2002

Course No./Title	NAME 361 / Heat Transfer
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Introduction: steady and unsteady state conduction in one dimension: cases of single and composite walls, cylinders and spheres, fins of uniform cross section. Transient heat transfer: system with negligible internal resistance. Hiesler charts. Introduction to two and three dimensional heat conduction. Convection: forced and natural, basic mechanism, methods of evaluation, non-dimensional parameters, empirical and semi-empirical methods. Radiation: fundamental laws, black and gray bodies, form factors, evaluation of form factors. Heat exchangers: parallel flow and counter flow. LMTD relationship.

Heat transfer cases in ship design: insulation in bulkheads, refrigerated spaces, fish holds in trawlers.

Course outcome By the end of the course, students will be able to:

1. Understand the principles of heat transfer.
2. Apply knowledge of heat transfer in insulation of ship's bulkhead and refrigerated spaces.

Reference 1. Heat Transfer, Holman, J., McGraw-Hill Series in Mechanical Engineering, 2009
2. Principles of Heat Transfer, Frank Kreith, Raj M. Manglik & Mark S. Bohn, Cengage Learning, 2010

Course No./Title	NAME 363 / Theory of Machines
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Introduction. Simple mechanism. Velocity in mechanisms (instantaneous centre methods and relative velocity method). Accelerations in mechanisms. Mechanisms with lower pairs. Friction. Belt, rope and chain drive. Toothed gearing. Gear trains. Gyroscopic couple and precision motion. inertia forces in reciprocating parts, turning moments diagram and flywheels, governors, brakes and dynamometer and cams.

Course outcome By the end of the course, students will be able to:

1. gain knowledge of theories and mechanisms applied in machine dynamics
2. apply the knowledge in machine dynamics problems.

Reference 1. Theory of Machines, Khurmi, R. S. & Gupta, J. K., Eurasia Publishing House, India, 2005

Course No./Title	NAME 400 / Thesis
Credit hours	6.00
Contact hours	12 hrs./wk.

Course content Major field of project and thesis are as follows:

(a) ship design (b) ship construction (c) strength of ship (d) material testing and fracture problems (e) ship motion (f) resistance and propulsion of ships (g) marine engines and ship vibration (h) marine transportation system (i) marine engineering (j) dynamics of ship/floating bodies/structures (k) Environmental impact assessment (l) Life cycle assessment (LCA) (m) computational fluid dynamics (CFD) etc.

Course outcome By the end of the course, students will be able to:

1. carry out research independently in the field mentioned above.

Reference

Course No./Title	NAME 401 / Ship Structures
Credit hours	3.00
Contact hours	3hrs./wk.
Prerequisite	NAME 203

Course content Introduction to ship structural design. Longitudinal bending: the buoyancy and weight curves, the load, shearing force-bending moment curves. Approximations to maximum values of bending moment and shearing forces. Stresses and deflection of hull girder: bending theory, calculation of the section modulus, shear lag and its effect on the bending stress. Dynamic effects. Strength of plating: buckling of un-stiffened and stiffened plates, bulkheads, decks and tank-tops. Transverse strength of ships. Composite construction. Superstructure theory. Grillages. Finite element theory. Design of submarine pressure hull.

Course outcome By the end of the course, students will be able to:

1. explain longitudinal and transverse strength of ships and its structural members
2. evaluate the scantling of ship structural members
3. gain knowledge in the design of submarine pressure hull.

Reference

1. Baxter's Introduction to Naval Architecture, Warsash Publishing, 1992
2. Strength of Ships' Structures, William Muckle, Edward Arnold, Ltd., London, 1967

Course No./Title	NAME 402 / Ship Structures Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Sessional based on NAME 401.

Course outcome By the end of the course, students will be able to:

1. determine longitudinal and transverse strength of ships and its structural members
2. evaluate the scantling of ship structural members

Reference

1. Baxter's Introduction to Naval Architecture, Warsash Publishing, 1992
2. Strength of Ships' Structures, William Muckle, Edward Arnold, Ltd., London, 1967
3. Design of Ship Hull Structures: A Practical Guide for Engineers, Yasuhisa Okumoto, Yu Takeda, Masaki Mano & Tetsuo Okada Springer; 2009

Course No./Title	NAME 403 / Finite Element Method in Ship Structures
Credit hours	4.00
Contact hours	4hrs./wk.
Prerequisite	NAME 315

Course content Basic concept of finite element method (FEM) and its application to ship structure, transformations of local and global coordinate system, stiffness matrices, assembly of global stiffness matrix, boundary conditions, plane strain and plane stress analysis, convergence requirements. Isoparametric elements in two and three dimensions. Formulation of stiffness matrix for beam and shell elements, linear static analysis. Problems involving non-linear material behavior. Introduction to Finite Element softwares and analysis of frame structures.

Course outcome By the end of the course, students will be able to:

1. acquire knowledge on finite element method applied for structural analysis
2. develop numerical models based on finite element method
3. apply finite element method for design of ship structural members.

- Reference**
1. Finite Element Analysis, Bhavikatti, S. S., New Age international Publisher, India, 2005
 2. Finite Element Methods for Engineers, Dixxit, S. S., Cengage Learning, India, 2009

Course No./Title	NAME 405 / Computational Fluid Dynamics
Credit hours	4.00
Contact hours	4hrs./wk.
Prerequisite	NAME 315, NAME 103 & NAME 205

Course content Introduction. Governing equations of fluid flow. Green's theorem, Boundary integral methods and its application to radiation and diffraction problems, Discretization schemes: finite difference methods, finite volume methods, finite element methods, spectral methods etc. Grid generation. Flow visualization and frictional resistance computation for double body flows using Navier-Stokes equations. Free surface flow, free surface computation with linear and fully nonlinear conditions. Numerical treatment of fluid-body interface, turbulence modeling. CFD application to free surface flow past ship shape objects using Reynolds Averaged Navier Stokes Equation (RANSE).

Course outcome By the end of the course, students will be able to:

1. understand different numerical/computational methods applied for fluid flow analysis
2. apply knowledge of CFD in flow past ship hull.

- Reference**
1. Computational fluid dynamics- A practical Approach, Tu J., Geoh, G. H. & Liu C. Elsevier Publications, 2012
 2. Computational Fluid Dynamics- An Introduction, Wendt, J. F., Springer Verlag., 2008

Course No./Title	NAME 407 / Engineering Economics in Ship Design
Credit hours	3.00
Contact hours	3hrs./wk.

Course content	Supply and demand for marine transport. Freight markets and operating economics. Economic criteria. Practical cash flows. Economic complexities. General approach of ship design. Tendering and specification. Cost estimation. Comparison of alternative ship design. The optimum ship from economic point of view.
Course outcome	By the end of the course, students will be able to: 1. acquire knowledge on economics in ship design 2. apply economic criteria for optimum ship design.
Reference	1. Engineering Economics and Ship Design, I. L. Buxton, Imprint unknown, 2nd edition, December 1976

Course No./Title	NAME 409 / Dynamics of Marine Vehicles
Credit hours	4.00
Contact hours	4hrs./wk.

Course content	Recapitulation of gravity waves. Fundamental forms of ship motions. Ship motions in waves: uncoupled heaving, pitching and rolling motions, coupled pitching and heaving motions. General information on ocean waves. Application of statistics and probability theory: the random seaway. Ship motion response to regular and irregular waves. Dynamic effects.
Course outcome	By the end of the course, students will be able to: 1. relate the effects of wave parameters on ship's vertical motions 2. evaluate ship motions both in regular & irregular waves and dynamic effects
Reference	1. Dynamics of Marine Vehicles, Rameswar Bhattacharyya, Ocean engineering, John Wiley & Sons Inc, June 1978.

Course No./Title	NAME 410 / Dynamics of Marine Vehicles Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Sessional based on NAME 409

Course outcome By the end of the course, students will be able to:

1. relate the effects of wave parameters on ship's vertical motions
2. evaluate ship motions both in regular & irregular waves and dynamic effects

Reference 1. Dynamics of Marine Vehicles, Rameswar Bhattacharyya, Ocean engineering, John Wiley & Sons Inc, June 1978.

Course No./Title	NAME 411 / Shipyard Management
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Organogram. Responsibility and accountability chain. Management: structure and style. Trade union: legal rights and collective bargaining. Factors related to job satisfaction and dissatisfaction. Performance appraisal.

Shipbuilding: phase-wise work contents, initial estimation-procedures and practice, information flow, agreements, tendering and its evaluation, material flow.

Designer's roles: owner's requirements, builder's profit and society's rules. Material and technological constraints: alternative designs and acceptance of a compromise design. Post-production assessment for future guidance.

Course outcome By the end of the course, students will be able to:

1. acquire knowledge on management responsibility, shipbuilding processes and role as a designer
2. apply knowledge for performance appraisal of employees of a shipbuilding organization.

Reference 1. Ship Production, Richard L. Storch, Colin P. Hammon, Howard M. Bunch & Richard C. Moore, The Society of Naval Architects & Marine Engineers
2. Cost Management in Shipbuilding: Planning, Analysing and Controlling Product Cost in the Maritime Industry, Jan Fischer, GKP Publishing, 2011
3. Marine Engineering Economics and Cost Analysis, Everett C. Hunt & Boris S. Butman, Schiffer Publishing

Course No./Title	NAME 413 / Navigation and Shipping Laws
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Outline of navigation. Navigational aids and aids to navigation. Shipping laws and safety rules. Inland shipping ordinance (ISO) of Bangladesh. Life saving appliances and firefighting equipment. Safety of life at sea (SOLAS). International load line convention (ILLC). Role of IMO. Registration and survey of ships. Marine personnel. Accident enquiries. International marine conventions. Collision regulations. Legislations of marine pollutions. Outline of laws at sea.

Course outcome By the end of the course, students will be able to:

1. acquire knowledge on navigation, navigational aids and shipping laws
2. assess the safety of ship in respect of ILLC

Reference

1. International Convention for the Safety of Life at Sea: Consolidated text of the 1974 SOLAS Convention, the 1978 SOLAS Protocol, the 1981 and 1983 SOLAS, IMO (1986)

Course No./Title	NAME 419 / Ship Hull Vibration
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Vibration induced in ship structure due to wave, propeller and machinery. Free and forced vibration of single, two and multi-degree of freedom systems. Transverse vibration of beams. Added mass of hull girder vibration. Empirical formulae for calculating hull frequencies. Torsional, flexural and longitudinal vibrations of propeller shafting system. Measurement of ship vibration. Allowable limits of vibration in a ship. Consequences of vibration in different types of vessels. Reduction of vibration by propeller and machinery selection, suppression, isolation and insulation.

Course outcome At the end of the course, students will be able to:

1. acquire knowledge of vibrations in ship structure
2. evaluate the frequencies and amplitudes of vibrations in different modes in ship structure
3. determine the effect of vibration on ship structure

Reference

1. Ship Hull Vibration, F.H. Todd, Edward Arnold Publishers, First Edition Edition, 1961

Course No./Title	NAME 461 / Marine Engineering-III
Credit hours	4.00
Contact hours	4hrs./wk.
Prerequisite	NAME 161 & NAME 261

Course content Pumps: types: characteristics, head calculation, NPSH, blowers and compressors.

Refrigeration and air-conditioning: thermodynamics principles. Air conditioning system for ships. Heating and ventilating systems. Air treatment in cargo spaces.

Marine auxiliary machineries: windlasses, winches, cargo access equipment for dry, unitized, liquid and cryogenic cargoes

Steering gear: types and characteristics, drives, design criteria, testing, commissioning.

Pipes: pipe materials, piping systems and valves, steam traps, anchors, anchor hawse, chains, etc. Emergency systems.

Course outcome At the end of the course, students will be able to:

1. acquire knowledge of pumps, refrigeration and air-conditioning systems, marine auxiliary machineries, steering gear and piping systems used in ship
2. evaluate the capacities of pumps, refrigeration and air-conditioning systems and steering gear .

Reference

1. Marine Auxiliary Machinery, H D Mc-George, Butterworth-Heinemann, 1999
2. Pump Characteristics & Applications, Michael W. Volk, Taylor & Francis Group, 2005
3. Refrigeration & Air Conditioning, G.H.Hundy, A.R.Trott, TC Welch, Butterworth-Heinemann

Course No./Title	NAME 462 / Marine Engineering-III Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Sessional based on NAME 461

Course outcome At the end of the course, students will be able to:

1. calculate the capacities of pumps, refrigeration and air-conditioning systems and steering gear .

Reference

1. Marine Auxiliary Machinery, H D Mc-George, Butterworth-Heinemann, 1999
2. Pump Characteristics & Applications, Michael W. Volk, Taylor & Francis Group, 2005
3. Refrigeration & Air Conditioning, G.H.Hundy, A.R.Trott, TC Welch, Butterworth-Heinemann

2.32. Basic science courses

Course No./Title	Phy 101 / Structure of Matter, Electricity, Magnetism and Modern Physics
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Structure of Matter: Crystalline and non-crystalline solids, Single crystal and polycrystal solids, Unit cell, Crystal systems, Co-ordinations number, Crystal planes and directions, NaCl and CsCl structure, Packing factor, Miller indices, Relation between interplaner spacing and Miller indices, Bragg's Law, Methods of determination of interplaner spacing from diffraction patterns; Defects in solids: Point defects, Line defects, Bonds in solids, Interatomic distances, Calculation of cohesive and bonding energy, Introduction to bond theory, Distinction between metal, Semiconductor and insulator.

Electricity & Magnetism: Coulomb's Law, Electric field (E), Gauss's Law and its application, Electric potential (V), Capacitors and capacitance, Capacitors with dielectrics, Dielectrics-an atomic view, Charging and discharging of a capacitor, Ohm's Law, Kirchoff's Law, Magnetic field, Magnetic induction, Magnetic force on a current carrying conductor, Torque on a current carrying loop, Hall effect, Faradays Law of electromagnetic induction, Lenz's Law, Self induction, Mutual induction, Magnetic properties of matter, Hysteresis curve, Electromagnetic oscillation, L-C oscillation and its analogy to simple harmonic motion.

Modern Physics: Michelson-Morley's experiment, Galilean transformation, Special theory of relativity and its consequences, Quantum theory of radiation, Photo-electric effect, Compton effect, Wave Particle duality, Interpretation of Bohr's postulates, Radioactive disintegration, Properties of nucleus, Nuclear reactions, Fission, Fusion, Chain reaction, Nuclear reactor.

Course outcome By the end of the course, students will be able to:

1. identify different types of crystal as well as structure of matter as whole, the mechanism of electron flow, magnetic behavior due to electron flow, theory of relativity, nuclear particle and nuclear energy
2. distinguish different crystal structures, fundamental laws of electro-magnetism, relativistic and non-relativistic motion and their consequences
3. interpret crystal imperfection and its importance, theories of electro-magnetism, matter wave and nuclear reaction
4. analyze electric structure and equipments, solid structure and nuclear reaction

Reference

1. Engineering Physics by D.R. Joshi, Mc Graw Hill
- Engineering Physics by H.K. Malik and A.K. Singh, Mc Graw Hill.
2. Quantum Mechanics by Powel & Craseman.
3. Optics- A. K. Ghatak

Course No./Title	Phy 102 / Physics Sessional
Credit hours	1.50
Contact hours	3hrs./wk
Course content	Sessional based on Phy 101
Course outcome	By the end of the course, students will be able to: 1. identify different types of crystal as well as structure of matter as whole, the mechanism of electron flow, magnetic behavior due to electron flow, theory of relativity, nuclear particle and nuclear energy 2. distinguish different crystal structures, fundamental laws of electro-magnetism, relativistic and non-relativistic motion and their consequences 3. interpret crystal imperfection and its importance, theories of electro-magnetism, matter wave and nuclear reaction 4. analyze electric structure and equipments, solid structure and nuclear reaction
Reference	1. Engineering Practical Physics by S.Panigrahi & B.Mallick –S.Pub. 5 5

Course No./Title	Chem 101 / Chemistry
Credit hours	3.00
Contact hours	3hrs./wk
Course content	Modern concept of Atomic Structure, Advanced concepts of bonds and molecular structure, Crystal structures, Modern periodic table, Chemistry of Transition metals, Properties and uses of noble gases, Acids and Bases, Chemistry of solutions, Properties of dilute solutions, Chemical equilibrium, Thermo chemistry, Electrochemical cells, Ionization of water and pH, Chemical kinetics, Phase rule and phase diagrams, Selected topics on organic chemistry, Introduction to organic polymer, Basic concepts of dyes color and constitution.
Course outcome	By the end of the course, students will be able to: 1. explain about atomic structure, different types of bonding, properties of elements and gases 2. calculate atomic radius, wave length, frequency, bond angle, bond order etc. 3. identify different types of acids and bases; and their application 4. apply different types of solutions in different purposes 5. construct electrochemical cells for measuring e.m.f. of an electrolytic solution
Reference	1. Physical Chemistry by G.M. Barrow, 6th edition, Tata McGraw Hill, New Delhi. 2. Physical Chemistry by P.W. Atkins, 5th / 6th edition Oxford.

Course No./Title	Chem 102 / Chemistry Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Volumetric Analysis: Acidimetry-alkalimetry, Titration's involving redox reactions, Determination of Cu, Fe and Ca volumetrically, Complex metric titration, determination of Ca, Mg in water

Course outcome By the end of the course, students will be able to:

1. explain the basic principles of acid-base titration and redox titration
2. differentiate between acid-base titration and redox titration and estimate the amount of iron present in stainless steel
3. prepare a produce and estimate the amount of calcium present in a stone sample

Reference

Course No./Title	Math 101 / Calculus
Credit hours	4.00
Contact hours	4hrs./wk.

Course content

Differential Calculus: Limit, Continuity and Differentiability. Differentiation of explicit and implicit functions and parametric equations. Differentials. Successive differentiation of various types of functions. Leibnitz's theorem. Rolle's theorem. Mean Value theorems. Taylor's theorem. Maclaurin's theorem. Lagrange's form of remainders. Cauchy's form of remainder. Expansion of functions by differentiation and integration. Evaluation of indeterminate forms by L'Hospitals rule. Equation of tangent and normal. Partial differentiation. Euler's theorem. Maxima and Minima of functions of single variable. Curvature and circle of curvature. Asymptotes.

Integral Calculus: Integration by parts. Standard integrals. Integration by the method of successive reduction. Definite integral with properties. Improper integral. Beta function and Gamma Function. Area. Arc lengths of curves in Cartesian and polar co-ordinates. Volumes of solid of revolution. Area of surface of revolution.

Course outcome

By the end of the course, students will be able to:

1. co-relate between the basic idea of differentiation and integration of function
2. explain the fundamentals of functions, graph, limit, continuity & differentiability of practical problems
3. apply certain fundamental theorems in real life problems
4. calculate the area, volume, rectification, maximum-minimum values of circle, cube, cylinders and sphere
5. validate a function if it satisfies certain criteria to be applicable for different theorems

Reference

1. Calclus by Thomas and Finney, Nineth Edition, Adison Weseley

Course No./Title	Math 201 / Vector Analysis, Differential Equation and Partial Differential Equation
Credit hours	4.00
Contact hours	4hrs./wk.

Course content

Vector Analysis: Scalars and vectors, Equality of vectors, Addition and subtraction of vectors, Multiplication of vectors by scalars, Position vector of a point, Resolution of vectors, Scalar and vector product of two vectors and their geometrical interpretation, Triple products and multiple products, Application to geometry and mechanics, Linear dependence and independence of vectors, Differentiation and integration of vectors together with elementary applications, Definition of line, surface and volume integrals, Gradient, Divergence and Curl of point functions, various formulae, Gauss's theorem, Stoke's theorem, Green's theorem and their applications.

Differential Equation : Solution of differential equations of higher order when dependent and independent variables are absent, Solution of homogeneous differential equations, Solution of differential equation by the method based on factorization of operators, Solution of differential equations in series by the method of Frobenius, Bessel's functions, Legendre's polynomials and their properties.

Partial Differential Equation: Introduction, Equations of the linear and non-linear first order, Standard forms, Linear equations of higher order, Equations of the second order with variable co-efficient.

Course outcome

At the end of the course, the student will be able to

1. solve the basic problems in differential equations, partial differential equations and vector analysis using standard method
2. Formulate and apply mathematical models for solving physical problems

Reference

1. Advanced Engineering Mathematics by E. Kreyszig Publisher: John Willey & Sons Inc- 8th Edition
2. Differential Calculus by Santi Narayan and Mittal, Chapters 14, 15 Publisher: S. Chand

Course No./Title	Math 203 / Statistics, Fourier Analysis and Matrices, Laplace Transformations
Credit hours	4.00
Contact hours	4hrs./wk.

Course content

Statistics: Frequency distribution, Mean, median, mode and other measures of central tendency, Standard deviation and other measures of dispersion, Moments, Skewness and Kurtosis, Elementary probability theory and discontinuous probability distribution, e.g. binomial, Poisson and negative binomial, Continuous probability distributions, e.g. normal and exponential, Characteristics of distributions, Elementary sampling theory, Estimation, Hypothesis testing and regression analysis.

Fourier analysis: Real and complex form, Finite transform, Fourier integral, Fourier transforms and their uses in solving boundary value problems.

Matrices: Definition of matrix, Different types of matrices, Algebra of matrices, Adjoint and inverse of a matrix, Rank and elementary transformations of matrices, Normal and canonical forms, Solution of linear equations, Quadratic forms, Matrix polynomials, Cayley-Hamilton theorem, Eigenvalues and eigenvectors.

Laplace Transforms: Definition of Laplace transforms, Elementary transformation and properties, Convolution, Solution of differential equation by Laplace transforms, Evaluation of integrals by Laplace's transforms.

Course outcome At the end of the course, the student will be able to

1. understand the theory of statistics, Fourier analysis, matrices and Laplace transforms
2. Formulate and apply mathematical models of statistics, Fourier analysis, matrices and Laplace transforms for solving physical problems

Reference

1. Fundamentals of statistics-S.C.Gupta, Himalaya Publishing house, 1996
2. Mathematical Physics-B.D.Gupta, Vikas Publishing House (pvt.) Ltd., 2004

2.3.3 Social science courses

Course No./Title	Hum 101 / English
Credit hours	2.00
Contact hours	2hrs./wk.

Course content English phonetics: the places and manners of articulation of the English sounds, Vocabulary, English grammar: construction of sentences; some grammatical problems; Comprehension; Composition on current affairs; Precis writing; Report writing: commercial correspondence and tenders; Short stories written by some well known classic writers.

Course outcome At the end of the course, the student will be able to

1. correctly pronounce words with the help of dictionary
2. eliminate common errors in written English
3. develop soft skill like oral, written and communication English.

Reference

1. An Introduction to Professional English and Soft Skills by B.K.Das et al., Cambridge University Press. (Facilitated by BPUT).
2. Business Communication by Meenakshi Raman and Prakash Singh (Oxford)
3. Crash Course in Personal Development by Brian Clegg (Kogan Page)

Course No./Title	Hum 201 / Sociology
Credit hours	2.00
Contact hours	2hrs./wk.

Course content Scope , Some basic concepts, Social evaluation and techniques of production, Culture and civilization, Social structure of Bangladesh, Population and world Resources, Oriental and Occidental societies, Industrial revolution, Family-urbanization and industrialization, Urban Ecology, Co-operative and socialist movements, Rural Sociology.

Course outcome By the end of the course, students will be able to:

1. identify basic concepts of sociology
2. explain different types of society and explore some revolutions and social movement
3. understand family, population, industrialization, world resources for its necessity in society

Reference

1. Introduction to Sociology-W.E.Hewitt, Jerry White and J. Teevan- Pearson Education, 2010

Course No./Title	Hum 103 / Economics
Credit hours	2.00
Contact hours	2hrs./wk.

Course content Definition of Economics, Economics and Engineering, Micro Economics: The theory of demand and supply and their elasticity's, Price determination, Nature of an economic theory, Applicability of economic theories to the problem of developing countries, Indifference curve technique, Marginal analysis, Optimization, Market production, Production function, Types of productivity, Rational region of production of an engineering firm, The short run and the long run, Fixed cost and variable cost, Internal and external economies and diseconomies. Macro-economics: Savings, investment, National Income Analysis, Inflation, Monetary policy, Fiscal policy and Trade policy with reference to Bangladesh, Planning in Bangladesh

Course outcome At the end of the course, the student will be able to

1. Understand the basic concept and theory of micro and macro economics
2. Apply theory and methods in economic analysis

Reference 1. Engineering Economics and Costing-Sasmita Mishra, PHI Learning Private Ltd., 2010

Course No./Title	Hum 301 / Principles of Accounting
Credit hours	2.00
Contact hours	2hrs./wk.

Course content Principles of accounting: Accounts, Transactions, The accounting procedures and financial statements, Cost in general: Objectives and classifications, Overhead costing, Cost sheet under job costing, Operating costing and process costing, Marginal costing: Tools and techniques, Cost-volume-profit analysis, Relevant costing: Analyzing the profitability within the firm, Guidelines for decision making, Long-run planning and control, Capital budgeting.

Course outcome By the end of the course, students will be able to:

1. recognize the accounting principles, accounting cycle, different types of costs and development
2. demonstrate the relationship among various procedures of accounting cycle, different types of costing methods
3. calculate the value of different accounting data viz. profit, loss and financial characteristics
4. evaluate the overall financial status for different projects and organizations both in the long run and short term

Reference 1. Principles of Accounting-Belverd E. Needles, Marian Powers and Susan V. Crosson, Cengage Learning, 2010

2.3.4 Allied engineering courses

Course No./Title	EEE 101 / Electrical Engineering Principles
Credit hours	2.00
Contact hours	2 hrs./wk.

Course content Direct Current: Theorems of electric circuit, electrical network analysis, measuring instruments. Alternating current: AC quantities and waveforms, phasor algebra, AC circuit analysis, three phase circuits. Transformers: Single phase and three phase, auto transformer. Fundamentals of DC generators, DC motors: principle and operation.

Course outcome By the end of the course, students will be able to:

1. differentiate between DC and AC circuits and interpret related parameters
2. illustrate different circuit theorems and analyze Dc/AC networks
3. explain the fundamental principles of various electric machines

Reference

1. Principles and Applications of Electrical Engg., Rizzoni, McGrawHill
2. Electrical & Electronic Technology, E. Huges, Pearson, 9th Edition
3. Basic Electrical Engineering, A. Fitzerlad, D. E.Higginbotham and A.Grabel, TMH, 5th Ed.
4. Electrical Engineering Fundamentals, Vincent Del Toro, 2nd Edition, PHI

Course No./Title	EEE 102 / Electrical Engineering Principles Sessional
Credit hours	0.75
Contact hours	1.5hrs./wk.

Course content Experiments based on EEE 101

Course outcome By the end of the course, students will be able to:

1. differentiate between DC and AC circuits and interpret related parameters
2. illustrate different circuit theorems and analyze Dc/AC networks
3. explain the fundamental principles of various electric machines

Reference

Course No./Title	Shop 106 / Machine Shop and Welding Shop Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Machine shop: Kinds of tools, Common bench and hand tools, Marking and layout tools, Measuring tools, Cutting tools, Machine tools, Bench work with job, Drilling Machine, Practice: Types of drilling machine, use and application, Shaper machine practice: Types of shaper machine, Size and capacity, use and application. Lathe machine practice: Types of lathe, Size and capacity, use and application, Milling Machine practice: Types of milling machine, use and application.

Welding shop: Methods of metal joints: Riveting, Grooving, Soldering, Welding, Types of welding joint and welding practice, Position of Welding: Flat, Vertical, Horizontal, Overhead, Polarity of welding, Electric arc welding and the necessary accessories, Welding of different types of materials: Low carbon steel, cast iron, Brass, Copper, Stainless Steel, Aluminum, Types of Electrode, Fluxes and their composition, Arc welding defects, Test of arc welding: Visual, Destructive and Non-destructive.

Types of gas welding and gas welding equipment; Gases and types of flame; Welding of different types of materials; Gas welding defects; Test of gas welding.

Course outcome At the end of the course, the student will be able to

1. understand the use of hand tools, measuring tools and machine tools etc.
2. understand different types of joints, joining equipment and accessories
3. apply tools for shaping ,milling and joining for a job

Reference

1. Elements of Workshop Technology, Vol. I and II by Hajra choudhary, Khanna Publishers
2. Workshop Technology by WAJ Chapman, Viva Books
3. Workshop Manual by Kannaiah/ Narayana, Scitech

Course No./Title	EEE 201 / Electrical and Electronic Engineering for Marine Engineers
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Three phase induction motors. AC generators, synchronous motor, speed control of three phase motors. Diodes, BJTs, diode and BJT circuits, MOSFET and SCR as power switching devices, controlled rectifiers and inverters. Radar and wireless equipments, electronic navigation aids, LORAN, RDF and Decca Chain.

Course outcome By the end of the course, students will be able to:

1. explain several electrical machines, electronic circuits with diodes and different navigation systems
2. employ different electrical machines in practical applications
3. construct practical power and switching circuits using several electronic elements.
4. design electronic navigation systems with RADAR, LORAN and RDF

Reference

1. Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092 (Selected Portions).
2. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.
3. Electronics Principles (7th Edition), Albert Malvono and David J. Bates, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Course No./Title	EEE 202 / Electrical and Electronic Engineering for Marine Engineers Sessional
Credit hours	1.50
Contact hours	3hrs./wk.

Course content Laboratory experiments based on EEE 201

Course outcome By the end of the course, students will be able to:

1. explain several electrical machines, electronic circuits with diodes and different navigation systems
2. employ different electrical machines in practical applications
3. construct practical power and switching circuits using several electronic elements.
4. design electronic navigation systems with RADAR, LORAN and RDF

Reference

Course No./Title	MET 201 / Shipbuilding Materials
Credit hours	3.00
Contact hours	3hrs./wk.

Course content Metals as materials of construction; Industrially significant properties of metallic materials; Production, properties and uses of Pig Iron, Cast Iron and Carbon Steels; Nonferrous alloys; Protective Coatings; Ferrous alloys: Plain carbon, alloy, tool, stainless, heat-resisting and creep-resisting steels etc.; The Fe-Fe₃C equilibrium; Different types of heat-treatment operations; Case hardening of steels, Cement, Ferro-cement, Timber, Rubber, Glass and Plastics.

Course outcome By the end of the course, students will be able to:

1. describe the production processes & uses of different types of metals & alloys
2. correlate between microstructure, heat treatment & properties of ferrous alloys
3. select the appropriate materials for marine and ship building applications

Reference

1. Metallurgy Fundamentals-Daniel A. Brandt, J.C. Warner, Good Heart Willcox Company, 1999

Course No./Title	MET 202 / Shipbuilding Materials Sessional
Credit hours	1.50
Contact hours	3 hrs./wk.

Course content Experiments based on MET 201

Course outcome By the end of the course, students will be able to:

1. describe the production processes & uses of different types of metals & alloys
2. correlate between microstructure, heat treatment & properties of ferrous alloys
3. select the appropriate materials for marine and ship building applications

Reference