DIPLOMA IN ENGINEERING
PROBIDHAN-2016

SHIPBUILDING TECHNOLOGY (680)

1st SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	61011	Engineering Drawing	0	6	2	0	0	50	50	100
2	65712	English	2	0	2	40	60	0	0	100
3	65911	Mathematics -1	3	3	4	60	90	50	0	200
4	65912	Physics -1	3	3	4	60	90	25	25	200
5	66711	Basic Electricity	2	3	3	40	60	25	25	150
6	65711	Bangla	3	3	4	60	90	50	0	200
7	68011	General Ship Knowledge	2	0	2	40	60	0	0	100
		Total	**15**	**18**	**21**	**300**	**450**	**200**	**100**	**1050**

2nd SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68021	Naval Architecture	2	3	3	40	60	25	25	150
2	68022	Shipbuilding Materials	2	3	3	40	60	25	25	150
3	65921	Mathematics -2	3	3	4	60	90	50	0	200
4	65922	Physics -2	3	3	4	60	90	25	25	200
5	65722	Communicative English	1	3	2	20	30	50	0	100
6	65811	Social Science	3	0	3	60	90	0	0	150
7	67011	Basic Workshop Practice	0	6	2	0	0	50	50	100
		Total	**14**	**21**	**21**	**280**	**420**	**225**	**125**	**1050**

3rd SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	66611	Computer Application	0	6	2	0	0	50	50	100
2	68032	Welding	1	6	3	40	60	50	50	200
3	66811	Basic Electronics	2	3	3	40	60	25	25	150
4	67033	Machine shop Practice	1	3	2	20	30	50	50	100
5	65931	Mathematics -3	3	3	4	60	90	25	25	200
6	65913	Chemistry	3	3	4	60	90	25	25	200
7	65812	Physical Education & Life Skill Development	0	3	1	0	0	50	0	50
		Total	**10**	**27**	**19**	**240**	**360**	**250**	**200**	**900**

4th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	67042	Metallurgy	2	3	3	40	60	25	25	150
2	67041	Engineering Mechanics	3	3	4	60	90	25	25	200
3	68042	Shipyard Practice	2	3	3	40	60	25	25	150
4	68041	Shipbuilding Drawing -1	0	6	2	0	0	50	50	100
5	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
6	68043	Sheet Metal & Metal Forming	1	3	2	20	30	25	25	100
7	67941	I C Engine Principles	2	3	3	40	60	25	25	150
		Total	**12**	**24**	**19**	**240**	**360**	**200**	**200**	**950**

5th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	67056	Advanced Machine Shop	1	6	3	20	30	50	50	150
2	67051	Hydraulics & Hydraulic Machineries	2	3	4	60	90	25	25	200
3	68053	Marine Refrigeration & Air conditioning	2	3	3	40	60	25	25	150
4	68051	Estimating & Costing of Shipbuilding	2	3	3	40	60	25	25	150
5	68052	Shipbuilding Drawing -2	0	6	2	0	0	50	50	100
6	65851	Accounting Theory and Practice	2	3	3	40	60	25	25	150
7	67955	Instrumentation & Control	2	3	3	40	60	25	25	150
		Total	**11**	**27**	**20**	**220**	**330**	**225**	**225**	**1000**

6th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68062	Computer Aided Drawing in Shipbuilding	1	6	3	20	30	50	50	150
2	67066	Advanced Welding	1	6	3	20	30	50	50	150
3	67961	Ship Safety & Fire fighting	2	3	3	40	60	25	25	150
4	67064	Strength of Materials	3	3	4	60	90	25	25	150
5	68061	Ship Construction & Fittings	2	3	3	40	60	25	25	150
6	65852	Industrial Management	2	0	2	40	60	0	0	100
7	67976	Marine Electrical & Electronic System	1	3	2	20	30	25	25	100
8	68063	CAM and CNC	1	3	2	20	30	25	25	100
		Total	**13**	**27**	**22**	**260**	**390**	**200**	**200**	**1050**

7th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68071	Hull Layout & Construction	2	3	3	40	60	25	25	150
2	68073	Ship Propulsion & Auxiliaries	1	3	2	20	30	25	25	100
3	67977	Maritime Laws	2	0	2	40	60	0	0	100
4	68072	Marine Engines	1	3	2	20	30	25	25	100
5	68074	Ship Design	2	3	3	40	60	25	25	150
6	68075	Ship Maintenance and Repair	1	3	2	20	30	25	25	100
7	65853	Innovation & Entrepreneurship	2	0	2	40	60	0	0	100
8	67952	Engineering Thermodynamics & Heat Transfer	2	3	3	40	60	25	25	150
9	68076	Shipbuilding Project	0	6	2	0	0	50	50	100
Total			**13**	**24**	**21**	**260**	**390**	**200**	**200**	**1050**

8th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68081	Shipbuilding Technology Industrial Training	0	0	6	0	0	150	0	300
		Graduation Project Presentation				0	0	0	150	
Total			**0**	**0**	**6**	**0**	**0**	**150**	**150**	**300**

BANGLADESH TECHNICAL EDUCATION BOARD

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016) **(খসড়া)**

SHIPBUILDING TECHNOLOGY

TECHNOLOGY CODE: 80

SYLLABUS
(PROBIDHAN-2016)

FIRST SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

1st Semester
Shipbuilding Technology

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				
						Theory		Practical		Total
						Cont. assess	Final exam	Cont. assess	Final exam	
1	61011	Engineering Drawing	0	6	2	0	0	50	50	100
2	65712	English	2	0	2	40	60	0	0	100
3	65911	Mathematics - 1	3	3	4	60	90	50	0	200
4	65912	Physics - 1	3	3	4	60	90	25	25	200
5	66711	Basic Electricity	2	3	3	40	60	25	25	150
6	65711	Bangla	3	3	4	60	90	50	0	200
7	68011	General Ship Knowledge	2	0	2	40	60	0	0	100
	Total		15	18	21	300	450	200	100	1050

ENGINEERING DRAWING **T P C**

0 6 2

OBJECTIVES

- To develop the ability to use various drawing instruments and materials.
- To enable in constructing and using various types of scales in drawing.
- To provide the ability to construct various geometrical figures.
- To enable to adopt various symbols used in drawing.
- To understand the orthographic and isometric projection.

SHORT DESCRIPTION

Drawing instruments and their uses; Lettering, numbering and constructing title strip; Adopting alphabet of lines and dimensioning; Constructing scales; Constructing geometrical figures; Constructing conic sections; Adopting symbols; Views and isometric projections.

DETAIL DESCRIPTION

DRAWING INSTRUMENTS AND MATERIALS

1 Practice with drawing instruments and materials for basic drawing technique.

1.1 Identify the different types of drawing instruments.
1.2 Use different types of drafting equipment.
1.3 Use different types of drafting software.
1.4 Identify the standard sizes of drawing board and sheets.
1.5 Draw the border lines in drawing sheets following standard rule.
1.6 Draw horizontal, vertical and inclined lines with the help of set squares and T-square.
1.7 Draw 15 degree, 75 degree, 105 degree and 120 degree angles with the help of set squares.
1.8 Use lettering guide, template, scale pantograph and French curve.

LETTERING NUMBERING AND TITLE STRIP

2 Letter and number freehand and with instruments.

2.1 Identify the necessity of good lettering in engineering drawing.
2.2 Draw freehand single stroke vertical letters from A to Z (upper and lower case) and numbers 0 to 9.
2.3 Draw freehand inclined (65 degree to 75 degree) single stroke letters from A to Z (upper and lower case) and numbers from 0 to 9.
2.4 Draw block letters (Gothic) using 5: 4 and 7: 5 proportions and height.
2.5 Select a suitable size of letters and write a few sentences using all the letters selecting suitable scale.
2.6 Draw title strip with proper placement using suitable size of letters and measurements.

ALPHABET OF LINES AND DIMENSIONING

3 Adopt the alphabet of lines.

3.1 Select different lines in drawing.
3.2 Use center line, hidden line, phantom line, break line, dimension line, extension line, section line and cutting plane line.

3.3 Use different thickness of line to emphasize a part of drawing.
3.4 Select recommended grades of pencils for various types of lines for engineering drawing.

4 Adopt the elements and theory of dimensioning.

4.1 Put dimensions in engineering drawing according to an accepted standard.
4.2 Identify the elements of dimensions from a given dimensioned drawing.
4.3 Apply aligned and unidirectional system of dimensioning.
4.4 Draw size and location of dimension, continuous dimension, staggered dimension and dimensioning in limited space.
4.5 Add necessary dimension to a given drawing with suitable arrows.

CONSTRUCTION OF SCALE

5 Prepare scale for drawing application.

5.1 Calculate representative fraction and interpret a scale reading.
5.2 Use different types of scale to find full size dimension.
5.3 Draw a plain scale to show meters, centimeters and millimeters of a given distance on object.
5.4 Draw a diagonal scale to show three units having given RF.
5.5 Read particular distance on plain and diagonal scale.
5.6 Use scale of chord.
5.7 Draw angle of 49 degree, 78 degree and 95 degree with the help of scale of chord.

GEOMETRICAL CONSTRUCTIONS & CONIC SECTIONS

6 Construct geometric figures (regular polygons) & Construct conic sections.

6.1 Draw regular polygons i.e. pentagon, hexagon and octagon having given one side.
6.2 Draw an ellipse by concentric circle method.
6.3 Draw an ellipse by parallelogram method.
6.4 Draw an ellipse by four center method.
6.5 Draw a parabola having given foci and director.
6.6 Draw a parabola from given abscissa and ordinate.

SYMBOLS

7 Adopt standard symbols in drawing.

7.1 Identify symbols used in drawing.
7.2 Draw a legend using symbols of different engineering materials.
7.3 Draw the symbols of different plumbing fittings and fixtures used in drawing.
7.4 Draw the symbols of different electrical fittings and fixtures used in drawing.
7.5 Interpret information from drawing containing standard symbols.

8. Understand the views of engineering drawing.

8.1 Identify different types of views
8.2 Interpret different types of views

9 Apply the Principles of orthographic projection to a straight line.

9.1 Draw the orthographic projection of a straight line under the following conditions : -

a) Line parallel to both planes
b) Line perpendicular in vertical plane and parallel to horizontal plan
c) Line parallel to vertical plane and perpendicular to horizontal plane
d) Line inclined at given angle to horizontal plane and parallel to vertical plane
e) Line inclined at given angle to vertical plane and parallel to horizontal plane

10 Apply the principles of orthographic projection of rectangular and circular planes (Lamina)

10.1 Draw the orthographic projection of rectangular lamina Parallel to both planes.

10.2 Draw the orthographic projection of rectangular lamina inclined at given angle to horizontal plane

10.3 Draw the orthographic projection of circular lamina parallel to both planes

11 Apply the principles of orthographic projections of geometric solids

11.1 Draw the orthographic projection of a cube kept at an angle with one of the planes in first angle method

11.2 Draw the orthographic projection of a pyramid kept at an angle with both the planes in 1st angle method

11.3 Draw the orthographic projection of a cone kept at an angle with both the planes in third angle method.

11.4 Draw the orthographic projection of a prism kept at an angle with vertical plane in third angle method.

ISOMETRIC PROJECTION

12 Understand the importance, use and scope of isometric views in engineering.

12.1 Identify isometric views

12.2 Draw the isometric view of rectangular and circular lamina

12.3 Draw the isometric projection of solids such as: cube, cylinder, pyramid, prism and steps from different orthographic views

12.4 Draw the isometric projection of three deterrent engineering parts from orthographic views

REFERENCE BOOKS

1 Geometrical Drawing - I H Morris
2 Prathamic Engineering Drawing - Hemanta Kumar Bhattacharia
3 Civil Engineering Drawing - Guru Charan singh

ENGLISH Subject Code :…….	T	P	C
	2	0	2

Full Marks: 100

Continuous Assessment : 40 Marks

Theory (Final Exam) : 60 Marks

Objectives:

After the completion of the course, learners will be able to develop-

- Reading, Listening with understanding
- The fluency of speech
- Grammatical accuracy with emphasis on spelling & punctuation
- Creative writing

CONTENT

Seen comprehension :(Marks-20)

Unit	Lesson	Title
People Or Institutions Making History (Unit one)	1	Nelson Mandela ,from Apartheid Fighter To President
	2	The Unforgettable History
Food Adulteration(Unit Three)	1	Food Adulteration Reaches Height
	2	Eating Habit and Hazards
Human Relationship(Unit Four)	2	Love and Friendship
Environment and Nature (Unit Eight)	1	Water ,Water Everywhere
	5	Kuakata: Daughter Of The Sea
Greatest Scientific Achievement (Unit Thirteen)	1	Some Of The Greatest Scientific Achievements Of The Last 50 Years
	2	Science and Technology Against an Age- old Disease
Art and Music (Unit Fourteen)	1	What is Beauty?
	3	Crafts In Our Time
Tours and Travels (Unit Fifteen)	1	Travelling to A village in Bangladesh
	4	The Wonders of Vilayet

N.B: The Unit mentioned refers to the Text Book (1st Paper) English for Today for class 11 – 12

by National Curriculum & Text Book Board, Dhaka.

Grammar (Marks-20)

1. (a) Uses of Articles.
(b) Uses of Tense *(Right forms of verbs with indicators)
(c) Classify verbs: (Regular and Irregular verbs, Auxiliary, Principal, finite, non-finite verbs,)
2. Sentence:
(a) Changing Sentences: (Assertive, Interrogative, Optative, Imperative, Exclamatory Simple, Complex and Compound) ,Comparison Of Adjectives/Adverbs

(b) Question making: WH, Yes/No, Tag question

3. Enrich vocabulary: synonyms, Antonyms ; suffix and prefix.

4. Voice , Narration

5. Sentence Analysis :

Study of part of Speech,(Type of verbs-Regular and Irregular verbs , Auxiliary and Principal verb)
Study Of Phrases and Clauses (Noun/ Adjective/ verb/ participle /adverbial/ prepositional phrases and Principal /Sub ordinate //co ordinate clauses)

Free Writing (Marks -20)

1. Write dialogues: (with teacher, principal, shopkeeper, hotel manager, station master, newcomer, buyers, doctor, friend, colleagues etc).
2. Report writing on different events/ occasions/ accidents.
3.. Writing situational personal and official letters.
4. Writing job application with CV /Appointment letter / joining letter
5. Write a guided paragraph with questions.

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MATHEMATICS-1 T P C
3 3 4

OBJECTIVES

- To acquaint the students with the basic terminology of Algebra.
- To be able to understand the complex numbers which are being used in electrical engineering.
- To be able to understand the binomial expansion.
- To be able to use the knowledge of trigonometry in solving problems of engineering importance.

SHORT DESCRIPTION

Algebra : AP & GP, Polynomials & polynomial equations, Complex number, Permutation & Combination, Binomial theorem for positive integral index and negative & fractional index.

Trigonometry: Ratio of associated angles, Compound angles, Transformation formulae, multiple angles and Sub-multiple angles.

DETAIL DESCRIPTION

A**LGEBRA :**

1 Understand the concept of AP & GP.

1.1 Define AP and common difference.
1.2 Find last term and sum of n terms, given first term and common difference.
1.3 Define GP and common ratio.
1.4 Find the sum of n terms given first and common ratio.

2 Apply the concept of polynomial in solving the problems.

2.1 Define polynomials and polynomial equation.
2.2 Explain the roots and co-efficient of polynomial equations.
2.3 Find the relation between roots and co-efficient of the polynomial equations.
2.4 Determine the roots and their nature of quadratic polynomial equations.
2.5 Form the equation when the roots of the quadratic polynomial equations are given.
2.6 Find the condition of the common roots of quadratic polynomial equations.
2.7 Solve the problems related to the above.

3 Understand the concept of complex numbers.

3.1 Define complex numbers.
3.2 Perform algebraic operation (addition, subtraction, multiplication, division, square root) with complex number of the form a + ib.
3.3 Find the cube roots of unity.
3.4 Apply the properties of cube root of unity in solving problems.

4 Apply the concept of permutation.

4.1 Explain permutation.
4.2 Find the number of permutation of n things taken r at a time when,
i) things are all different.
ii) things are not all different.
4.3 Solve problems of the related to permutation :
i) be arranged so that the vowels may never be separated. From 10 man and 6 women a committee of 7 is to be formed. In how many ways can this be done so as to include at least two women in the committee.

5 Apply the concept of Combination.

5.1 Explain combination.
5.2 Find the number of combination of n different things taken r at a time.
5.3 Explain ${}^{n}C_{r}$, ${}^{n}C_{n}$, ${}^{n}C_{0}$
5.4 Find the number of combination of n things taken r at a time in which p particular things

i) Always occur ii) never occur.

5.5 Establish i) ${}^{n}C_{r} = {}^{n}C_{n-r}$

ii) ${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$

5.6 Solve problems related to combination.

6 Apply partial fraction to break the numerator and denominator.

6.1 Define proper and improper fractions.

6.2 Resolve in to partial fraction of the followings types :

a) Denominator having a non-repeated linear factor.
b) Denominator having a repeated linear factor.
c) Denominator having a quadratic factors.
d) Denominator having a combination of repeated, non-repeated and quadratic factors.

7 Apply the concept of binomial theorem.

7.1 State binomial expression.

7.2 Express the binomial theorem for positive index.

7.3 Find the general term, middle term, equidistant term and term independent of x.

7.4 Use binomial theorem to find the value of

i) $(0.9998)^2$, correct to six places of decimal.

ii) $(1 + \sqrt{2})^5 - (1 - \sqrt{2})^5$

8 Apply the concept of binomial theorem for negative index.

8.1 Express the binomial theorem for negative and fractional index.

8.2 Solve problems of the following types:

Expand (i) $(1 - nx)^{-\frac{1}{n}}$ (ii) $\frac{1}{\sqrt{4.08}}$

TRIGONOMETRY :

9 Apply the concept of associated angles.

9.1 Define associated angles.

9.2 Find the sign of trigonometrical function in different quadrants.

9.3 Calculate trigonometrical ratios of associated angle.

9.4 Solve the problems using above.

10 Apply the principle of trigonometrical ratios of compound angles.

10.1 Define compound angles.

10.2 Establish the following relation geometrically for acute angles.

i) $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$.

ii) $\cos(A \pm B) = \cos A \cos B \pm \sin A \sin B$.

10.3 Deduce formula for $\tan(A \pm B)$, $\cot(A \pm B)$.

10.4 Apply the identities to work out the problems:

i) find the value of $\sin 75^0$, $\tan 75^0$.

ii) show that $\frac{\sin 75° + \sin 15°}{\sin 75° - \sin 15°} = \sqrt{3}$

iii) if $\alpha + \beta = \theta$, $\tan\alpha + \tan\beta = b$, $\cot\alpha + \cot\beta = a$,

show that $(a - b) = ab \cot\theta$.

11 Apply sum and product formula of trigonometrical ratios.

11.1 Express sum or difference of two sines and cosines as a product and vice-versa

11.2 Solve problems of the followings types:

i) show that, $\sin 55° + \cos 55° = \sqrt{2}\cos 10°$

ii) prove that, $\cos 80° \cos 60° \cos 40° \cos 20° = \frac{1}{16}$

12 Apply the concept of ratios of multiple angles.

12.1 State the identities for sin 2A, cos 2A and tan 2A.

12.2 Deduce formula for sin 3A, cos 3A and tan 3A.

12.3 Solve the problems of the followings types.

i) express $\cos 5\theta$ in terms of $\cos\theta$.

ii) if $\tan \alpha = 2 \tan \beta$, show that, $\tan (\alpha + \beta) = \frac{3 \sin 2\alpha}{1 + 3 \cos 2\alpha}$

13 Apply the concept of ratios of sub-multiple angles.

13.1 Find mathematically the identities for $\sin \alpha$, $\cos \alpha$ and $\tan \alpha$ in terms of $\frac{\alpha}{2}$ and $\frac{\alpha}{3}$

13.2 Solve the problems of the type :
find the value of $\cos 3°$, $\cos 6°$, $\cos 9°$, $\cos 18°$, $\cos 36°$ etc.

Reference

SL No	Athour	Title	Publication
01	S. P Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Graha Prakashan
02	H. K. Das	Mathematics for Polytechnic Students(Volume I)	S.Chand Prakashan
03	Ashim Kumar Saha	Higher Mathematics	Akshar patra Prakashani
04	S.U Ahamed & M A Jabbar	Higher Mathematics	Alpha Prakashani

(Pro-2016)	PHYSICS-I	T	P	C
		3	3	4

OBJECTIVES

- To develop the students a background of basic science i.e. Physics required for understanding technological subjects.
- To develop a working knowledge of common engineering and industrial materials and to enable to determine through experiments the properties of such materials.
- To develop through experiments an understanding of fundamental scientific concept.
- To develop a basic knowledge and concept of physical properties of common engineering and industrial materials.

SHORT DESCRIPTION

Measurement, Units; Vector and Scalar quantities; Motion and Equations of motion; Force and Newton's Laws of motion; Gravity and Gravitation; Simple Harmonic motion; Hydrostatics; Surface tension and viscosity; Pressure, Sound; wave and sound Concepts and nature of sound, Velocity of sound, Ultrasonic.

DETAIL DESCRIPTION

THEORY :

1. PHYSICAL WORLD AND MEASUREMENT

1.1. Nature of Physical World.
1.2. Scope and Excitement of Physics.
1.3. Few Terms about Physics.
1.4. Physics and other world of Technological Knowledge.
1.5. Principle of Measurement.
1.6. Fundamental and Derived Quantities and Units.
1.7. Dimensions of Units.
1.8. Errors in Measurement.

2. SCALAR AND VECTOR QUANTITIES

2.1 Define vector and scalar quantities with examples.
2.2 Show the various representations of the vector quantities; and representation of a vector by unit vector.
2.3 Find and explain the resultant of two vectors in different directions.
2.4 Resolve a vector into horizontal & vertical component.
2.5 Explain the dot and cross product of two vectors.
2.6 Define laws of triangle of vector.

3. MOTION AND EQUATIONS OF MOTION

3.1 Define rest and motion
3.2 Classify and explain of motion.
3.3 Define and explain displacement, speed, velocity, acceleration and retardation.

3.4 Deduce the relationship between displacement, velocity, acceleration and retardation from these definitions.
3.5 Motion of a Projectile.
3.6 Equation of motion of a freely moving body thrown obliquely vertically upward or motion of a projectile.
3.7 Define angular velocity and linear velocity with their units.
3.8 Deduce the relation between angular velocity and linear velocity.
3.9 Define centripetal and centrifugal force with examples.
3.10 Prove that centrifugal force = $\frac{mv^2}{r}$
3.11 State and explain the laws of falling bodies and mention the equation of motion of a body when it is projected vertically upwards or downwards.

4. NEWTON'S LAWS OF MOTION FORCE AND FRICTION

4.1 Define force.
4.2 State Newton's laws of motion.
4.3 Define different units of force and their correlation and also mention the dimension of force.
4.4 Prove P=mf, from Newton's 2nd law of motion.
4.5 Find out the resultant of parallel forces.
4.6 Define inertia and momentum
4.7 State and prove the principles of conservation of momentum.
4.8 Define friction and describe the different kinds of friction.
4.9 Define the co-efficient of static friction.
4.10 Show that the co-efficient of static friction is equal to the tangent of angle of repose
4.11 State the merits and demerits of friction.

5. GRAVITY AND GRAVITATION

5.1 Define and explain the Kepler's Law.
5.2 Define gravity and gravitation.
5.3 Define and determine the gravitational constant (G) and also mention its units and dimension.
5.4 Define acceleration due to gravity 'g' and also mention its units and dimension.
5.5 Discuss the variation of 'g' at different places.
5.6 Define mass and weight with their units and dimension.
5.7 Distinguish between mass and weight.
5.8 Define and explain gravitational potential and escape velocity

6. SIMPLE HARMONIC MOTION (SHM)

6.1 Define Periodic and simple harmonic motion (SHM).
6.2 State the characteristics of SHM.
6.3 Describe a simple pendulum and a second pendulum.
6.4 Define effective length, amplitude, phase, complete oscillation, period of oscillation, frequency.
6.5 State and explain the laws of simple pendulum.
6.6 Motion of simple pendulum and it's time period.

7. WORK, POWER AND ENERGY

7.1 Define work, power and energy.
7.2 State the units and dimensions of work, power and energy.
7.3 State and prove the principle of the conservation of energy.
7.4 Define potential energy (PE) and kinetic energy (KE).
7.5 Derive the equation of potential and kinetic energy.
7.6 Recognize that the useful work can be found from:

$$\text{Efficiency} = \frac{\text{output work}}{\text{input work}} \times 100.$$

8. ELASTICITY

8.1 Name some of the general and special properties of matter.
8.2 Define Elasticity and Elastic limit.
8.3 Define perfectly elastic body and perfectly rigid body.
8.4 Define stress and strain with their units and dimensions.
8.5 State and explain the Hook's law.
8.6 Describe various kinds of modulus of elasticity.
8.7 Mention the units and dimensions of modulus of elasticity.
8.8 Define and explain Poisson's ratio.

9. HYDROSTATICS

9.1 Define pressure as force per unit area and state that it is measured in N/m^2 or Pascal.
9.2 State characteristics of liquid pressure.
9.3 Establish the pressure at a point in a fluid depend upon the density of the fluid, the depth in the fluid and acceleration due to gravity.
9.4 Surface tension and surface energy, Angle of contact.
9.5 Capillarity and theory of capillarity.
9.6 Viscosity and co-efficient of viscosity.
9.8 Necessity of viscosity.

10. WAVE AND SOUND

10.1 Wave and wave motion.
10.2 Transverse wave and longitudinal wave.
10.3 Some definitions relating waves.
10.4 Progressive wave and stationary waves.
10.5 Equation of progressive wave.
10.6 Sound and production of sound.
10.7 Sound is a longitudinal traveling wave.
10.8 Interference of sound: Constructive and Destructive interference.
10.9 Define beats and Mechanism of formation of beats.

11. SOUND AND VELOCITY OF SOUND

11.1 Identify that sound is produced by vibration and travels through a medium as a longitudinal wave.
11.2 Recognize that sound can be produced of different pitches (frequencies) & that the human ear has an audible frequency range covering approximately 20 Hz to 20 KHz.
11.3 State the approximate frequency range for
a. infrasonic sound, b. Ultrasonic (supersonic) sound.
11.4 Explain how sound is absorbed, reflected & refracted by different types of surface.
11.5 Describe the practical uses of echo sounding devices.
11.6 Define velocity of sound.
11.7 State the velocity of sound at NTP in still air.
11.8 Compare the effects of pressure, temperature & humidity on the velocity of sound in air.

PRACTICAL

1. Determine accurate diameter/side of an object using vernier calipers.
2. Measure the area of cross section of a wire by micrometer screw gage.
3. Measure the thickness of a glass plate by speedometer.
4. Verify the law of parallelogram of forces by a force board.
5. Draw L-T^2 graph and determine the value of "g" by using a simple pendulum.
6. Determine the coefficient of static friction.
7. Determine Young's modulus of a steel wire by Searle's apparatus.
8. Determine gravity of a solid heavier than and insoluble in water by hydrostatic balance.
9. Determine specific gravity of a liquid by specific gravity bottle.
10. Determine velocity of sound by resonance air column method.

REFERENCE BOOKS:

1. Higher Secondary Physics - First Part - by Dr. Shahjahan Tapan
2. A Text Book of Properties of of matter -By N Subrahmanyam and Brij Lal
3. A Text Book of Sound -By N Subrahmanyam and Brij Lal
4. Higher Secondary Physics- First Part -by Prof. Golam Hossain Pramanik
5. Higher Secondary Physics- First Part -by Ishak Nurfungnabi

BASIC ELECTRICITY

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OBJECTIVES

- To familiarize the basic electrical quantities & laws and to apply them in solving problems of electrical circuits.
- To acquaint with electro-chemistry, electro-magnetism, electro-magnetic induction and electrostatic.
- To introduce electrical wiring.

SHORT DESCRIPTION

Electric current, voltage, resistance ; ohm's law; Conductors, semiconductors and insulators; Basic electrical circuits; Power and energy; Basic electro-chemistry; Electro-magnetism; Electro-magnetic induction; Electrostatics; Wires and cables; Hand tools used in wiring; House wiring; Controlling devices; Protective devices; Earthing.

DETAIL DESCRIPTION

Theory:

ELECTRIC CURRENT, VOLTAGE & RESISTANCE

1 Understand electricity and its nature.

1.1 State the meaning of electricity.
1.2 Describe the structure of atom.
1.3 Define current, voltage and resistance.
1.4 State the units of current, voltage and resistance.

CONDUCTOR, SEMICONDUCTOR & INSULATOR

2 Understand conductor, semiconductor **and insulator.**

2.1 Define conductor, semiconductor and insulator.
2.2 Explain the conductor, semiconductor, and insulator according to electron theory .
2.3 List different types of conductors, semiconductors and insulators.
2.4 Describe the factors effecting the resistance of a conductor.
2.5 State laws of resistance.
2.6 Prove the relation $R = \rho \frac{L}{A}$
2.7 Explain the meaning of resistivity and name the unit of resistivity.
2.8 Solve problems relating to laws of resistance.

OHM'S LAW

3 Understand Ohm's Law

3.1 State Ohm's law.
3.2 Explain the limitations of Ohm's law
3.3 Deduce the relation between current, voltage and resistance.
3.4 Solve problems relating to Ohm's law.

BASIC ELECTRIC CIRCUITS

4 Understand electric circuit.

4.1 Define electric circuit.
4.2 State the elements of electrical circuit
4.3 Classify electric circuits.
4.4 Define series circuit, parallel circuit and mixed circuit.
4.5 Describe the characteristic of series circuit and parallel circuit.
4.6 Calculate the equivalent resistance of series circuit, parallel circuit and mixed circuit.
4.7 Solve problems relating to series, parallel and mixed circuit.

POWER AND ENERGY

5 Apply the concept of electrical power and energy.

5.1 Define electrical power and energy.
5.2 State the unit of electrical power and energy.
5.3 Show the relation between electrical power and energy.
5.4 List the name of instruments for measuring electrical power and energy.
5.5 Draw the connection diagram of wattmeter and energy meter in an electrical circuit.
5.6 Solve problems relating to electrical power and energy .

6 Understand the principles of Joule's law.

6.1 Describe the heating effect of electricity.
6.2 Explain Joule's law regarding the development of heat in electrical circuit.
6.3 Explain Mechanical equivalent of heat (J)
6.4 Solve problems relating to Joule's law.

BASIC ELECTRO-CHEMISTRY

6 Understand the concept of cells.

7.1 Describe the meaning of potential difference.
7.2 Define the meaning of cell.
7.3 Classify cell.
7.4 Define Primary Cell
7.5 List different types of primary Cell
7.6 Describe the construction and principle of action of a simple Voltaic cell.
7.7 List the defects of a simple Voltaic cell.
7.8 Describe the causes of defects of a simple Voltaic cell.
7.9 Describe the methods of removing the defects of a simple Voltaic cell.
7.10 Distinguish between Primary & Secondary Cell

8 Understand the concept of capacitors and inductors.

8.1 Define capacitor and capacitance.
8.2 Name the unit of capacitance.
8.3 Name the different types of capacitor.
8.4 State the uses of capacitor.

8.5 Define inductor and inductance.
8.6 Name the unit of inductance
8.7 Name the different types of inductor.
8.8 State the uses of inductor.
8.9 Determine the equivalent capacitance of a number of capacitors connected in series and parallel.
8.10 Explain energy storage in a capacitor.
8.11 Solve the problems relating to capacitors.

ELECTRO - MAGNETISM

9 Understand Electro - magnetism.

9.1 Describe magnetic field, magnetic lines of force and its properties.
9.2 Describe field intensity and magnetic flux density.
9.3 Distinguish between absolute permeability and relative permeability.
9.4 Describe the concept of magnetic effect of electrical current.
9.5 States Maxwell's cork screw rule.
9.6 Explain the force experienced in a current carrying conductor in a magnetic field.
9.7 State Fleming's left hand rule.
9.8 Explain the work done by a moving conductor in a magnetic field.
9.9 Explain the force between two parallel current carrying conductor.

ELECTRO MAGNETIC INDUCTION

10. Understand electro- magnetic induction.

10.1 Define Faraday's laws of electro-magnetic induction.
10.2 Describe the magnitude of dynamically induced emf and statically induced emf
10.3 Solve problems relating to emf generation.
10.4 Define Lenz's law and Fleming's right hand rule for determining the direction of induced emf and current.
10.5 Define self induced emf and self inductance.
10.6 Explain inductance of a iron cored inductor.
10.7 Define mutual inductance and co-efficient of coupling.

WIRES AND CABLES

11. Understand the uses of wires and cables.

11.1 Define electrical wires and cables.
11.2 Distinguish between wires and cables.
11.3 Describe the construction and uses of PVC, VIR, TRS or CTS and flexible wires
11.4 Describe the procedure of measuring the size of wires and cables by wire gauge.
11.5 Describe the current carrying capacity of a wire.

JOINTS AND SPLICES

12. Understand the usefulness of joints and splices.

12.1 Define the meaning of joints and splices.
12.2 State the five steps of making a joint.
12.3 Describe the procedure to make a pig tail joint, western union joint, Britannia joint, duplex joint, tap joint, simple splice.
12.4 Give example of uses of above mentioned joints.

HOUSE WIRING

13. Understand the different methods of house wiring.

13.1 State the meaning of wiring.
13.2 List the types of wiring.
13.3 State the procedure for Channel wiring, surface conduit wring and concealed wiring.
13.4 State the types of wiring used in :
a) Residential building.
b) Workshop
c) Cinema hall/Auditorium
d) Temporary shed
13.5 List the name of fittings used in different types of electrical wiring.

CONTROLLING DEVICES

14. Understand the construction and uses of controlling devices.

14.1 Define controlling device.
14.2 Name the different types of controlling devices.
14.3 Describe the constructional features and uses of tumbler switch, iron clad switch, push button switch and gang switch.

PROTECTIVE DEVICES

15. Understand the construction and uses of protective devices.

15.1 Define protective devices.
15.2 Name the different types of protective devices.
15.3 Name the different types of fuses used in house wiring.
15.4 Describe the construction and uses of renewable fuse.
15.5 Name the different types of circuit breaker used in house wiring.
15.6 Describe safety procedure against electrical hazards.
15.7 List the performance of safety practices for electrical equipment, machines and accessories.

EARTHING

16. Understand the necessity of ear thing.

16.1 Define earthing and mention the elements of earthing..
16.2 Explain necessity of earthing
16.3 Name different types of ear thing.
16.4 List the value of earthing resistance in different condition.

WIRING DIAGRAM

17. Apply the principle of controlling electrical circuit by switch.

17.1 Sketch the wiring diagram of one lamp controlled by one SPST switch and describe its uses.
17.2 Sketch the wiring diagram of one lamp controlled by two SPDT switch and describe its uses.
17.3 Draw the wiring diagram of a calling bell.
17.4 Draw the wiring diagram of a calling bell with more than one lamp controlled from more than one point.
17.5 Draw the wiring diagram of a fluorescent tube light circuit.
17.6 Describe the working principle of fluorescent tube light.

Practical:

1 Practice with electrical measuring instruments.

1.1 Identify Voltmeters, Ammeters, Ohm Meter, Wattmeter, Energy meter and AVO meter.
1.2 Select & read the scale of given meters.
1.3 Connect correctly voltmeter, ammeter, wattmeter and energy meter to a given circuit..

2 Verify Ohm's Law.

2.1 Sketch the circuit diagram for the verification of Ohm's Law.
2.2 List tools, equipment and material required for the experiment.
2.3 Prepare the circuit according to the circuit diagram using proper equipment.
2.4 Check all connections before the circuit is energized.
2.5 Verify the law by collecting relevant data.

3 Verify the characteristics of series and parallel circuits.

3.1 Draw the working circuit diagram.
3.2 List tools, equipment and materials required for the experiment.
3.3 Prepare the circuit according to the circuit diagram using proper equipment.
3.4 Check all connections before the circuit is energized.
3.5 Record data and verify that in a series circuit total voltage and resistance is equal to the summation of individual voltage and resistance respectively but total current is equal to the individual current.
3.6 Record data and verify that for a parallel circuit supply voltage is equal to the branch voltage, supply current is equal to summation of branch currents and total conductance is equal to the summation of branch conductance.

4 Show skill in measuring the power of an electric circuit.

4.1 Sketch the necessary circuit diagram of an electrical circuit w electrical load, ammeter, voltmeter and wattmeter.
4.2 Prepare the circuit according to the circuit diagram using ammeter, voltmeter and wattmeter.
4.3 Record the power, measured by the wattmeter and verify t reading with that of calculated from ammeter and voltmeter.
4.4 Compare the measured data with that of calculated and rat power.

5 Show skill in measuring the energy consumed in an electrical circuit.

5.1 Sketch the necessary diagram of an electric circuit wattmeter, energy meter and electrical load.
5.2 Prepare the circuit according to the circuit diagram user wattmeter and energy meter.
5.3 Record the energy measured by the energy meter and verify with that of calculated from wattmeter for a fixed time..

6 Make artificial magnets.

6.1 Make an artificial magnet by rubbing method (Single touch)
6.2 Make an artificial magnet by divided touch method.
6.3 Make an artificial magnet by passing electrical current.
6.4 Detect the polarity of the produced artificial magnet with the help of a compass needle.

7 . Practice with hand tools, wires and cables.

7.1 List the hand tools used in electrical wiring.
7.2 Identify the hand tools used in electrical wiring.
7.3 Draw neat sketches of hand tools used in electrical wiring.
7.4 Identify different types of wires and cables.
7.5 Measure the diameter of the identified wire and cables using standard wire gauge.

8. Show skill in making a duplex joint and a T-joint.

8.1 Sketch a duplex joint and a T-joint

8.2 Perform skinning and scraping of two pieces of PVC duplex cal and two pieces of simplex PVC cables.

8.3 Make the joints according to sketches.

8.4 Write a report.

9. Show skill in preparing wring circuit of two lamps controlled from the points separately.

9.1 Sketch a working circuit of two lamps controlled from two point separately.

9.2 Make the wiring circuit using required materials and equipment a wiring board.

9.3 Test the connection of circuit by providing proper supply.

10. Show skill in preparing wiring circuit of one lamp controlled from the points.

10.1 Sketch a working diagram of one lamp controlled by two SPD tumbler switches.

10.2 Complete the wiring circuit using required materials and equipment on wiring board.

10.3 Test the connection of circuit by providing proper supply.

11. Show skill in preparing wiring circuit of one bell with two indicating lamp controlled from two points.

11.1 Sketch a working diagram of one bell with two indicating lamps controlled by two push button switch.

11.2 Make the wiring circuit using required materials and equipment in wiring board.

11.3 Test the connection of circuit by providing proper supply.

12 Show skill in preparing wiring circuit of a fluorescent tube light.

12.1 Sketch a working diagram of a fluorescent tube light circuit.

12.3 Make the connection of a fluorescent tube light circuit using required materials and equipment.

12.4 Test the connection of the circuit by providing supply.

REFERENCE BOOKS

1 A text book of Electrical Technology - B. L. Theraja

2 Basic Electricity - Charles W Ryan

3 Basic Electrical theory and Practice - E. B. Babler

4. Solved Examples in Electrical Calculation - D. K. Sharma

5. Introduction to Electrical Engineering - V.K. Mehta

BANGLA T P C
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উদ্দেশ্য :

১. মাতৃভাষা হিসেবে বাংলা ভাষার প্রকৃতি ও বৈশিষ্ট্য সম্পর্কে ধারণা লাভ। ভাষার ব্যবহারে প্রায়োগিক যোগ্যতা অর্জন।
২.বাংলা সাহিত্য পঠন-পাঠনের মাধ্যমে জাতীয় চেতনা, দেশপ্রেম, মুক্তিযুদ্ধের চেতনা, শুদ্ধাচার, নীতি ও মূল্যবোধের উন্মেষ ঘটানো।

সংক্ষিপ্ত বিবরণী :

মাতৃভাষা ও সৃজনশীলতা : বাংলা ভাষা রীতির বিচিত্রতা, বানান রীতি, পত্র রচনা এবং কবিতা, প্রবন্ধ, নাটক, উপন্যাস ও ছোট গল্প ।

বিশদ বিবরণী:

১.বাংলা ভাষার প্রয়োগঃ

ক)বাংলা ভাষা :

ভাষার সংজ্ঞা, বাংলা ভাষা রীতি - সাধু, চলিত , আঞ্চলিক বা উপভাষা (সংজ্ঞা, বৈশিষ্ট্য, পার্থক্য ও উদাহরণ)

খ) বাংলা বানান রীতি ও শব্দ প্রয়োগ:

১.বাংলা একডেমির প্রমিত বানান রীতি, ণ-ত্ব ও ষ-ত্ব বিধি
২. শব্দ ও শব্দের শ্রেণি বিভাগ (সংজ্ঞা, শব্দের গঠন, উৎস বা উৎপত্তি ও অর্থগত)
৩.বাক্য প্রকরণ ও গঠন রীতি (সংজ্ঞা, বাক্য গঠন এবং প্রকার)

গ) পত্র রচনা :

আবেদন পত্র (চাকুরি, ছুটি), চাকুরিতে যোগদান পত্র, মানপত্র, স্মারকলিপি, সংবাদপত্রে প্রকাশের জন্য পত্র

২. বাংলা সাহিত্যঃ

ক. কবিতা :

১.বঙ্গভাষা –মাইকেল মধুসূদন দত্ত
২. সোনার তরী – রবীন্দ্র নাথ ঠাকুর
৩. উমর ফারৰক –কাজী নজরৰল ইসলাম
৪. বাংলার মুখ আমি– জীবনানন্দ দাশ
৫. আসাদের শার্ট – শামসুর রাহমান
৬. স্বাধীনতা শব্দটি কি করে আমাদের হলো? – নির্মলেন্দু গুণ

খ. প্রবন্ধ :

১. অর্ধাঙ্গী –রোকেয়া সাখাওয়াত হোসেন
২.বইকেনা – সৈয়দ মুজতবা আলী

গ. একাঙ্কিকা (নাটিকা)ঃ

১.মানুষ –মুনীর চৌধুরী

ঘ. উপন্যাসঃ

১.লালসালু – সৈয়দ ওয়ালী উলৰাহ

ঙ.ছোট গল্পঃ

১. হৈমন্তী – রবীন্দ্র নাথ ঠাকুর
২. একুশের গল্প – জহির রায়হান
৩. পাতালেহাসপাতালে – হাসান আজিজুল হক

ব্যবহারিক

১.নির্ধারিত বক্তৃতা :

বাংলাদেশ ও বাঙালি সংস্কৃতি, বিভিন্ন জাতীয় দিবস (একুশে ফেব্রুয়ারি ও আন্তর্জাতিক

মাতৃভাষা দিবস, স্বাধীনতা দিবস, বিজয় দিবস,জাতীয় শোক দিবস, মুজিব নগর দিবস, মহান মে দিবস)

প্রাতিষ্ঠানিক বক্তৃতা- নবাগত শিৰক/ছাত্রছাত্রীদের বরণ, গুরৰত্বপূর্ণ ব্যক্তিবর্গের আগমন উপলৰে বক্তৃতা।

২. উপস্থিত বক্তৃতা :

বিষয়বস্তু উন্মুক্ত

৩.আবৃত্তি :

১. মানুষ - কাজী নজরৰল ইসলাম
২. আকাশ নীলা - জীবনানন্দ দাশ
৩. পলৰী জননী -জসীম উদ্‌দীন
৪. ছাড়পত্র - সুকান্ত ভট্টাচার্য
৫. তোমাকে পাওয়ার জন্য হে স্বাধীনতা - শামসুর রাহমান
৬. নিষিদ্ধ সম্পাদকীয় – হেলাল হাফিজ

৪. বিতর্ক (নমুনা)

সংস্কৃতিই আধুনিক মানুষের ধর্ম
তথ্য প্রযুক্তির অবাধ ব্যবহারই যুব সমাজেরঅবৰয়ের মূল কারণ
গতানুগতিক শিৰা নয় কর্মমুখি শিৰাই অর্থনৈতিক মুক্তির চাবিকাঠি
চালকের অসাবধনতাই সড়ক দুর্ঘটনার প্রধান কারণ
মুক্তিযুদ্ধের চেতনাই অসাম্প্রদায়িক বাংলাদেশ প্রতিষ্ঠার মূলমন্ত্র
প্রযুক্তির বিকাশই প্রকৃতি বিনাশের একমাত্র কারণ

৫. প্রতিবেদন প্রণয়ন ও উপস্থাপন:

স্থানীয় বিভিন্ন সমস্যা ও অনুসন্ধানী যে কোন বিষয়।

GENERAL SHIP KNOWLEDGE	T	P	C
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AIMS

- To be able to develop knowledge of ship.
- To be able to develop knowledge of principal dimensions of a ship
- To be able to identify shipbuilding terms and different parts of the ship.
- To be able to develop knowledge of ship equipments & outfitting.

SHORT DESCRIPTION

Ship, Principal dimensions of a ship; Fore part of the ship; Midship part of the ship; After part of the ship; Hull; Keel; Deck; bulkhead of ship, Deck equipments & engine room machineries; out fitting of ship, Rope; Rigging items; Anchors and cables; Ship compass; Elementary navigation &safety of ship.

DETAIL DESCRIPTION.S

1 Understand the ship

1.1 Define the ship.

1.2 History of ship.

1.3 Classify the ship.

2 Understand the principal dimensions of a ship with sketch.

2.1 Define length overall of a ship.
2.2 Define length between perpendiculars of a ship.
2.3 Define register length of ship.
2.4 Define load water line.
2.5 Define light water line.
2.6 Define deep water line.
2.7 Define construction water line.
2.8 Define breadth of a ship.
2.9 Define moulded breadth of a ship.
2.10 Define depth of a ship.
2.11 Define moulded depth of ship.
2.12 Define draft of a ship.
2.13 Define air draft of ship.
2.14 Define freeboard of a ship.

3 Understand the fore part of a ship with sketch.

3.1 Define fore part of a ship.
3.2 Define foreword perpendicular.
3.3 Define bow of a ship.
3.4 Classify bow of a ship.
3.5 Define bulbous bow.
3.6 Explain the function of bulbous bow.
3.7 Define fore peak tank.

3.8 Define chain locker, stem bar, stem plate, cant frame, collision bulkhead, breast hook, Jack staff, forefoot, rabbet, Hawse pipe.
3.9 Describe the function of stem bar & stem plate.
3.10 Define the bow thrust & explain the function of bow thrust.
3.11 Describe forward peak bulkhead.
3.12 Define the wash plate & explain the function of wash plate.

4 Understand the midship of a ship

4.1 Define midship of a ship.
4.2 Define & identify the keelson, floor, margin plate, bilge bracket, frame, side stringer, beam knee, beam bracket, beam & girder.
4.3 Define the cofferdam, ballast tank, double bottom tank, wing tank, cargo hold.
4.4 Describe centerline of a ship.
4.5 Describe the baseline of a ship.
4.6 Define the deck line of ship.
4.7 Define hatch coaming, gangway, and freeing port.

5 Understand the after part of a ship.

5.1 Define after part of a ship.
5.2 Define afterward perpendicular.
5.3 Define transom stern, ordinary stern, cruiser stern, rudder trunk, stern frame, skeg & Sole piece.
5.4 Describe after peak bulkhead.
5.5 Define after peak tank.
5.6 Define the steering compartment of ship.
5.7 Define the skylight, lighting hole.
5.8 Describe the engine room.
5.9 Mention the list machineries & equipments in engine room.

6 Understand the hull form of ship.

6.1 Define flare.
6.2 Define tumblehome.
6.3 Define camber.
6.4 Explain functions of camber.
6.5 Define sheer, explain the function of sheer.
6.6 Define rise of floor.

7 Understand the hull of a ship.

7.1 Define hull of a ship.
7.2 Mention the part of a hull.
7.3 Define & Identify the keel, bottom, tank top, bilge, bilge radius, shell, deck, sheer strakes,
7.4 Define fender. explain the function of fender
7.5 Describe the bulwark of ship & explain the function of bulwark.
7.6 Define hatch opening and its related terms
7.7 Describe the appendages of ship.
7.8 Define the bilge keel of ship & explain the function of bilge keel.
7.9 Define the port & starboard of ship.

8 Understand the bulkhead of ship.

8.1 Define the bulkhead of ship.
8.2 Classify the bulkhead of ship.

8.3 Explain the function of bulkhead.
8.4 Differentiate between watertight & non- watertight bulkhead.

9 Understand that keel of ship.

9.1 Define keel..
9.2 Classify the keel.
9.3 Explain the function of keel.
9.4 Define keel block.

10 Understand the superstructure & accommodation deck of ship

10.1 Define superstructure.
10.2 Define main deck, prop deck, bridge deck, forecastle deck, raised deck, tween deck & shelter deck.

11 Understand the deck of ship.

11.1 Define deck.
11.2 Classify deck.
11.3 Describe each type of deck.

12 Understand the deck equipments & Out fittings.

12.1 Define bollard.
12.2 Mention the list of deck equipments of ship.
12.3 Define davit & derrick.
12.4 Describe the functions of davit. & derrick
12.5 Define capstan, windless & winch
12.6 Define manhole, air vent pipe, sounding pipe, scupper, scuttle & gas escape line.
12.7 Define hatch cover &classify the hatch cover.
12.8 Define hatch cover &classify the hatch cover.
12.9 Define bilge line, ballast line.
12.10 Define railing, catwalk, ladder, funnel , mast

13 Understand the rope.

13.1 Define rope.
13.2 Classify rope.
13.3 Explain the use of rope.

14 Understand the rigging items.

14.1 Define shackles and thimble.
14.2 Describe different parts of shackle and thimble.
14.3 Mention the classification of shackle and thimble.

15 Understand the anchor and cables.

15.1 Define anchor.
15.2 Mention the classification of anchor.
15.3 Describe the usage of cables.

16 Understand the ship compass.

16.1 Define compass.
16.2 Classify compass.
16.3 Mention the necessity of compasses in a ship.

17 Understand elementary navigation.

17.1 Define elementary navigation.
17.2 Define navigation chart.
17.3 Describe the importance of navigation chart in a ship.
17.4 Define navigation light.
17.5 Mention the classification of navigation light.
17.6 Describe the importance of navigation of light.

18 Understand the safety equipments of ship.

18.1 Define the safety of ship.
18.2 Mention the list of personal safety items.
18.3 Mention the list of survival safety equipments of ship.
18.4 Define the life boat, life jacket, life buoya, life raft
18.5 Define fire extinguisher
18.6 Classify the fire extinguisher.
18.7 Define the fire hydrant line.

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4. Merchant Ship Construction
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4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016)

SHIPBUILDING TECHNOLOGY

TECHNOLOGY CODE: **680**

2nd SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

SHIPBUILDING TECHNOLOGY (680)

2nd SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68021	Naval Architecture	2	3	3	40	60	25	25	150
2	68022	Shipbuilding Materials	2	3	3	40	60	25	25	150
3	65921	Mathematics -2	3	3	4	60	90	50	0	200
4	65922	Physics -2	3	3	4	60	90	25	25	200
5	65722	Communicative English	1	3	2	20	30	50	0	100
6	65811	Social Science	3	0	3	60	90	0	0	150
7	67011	Basic Workshop Practice	0	6	2	0	0	50	50	100
Total			**14**	**21**	**21**	**280**	**420**	**225**	**125**	**1050**

68021 NAVAL ARCHITECTURE **T P C**
2 3 3

OBJECTIVES

To be able to develop knowledge in the area of Naval Architecture with special emphasis on:

- Hydrostatics for a ship.
- Different types of coefficients of form in designing a ship.
- Calculation of area, volume, moments, displacement, buoyancy using Simpson's 1st and 2nd rules .
- Concept of Stability, Met center and Inclining Experiment of a ship.
- Trim, resistance, propeller of a ship.
- To solve various types of problems related to ship

SHORT DESCRIPTION

Hydrostatics, Displacement, TPC & TPI, coefficients of form, similar figures, Simpson's first rule, Simpson's second rule, center of gravity, stability, Metacenter and inclining experiment of ship, Trim, changes of trim, Resistance, frictional resistance, residuary resistance, power to overcome resistance , Fuel consumption & Fuel coefficient , propeller and its related terms , thrust by a propeller, various types of power and mean pressure.

1. Hydrostatics

1.1 Define density and relative density
1.2 Define pressure and hydrostatic load.
1.3 Mention the units of pressure and load.
1.4 Derive the formula of pressure exerted by liquid.
1.5 Calculate pressure exerted by liquid.
1.6 Find load on an immersed plane.
1.7 Define center of pressure.

2. Displacement of ship

2.1 State Archimede's principle.
2.2 Define displacement, weight displacement & volume displacement.
2.3 Solve problems related to displacement of a ship.
2.4 Define buoyancy and center of buoyancy .
2.5 Define VCB and LCB.
2.6 State Morrishes formula to calculate VCB.

3. Tonne per centimeter immersion (TPC) and TPI

3.1 Define TPC and TPI.
3.2 Mention the formula to calculate TPC.
3.3 Mention the practical uses of TPC.
3.4 Solve problems related to TPC.

4. Various coefficients of form

4.1 Define water plane area and midship section area
4.2 Define block coefficient (C_b), water plane area coefficient (C_w), midship section area coefficient (C_m), prismatic coefficient(C_p).
4.3 Find out the mathematical relation among C_b , C_p and C_m.
4.4 Solve problems related to various coefficients of forms.
4.5 Define wetted surface area, S.
4.6 State Denny's formula and Taylor's formula to calculate S.

5. Similar figures.

5.1. Define similar figures.
5.2. State the Mathematical condition for becoming two similar ships .
5.3. Express the derivation of relation between the areas of large circle to small circle.
5.4. Express the derivation of relation between the volumes of large sphere to small sphere.
5.5. Express the derivation of the formula for displacement and wetted surface area of a ship by using similar figures.

5.6. Solve problems to calculate displacement and wetted surface area of certain model ship using the formula of similar figures.

6. Simpson's first rule

6.1 State and explain Simpson's first rule.
6.2 Mention Simpson's multipliers for first rule.
6.3 Calculate water plane area, midship section area, volume and first moment of area using Simpson's first rule.

7. Simpson's second rule

7.1 State and explain Simpson's second rule.
7.2 Mention Simpson's Multipliers for second rule
7.3 Calculate water plane area, midship section area and volume of a ship using Simpson's second rule.

8. Centre of gravity of ship

8.1 Define center of gravity and centroid.
8.2 Distinguish between centre of gravity and centroid.
8.3 Explain VCG and LCG.
8.4 Define KG and Kg.
8.5 Find out the shift in CG due to addition of mass.
8.6 Derive the formula for the shift in CG due to movement of mass.

9. Stability, Metacenter and Inclining Experiment of a ship.

9.1 Define stable, unstable and neutral equilibrium of a ship.
9.2 Explain stable, unstable and neutral equilibrium of a ship.
9.3 Define Metacenter with diagram.
9.4 Define righting moment and righting lever.
9.5 Explain the stability of a ship with respect to the position of metacenter.
9.6 Explain the stability of a ship with respect to the value of metacentric height.
9.7 Explain Inclining experiment of a ship to find out GM.
9.8 Solve problems related to GM, KG & KM.

10. Trim and changes in trim

10.1 Define trim, LCF, mean draught, MCTIcm, trimming moment, trimming lever.
10.2 Explain the change in trim due to addition of masses.
10.3 Derive the formula to determine trim.
10.4 Find out the change in mean draught due to change in density.
10.5 Find out the change in trim due to change in density.

11. Resistance of a moving ship through water

11.1 Define resistance of a ship & its units.
11.2 Classify resistance.
11.3 Explain frictional resistance.
11.4 State the influential factors of frictional resistance.
11.5 State Froude's formula to calculate frictional resistance.
11.6 State the formula to find out'f'(a coefficient).
11.7 Solve problems regarding frictional resistance.
11.8 Explain residual resistance and its classification.
11.9 Explain Froude's Law of comparison to find out speed-length ratio.

12. Methods to calculate power of a ship to overcome resistance

12.1 Define effective power (naked) (epn).
12.2 Define SCF (Ship Correlation Factor).
12.3 Calculate effective power to overcome total resistance of a ship.
12.4 Define Admiralty coefficient.
12.5 Explain Admiralty coefficient to evaluate shaft power of a ship.
12.6 Solve problems to find out shaft power of a ship.

13. Fuel consumption and fuel coefficient

13.1 Define SFC (Specific Fuel Consumption).
13.2 State the formula to calculate fuel consumption/day in tonne.
13.3 Solve problems regarding fuel consumption /day for a ship.

14. Propeller and its related terms

14.1 Define propeller, propeller pitch, pitch ratio, slip, real slip, apparent slip, positive apparent slip, negative apparent slip.
14.2 Define wake, wake fraction, speed of advance, projected area of propeller, developed area of propeller, BAR, DAR.
14.3 Solve problems related to above terms of propeller.

15. Thrust by a propeller

15.1 Define thrust and thrust power (tp).
15.2 State the formula to calculate thrust.
15.3 Solve problems to find out thrust and thrust power.

16. Powers of propeller and mean pressure.

16.1 Define mechanical efficiency, transmission efficiency, propeller efficiency, hull efficiency, QPC.
16.2 State the formulas for various efficiency.
16.3 Solve problems related to power & efficiency.
16.4 Derive a formula to find out the relation among mean effective pressure, propeller pitch and rpm.
16.5 Solve problems related to mean pressure.

PRACTICAL

1. Draw a layout of elevation of a general Arrangement of a ship with shear.
2. Draw a ship with length overall and length between perpendiculars.
3. Draw a layout of a midship, with and without rise of floor, bilge radius, camber.
4. Draw a layout of midship with keel, rise of floor, bilge radius, camber.
5. Draw various sizes of keel with centre keelson.
6. Draw a beam with beam bracket and deck longitudinal.
7. Draw a floor with side keelson with and without rise of floor and bilge radius.
8. Draw a main frame with side stringer.
9. Draw a web frame with side stringer.
10. Draw details drawing of a midship showing bracket between main frame and beam.
11. Draw details drawing of a midship showing bracket between web frame and web beam.
12. Draw details drawing of a midship showing bracket of gusset between main frame floor.
13. Draw details drawing of a midship showing bracket or gusset between web frame and floor.
14. Draw a complete midship section.

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2. Merchant Ship Construction -H.J.Pursey
3. Brown Sons & Ferguson Ltd.7th edition. Basic Ship Theory -Rawson & Tuper

68022 SHIPBUILDING MATERIALS

T	P	C
2	3	3

OBJECTIVES:

- To be able to identify and classify the materials used for construction in engineering fields as well as in shipbuilding industries.
- To be able to understand the characteristics of various engineering materials in shipbuilding industries.
- To be able to understand the sources of different engineering materials in shipbuilding industries.
- To be able to understand the uses of different engineering materials in shipbuilding industries.

SHORT DESCRIPTION

Aspects of engineering materials; Engineering uses of iron and its alloys; Non-ferrous materials; Brief concept on brick, sand, cement and tiles; aluminium; copper and its alloys; wood; Artificial wood; Paint; Glass and its products; Insulating Materials; Heat and sound absorbing materials, Fundamental aspects of water proof and fire proof materials; Plastic Materials.

DETAIL DESCRIPTION:

1.Various aspects of engineering materials

1.1 Define engineering materials.
1.2 Mention the classification of engineering materials.
1.3 List the characteristics of engineering materials.
1.4 List the common types of engineering materials used in shipbuilding technology.

2. Engineering uses of iron and its alloys

2.1 Mention the names of the common ores of iron.
2.2 Explain iron as an engineering material.
2.3 Mention the classification of steel on the basis of carbon contents.
2.4 List the names of commercial steels.
2.5 Define alloy steel.
2.6 List the common types of alloy steels.
2.7 List the common types of steel products used in shipbuilding industries.

3. Non-ferrous materials.

3.1 Define non-ferrous metal.
3.2 List the common non-ferrous metals used in engineering field.
3.3 Explain the uses of non-ferrous metals in shipbuilding Industries.
3.4 Explain different non-ferrous alloys.
3.5 List the common non-ferrous alloy in shipbuilding industries.

4. Brief concept on brick, sand, cement and tiles:

4.4 Define brick and mention various classes of bricks.
4.2 Mention different constituents for manufacturing of good bricks.
4.3 Classify sand according to their sources.
4.4 Mention the specifications of good sand.
4.5 Define cement.
4.6 Mention the functions of various ingredients of cement.
4.7 Identify clay tiles, concrete tiles, Plastic tiles, Mosaic tiles, Marble tiles, Glazed tiles.
4.8 Mention the uses of different kinds of tiles.

5. Aluminium as an engineering material.

5.1 Define the characteristics of aluminum.
5.2 Mention the uses of aluminum in Shipbuilding industries.
5.3 List the common aluminum alloys.
5.4 Mention the uses of aluminium alloys in shipbuilding industries.

6. Copper and its alloys.

6.1 Define the characteristics of copper.
6.2 Describe the uses of copper as an engineering material in shipbuilding industries.
6.3 Mention the names of the principal constituents of copper based alloys.
6.4 Mention the uses of copper alloys in shipbuilding industries.

7. Wood as an engineering material.

7.1 Define timber.
7.2 Explain the uses of wood as an engineering material.
7.3 State the characteristics of a good timber.
7.4 Mention the common defects in timber.
7.5 Explain the advantages of timber as constructional material.
7.6 Mention the common types of timbers used in shipbuilding industries.
7.7 Explain the methods of preservation of woods and their seasoning.

8. Artificial wood.

8.1 Distinguish between natural wood and artificial wood.
8.2 Mention the Classification of artificial wood.
8.3 Explain the process of manufacturing different types of artificial woods.
8.4 Mention the advantages of artificial wood over natural wood.
8.5 Mention the uses of artificial wood in shipbuilding industries.

9. Paint.

9.1 Define paint.
9.2 Mention the characteristics of good paint.
9.3 List the essential constituents of paint.
9.4 Mention the function of each constituent.
9.5 Explain the methods of application of paint.
9.6 Define marine paint.
9.7 Explain the composition of painting for the works inside of a ship.
9.8 Explain the composition of painting for the works outside of a ship above the waterline.
9.9 Explain the composition of painting for the works outside of a ship below the waterline.

10. Glass and its products.

10.1 Mention the main constituents of glass.
10.2 Mention the functions of each constituents.
10.3 Explain different types of glass products in shipbuilding Industries.
10.4 Explain the uses of glass products in shipbuilding Industries.

11. Insulating materials.

11.1 Define insulating materials.
11.2 Mention the functions of insulating materials.
11.3 List the name of different natural and synthetic insulating materials.
11.4 Explain the sources of obtaining natural insulating materials.
10.5 List the names of synthetic insulating materials.
10.6 Mention the names of insulating materials used in shipbuilding industries.

12. Heat and sound absorbing materials.

12.1 List five natural heat absorbing materials.
12.2 Explain the sources of obtaining rubber, cork and ebonite.
12.3 Explain the uses of asbestos as insulating material.
12.4 List three natural sound absorbing materials.
12.5 Mention the names of sound absorbing five materials.
12.6 Explain light weight concrete used in acoustic works.
12.7 Mention the names of heat and sound absorbing materials used in shipbuilding industries.

13. Fundamental aspects of fire proof and water proof materials.

13.1 Mention the names of fire proof materials.
13.2 Mention the names of water proof materials.
13.3 Explain the uses of rubber as water proof material
13.4 Explain the uses of asbestos as fire and water proof materials.
13.5 Explain the manufacturing process of asbestos.
13.6 List the characteristics of refractory materials.
13.7 Mention the names of fire proof and water proof materials used in shipbuilding industries.

14. Plastic as an engineering material.

14.1 Define plastic.
14.2 List the names of raw materials of plastic.
14.3 Explain the properties of plastic.
14.4 Mention the classification of plastics.
14.5 Explain the uses of plastic as an engineering material in shipbuilding industries.

PRACTICAL

1. Show skill in identifying ferrous and non ferrous metal.
2. Show skill in identifying iron and state its characteristics by physical observation.
3. Show skill in identifying mild steel, alloy steel, cast iron and other ores of iron and state their characteristics by physical observation.
4. Show skill in identifying brick, sand, cement and tiles and state their characteristics by physical observation.
5. Show skill in identifying copper and state its characteristics by physical observation.
6. Show skill in identifying aluminum and state its characteristics by physical observation.
7. Show skill in identifying wood, timber and good timber and state their characteristics by physical observation.
8. Show skill in identifying natural wood and artificial wood and state their characteristics by physical observation.
9. Show skill in identifying paint and marine paint and state their characteristics by physical observation.
10. Show skill in identifying insulating materials and state their common characteristics by physical observation.
11. Show skill in identifying glass and state its characteristics by physical observation.
12. Show skill in identifying asbestos and state its characteristics.
13. Show skill in identifying plastics and state their common characteristics by physical observation.

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1. A Text book on Engineering Materials - G.J. Kulkarni
2. Workshop practice, Volume-1 -H.K. Hajra. Chowdhury.A.K. Hajra. Chowdhury.Media promoter & publication Pvt. Ltd.
3. Technical Metal - Herald V. Johnson, Ches. A. Benett. Collness.
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65921 MATHEMATICS -2

T	P	C
3	3	4

OBJECTIVES

- To enable in solving the simultaneous equations with the help of determinant and matrix.
- To make understand the exponential series.
- To provide ability to apply the knowledge of differential calculus in solving problem like slope, gradient of a curve, velocity, acceleration, rate of flow of liquid etc.
- To enable to apply the process of integration in solving practical problems like calculation of area of a regular figure in two dimensions and volume of regular solids of different shapes.

SHORT DESCRIPTION

Algebra : Determinants, Matrix, Exponential Series.

Trigonometry : Inverse circular functions, Properties of triangle and solution of triangles.

Differential Calculus : Function and limit of a function, differentiation with the help of limit, differentiation of functions, geometrical interpretation of $\frac{dy}{dx}$, successive differentiation and Leibnitz theorem, partial differentiation.

Integral Calculus : Fundamental integrals, integration by substitutions, integration by parts, integration by partial fraction, definite integrals.

DETAIL DESCRIPTION

ALGEBRA :

1 Apply determinants to solve simultaneous equations.

1.1 Expand a third order determinant.
1.2 Define minor and co-factors.
1.3 State the properties of determinants.
1.4 Solve the problems of determinants.
1.5 Apply Cramer's rule to solve the linear equation.

2 Apply the concept of matrix.

2.1 Define matrix, null matrix, unit matrix, square matrix. column matrix, row matrix, inverse matrix, transpose matrix, adjoin matrix, rank of a matrix, singular matrix.
2.2 Explain equality, addition and multiplication of matrix.
2.3 Find the rank of a matrix.
2.4 solve the problems of the following types:
  i) Solve the given set of linear equations with the help of matrix.
  ii) Find the transpose and adjoin matrix of a given matrix.

3 Understand exponential series.

3.1 Define e.
3.2 Prove that e is finite and lies between 2 and 3.
3.3 Prove that $e^x = 1 + \frac{x}{\lfloor 1} + \frac{x^2}{\lfloor 2} + \frac{x^3}{\lfloor 3} + \frac{x^4}{\lfloor 4}$ ..... to ∞
3.4 Solve problems of the followings types :

i) $1 + \frac{1}{\lfloor 2} + \frac{1}{\lfloor 4} + \frac{1}{\lfloor 6}$ + ... to ∞

ii) $\frac{1}{\lfloor 2} + \frac{1+2}{\lfloor 3} + \frac{1+2+3}{\lfloor 4} + \frac{1+2+3+4}{\lfloor 5}$ + ... to ∞

TRIGONOMETRY

4 Apply the concept of inverse circular function.

4.1 Explain the term inverse circular function and principal value of a trigonometrical ratio.

4.2 Deduce mathematically the fundamental relations of different circular functions.

4.3 Convert a given inverse circular function in terms of other functions.

4.4 Prove mathematically

i) $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \dfrac{x+y}{1-xy}$.

ii) $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \tan^{-1} \dfrac{x+y+z-xyz}{1-xy-yz-zx}$

iii) $\sin^{-1} x + \sin^{-1} y = \sin^{-1} \left(x\sqrt{1-y^2} + y\sqrt{1-x^2}\right)$

iv) $2\tan^{-1} x = \sin^{-1} \dfrac{2x}{1+x^2} = \cos^{-1} \dfrac{1-x^2}{1+x^2} = \tan^{-1} \dfrac{2x}{1-x^2}$

4.5 Solve problems of the following types.

a) $2\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{4} = \frac{\pi}{4}$

b) $\cos \tan^{-1} \cot \sin^{-1} x = x$.

c) Prove that the area of the segment cut from a circle of radius r by a chord at a distance d from the centre is given by

$K = r^2 \cos^{-1} \dfrac{d}{r} - d\sqrt{r^2 - d^2}$

5 Apply the principle of properties of triangles.

5.1 Prove the followings identities :

i) $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C} = 2R$.

ii) $a^2 = b^2 + c^2 - 2bc \cos A$

iii) $a = b \cos C - c \cos B$.

v) $\Delta = \dfrac{1}{2} bc \sin A$.

5.2 Establish the followings.

a) $\tan \dfrac{A}{2} = \sqrt{\dfrac{(s-b)(s-c)}{s(s-a)}}$

b) $\tan \dfrac{B-C}{2} = \dfrac{b-c}{b+c} \cot \dfrac{A}{2}$

c) $\Delta = \dfrac{abc}{4R}$

5.3 Solve the problems of the following types:

i) Prove $\cos (B - C) + \cos A = \dfrac{bc}{2R}$

ii) An object experiences two forces F_1 and F_2 of magnitude 9 and 13 Newtons with an angle 100^0 between their directions. Find the magnitude of the resultant R.

DIFFERENTIAL CALCULUS

6 Understand the concept of functions.

6.1 Define constant, variable, function, domain, range

6.2 Solve problems related to functions.

7 Understand the concept of limits.

7.1 Define limit and continuity of a function.

7.2 Distinguish between $\lim_{x \to a}$ f(x) and f(a).

7.3 Establish (i) $\lim_{x \to 0} \frac{\sin x}{x} = 1$

(ii) $\lim_{x \to 0} \frac{\tan x}{x} = 1$

8 Understand differential co-efficient and differentiation.

8.1 Define differential co-efficient in the form of

$$\frac{dy}{dx} = \lim_{h \to 0} \frac{f(x + h) - f(x)}{h}$$

8.2 Find the differential co-efficient of algebraic and trigonometrical functions from first principle.

9 Apply the concept of differentiation.

9.1 State the formulae for differentiation:

(i) sum or difference

(ii) product

(iii) quotient

(iv) function of function

(v) logarithmic function

9.2 Find the differential co-efficient using the sum or difference formula, product formula and quotient formula.

9.3 Find the differential co-efficient function of function and logarithmic function.

10 Apply the concept of geometrical meaning of $\frac{dy}{dx}$

10.1 Interpret $\frac{dy}{dx}$ geometrically.

10.2 Explain $\frac{dy}{dx}$ under different conditions

10.3 Solve the problems of the type:
A circular plate of metal expands by heat so that its radius increases at the rate of 0.01 cm per second. At what rate is the area increasing when the radius is 700 cm ?

11 Use Leibnitz's theorem to solve the problems of successive differentiation.

11.1 Find 2nd, 3rd and 4th derivatives of a function and hence find n-th derivatives.

11.2 Express Leibnitz's theorem

11.3 Solve the problems of successive differentiation and Leibnitz's theorem.

12 Understand partial differentiation.

12.1 Define partial derivatives.

12.2 State formula for total differential.

12.3 State formulae for partial differentiation of implicit function and homogenous function.

12.4 State Euler's theorem on homogeneous function.

12.5 Solve the problems of partial derivatives.

INTEGRAL CALCULUS

13 Apply fundamental indefinite integrals in solving problems.

13.1 Explain the concept of integration and constant of integration.

13.2 State fundamental and standard integrals.

13.3 Write down formulae for:

(i) Integration of algebraic sum.

(ii) Integration of the product of a constant and a function.

13.4 Integrate by method of substitution, integrate by parts and by partial fractions.

13.5 Solve problems of indefinite integration.

14 Apply the concept of definite integrals.

14.1 Explain definite integration.

14.2 Interpret geometrically the meaning of $\int_a^b f(x)\,dx$

14.3 Solve problems of the following types:

(i) $\int_0^{\pi/2} \cos^2 x \, dx.$ (ii) $\int_0^1 \frac{(\sin^{-1} x)^2}{\sqrt{-x^2}} dx$

P* =Practical continuous assessment

Reference

SL No	Athour	Title	Publication
01	S. P Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Graha Prakashan
02	H. K. Das	Mathematics for Polytechnic Students(Volume I)	S.Chand Prakashan
03	Shri Shantinarayan	Engg.Maths Vol I & II	S.Chand & Comp
04	Dr. B M Ekramul Haque	Higher Mathematics	Akshar Patra Prakashani
05	Md. Abu Yousuf	Differential & Integral Calculus	Mamun Brothers

65922	PHYSICS-2	T	P	C
		3	3	4

OBJECTIVES

- To develop a foundation in scientific principles and processes for the understanding and application of technology.
- To develop an understanding of fundamental scientific concepts through investigation and experimentation.
- To provide a common base for further studies in technology and science.
- To develop the basic knowledge of modern physics.

SHORT DESCRIPTION

Thermometry and Heat Capacity; Expansion of materials (effect of heat); Heat transfer; Humidity; Nature of heat and Thermodynamics; Photometry; Reflection of light; Refraction of light; Electron , photon and Radio activity; Theory of Relativity.

DETAIL DESCRIPTION

THEORY

1. THERMOMETRY AND HEAT CAPACITY

1.1 Define heat and temperature.
1.2 Mention the units of measurement of heat and temperature.
1.3 Distinguish between heat and temperature.
1.4 Identify the range of the Celsius scale determined by the boiling point and melting point of water
1.5 State the construction and graduation of a mercury thermometer.
1.6 Define specific heat capacity, thermal capacity and water equivalent with their units.
1.7 Prove the total heat gained by an object is equal to the sum of the heat lost by all the surrounding objects.
1.8 Explain the principle of calorimetry.
1.9 Define various kinds of specific latent heat.
1.10 Determine the latent heat of fusion of ice and latent heat of vaporization of water.
1.11 Determine the specific heat of a solid by calorimeter.

2. EFFECT OF HEAT ON DIMENSION OF MATERIALS

2.1 Show that different materials change in size at different amounts with the same heat source.
2.2 Explain the meaning of differential expansion in bimetallic strip, thermostats, compensated pendulum etc.
2.3 Explain the methods of overcoming problems caused by the expansion of materials in buildings, machinery, railway lines and bridges.
2.4 Mention the units co-efficient of linear, superficial and cubical expansion of solids.
2.5 Define the co-efficient of linear, superficial and cubical expansion of solids.
2.6 Relation between the co-efficient of linear, superficial and cubical expansion of solids.
2.7 Define real and apparent expansion of liquid.

2.8 Relation between the real and apparent expansion of liquid.

3. HEAT TRANSFER

3.1 Identify the phenomena of heat transferring from hot bodies to cold bodies.
3.2 Explain the methods of heat transfer by conduction, convection and radiation with examples of each type of transfer.
3.3 Define thermal conductivity (K) and Co-efficient of thermal conductivity.
3.4 Find the unit and dimension of Co-efficient of thermal conductivity.
3.5 List the factors which determine the quantity of heat (Q) flowing through a material.
3.6 Show that the quantity of heat flowing through a material can be found from

$$Q = \frac{KA\,(\theta_H - \theta_C)t}{d}$$

3.7 State Stefan-Boltzman Law and wien's law.
3.8 State Newton's law of cooling.
3.9 Explain Green house effect.

4. HUMIDITY

4.1 Define Standard Temperature and Pressure.
4.2 Define Humidity, Absolute Humidity, Relative Humidity and Dewpoint.
4.3 Relation between vapour pressure and air pressure.
4.4 Determine Humidity by wet and dry bulb hygrometer.
4.5 Explain few phenomena related to hygrometry.

5. NATURE OF HEAT AND THERMODYNAMICS

5.1 Describe the caloric theory and kinetic theory of heat.
5.2 Explain the mechanical equivalent of heat.
5.3 State and Explain the first law of thermodynamics .
5.4 Explain Isothermal and adiabatic change.
5.5 Explain Specific heat of a gas, Molar specific heat or molar heat capacity.
5.6 Relate between pressure and volume of a gas in adiabatic Change i, e;PV^{γ}=const.
5.7 State and Explain Reversible process and irreversible process.
5.8 State & explain 2^{nd} law of thermodynamics
5.9 Entropy: Definition, unit and significant.
5.10 Explain Change of entropy in a reversible and irreversible process.
5.11 Give an example of increase of entropy in irreversible process.

6. PHOTOMETRY

6.1 Define light, medium (transparent, translucent, opaque), luminous & non-luminous bodies, parallel, convergent & divergent of rays.
6.2 Show the travel of light in straight line.
6.3 Define photometry, luminous intensity, luminous flux, brightness and illuminating power.
6.4 Mention relation between luminous intensity & illuminating power.
6.5 Explain inverse square law of light.
6.6 Describe the practical uses of light waves in engineering.

7. REFLECTION OF LIGHT

7.1 Define mirror (plane & spherical), image (real & virtual) and magnification of images.
7.2 Describe the reflection of light.
7.3 State the laws of reflection of light.
7.4 Express the verification of laws of reflection.
7.5 Define pole, principal axis, center of curvature, radius of curvature, principal focus in case of concave & convex mirrors.
7.6 Find the relation between focal length & radius of curvature of a concave & convex mirror.
7.7 Express the general equation of concave and convex mirror.

8. REFRACTION OF LIGHT

8.1 Define refraction of light Give examples of refraction of light
8.2 State the laws of refraction and Express the verification of laws of refraction
8.3 Define absolute and relative refractive index and Relate absolute and relative refractive index
8.4 Explain the meaning of total internal reflection and critical angle and Relate total internal reflection and critical angle.
8.5 Give examples of total internal reflection.
8.6 Describe refraction of light through a prism.
8.7 Express the deduction of the relation between refractive index, minimum deviation and angle of the prism.
8.8 Define lens and mention the kinds of lens.
8.9 Identify and List uses of lens.
8.10 Express the deduction of the general equation of lens (Concave & convex).

9. ELECTRON, PHOTON AND RADIO-ACTIVITY

9.1 Describe Electrical conductivity of gases.
9.2 Describe Discharge tube.
9.3 Cathode ray : Definition and its properties
9.4 X-ray : Definition, properties & uses
9.5 Discuss Photo electric effect .
9.6 Derive Einstein's photo electric equation
9.7 Define and explain radio-activity.
9.8 Describe radio-active decay law.
9.9 Define half-life and mean-life of radio-active atoms.
9.10 Define nuclear fission and fusion.

10. THEORY OF RELATIVITY

10.1 Define Space, time and Mass.
10.2 Define rest mass.
10.3 Express the theory of relativity.
10.4 Explain special theory of relativity and its fundamental postulate.
10.5 Mention different Kinds of theory of relativity.
10.6 The Relativity of Length - Length contraction.
10.7 The Relativity of Time – Time dilation.
10.8 Deduce Einstein's mass -energy relation

PRACTICAL

1. Compare the operation of common thermometers.
2. Determine the co-efficient of linear expansion of a solid by Pullinger's apparatus.
3. Measure the specific heat capacity of various substances.(Brass, steel).
4. Determine the latent heat of fusion of ice.
5. Determine the water equivalent by calorimeter.
6. Compare the luminous intensity of two different light sources.
7. Verify the laws of reflection.
8. Find out the focal length of a concave mirror.
9. Determine the refractive index of a glass Slab.
10. Determine the angle of Minimum deviation and refractive index of a glass prism by using I-D graph.

REFERENCE BOOKS:

1. Higher Secondary Physics – Second Part - by Dr. Shahjahan Tapan
2. A Text Book of Heat and Thermodynamics - by N Subrahmanyam and Brij Lal
3. A Text Book of Optics - by N Subrahmanyam and Brij Lal
4. Higher Secondary Physics -Second Part - by Prof. Golam Hossain Pramanik
5. Higher Secondary Physics -Second Part - by Ishak Nurfungnabi
6. Thermodynamics - by K K Ramalingam

65722 **COMMUNICATIVE ENGLISH** **T P C**
1 3 2

Full Marks: 100 (Practical-50.Theoretical-50)

Introduction

This Course Will Provide A Unique Foundation In The Basic Level For Developing Listening, Speaking, Reading And Writing Skills Into Some Of More Specialized And Advanced Capabilities Of Basic Operation In Communication.

Theory Part

Total Mark: : 50
Continuous Assessment : 20
Final Exam : 30

Objectives:

After The Completion of the Module, Learners Will Be Able To Develop-

Creative Writing Ability
Transferring Information, Ideas And Knowledge
#Communicative Competence Effectively In The Workplace Situation.

1.Comprehension For Reading Task (Mark:10)

(Text May Be Taken From Contemporary Journals, Editorial of News Papers Or From Online Resources)

Test Items:

1. MCQ (Guessing Meaning from Context)
2. Rearranging
3. Gap-Filling (With Clues or Without Clues)
4. Answering Questions
5. Summarizing

2. Composition (Mark: 20)

The Following Are The Topic Title Introduced For Writing Task:

1. Introduce Formal/Informal Greeting &Farewell
2. Describe The Idea Of Communication & Presentation Skills
3. Write Paragraph On The Basis Of Comparison and Contrast
4. Narrate Process, Stories And Interpreted Charts, Graphs.
5. Write Letters to the Print and Electronic Media
6. Write Letters of Advice, Complaints, Inquiry, Order and Cancellation
6. Prepare Seven Days Weather Report.
7. Make An Attractive Poster For The People Giving Advice To Protect The Environment.
8. Prepare A Series Of Questions About Personal Information, Place Of Interest, Foods, Hobby And Employment Opportunity.

9. Write Dialogue On The Following Situations
   # About Exchanging Views With A Person And Introducing One Narrating Daily Activities
   # Meeting At The Train Station & Asking Question About The Departure And Arrival Of The Train To The Station Manager
   # Meeting at The Airport And Asking The Flight Schedule
   # Getting To The Hotel And Asking For A Reservation
   # Social Language for Telephonic Conversation
   # Talking About the Weather, Trips & Sight Seeing
   # Asking Permission and Making Request.
   # Talking About Office and Office Manner
   # Talking About Etiquette and Manner

10. Prepare Job Application With A Complete CV For Job Suitable For You.

Practical Part:

Objectives:

1.Communicate The Areas That Learners Encounter In Real Life Situation.

2.Reinforce The Basic Language Skills Of Listening And Speaking.

3.Integrate ICT As Tools In Learning Language.

Course Content

Unit	Lesson	Title
1. Use Of Dictionary	Define Dictionary	1.1 Know How To Use A Dictionary 1.2 Learn At Least 10 Words In A Day With Correct Pronunciation (Follow The Link : Www.Marriunm-Englishdictionary.Com)
2. Basic Vocabulary Practice	Basic Words For Communication By ODGENS	2.1 Use 10 Most Common Formulas (Structure) To Write Correct Sentence. (Follow The Link: Www.Odgensbasicvocabulary.Com Www.Grammarly.Com)
3.Listening Skill Practice	Listen To The Audio Video Presentation On Current Real Life Situation	3.1 Practice Audio Video Conferencing Activities. 3.2. Communicate With The English Speaking People Online (Link: Www.Speaking24.Com)
4. Speaking Skill Practice (Self Interpretation)	Introduce Yourself With The Vocabulary Prescribed By ODGENS	4.1 Browse Vocabulary Related Phrases To Introduce You. (Link : Www.Youtube.Com/ Let Me Introduce Myself)
5. Listening Skill Practice	Listen To The Weather Reports, Sports Commentary In The English TV Channels.	5.1 Prepare Seven Days Weather Report For The Place You Are Staying. 5.2. Make Some Attractive Poster To Protect The Environment.
6. Speaking Skill Practice	Identify Formal And Informal Social Language	6. 1 Practice Conversation Emphasizing On Greetings & Farewell (Link- Www.Esl.Guide@About.Com) 6.2 Take Part In Audio Video Conferencing Activities 6.3 Ask Questions About Personal Information, Place Of Interest, Food, Hobby, Employment Opportunity With Foreign Friends Using Social Media.
7. Writing Skill Practice	Develop Paragraph	7.1 Develop Paragraph On The Basis Of Comparison, Contrast And Analysis. Check Plagiarism Wordiness By The Correction Software (Www.Grammarly.Com) 7.2. Write E-Mail, Send And Reply E-Mail

8. Listening Skill Practice	Watch Short Films, Documentary And Listen To The English Music(With Lyric) To Practice In A Group	8.1 Listen To Hard Talk, Interview 8.2. Prepare A Series Of Questions To Interview A Celebrity 8.3. Down Load Documentary From Www.Youtube.Com/Education
9.Presentation	Define Presentation	9.1 Edutain/Entertain Yourself Preparing A Documentary In A Group With The Activities Done During The Period Of Class Hours In The Lab For Communicative English.

Evaluation:

Students Can Be Evaluated Individually Or In A Group On The Basis Of Performance Done In The Lab. Furthermore, They May Be Given Online Test Using Authenticated Websites Like

Www.Britishcoucil.Org/Education/Blog/Podcast/News/Weather,Www.Englishteststore.Com.Www.Ieltsexam.Com

Lab-Facilitator, 30 Students In A Group:

Physical Facility	Size (In Ft)	Area (In Sq Ft)
Class Room Cum Laboratory	1 5 × 20	300
Library	15 × 20	300
Wash Room	4 × 7	28

Lists Of Equipments And Resources For 30 Learners:

Personal Computers With Accessories	15
Projector Multimedia	01
Printer	01
Scanner	01
Modem	01
Essential Software	01 Set
Internet Connection For Each Computer	Broad Band/Dial Up
Camera (Digital)	01
Video Conferencing Equipments	01 Set
TV Card	01
Satellite Cable Connection	01
Head Phone	15
Related Books And Journals	01
First Aid Box	01

Reference:
Www.Britishcouncil.Org,Www.Marium-Websters.Com,Www.Compellingconversation.Com, Www.Esl.Guide@About.Com, Www.Bbc.Com/News, Www.Speaking24.Com, Www.Itutor.Com, Www.Ieltsexam.Com, Www.Englishteststore.Com, Www.Ginger.Com, Www.Grammarly.Com

(Note: This Course May Be Introduced After Fourth Semester Coz It Needs Some Maturity Of The Students To Adopt With The Course Materials And The Contents. These Themes Are Suggestive Not Prescriptive.)

SOCIAL SCIENCE

T	P	C
3	0	3

OBJECTIVE

To provide opportunity to acquire knowledge and understanding on :

- importance of civics and its relationship with other social sciences
- The relationship of an individual with other individuals in a society
- social organizations, state and government
- rule of law, public opinion and political parties
- UNO and its roles
- The basic concepts and principles of economics and human endeavor in the economic system.
- The realities of Bangladesh economy and the current problems confronting the country.
- The role of Diploma Engineers in industries.
- our motherland and its historical background
- good citizenship through practicing our socio- economic culture
- liberation war and its background
- nationalism and life style of the nation

SHORT DESCRIPTION

Civics and Social Sciences; Individual and Society; Nation and Nationality; Citizenship; state and government; Law; Constitution; Government and its organs; public Opinion; Political Party; UNO and its organs;
Scope and importance of Economics; Basic concepts of Economics- Utility, Wealth, Consumption, income wages, salary, value in use and savings; Production – meaning, nature, factors and laws; Demand and Supply; market equilibrium, national income, Current economic problems of Bangladesh; Role of Diploma Engineers in the economic development of Bangladesh; Occupations and career planning; Engineering teem.

Part-1 (Civics)

1. **Understand the meaning and scope of civics and inter relations of social sciences.**
   - 1.1 Define civics and social science.
   - 1.2 Explain the importance of civics in the personal and social life of an individual.
   - 1.3 Describe the relationship of all social science (civics, Economics, political science, Sociology, ethics)

2. **Understand the relationship of the individual with the society, Nationality and nation, Rights and duties of a citizen.**
   - 2.1 Define the concept (individual, society, socialization, Nation, Nationality, citizen and citizenship).
   - 2.2 State the relationship among the individuals in the society.
   - 2.3 Discuss the methods of acquiring citizenship and state the causes of losing citizenship
   - 2.4 Describe the rights of a citizen and state the need for developing good citizenship.

3. **Appreciate the relationship between the state and government, law and organs of government.**
   - **3.1** Meaning the state, government and law
   - 3.2 Discuss the elements of state.
   - 3.3 Discuss the classification of the forms of government
   - 3.4 Distinguish between cabinet form of Government and presidential form of government.
   - 3.5 Describe the main organs of Government (legislature, Executive and judiciary)
   - 3.6 Discuss the sources of law

4. **Understand and the classification of constitution**
   - 4.1 Define the Constitution.
   - 4.2 Explain the deferent form of Constitution

4.3 Explain state the salient feature of Bangladesh constitution.
4.4 Define the fundamental rights of Bangladesh constitution.
4.5 Meaning of human rights.

5. Understand the role of UNO in maintaining world peace

5.1 Explain the major functions of UNO.
5.2 State the composition and functions of General Assembly.
5.3 Describe the Composition and functions of Security Council.
6.4 Discuss the role of Bangladesh in the UNO.

6. Understand the role of Ethics values and good governance

6.1 Define the values, ethics and good governance.
6.2 Discuss the role of government to establish good governance

Part-2 (Economics)

1. Understand the fundamental concepts of economics.

1.1 Define the Microeconomics and Macroeconomics.
1.2 Discuss the definition of Economics as given by eminent economists.
1.3 Describe the importance of economics for Technical Student.
1.4 Define commodity, utility, value, wealth, consumption, income, savings, wages, value in use, value in exchange and salary.
1.5 Differentiate between value in use and value in exchange.
1.6 Explain wealth with its characteristics.

2. Understand the production process and the concept of the law of diminishing returns in the production process.

2.1 Discuss production mode and process
2.2 Explain the nature of different factors of production.
2.3 Discuss production function.
2.4 Discuss the law of diminishing returns.
2.5 State the application and limitations of the law of diminishing returns.
2.6 Describe the law of production (increasing constant and diminishing).

3. Understand the concept of demand, supply and utility.

3.1 Define the term, “demand and supply”.
3.2 Explain the law of demand and supply .
3.3 Draw the demand and supply curve.
3.4 Discuss Market equilibrium.
3.5 Define the utility, total and marginal utility
3.6 Illustrate the law of diminishing utility.
3.7 Explain the law of diminishing marginal utility

4. Understand national income.

4.1 Define nation income.
4.2 Explain how to measure national income.
4.3 Discuss GNP, GDP and NNP.
4.4 Discuss economic development and growth

5. Understand the current issues and the availability and use of natural resource in the economic development of Bangladesh

5.1 Define rural and urban economics.
5.2 Identify major problems of rural and urban economy.
5.3 Explain the migration of rural population to urban areas.
5.4 List of the Natural resource of Bangladesh and classify them according to sources of availability.
5.5 Explain the importance of the mine, forest and water resources and potential uses for sustainable development.

6. Role of a Diploma Engineer in the Development of Bangladesh Economy.

6.1 Explain the concept of the term, "Engineering team"
6.2 Identify the functions of Engineers, Diploma Engineers, craftsmen forming the engineering team.
6.3 Discuss the role of a Diploma Engineer in the overall economic development of Bangladesh.
6.4 Explain socio-economic status of a diploma Engineer.

Part-3 ((Bangladesh: History& Culture)

সংক্ষিপ্ত বিবরণী

ইতিহাস

- ইতিহাসের সংজ্ঞা ।
- বাংলাদেশের আবহাওয়া ও অধিবাসী ।
- বাংলায় ইংরেজ শাসন ক্ষমতালাভ ও প্রতিষ্ঠা ।
- ব্রিটিশ বিরোধী সশস্ত্র প্রতিরোধ আন্দোলন; সংস্কার আন্দোলন ও জাতীয়তাবাদেও বিকাশ এবং বাংলার নবজাগরণ; বঙ্গভঙ্গ ও বঙ্গভঙ্গ উত্তরকালে বাংলার রাজনীতি ও দেশ বিভাগ ।
- পাকিস্তান আমলে বাংলাদেশ, বঙ্গবন্ধুর নেতৃত্বে বাংলাদেশের মুক্তি সংগ্রাম ও স্বাধীনতালাভ ।

সংস্কৃতি

সংস্কৃতি, সভ্যতার সংজ্ঞা, সংস্কৃতির প্রকরণ, ভাষা আন্দোলন উত্তর বাংলার সংস্কৃতি, স্বাধীনতা উত্তর বাংলাদেশের সংস্কৃতির বিবর্তন, বাংলাদেশের সংস্কৃতিতে প্রত্নতার্ত্ত্বিক নিদর্শন ও ক্ষুদ্র নৃতাত্ত্বিক গোষ্ঠীসমূহ ।

সহায়ক পুস্তক

হক, মোজাম্মেল "পৌরনীতি"– হাসান বুক হাউস
প্রফেসর এমাজউদ্দিন "রাষ্ট্রবিজ্ঞান" আজিজিয়া লাইব্রেরী
আলী, মাসুম "অর্থনীতি"
চক্রবর্তী, মনতোষ– "প্রিন্সিপলস অব ইকোনোমিক্স"
মার্শাল, আলফ্রেড,–" প্রিন্সিপলস অব ইকোনোমিক্স"
রহমান, আনিসুর –"অর্থনীতি"
রহিম, চৌধুরী, মাহমুদ ও ইসলাম, "বাংলাদেশের ইতিহাস (পরিবর্ধিত ও পরিমার্জিত)" ; নওরোজ কিতাবিস্তান, আগস্ট, ১৯৯৯ ।
কে, আলী"বাংলাদেশের ইতিহাস"; আজিজিয়া বুক ডিপো, ২০০১ ।
সিরাজুল ইসলাম, "বাংলাদেশের ইতিহাস-১৭০৪-১৯৭১"; ১ম, ২য় ও ৩য় খন্ড; বাংলাদেশ এশিয়াটিক সোসাইটি, ফেব্রুয়ারি ২০০০ ।
কো-আন্তোনভা, প্রি, কতোভস্কি, "ভারত বর্ষের ইতিহাস"; প্রগতি প্রকাশন, ১৯৮৮ ।
গোপাল হালদার; "সংস্কৃতির রূপান্তর"; মুক্তধারা, মে ১৯৮৪ ।
মোতাহের হোসেন চৌধুরী, "সংস্কৃতি কথা"; নওরোজ কিতাবিস্তান, জানুয়ারি ১৯৯৮ ।
গোপাল হালদার, "বাংলা সাহিত্যের রূপরেখা-১ম ও ২য় খন্ড"; মুক্তধারা ।

BASIC WORKSHOP PRACTICE

T	*P*	*C*
0	**6**	**2**

AIMS

To provide the students with an opportunity to acquire knowledge and skills to

- Perform different metal & fitting works.
- Perform basic welding works.
- Use and take care of fitting and welding tools & equipment.

SHORT DESCRIPTION

Fitting : Safety Precautions, Common hand tools; Measuring instruments; Laying out; Sawing, chipping, filing, grinding and finishing, drilling and thread cutting;
Welding: Arc welding; Gas welding; welding with non-ferrous metal; Resistance welding; TIG & MIG welding; Gas & Plasma cutting.

Practical:

1 Understand the safely productions in Fitting & welding shop:
- 1.1. State general safety precaution in Fitting shop.
- 1.2. State general safety precaution in welding shop.
- 1.3. State the importance of good house keeping.

2 Demonstrate the application of basic metal working hand tools.
- 2.1 Identify common hand tools used for metal and fitting works.
- 2.2 Check hand tools for sharpness.
- 2.3 Carryout minor maintenance and sharpening of tools used for fitting works.
- 2.4 Follow safety procedure during working in the fitting shop.

3 Demonstrate the application of measuring instruments and gages for bench work.
- 3.1 Identify the measuring and layout tools.
- 3.2 Take measurement with vernier caliper and micrometer.
- 3.3 Measure and layout a fitting job.
- 3.4 Check/measure with gages (sheet and wire gage, drill gage, etc).

4 Show skill in sawing, chipping, filing, drilling, reaming and grinding.
- 4.1 Identify the operations of sawing, chipping, filing, drilling, reaming and.
- 4.2 Perform sawing, chipping, filing, drilling, reaming and grinding operations.
- 4.3 Make a job involving sawing, chipping, filing, drilling, reaming and grinding operations (Hinge, Angle gage, etc).
- 4.4 Follow safety procedures during sawing, chipping, filing, drilling, reaming and grinding.

5 Show skill in cutting threads.
- 5.1 Identify the taps and dies.
- 5.2 Cut internal and external threads with tap and die.
- 5.3 Follow safety procedures during working with taps and dies.

6 Show skill in making sheet metal jobs.
- 6.1 Select appropriate sheet metal.
- 6.2 Select tools and equipment for sheet metal works.
- 6.3 Layout the sheet for jobs.(Development Drawing)
- 6.4 Make seam joint.
- 6.5 Rectangular tray, Dust pan, Funnel etc.

7 Show skill in Arc Welding:
- 7.1 Identify the Arc welding machine.
- 7.2 Select tools and equipment for Arc welding.
- 7.3 Prepare a work piece for an Arc welding joint.
- 7.4 Select Proper current and voltage for Arc welding.
- 7.5 Select appropriate electrode.
- 7.6 Practice uniform and straight weld bead.
- 7.7 Make Arc welding joints 1F, 2F (Lap, butt, tee, corner, etc.)
- 7.8 Follow safe working procedures during Arc welding.

8 Show skill in Gas Welding:

8.1 Identify the Gas welding cylinders.
8.2 Select tools and equipment for Gas welding.
8.3 Prepare a work piece for a Gas welding joint.
8.4 Select appropriate a filler rod and flux.
8.5 Select appropriate flame for Gas welding.
8.6 Practice uniform and straight weld bead.
8.7 Make Gas welding joints 1F, 2F (Lap, butt, tee, corner, etc.)
8.8 Follow safe working procedures during Gas welding.

9 Show skill in Gas and Plasma cutting

9.1 Identify the Gas cutting torch and Plasma cutting machine.
9.2 Select tools and equipment for Gas cutting and Plasma cutting machine.
9.3 Select appropriate flame and high pressure oxygen flow for gas cutting.
9.4 Select appropriate current, voltage and high presser air flow for plasma cutting.
9.5 Metal cutting by gas and plasma cutting machine.
9.6 Follow safe working procedures during Gas and plasma cutting machine.

10 Show Skill in TIG Welding:

10.1 Identify the TIG welding machine.
10.2 Select tools and equipment for TIG welding.
10.3 Prepare a work piece for a TIG joint.
10.4 Select Proper current and voltage for TIG welding.
10.5 Select appropriate electrode and holder / electrode casing.
10.6 Practice uniform and straight weld bead.
10.7 Make TIG welding joints 1F (butt.)
10.8 Follow safe working procedures during TIG welding.

11 Show Skill in MIG Welding:

11.1 Identify the MIG welding machine.
11.2 Select tools and equipment for MIG welding.
11.3 Prepare a work piece for a MIG joint.
11.4 Select Proper current and voltage for MIG welding.
11.5 Select appropriate electrode and pressure roller.
11.6 Practice uniform and straight weld bead
11.7 Make MIG welding joints 1F (butt.)
11.8 Follow safe working procedures during MIG welding.

12 Show skill in resistance welding.

12.1 Identify the resistance welding machines.

12.2 Identify accessories and tools for resistance welding.

12.3 Make spot welding joints.

12.4 Follow safe working procedures during working with spot welding machine.

REFERENCE BOOKS

1	Basic Sheet Metal Practice	—	J. W. Giachino
2	Prathomic Fitting Sikkha	—	Hemanta Kumar Bhattacharia
3	Welding Principles for Engineers	—	Morris
4	Metal Fabrication	—	Robert L. O'con
5	Sheet Metal Work	—	Blackburn & Cassidy
6	Manufacturing Technology Lab Manual	—	T Jeyapoovan • S Sundaram

BANGLADESH TECHNICAL EDUCATION BOARD
Agargoan, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016)

SHIPBUILDING TECHNOLOGY

TECHNOLOGY CODE: **680**

3rd SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

SHIPBUILDING TECHNOLOGY (680)

3rd SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	66611	Computer Application	0	6	2	0	0	50	50	100
2	68032	Welding	1	6	3	40	60	50	50	200
3	66811	Basic Electronics	2	3	3	40	60	25	25	150
4	67033	Machine shop Practice	1	3	2	20	30	50	50	100
5	65931	Mathematics -3	3	3	4	60	90	25	25	200
6	65913	Chemistry	3	3	4	60	90	25	25	200
7	65812	Physical Education & Life Skill Development	0	3	1	0	0	50	0	50
Total			**10**	**27**	**19**	**240**	**360**	**250**	**200**	**900**

66611	COMPUTER APPLICATION	T	P	C
		0	6	2

OBJECTIVES

-

SHORT DESCRIPTION

DETAIL DESCRIPTION

1. Operate a personal Computer

1.1 Start up a Computer

1.1.1 ***Peripherals*** are checked and connected with system unit
1.1.2 Power cords / adapter are connected properly with computer and power outlets socket
1.1.3 Computer is switched on gently.
1.1.4 PC ***desktop / GUI settings*** are arranged and customized as per requirement.

1.2 Operate Computer

1.2.1 Files and folders are created.
1.2.2 Files and folders are ***manipulated*** as per requirement.
1.2.3 Properties of files and folders are viewed and searched.
1.2.4 Control panel settings are practiced.
1.2.5 ***Memory devices*** are formatted as per requirement.

1.3 Shutdown computer

1.3.1 unsaved file and folders are closed
1.3.2 Open software is closed and hardware devices are switched off.
1.3.3 Computer is switched off gently.
1.3.4 Power at the respective power outlets is switched off.

2. Type text and documents in English and Bangla.

2.1 Install the Typing Tutor software

2.1.1 Required ***Hardware*** and ***software*** are ready to use.
2.1.2 Typing tutor software are collected and selected
2.1.3 English Typing tutor software is installed.
2.1.4 Specialized Bangla Typing tutor software is installed.

2.2 Practice text typing in English and Bangla

2.2.1 Typing tutor software is started.
2.2.2 English Home key drilling are practiced systematically
2.2.3 Intermediate level typing speed(25 cps) are achieved.
2.2.4 Specialized Bangla Typing tutor / software are installed.
2.2.5 Bangla Home key typing are practiced systematically
2.2.6 Text documents are typed repeatedly for increasing typing speed.

2.3 Type documents

2.3.1 ***Word processor*** is started.
2.3.2 Text document are typed.
2.3.3 Intermediate level typing speed (30 cps) in English and (20 cps) in Bangla are achieved.

3. Operate Word Processing Application

3.1 **Create documents**:

3.1.1 Word-processing application are opened.

3.1.2 ***Documents*** are created.
3.1.3 Data are added according to information requirements.
3.1.4 Document templates Used as required.
3.1.5 Formatting tools are used when creating the document.
3.1.6 Documents are Saved to directory.

3.2 Customize basic settings to meet page layout conventions:

3.2.1 Adjust page layout to meet information requirements
3.2.2 Open and view different toolbars
3.2.3 Change ***font format*** to suit the purpose of the document
3.2.4 Change alignment and line spacing according to document information requirements
3.2.5 Modify margins to suit the purpose of the document
3.2.6 Open and switch between several documents

3.3 Format documents

3.3.1 Use formatting features and styles as required.
3.3.2 Highlight and copy text from another area in the document or from another active document
3.3.3 Insert headers and footers to incorporate necessary data
3.3.4 Save document in another ***file format***
3.3.5 Save and close document to ***a storage device.***

3.4 Create tables:

3.4.1 Insert standard table into document
3.4.2 Change cells to meet information requirements
3.4.3 Insert and delete columns and rows as necessary
3.4.4 Use formatting tools according to style requirements

3.5 Add images:

3.5.1 Insert appropriate ***images*** into document and customize as necessary
3.5.2 Position and resize images to meet document formatting needs

3.6 Print information and Shutdown computer:

3.6.1 P*rinter* is connected with computer and power outlet properly.
3.6.2 Power is switched on at both the power outlet and printer.
3.6.3 Printer is installed and added.
3.6.4 Correct printer settings are selected and document is printed.
3.6.5 Print from the printer spool is viewed or cancelled and
3.6.6 Unsaved data is saved as per requirements.
3.6.7 Open software is closed and computer hardware devices are shut downed.
3.6.8 Power at the respective power outlets is switched off.

4. Operate Spreadsheet application

4.1 Create spreadsheets

4.1.1 Open spreadsheet application,
4.1.2 create spreadsheet files and enter numbers, text and symbols into cells according to information requirements
4.1.3 Enter ***simple formulas and functions*** using cell referencing where required
4.1.4 Correct formulas when error messages occur
4.1.5 Use a range of common tools during spreadsheet development
4.1.6 Edit columns and rows within the spreadsheet
4.1.7 Use the auto-fill function to increment data where required
4.1.8 Save spreadsheet to directory or folder

4.2 Customize basic settings:

4.2.1 Adjust page layout to meet user requirements or special needs
4.2.2 Open and view different toolbars
4.2.3 Change font settings so that they are appropriate for the purpose of the document
4.2.4 Change ***alignment*** options and line spacing according to spreadsheet ***formatting features***
4.2.5 ***Format*** cell to display different styles as required
4.2.6 Modify margin sizes to suit the purpose of the spreadsheets

4.2.7 View multiple spreadsheets concurrently

4.3 Format spreadsheet:

4.3.1 Use formatting features as required

4.3.2 Copy selected formatting features from another cell in the spreadsheet or from another active spreadsheet

4.3.3 Use ***formatting tools*** as required within the spreadsheet

4.3.4 Align information in a selected cell as required

4.3.5 Insert headers and footers using formatting features

4.3.6 Save spreadsheet in another format

4.3.7 Save and close spreadsheet to ***storage device***

4.4 Incorporate object and chart in spreadsheet:

4.4.1 Import an object into an active spreadsheet

4.4.2 Manipulate imported ***object*** by using formatting features

4.4.3 Create a chart using selected data in the spreadsheet

4.4.4 Display selected data in a different chart

4.4.5 Modify chart using formatting features

4.5 Create worksheets and charts

4.5.1 Worksheets are created as per requirement

4.5.2 Data are *entered*

4.5.3 ***Functions*** are used for calculating and editing logical operation

4.5.4 ***Sheets*** are formatted as per requirement.

4.5.5 ***Charts*** are created.

4.5.6 Charts/ Sheets are previewed.

4.6 Print spreadsheet:

4.6.1 Preview spreadsheet in print preview mode

4.6.2 Select basic printer options

4.6.3 Print spreadsheet or selected part of spreadsheet

4.6.4 Submit the spreadsheet to ***appropriate person*** for approval or feedback

5. Operate Presentation Package:

5.1 Create presentations:

5.1.1 Open a presentation package application and create a simple design for a presentation according to organizational requirements

5.1.2 Open a blank presentation and add text and graphics

5.1.3 Apply existing styles within a presentation

5.1.4 Use presentation template and slides to create a presentation

5.1.5 Use various ***Illustrations*** and ***effects*** in presentation

5.1.6 Save presentation to correct directory

5.2 Customize basic settings:

5.2.1 Adjust display to meet user requirements

5.2.2 Open and view different ***toolbars*** to view options

5.2.3 Ensure ***font settings*** are appropriate for the purpose of the presentation

5.2.4 View multiple slides at once

5.3 Format presentation:

5.3.1 Use and incorporate organizational charts, bulleted lists and modify as required

5.3.2 Add ***objects*** and manipulate to meet presentation purposes

5.3.3 Import ***objects*** and modify for presentation purposes

5.3.4 Modify slide layout, including text and colors to meet presentation requirements

5.3.5 Use ***formatting tools*** as required within the presentation

5.3.6 Duplicate slides within and/or across a presentation

5.3.7 Reorder the sequence of slides and/or delete slides for presentation purposes

5.3.8 Save presentation in another ***format***

5.3.9 Save and close presentation to disk

5.4 Add slide show effects:

5.4.1 Incorporate preset animation and multimedia effects into presentation as required to enhance the presentation

5.4.2 Add slide transition effects to presentation to ensure smooth progression though the presentation

5.4.3 Test presentation for overall impact

5.4.4 Use onscreen navigation tools to start and stop slide show or move between different slides as required

5.5 Print presentation and notes:

5.5.1 Select appropriate print format for presentation

5.5.2 Select preferred slide orientation

5.5.3 Add notes and slide numbers

5.5.4 Preview slides and spell check before presentation

5.5.5 Print the selected slides and submit presentation to appropriate person for feedback

6. Access Information using Internet and electronic mail

6.1 Access resources from internet

6.1.1 Appropriate internet ***browsers*** are selected and installed

6.1.2 Internet browser is opened and web address / URL is written/selected in /from address bar to access ***information.***

6.1.3 ***Search engines*** are used to access information

6.1.4 Video / Information are Shared /downloaded / uploaded from / to web site/***social media.***

6.1.5 ***Web based resources*** are used.

6.1.6 Netiquette' (or web etiquette) principles are searched and followed

6.2 Use and manage Electronic mail

6.2.1 ***Email services*** are identified and selected to create a new email address

6.2.2 Email account is created

6.2.3 Document is prepared, attached and sent to different types of recipient.

6.2.4 Email is read, forwarded, replied and deleted as per requirement.

6.2.5 Custom email folders are created and ***manipulated***

6.2.6 Email message is printed

68032 Welding

T	P	C
1	6	3

AIMS

To be able to develop knowledge, Skill and attitude in the area of arc welding and gas welding with special emphasis on:

- To identify welding tools, equipment's and machines.
- To operate welding tools, equipments, machines and its care and maintenance.
- To be able to understand the various welding processes, testing welding joint and their defects.
- To be able to perform the welding joints of metals & alloys.

SHORT DESCRIPTION

Scope and importance of welding; Safety rules; Welder's hand tools and measuring tools; Welding machines; Welding symbol; Principles of arc welding; Arc welding electrode; Types of weld & welded joints; Edge preparation of welded joints; Welding defects and its remedy; Gas regulator; Welding and cutting blow pipe; Welding flame, combustion and fusion; Principles of gas welding ; Gas welding defects & its remedy; Distortion control in welded joints; Techniques of identification of metals; Pre-heating and post heating; Testing of welded joints; Principles of TIG and MIG welding.

DETAIL DESCRIPTION

THEORY

1. Introduction to Welding Technology.

1.1 Define Welding

1.2 Describe the scope and importance of welding.

1.3 Classify the welding process.

1.4 Describe some common (mechanical and electrical) terms related to welding.

1.5 List the condition for obtaining satisfactory welds.

1.6 List the procedure for selection of a welding process.

1.7 Identify and explain the factors for making a good weld.

1.8 Explain the causes and types of distortion.

1.9 Describe the methods of controlling distortion.

2. Understand health and safety in welding.

2.1 State the objective of safety of workshop.

2.2 Describe the welding hazard.

2.3 State equipment selection, maintenance and safety.

2.4 Describe General health and safety in welding.

2.5 Describe Fire and explosion prevention hot work

2.6 Define PPE and OSH.

2.7 Describe Fume and gas control.

2.8 Describe Local exhaust ventilation for welding process.

2.9 Describe Electrical safety.

2.10 Describe Safe use of welding gas.

2.11 Describe Hazardous substances, metal preparation and hot metal spark.

2.12 State welding in confined spaces

2.13 State radiation, noise and vibration in welding.

2.14 Describe hand tool fitness and safety.

3. Understand the tools, equipment and machines used for welding.

3.1 List the welder's hand tools and mention their uses.

3.2 List the welder's measuring tools and mention their uses.

3.3 List the arc and gas welding machines and mention their uses.

3.4 Explain care and maintenance of the arc and gas welding machines.

4. Understand the welding symbol.

4.1 Identify the welding symbols.

4.2 Draw various welding symbols.

4.3 State the uses of various types of welding symbols.

5. Understand the arc welding.

5.1 State the principles of arc welding.

5.2 Mention the function of flux.

5.3 Describe the characteristics of arc.

5.4 Classify the arc welding.

5.5 Explain the voltage and current regulation of the arc welding set.

5.6 Describe the different types of electrodes used in the arc welding.

5.7 Describe the selection procedure of electrode.

5.8 Identify different types of electrode coating.

5.9 State the functions of Electrode coating.

5.10 Describe the process of storing electrodes.

5.11 Define and classify polarity used in the arc welding.

5.12 Explain the effect of polarity.

5.13 Describe the causes and remedies of arc welding defects.

6. Understand types of welded joint and weld.

6.1 Classify welded joints.

6.2 Describe different types of welded joints.

6.3 Classify welds.

6.4 Describe different types of weld.

7. Understand edge preparation welded joints.

7.1 Define edge preparation.

7.2 Describe the importance of edge preparation.

7.3 Explain the care of edge preparation.

8. Understand about welding gases and how to use the cylinders.

8.1 Classify and state the properties gases used in welding.

8.2 State the sources of oxygen and acetylene collection.

8.3 Describe the process of gas (oxygen and acetylene) filling.

8.4 Explain the reason of dissolving acetylene.

8.5 Describe the method of dissolving.

8.6 Describe the maintenance and storage procedure of acetylene cylinders.

9. Understand the gas welding regulator, cutting blowpipe, flame, filer metals, combustion and fusion.

9.1 Describe the working principles and maintenance procedure of gas welding regulator.

9.2 Classify the blowpipe and identify the different parts and mention their function.

9.3 Classify the flame and mention their uses.

9.4 State the identification process of flame.

9.5 Define fine filer metals and describe the uses of filer metals.

9.6 Define combustion and fusion.

9.7 Describe the process of combustion and fusion of base metal.

10. Understand gas welding.

10.1 State gas welding techniques.

10.2 Describe the preparation of work piece.

10.3 Explain the holding and manipulation of blowpipe.

10.4 State the holding and manipulation of filler metal.

10.5 State the correct flame and its proper height.

10.6 Describe the causes and remedies of gas welding defects..

11. Understand the techniques of identification of metals.

11.1 List the methods of identification of metals.

11.2 Describe the procedure to identify metal by spark test.

11.3 Describe the procedure to identify metal by appearance test.

11.4 Describe the procedure to identify metal by magnetic test.

11.5 Describe the procedure to identify metal by Chisel test.

11.6 Describe the procedure to identify metal by fracture test.

11.7 Describe the procedure to identify metal by flame test.

12. Understand the preheating and post heating.

12.1 Define pre-heating.

12.2 Mention the role of pre-heating in welding.

12.3 Mention the role of post-heating.

12.4 Mention the pre-heating temperature of different metals.

13. Understand the test of welded joints.

13.1 List the methods of testing welded joints.

13.2 Describe the visual test.

13.3 Describe the break test.

13.4 Describe the bend test.

13.5 Describe the radiographic test.

13.6 Describe the ultrasonic testing.

13.7 Describe the magnetic particle inspection.

14. Understand the TIG and MIG welding.

14.1 State the principles of TIG and MIG welding.

14.2 List the TIG and MIG equipments and machines and mention their uses.

14.3 Describe the safety to be taken for the machines and equipment for TIG and MIG welding.

14.4 Explain the differences between TIG and MIG welding.

PRACTICAL

1 Cut metals by hacksaw.

1.1 Prepare the work piece as per drawing.

1.2 Hold the work piece firmly.

1.3 Select blade.

1.4 Cult the work piece.

1.5 Checked the work piece during and after cutting.

2. Chip the metal.

2.1 Prepare work piece as per drawing.

2.2 Hold the work piece firmly.

2.3 Select Chisel.

2.4 Select hammer.

2.5 Hold Chisel.

2.6 Finish clipping.

2.7 Cheeked the work piece during and after clipping.

3. Drill and File the metals.

3.1 Prepare work piece as per drawing.

3.2 Hold the work piece firmly.

3.3 Select drill bit.

3.4 Hold drill bit.

3.5 Drill the work piece.

3.6 File the Work piece.

3.7 Cheeked the work piece during and after drilling.

4. Make straight single bead (Flat position).

4.1 Prepare the work piece.

4.2 Select electrode.

4.3 Connect work piece.

4.4 Hold the electrode.

4.5 Set current.

4.6 Weld the work piece.

4.7 Check weld.

5. Weld Tee joint single run (Flat position).

5.1 Prepare the work piece.

5.2 Select electrode.

5.3 Connect work piece.

5.4 Hold the electrode.

5.5 Set current.

5.6 Tack the work piece.

5.7 Pre-set the work piece.

5.8 Weld the work piece.

5.9 Check weld.

6. Weld multi run Tee joint (Flat position).

6.1 Prepare the work piece.

6.2 Select electrode.

6.3 Connect work piece.

6.4 Hold the electrode

6.5 Set current.

6.6 Tack the work piece.

6.7 Pre-set the work piece.

6.8 Weld the joint (multi run).

6.9 Check weld.

7. Make single run lap joint (Flat position).

7.1 Prepare the work piece.

7.2 Select electrode.

7.3 Connect work piece.

7.4 Hold the electrode.

7.5 Set current.

7.6 Tack the work piece.

7.7 Pre-set the work piece.

7.8 Weld the work piece.

7.9 Check weld.

8. Weld inside and outside corner joint (Flat position).

8.1 Prepare the work piece.

8.2 Select electrode.

8.3 Connect work piece.

8.4 Hold the electrode.

8.5 Set current.

8.6 Tack the work piece.

8.7 Weld the work piece (multi-run).

8.8 Check weld.

9. Make closed and open square butt joint (Flat position).

9.1 Prepare the work piece.

9.2 Select electrode.

9.3 Connect work piece.

9.4 Hold the electrode.

9.5 Set current.

9.6 Tack the work piece.

9.7 Weld the work piece (multi run).

9.8 Check weld

10. Weld single Vee butt joint (Flat position without and without penetration).

10.1 Prepare the work piece.

10.2 Select electrode.

10.3 Connect work piece.

10.4 Hold the electrode.

10.5 Set current.

10.6 Tack the work piece.

10.7 Weld the work piece (multi run).

10.8 Check weld

11 . Weld single beads (Vertical upward Position).

11.1 Prepare the work piece

11.2 Select electrode.

11.3 Connect work piece.

11.4 Hold the electrode.

11.5 Set current.

11.6 Tack the work piece.

11.7 Weld the work piece (multi run).

11.8 Check weld

12 Weld single Vee butt joint (Flat position without and without penetration).

12.1. Prepare the work piece

12.2 Select electrode.

12.3 Connect work piece.

12.4 Hold the electrode.

12.5 Set current.

12.6 Tack the work piece.

12.7 Weld the work piece (multi run).

12.8 Check weld

13 Make tee and Lap joint (Vertical position)

13.1 Prepare the work piece.

13.2 Select electrode.

13.3 Connect the work piece.

13.4 Hold the electrode.

13.5 Set current.

13.6 Tack the work piece.

13.7 Present the work piece

13.8 Hold the work piece in vertical position.

13.9 Weld the tee joint.

13.10 Check weld.

14 Make inside and outside corner joint (Vertical position)

14.1 Prepare the work piece.

14.2 Select electrode.

14.3 Connect the work piece.

14.4 Hold the electrode.

14.5 Set current.

14.6 Tack the work piece.

14.7 Hold the work piece. in vertical position.

14.8 Weld the work piece.

14.9 Check weld.

15 Assemble & Disassemble gas welding equipment.

15.1 Identify gas cylinders.

15.2 Clean the cylinder valve

15.3 Set the regulator on the cylinder.

15.4 Connect rubber hoses to the blow pipe shank and regulators.

15.5 Connect welding tip/nozzle to the blowpipe shank.

15.6 Test the gas leakage.

16 Make flame.

16.1 Select electrode.

16.2 Connect work piece.

16.3 Hold the electrode.

16.4 Set current.

16.5 Tack the work piece.

16.6 Weld the work piece (multi run).

16.7 Select electrode.

16.8 Connect work piece.

16.9 Hold the electrode.

16.10 Set current.

16.11 Tack the work piece.

16.12 Weld the work piece (multi run)..

17 Weld straight bead without filler metal (flat position).

17.1 Prepare the work piece.

17.2 Select the nozzle.

17.3 Adjust the gas pressure.

17.4 Ignite blowpipe.

17.5 Adjust the flame.

17.6 Weld the straight bead.

17.7 Check the weld.

18 Weld edge joint without filler metal (flat position).

18.1 Prepare the work piece.

18.2 Select the nozzle.

18.3 Select the filler metal.

18.4 Adjust the flame.

18.5 Ignite blowpipe.

18.6 Adjust the flame.

18.7 Take the porkpie.

18.8 Weld the work piece.

18.9 Check the weld.

19 Weld squire and Outside Corner butt joint (flat position)

19.1 Prepare the work piece.

19.2 Select the nozzle.

19.3 Select the filler metal.

19.4 Adjust the gas pressure.

19.5 Ignite blowpipe.

19.6 Adjust the flame.

19.7 Take the porkpies.

19.8 Weld the work piece.

19.9 Check the weld.

20 Weld Lap and tee joint (flat position).

20.1 Prepare the work piece.

20.2 Select the nozzle.

20.3 Select the filler metal.

20.4 Adjust the gas pressure.

20.5 Ignite blowpipe.

20.6 Adjust the flame.

20.7 Take the work piece.

20.8 Weld the work piece.

20.9 Check the weld.

21 Weld Straight-bead without filler rod (Vertical position).

21.1 Prepare the work piece.

21.2 Select the nozzle.

21.3 Select the filler metal.

21.4 Adjust the gas pressure.

21.5 Ignite blowpipe.

21.6 Adjust the flame.

21.7 Hold the work pieces in vertical position.

21.8 Weld the work piece.

21.9 Check the weld.

22 Weld Lap, Butt and Tee joint (Vertical position)

22.1 Prepare the work piece.

22.2 Select the nozzle.

22.3 Select the filler metal.

22.4 Adjust the gas pressure.

22.5 Ignite blowpipe.

22.6 Adjust the flame.

22.7 Take the work piece.

22.8 Hold the work pieces in vertical position.

22.9 Weld the work piece.

22.10 Check the weld.

23 Cut metals by flame (hand cutting and Machine cutting/Auto cutting)

23.1 Prepare the work piece.

23.2 Adjust the gas pressure.

23.3 Ignite blowpipe.

23.4 Adjust the flame.

23.5 Take the work piece.

23.6 Put the work piece on the table & cut it by manually.

23.7 Cheek the cut.

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   - Kobe Steel, Ltd.
10. Health and safety in welding
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BASIC ELECTRONICS

T	P	C
2	3	3

OBJECTIVES

- To provide the understanding skill on Electronic Components, Electronic measuring and testing equipments.
- To provide understanding and skill on the basic concept of semiconductor junction and to identify physically a range of semiconductor diodes.
- To develop comprehensive knowledge and skill on special diodes and devices.
- To develop the abilities to construct different rectifier circuits.
- To provide understanding of the basic concept and principle of transistor and to identify physically a range of transistor.
- To provide understanding and skill on the basic concept of logic gates.

SHORT DESCRIPTION

Electronic components; measuring and test equipment; Color code and soldering; Semiconductor; P-N junction diode; Special diodes and devices; Power supply; Transistor; Transistor amplifier; Logic gates.

DETAIL DESCRIPTION

Theory:

1. Understand the Electronics, its components and measuring and testing equipments.

1.1 Define Electronics.
1.2 Describe the scope of Electronics.
1.3 Describe the active and passive components used in electronic circuits.
1.4 Define Resistor, Inductor and Capacitor and mention the function of them in electronic circuits.
1.5 Describe the procedure of determining the value of Resistor, Inductor and Capacitor using numeric and color code.
1.6 Describe the function of (i) Ammeter, (ii) Volt meter, (iii) AVO meter, (iv) Function Generator, (v) Logic Probe, (vi) Semiconductor Device Tester and (vii) Oscilloscope.

2. Understand the Concept of Semiconductor used in Electronics.

2.1 Define Semiconductor.
2.2 Describe covalent bond and the effect of temperature on Semiconductor.
2.3 Explain the energy band diagram of Conductor, Semiconductor and Insulator.
2.4 Explain the characteristics of Carbon, Silicon, Germanium and Gallium Arsenide.
2.5 Describe the classification of Semiconductor.
2.6 Describe the generation & recombination of hole and electron during doping in Extrinsic Semiconductor.
2.7 Describe the formation of P-type & N-Type Semiconductor material.
2.8 Explain the majority & minority charge carrier of P-type & N-Type Semiconductor.

3. Understand the Concept of P-N Junction Diode

3.1 Define PN junction diode
3.2 Describe the formation of depletion layer in PN junction.
3.3 Discuss potential barrier, drift & diffusion current and their physical significance.
3.4 Explain forward and reverse bias in PN junction with barrier voltage**.**
3.5 Mention the behavior of PN junction under forward and reverse bias.
3.6 Explain the forward and reverse Voltage-Current (VI) characteristics curve of PN junction diode.
3.7 Define (I) static resistance, (II) Dynamic resistance, (III) Forward breakdown voltage and (IV) Peak Inverse Voltage (PIV) and (IV) Reverse break down voltage.
3.8 Describe the specification of PN Junction diode.

4. Understand the DC power supply.

4.1 Define dc power supply and describe its importance in electronics.
4.2 Define regulated and unregulated power supply.
4.3 Describe the operation of a typical regulated dc power supply with block diagram.
4.4 Define rectifier and rectification.
4.5 Explain the operation of Half wave, Full wave and Bridge rectifier circuit.
4.6 Determine the ripple factor, efficiency and TUF of Half wave, Full wave and Bridge rectifier.
4.7 Define filter circuit and explain the operation of Capacitor, Inductor-Capacitor and pi (π) filter circuit.

5. Understand the Concepts of Special diodes.

5.1 Define Zener Diode.
5.2 Describe the operation of Zener diode.
5.3 Explain VI characteristics of Zener diode.
5.4 Explain Zener diode as a auto-variable resistor.
5.5 Describe the application of Zener diode in (i) voltage stabilization, (ii) meter protection and (iii) peck clipper circuits.
5.6 Describe the construction, operation and application of (i) Tunnel diode, (ii) Varactor diode, (iii) Schottky diode, (iv) Step-Recovery diode, (v) PIN diode, (vi) LED, (vii) LCD, (viii) photo diode and (ix) Solar cell.

6. Understand the construction and operation of Bipolar Junction Transistor (BJT)

6.1 Define Transistor.
6.2 Describe the construction of PNP and NPN Transistor.
6.3 State the biasing rules of BJT.
6.4 Explain the mechanism of current flow of PNP and NPN Transistor.
6.5 Establish the relation among Base, Emitter and Collector current ($I_E = I_C + I_B$).
6.6 Draw the three basic transistor configuration (CB, CC, CE) circuits.
6.7 Describe current amplification factor α, β and γ.
6.8 Establish the relation among α, β and γ.
6.9 Solve problem related to I_E, I_C, I_B, α, β and γ

7. Understand the concept of BJT Amplifier

7.1 Define (i) Amplifier, (ii) Amplification and (III) Gain.
7.2 Mention the classification of Amplifier.
7.3 Describe the principle of operation of a common emitter (CE) Amplifier.
7.4 Draw DC & AC equivalent circuits of the CE amplifier circuit.
7.5 Mention the formula of (i) Input resistance, (ii) Output Resistance, (iii) Current gain, (iv) Voltage gain and (v) power gain.
7.6 Solve problem related to different gain and resistance.

8. Understand the main feature of digital electronics

8.1 Describe the difference between analog and digital system.
8.2 State the advantage of digital system over analog system.
8.3 Define logic gate.
8.4 Describe the basic logic gates and their function (AND gate, OR gate and NOT circuit or INVERTER).
8.5 Describe the NAND, NOR, XOR & XNOR logic gates and their function.
8.6 Define Truth table and Prepare truth table to describe the function of AND, OR, NOT, NAND, NOR, XOR and XNOR logic gates.

Practical:

1 Show skill in identifying the electronic components.

1.1 Observe the electronic components board and read the manuals.
1.2 Identify the different types of resistors with their values, tolerance and wattage.
1.3 Identify the different types of potentiometer with their values and wattage.
1.4 Identify the different types of capacitors with their values, dc working voltages and types.
1.5 Identify the different types of diode and rectifier with the specification numbers and specifications.
1.6 Identify the different types of transistors with their specification number and specifications.
1.7 Identify the different types of LED's, IC's and miniature relays with their specification number and specification.
1.8 Identify different types of transformer with their specification.
1.9 Identify different inductors with their values and current ratings.
1.10 Study the printed circuit boards.
1.11 Sketch the symbols of components used in electronic circuits.
1.12 Describe the basic function of each component.
1.13 Write a report on above activities.

2 Show skill in electrical measurement.

2.1 Perform simple voltage and current measurements on basic series and parallel resistor circuits using the following instruments.
a) Voltmeters and ammeters.
b) AVO meters.
c) Digital multi-meter.
d) Basic CRO.

3 Show skill for determining the values of different resistors and capacitors with the help of color code.

3.1 Select color code resistors of different values.
3.2 Identify the colors and their numerical numbers.
3.3 Determine the value of resistors with tolerance.
3.4 Determine the value of capacitors and dc working voltage.
3.5 Write a report on above activities.

4 Show skill in performing soldering.

4.1 Select wires (single strand and multi strand) and cut wires to required length.
4.2 Select soldering iron, soldering tag and soldering lead.
4.3 Remove wire insulation to required length.
4.4 Clean and tin both iron and work piece.
4.5 Use a tinned iron in order to transfer adequate heat to the joint.
4.6 Joint two singles stranded wires mechanically and solder.
4.7 Joint two multi-strand wires mechanically and solder.
4.8 Perform soldering exercise for making three dimensional wire frames.
4.9 Sketch and write a report on the job.

5 Show skill in soldering & de-soldering of electronic components and wires to the other components and circuit boards.

5.1 Select electronic components, wires and PCB.
5.2 Determine the rating of the soldering iron suitable for the work piece.
5.3 Clean and tin both iron & work piece.
5.4 Feed new soldering materials to the tinned and heated joint in order to produce a correct soldering.
5.5 Check the quality of soldering.
5.6 Clean and tin iron and de-solder the joint and components.
5.7 Use solder suckers and solder braid for de-soldering.

5.8 Write a report on the Job.

6 Show skill in checking the semi-conductor diode.

6.1 Collect a range of semi-conductor diodes and manufactures literature.
6.2 Select the digital multi-meter and set the selector switch to ohm range.
6.3 Determine the specification of semi-conductor diode.
6.4 Compare the determined specification with that of manufactures literature.
6.5 Measure forward & reverse resistances of the diode.
6.6 Identify P and N side of the diode.
6.7 Determine the condition of the diode.

7 Show skill in sketching forward and reverse characteristics curves of a semiconductor diode.

7.1 Select meter, power supply, components and materials.
7.2 Complete circuit according to circuit diagram for forward bias.
7.3 Check all connections.
7.4 Measure forward bias and corresponding forward current.
7.5 Record results in tabular form.
7.6 Connect circuit according to circuit diagram of reverse bias.
7.7 Measure reverse bias and corresponding reverse current.
7.8 Record results in tabular form.
7.9 Sketch the curves from collected data.

8 Show skill in sketching waves of half wave rectifier circuit.

8.1 Select meter, component, oscilloscope and materials.
8.2 Complete circuit of a half wave rectifier according to circuit diagram.
8.3 Check the circuit before operation.
8.4 Measure the input and output voltage and observe wave shapes in the oscilloscope.
8.5 Sketch the input and output voltage wave shape.

9 Show skill in sketching waves of full wave center tapped rectifier circuit.

9.1 Select meter, component, oscilloscope and materials.
9.2 Complete a full wave rectifier circuit according to circuit diagram.
9.3 Check the circuit supply & polarity of supply.
9.4 Measure the input & output voltages and observe wave shapes in the oscilloscope.
9.5 Sketch the output voltage wave shape.
9.6 Compare the result with full wave rectifier circuit.

10 Show skill in constructing full wave bridge rectifier.

10.1 Select meter, component, oscilloscope and materials.
10.2 Build the circuit according to the circuit diagram.
10.3 Check the circuit.
10.4 Measure the input and output voltage.
10.5 Observe wave shape.
10.6 Compare the result with other rectifiers.

11 Show skill in identifying the bipolar junction transistor.

11.1 Select PNP and NPN bipolar junction transistors.
11.2 Take DMM and manufacture's literature of transistor.
11.3 Identify transistor terminals.
11.4 Measure base-emitter, base-collector, forward and reverse resistance.
11.5 Determine the specifications with help of manufacturer's literatures.
11.6 Identify PNP and NPN transistor.

12 Show skill in determining input and output characteristics of a transistor in common emitter connection.

12.1 Select component, AVO meters, circuit board and required materials.
12.2 Construct the circuit.
12.3 Adjust the biasing voltage to appropriate point.
12.4 Record input and output voltage and current.

12.5 Plot the curve with recorded data.

13 Show skill in testing special diodes.

13.1 Select different types of special diodes.
13.2 Set the AVO meter in the ohm scale.
13.3 Measure resistances for each of two terminals.
13.4 Determine the condition (good and bad).
13.5 Determine the different terminals.

14 Verify the truth tables of different types of logic gates.

14.1 Select the specific gate.
14.2 Prepare the experimental circuit.
14.3 Adjust the power supply.
14.4 Verify the truth table.

REFERENCE BOOKS :

1. A Text Book Of Applied Electronics - R.S. Sedha
2. Principles Of Electronics - V. K. Mehta
3. Basic Electronics (Solid Stater) - B. L. Theraja
4. Electronic Devices And Circuit Theory - Robert Boylestad
   - Louis Nashelsky

67033 MACHINE SHOP PRACTICE	T	P	C
	1	3	2

OBJECTIVES

- To enable recognize commonly used machine tools.
- To provide understanding the functions of commonly used machine tools.
- To develop skills in setting up and operating of machine tools.
- To provide concept of using Coolant in machining.
- To provide ability to set and operate commonly used allied tools and accessories.
- To provide understanding the operation of Milling Machine.
- To provide the concept of CNC Machine.

SHORT DESCRIPTION

Machine tools: Lathe machine; Drilling machine; Shaper; Planner; Grinding machine; Milling Machine; CNC machine; Measuring techniques.

DETAIL DESCRIPTION

Theory :

1 **Understand the concept of machine tools.**
- 1.1 State machine tools.
- 1.2 Classify commonly used machine tools.
- 1.3 Distinguish between tools and machine tools.
- 1.4 State general safety precautions to be observed in machine shop.

2 **Understand the application of Lathe machine.**
- 2.1 State the principle of Lathe machine.
- 2.2 Identify different types of lathe machines.
- 2.3 Identify major components of lathe machine.
- 2.4 Explain the function of different parts and attachments of lathe machine.
- 2.5 Carry out basic calculations for speed, feed and tapper angle for lathe works.
- 2.6 Identify single point cutting tools, tool materials, cutting angles and their relevant functions.
- 2.7 Distinguish between Single point cutting tools and multiple point cutting tools.

3. **Understand the application of Coolant in machining operation.**
- 3.1 Explain the necessity of coolant in machining.
- 3.2 Indentify different types of coolant.
- 3.3 Describe the use of various types of coolant.

4. **Understand the application of drilling machine.**
- 4.1 State the principle of drilling machine.
- 4.2 Identify different types of drilling machine.
- 4.3 Explain the function of different drilling machines.
- 4.4 Identify major components of drilling machine.
- 4.5 Illustrate work holding methods.
- 4.6 Carry out basic calculations for speed and feed.
- 4.7 Identify different types of twist drill, tool materials, cutting angles and their relevant functions.

5. **Understand the application of shaper and planner machine.**
   - 5.1 State the principle of shaper and planner machine.
   - 5.2 Identify the shaping machines.
   - 5.3 Identify major components of shaper and planner machine.
   - 5.4 Distinguish between shaper and planner machine.
   - 5.5 Describe the quick return mechanism and ram adjustments.
   - 5.6 Identify typical operations for shaper.

6 Understand the application of grinding machine.
   - 6.1 State the principle of grinding machine.
   - 6.2 Identify different types of grinding machines.
   - 6.3 Distinguish among surface grinder, cylindrical grinder and pedestal/bench grinder.
   - 6.4 Explain the need for grinding wheel balancing.
   - 6.5 Identify typical operations for the pedestal and surface grinder.
   - 6.6 Identify grinding wheel types, bonds and uses.

7 **Understand the features of milling machine.**
   - 7.1 State the meaning of Milling.
   - 7.2 Identify different types of milling machine.
   - 7.3 Indentify the principal parts of a milling machine.
   - 7.4 Distinguish among plain, universal, and vertical milling machine.
   - 7.5 Identify the various kinds of milling cutter.
   - 7.6 Mention the use of various milling cutter.
   - 7.7 Explain the purpose of indexing.

8 **Understand the concept of CNC Machine.**
   - 8.1 Define CNC machine.
   - 8.2 Distinguish between NC and CNC.
   - 8.3 State different types of CNC machine.
   - 8.4 Mention major components of CNC machine.
   - 8.5 Explain CNC programming.
   - 8.6 Explain the axis of motion.
   - 8.7 Specification of CNC Lathe Machine.

<u>Practical</u> :

1 Demonstrate the setting and operating of lathe machine.
   - 1.1 Perform simple setting up of machine, work piece, tool bit and setting machine speed and feed.
   - 1.2 Carry out machining operations for facing, parallel turning, center drilling.
   - 1.3 Produce a job to an engineering drawing specification.
   - 1.4 Carry out additional machining operations of knurling, taper turning, drilling, parting off, simple screw cutting and boring.
   - 1.5 Sharpen a number of commonly used single point cutting tools using pedestal grinder.
   - 1.6 Observe workshop safety precautions.

2 Demonstrate the setting and operating of shaping machine.
   - 2.1 Perform simple setting up of machine, work piece, tool bit, speed and feeds, ram position and stroke.
   - 2.2 Carry out machining operation for parallel shaping and vertical face shaping.
   - 2.3 Produce a simple job to an engineering drawing specification.
   - 2.4 Observe workshop safety precautions.

3 **Demonstrate the setting and operating of a drilling machine.**
   - 3.1 Perform simple setting up of machine, work piece, drill bit, speeds and feeds.

3.2 Sharpen a twist drill on the pedestal grinder.
3.3 Drill a number of holes with appropriate drill bit.
3.4 Observe workshop safety precautions.

4 **Demonstrate the setting and operating of a grinding machine.**
4.1 Determine type of wheel, grit, bond, balance and soundness by ringing.
4.2 Mount grinding wheel on machine spindle.
4.3 Use the pedestal grinder to grind single point tools and drill bits.
4.4 Perform simple setting up of surface grinding machine work piece, magnetic chuck, and hydraulic system of machine feed.
4.5 Produce a job to an engineering drawing specification.
4.6 Observe ground surface finish, grain direction, bouncing of wheel.
4.7 Carry out wheel dressing exercise on both pedestal grinder and surface grinder.
4.8 Observe workshop safety precautions.

5 Demonstrate workshop maintenance practice.
5.1 Produce a maintenance schedule common used in machine shop.
5.2 Carry out simple maintenance procedures, including lubrication.
5.3 Observe workshop safety precautions.

6 Milling machine setting and operation.
6.1 Set up the machine vice and hold work piece to produce a flat surface using a milling cutter.
6.2 Produce the parallel and slotted work piece using appropriate cutter.

7 Demonstrate CNC Lathe operation
7.1 Check machine connection before starting.
7.2 Setup machine zero (Axes).
7.3 Setup work offset.
7.4 Setup tool offset.
7.5 Load the tool and hold the work piece.
7.6 Program Lathe operation (Job).
7.7 Practice various operation (Turning, facing, drilling etc.).

REFERENCE BOOKS

1 Basic Machine Shop Practice I & II
— V. K. Tejwani
2 Workshop Technology I & II
— W. A. J Chapman
3 Machine Shop Practice I & II
— Berghardt
4 Machine Shop Practice
— Somenath De
5 Machine tool operation
— Anderson.

65931 MATHEMATICS -3

T	P	C
3	3	4

AIMS

- To enable to calculate the areas of regular polygons, hexagons, octagon, hydraulic mean depth (HMD) of a channel, area occupied by water of circular culvert. Excavation work.
- To provide the ability to calculate volume of regular solids like pyramid frustum of pyramid, prismoid, wedge and area of curved surfaces.
- To enable to use the knowledge of gradient of a straight line in finding speed, acceleration etc.
- To enable to use the knowledge of conic in finding the girder of a railway bridge, cable of a suspension bridge and maximum height of an arch.
- To make understand the basic concept and techniques of composition and resolution of vectors and computing the resultant of vectors.

- **SHORT DESCRIPTION**

Menstruation : Area of rectangles, squares, triangles, quadrilaterals, parallelograms, rhombus, trapezium, circle, sector, segment; Volume of rectangular solids, prism, parallelepiped, pyramids, cones, spheres, frustum of pyramid and cone; Area of curved surface of prism, Cylinder cone, pyramid and frustum of cone.

Co-ordinate Geometry: Co-ordinates of a point, locus and its equation, straight lines, circles and conic.

Vector: Addition and subtraction, dot and cross product.

DETAIL DESCRIPTION

MENSURATION:

1 Apply the concept of area of triangle.

1.1 Find the area of triangle in the form,

i) $A=\frac{\sqrt{3}}{4}a^2$, a = length of a side of equilateral triangle.

ii) $A=\frac{c}{4}\sqrt{4a^2-c^2}$, where a = length of equal sides, c = third side.

iii) $A=\sqrt{s\ (s-a)(s-b)(s-c)}$, where a, b, c = length of the sides of a triangle and 2s is the perimeter of the triangle.

1.2 Use formula in 1.1 to solve problems.

2 Apply the concept of finding areas of quadrilateral & Parallelogram & finding areas of rhombus & trapezium.

2.1 Define quadrilateral & Parallelogram.
2.2 Find the areas of quadrilateral when off sets are given.
2.3 Find the areas of a parallelogram.
2.4 Solve problems using above formulae.
2.5 Define rhombus & trapezium.
2.6 Find the areas of rhombus when the diagonals are given.
2.7 Find the areas of trapezium in terms of its parallel sides and the perpendicular distance between them.
2.8 Solve problems related to rhombus & trapezium.

3 Apply the concept of finding areas of regular polygon.

3.1 Define a regular polygon.
3.2 Find the area of a regular polygon of n sides, when
i) The length of one side and the radius of inscribed circle are given.
ii) The length of one side and the radius of circumscribed circle are given.
3.3 Find the area of a regular.
a) Hexagon
b) Octagon when length of side is given.
3.4 Solve problems of the followings types:

A hexagonal polygon 6 m length of each side has a 20 cm width road surrounded the polygon. Find the area of the road.

4 Understand areas of circle, sector and segment.

4.1 Define circle, circumference, sector and segment.
4.2 Find the circumference and area of a circle when its radius is given.
4.3 Find the area of sector and segment of a circle.
4.4 Solve problems related to the above formulae.

5 Apply the concept of volume of a rectangular solid.

5.1 Define rectangular solid and a cube.
5.2 Find geometrically the volume of a rectangular solid when its length, breadth and height are given.
5.3 Find the volume and diagonal of a cube when side is given.
5.4 Solve problems with the help of 6.2 & 6.3.

6 Apply the concept of surface area, volume of a prism, parallelepiped and cylinder.

6.1 Define a prism, parallelepiped and a cylinder.
6.2 Explain the formulae for areas of curved surfaces of prism, parallelepiped and cylinder.
6.3 Explain the formulae for volume of prism, parallelepiped and cylinder when base and height are given.
6.4 Solve problems related to 7.2, 7.3.

7 Apply the concept of the surface area, volume of pyramid, cone and sphere.

7.1 Define pyramid, cone and sphere.
7.2 Explain the formula for areas of curved surfaces of pyramid, cone and sphere.
7.3 Explain the formula for volumes of pyramid, cone and sphere.
7.4 Solve problems related to 8.2, 8.3.

CO-ORDINATE GEOMETRY

8 Apply the concept of co-ordinates to find lengths and areas.

8.1 Explain the co-ordinates of a point.
8.2 State different types of co-ordinates of a point.
8.3 Find the distance between two points (x_1, y_1) and (x_2, y_2).
8.4 Find the co-ordinates of a point which divides the straight line joining two points in certain ratio.
8.5 Find the area of a triangle whose vertices are given.
8.6 Solve problems related to co-ordinates of points and distance formula.

9 Apply the concept of locus & the equation of straight lines in calculating various Parameter.

9.1 Define locus of a point.
9.2 Find the locus of a point.
9.3 Solve problems for finding locus of a point under certain conditions.
9.4 Describe the Equation x=a and y=b and slope of a straight line.
9.5 Find the slope of a straight line passing through two point $(x_1, y_1,)$ and (x_2, y_2).
9.6 Find the equation of straight lines:
(i) Point slope form.
(ii) Slope Intercept form.
(iii) Two points form.
(iv) Intercept form.
(v) Perpendicular form.
9.7 Find the point of intersection of two given straight lines.
9.8 Find the angle between two given straight lines.
9.9 Find the condition of parallelism and perpendicularity of two given straight lines.
9.10 Find the distances of a point from a line.

10 Apply the equations of circle, tangent and normal in solving problems.

10.1 Define circle, center and radius.

10.2 Find the equation of a circle in the form:

(i) $x^2 + y^2 = a^2$

(ii) $(x - h)^2 + (y - k)^2 = a^2$

(iii) $x^2 + y^2 + 2gx + 2fy + c = 0$

10.3 Find the equation of a circle described on the line joining (x_1, y_1) and (x_2, y_2).

10.4 Define tangent and normal.

10.5 Find the condition that a straight line may touch a circle.

10.6 Find the equations of tangent and normal to a circle at any point.

10.7 Solve the problems related to equations of circle, tangent and normal.

11 Understand conic or conic sections.

11.1 Define conic, focus, Directorx and Eccentricity.

11.2 Find the equations of parabola, ellipse and hyperbola.

11.3 Solve problems related to parabola, ellipse and hyperbola.

VECTOR :

12 Apply the theorems of vector algebra.

12.1 Define scalar and vector.

12.2 Explain null vector, free vector, like vector, equal vector, collinear vector, unit vector, position vector, addition and subtraction of vectors, linear combination, direction cosines and direction ratios, dependent and independent vectors, scalar fields and vector field.

12.3 Prove the laws of vector algebra.

12.4 Resolve a vector in space along three mutually perpendicular directions

12.5 Solve problems involving addition and subtraction of vectors.

13 Apply the concept of dot product and cross product of vectors.

13.1 Define dot product and cross product of vectors.

13.2 Interpret dot product and cross product of vector geometrically.

13.3 Deduce the condition of parallelism and perpendicularity of two vectors.

13.4 Prove the distributive law of dot product and cross product of vector.

13.5 Explain the scalar triple product and vector triple product.

13.6 Solve problems involving dot product and cross product.

Reference

SL No	Athour	Title	Publication
01	G. V. Kumbhojkar	Companian to basic Maths	Phadke Prakashan
02	Murary R Spigel	Vector & Tensor Analysis	Schaum's Outline Series
03	Md. Abu Yousuf	Vector & Tensor Analysis	Mamun Brothers
04	Rahman & Bhattacharjee	Co-ordinate Geometry & Vector Analysis	H.L. Bhattacharjee
05	Md. Nurul Islam	Higher Mathematics	Akkhar Patra Prakashani

65913 CHEMISTRY

T	P	C
3	3	4

Objectives:

1. **To Understand Mole Concept And Volumetric Analysis.**
2. **To Represent The Formation Of Bonds In Molecules.**
3. **Able To Select Appropriate Materials Used In Construction.**
4. **Apply Knowledge To Enhance Operative Life Span Of Engineering Material And Structure By Various Protective Methods.**

Short Description: Chemistry Is A Basic Science Subject Which Is Essential To All Engineering Courses. It Gives Knowledge Of Engineering Material, Their Properties Related Application And Selection Of Material For Engineering Application. It Is Intended To Teach Student The Quality Of Water And Its Treatment As Per The Requirement And Selection Of Various Construction Materials And Their Protection By Metallic And Organic Coatings. The Topics Covered Will Provide Sufficient Fundamental As Well As Background Knowledge For The Particular Branch.

Section - 01 (Physical and Inorganic Chemistry)

1. Atomic Structure and Chemical Bond

1.1 Definition of Element, Atoms, Molecules, Fundamental Particle of Atom, Their Mass, Charge, Location.
1.2 Definition of Atomic Number, Mass Number, Isotope, Isotone and Isobar.
1.3 Electronic Configuration Based on Hunds Rule, Aufbau's Principle, Paulis Exclusion Principle
1.4 Definition Of Atomic Weight, Equivalent Weight of An Element, Molecular Weight, Mole In Terms of Number, Mass, Volume.
1.5 Define Symbol, Valency And Formula.
1.6 Explain Chemical Bond, Octet Rule.
1.7 Explain Formation of Various Types of Chemical Bonds: Covalent, Ionic, Co-Ordinate Bond.
1.8 Explain The Bonding Along With Example CH_4 , H_2, O_2, Nacl, $Mgcl_2$.
1.9 Explain Quantum Number, Orbit And Orbital.

2. Ionic Equilibrium

2.1 Concept of Acid, Base, Salt and Types Of Salts.
2.2 Ph, Poh, Ph Scale.
2.3 Basicity of An Acid and Acidity of A Base.
2.4 Normality, Molarity, Molality, Volumetric Analysis.
2.5 Titration and Indicator.
2.6 Buffer Solution and Its Mechanism.

3. Chemical Reaction, Oxidation and Reduction.

3.1 Define Chemical Reaction And Explain The Various Type Of Chemical Reaction.
3.2 Explain The Full Meaning Of A Chemical Equation.
3.3 Concept of Catalyst.
3.4 Modern Concept of Oxidation and Reduction.
3.5 Simultaneous Process of Oxidation and Reduction.
3.6 Explain The Oxidation Number.

4. Water Treatment

4.1 Concept of Hard And Soft Water
4.2 Hardness of Water
4.3 Describe The Softening Method Of Permuted Process And Ion Exchange Resin Process.
4.4 Advantage and Disadvantage of Hard Water in Different Industries.
4.5 Water Treatment Plant Visit and Reporting.

5. Corrosion And Alloy

5.1 Types of Corrosion. (Dry and Wet Corrosion)
5.2 Atmospheric Corrosion, Types Of Atmospheric Corrosion And Their Mechanism, Oxide Films Factors Affecting Atmospheric Corrosion.
5.3 Electrochemical Corrosion, Mechanism of Electrochemical Corrosion.Types of Electrochemical Corrosion. Factors Affecting Electrochemical Corrosion.
5.4. Protective Measures Against Corrosion: Coating (Galvanic and Zinc, Organic Coating Coating Agents, Electroplating, Metal Cladding)
5.5 Concept of Alloy.

Section -2 (Organic Chemistry)

6. Organic Chemistry and Introduction to Polymers:

6.1 Types of Chemistry.
6.2 Catenation Property of Carbon.
6.3 Organic Compounds, Its Properties and Applications.
6.4 Classification of Organic Compound By Structure and Functional Group: Definne: Homologous Series, Alkanes, Alkenes and Alkynes; Properties And Uses of General Formula ; Names and Structure of First Five Members Hydrocarbons .
6.5 Polymer, Monomer, Classification of Polymers, Polymerization, Addition and Condensation Polymerization.
6.6 Plastics: Definition, Its Types and Uses.

Section -3 (Industrial Chemistry)

7. Glass and Ceramic:

7.1 Concept of Glass and Its Constituents, Classification and Uses of Different Glass, Elementary Idea of Manufacturing Process of Glass.
7.2 Introduction to Ceramic Materials, Its Constituent.
7.3 Industrial Application of Glass and Ceramic.
7.4 Industry Visit and Reporting.

8. Soap and Detergent:

8.1 Introduction - A. Lipid B. Fats and Oils
8.2 Saponification of Fats and Oils, Manufacturing Of Soap.
8.3 Synthetic Detergent, Types of Detergents and Its Manufacturing.
8.4 Exclusives: TNT, RDX, Dynamite.
8.5 Paint and Varnish
8.6 Adhesives.

9. Cement, Pulp And Papers:

9.1 Concept of Cement and Its Constituents, Classification and Uses of Different Cement, Manufacturing Process 0f Cement.
9.2 Manufacturing Process of Pulp and Papers.
9.3 Industry Visit and Reporting.

Section - 4 (Practical Chemistry)

1. Use Of Laboratory Tools And Safety Measures

2. Observation And Measurement :

2.1 Determine the Strength of Hcl Solution Using 0.1N Na_2CO_3

2.2 Determine The Strength of Naoh By Using 0.1N Hcl Solution.

3. Qualitative Analysis Of Known And Unknown Salts :

3.1 Identification of Known Salt (Sample Copper, Iron, Aluminum, Led, Ammonium and Zinc Salt.)

3.2 Identification of Unknown Basic Radical (E.G. Led, Copper, Iron, Zinc, Aluminum, Ammonium)

3.3 Identification of Unknown Acid Radicals (E.G. Chloride, Nitrate, Sulphate, Carbonate)

Source or Reference Book

1. Higher Secondary Chemistry (Paper 1st And 2nd)- Writer Dr.Gazi Md.Ahsanul Karim. And Md.Robiul Islam
2. Higher Secondary Chemistry (Paper 1st And 2nd)- Writer Dr.Soroz Kanti Singha Hazari .
3. An Introduction To Metallic Corrosion And Its Prevention- Writer Raj Narayan.
4. Organic Chemistry- Writer Morrisson And Boyad.
5. Inorganic Chemistry - Writer Ali Haider

65812 PHYSICAL EDUCATION AND LIFE SKILL DEVELOPMENT T P C
0 3 1

OBJECTIVES

- To enhance body fitness.
- To make aware of First Aid Procedure.
- To acquaint with the Common games and sports.
- To develop Life Skill.

SHORT DESCRIPTION

Warm up; Yoga; Muscle developing with equipment; Meditation, First aid; sports science, Games & sports; Life skill development.

DETAIL DESCRIPTION

1. National Anthem and Assembly

1.1 Line and File.
1.2 Make assembly.
1.3 Recitation of national anthem.
1.4 National anthem in music.

2. Warm up

2.1 **General Warm-up :**
Spot running (Slow, Medium & Fast), Neck rotation, Hand rotation, Side twisting, Toe touching, Hip rotation, Ankle twisting, Sit up and Upper body bending (Front & Back).

2.2 **Squad Drill :**
Line, File, Attention, Stand at easy, Stand easy, Left turn, Right turn, About turn, Mark time, Quick march, Right wheel, Left wheel, Open order march & Closed order march.

2.3 **Specific warm up :**
Legs raising one by one, Leg raising in slanting position, Knee bending and nose touching, Heels raising, Toes touching (standing and laying position), Hand stretch breathing (Tadasana, Horizontal, Vertical).

2.4 Mass Physical Exercise
Hand raising, Side twisting, Front & back bending, Front curl, Straight arm curl two hand, Hands raising overhead and Push up.

3. Yoga

3.1 Dhyanasan : Shabasan, Padmasan, Gomukhasan, Sharbangasan, shashangasan Shirshasan
3.2 Shasthyasan : Halasan, Matshasan, Paban Muktasan, Ustrasan.
3.3 Prana and Pranayama: Nadisuddhi Pranayma, cooling pranayamas (sitali pranayama, Sitkari Pramayama, sadanta pranayama), Ujjayi pranayama,

4. Muscle Developing with equipment

4.1 Damball : Front curl, Hand sidewise stretching, Arms raising overhead.
4.2 Barball : Front press, Leg press, Rowing motion with leverage bar.
4.3 Rope climbing : Straight way climbing, Leg raising climbing.
4.4 Horizontal bar : Chinning the bar with front grip, Chinning the bar with wide back grip.
4.5 Jogging Machine : Slow, Medium, and Fast running.
4.6 A. B king pro (Rowing Machine): Sit up.
4.7 Sit up bench: Sit up.

5 **Meditation**

5.1 Define meditation.
5.2 Classification of Meditation.

5.3 Nadanusandhana (A-Kara chanting, U-Kara chanting, M-Kara chanting, AUM-kara chanting.
5.4 OM-Meditation.
5.5 Cyclic Meditation (Starting Prayer, Instant Relaxation Technique, Centring, Standing Asanas, Sitting Asanas, Quick Relaxation Technique).

6. **First Aid**
6.1 Define First Aid.
6.2 What do you mean by First Aider.
6.3 Discuss the responsibilities of a First Aider.
6.4 Different types of equipment of First Aid.
6.5 Muscle Cramp-Ice application (Remedy).
6.7 Dislocation-Ice application (Remedy).

7. Rules and Technique of games and sports
7.1 Kabadi.
7.2 Football.
7.3 Cricket.
7.4 Badminton.
7.5 Athletics.
7.6 Swimming.

8. Sports Science
8.1 Definition of Exercise physiology.
8.2 Function of muscles.
8.3 Concept of work, energy and power.
8.4 Effect of exercise on heart and circulatory system.
8.5 Motor components for physical fitness.
8.6 Definition of sports Biomechanics.
8.7 Definition of sports psychology.
8.8 Meaning of nutrition, Diet and Balanced diet.
8.9 Meaning of the terms –Test, measurement and Evaluation.

9. Show skill on conversation on day to day life
9.1 Today's Market price.
9.2 Festivals(religious festivals, National festivals).
9.3 Celebration of National days.
9.4 Aim in life.
9.5 Visited historical places/sites.

10. Human relation
10.1 Family relation.
10.2 Relation with nighbour.
10.3 Humanitarian Service.
10.4 Service for handicapped (intelligent, physical, social etc).
10.5 Service for orphan / Patient.

11 Vote of appreciation
11.1 About dress .
11.2 For good work.
11.3 For good result.
11.4 For good news.

12. Stress Management
12.1 Habit to be a man of humor.
12.2 Always brain should be cool.
12.3 Positive thinking.
12.4 Factors that determine our attitude.
12.5 The benefits of a positive attitude.
12.6 Steps to building a positive attitude.

13 Time Management

13.1 Determine essential time for a task.
13.2 Determine delay and unexpected time.
13.3 Determine time for daily activities .
13.4 Plan for daily activities.

14 Interview Technique

14.1 Mental preparation to face an interview.
14.2 Selection of dress for interview.
14.3 Introducing himself/herself to the interviewer .
14.4 Coping interview.

15 Team work

15.1 Organized a team.
15.2 Selection of team leader.
15.3 Distribution the task to the members.
15.4 Accepting opinion of team members.
15.5 Completion of task as a team.

16 Social work

16.1 Tree plantation.
16.2 Community service.
16.2.1 Rover Scout.
16.2.2 Sanitation.
16.2.3 Pure drinking water.
16.2.4 Social Culture.

Reference Book

Modern Yoga _Kany Lal Shah
Rules of games and sports_ Kazi Abdul Alim
Yoga _ Sobita Mallick
Iron Man_ Nilmoni Dass

BANGLADESH TECHNICAL EDUCATION BOARD

Agargoan, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

SYLLABUS (PROBIDHAN-2016)

SHIPBUILDING TECHNOLOGY

TECHNOLOGY CODE: **680**

4th SEMESTER

DIPLOMA IN ENGINEERING

PROBIDHAN-2016

SHIPBUILDING TECHNOLOGY (680)

4th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68041	Shipbuilding Drawing -1	0	6	2	0	0	50	50	100
2	68042	Shipyard Practice	2	3	3	40	60	25	25	150
3	68043	Sheet Metal & Metal Forming	1	3	2	20	30	25	25	100
4	67041	Engineering Mechanics	3	3	4	60	90	25	25	200
5	67042	Metallurgy	2	3	3	40	60	25	25	150
6	67911	I C Engine Principles	2	3	3	40	60	25	25	150
7	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
Total			**12**	**24**	**19**	**240**	**360**	**200**	**200**	**950**

68041 Shipbuilding Drawing-I

T	P	C
0	6	2

AIMS:

To be able to develop knowledge, skills and attitude in the area of Shipbuilding Drawing with special emphasis on:

- Various Shipbuilding Drawing Symbols.
- General Arrangement Drawing.
- Lines Plan Drawing

SHORT DESCRIPTION:

Various Shipbuilding Symbols, General Arrangement Drawing of Pontoon, General Arrangement Drawing of General Cargo, General Arrangement Drawing of Tugboat, Lines Plan Drawing of round bilge type, Lines Plan Drawing of Chine type.

DETAIL DESCRIPTION:

Practical:

1. Familiar with the Various Shipbuilding Drawing Symbols.

1.1. Identify the Various Shipbuilding Drawing Symbols.

1.2 Interpret information from drawing containing standard symbols.

2. Perform the General Arrangement Drawing of a Pontoon.

2.1 Draw the Elevation of a Pontoon according to the measurement and level it.

2.2 Draw Main Deck Plan of a Pontoon according to the measurement and level it

2.3 Draw Bottom Plan of a Pontoon according to the measurement and level it.

3. Perform the General Arrangement Drawing of a General Cargo Ship

3.1 Draw the Elevation of a General Cargo Ship according to the measurement and level it.

3.2 Draw Various Deck Plan of a General Cargo Ship according to the measurement and level it.

3.3 Draw Bottom Plan of a General Cargo Ship according to the measurement and level it.

4. Perform the General Arrangement Drawing of a Passenger Ship

4.1 Draw the Elevation of a Passenger Ship according to the measurement and level it.

4.2 Draw Various Deck Plan of a Passenger Ship according to the measurement and level it.

4.3 Draw Bottom Plan of a Passenger Ship according to the measurement and level it.

5. Perform the General Arrangement Drawing of a Tugboat

3.1 Draw the Elevation of Tugboat according to the measurement and level it.

3.2 Draw Various Deck Plan of Tugboat according to the measurement and level it.

3.3 Draw Bottom Plan of Tugboat according to the measurement and level it.

6. Perform the Lines Plan Drawing of Round Bilge Cargo Vessel.

6.1 Draw Profile/Sheer plan according to the GA of a Cargo Ship.

6.2 Draw Half-breadth Plan according to the GA of a Cargo Ship

6.3 Draw Body Plan according to the GA of a Cargo Ship.

6.4 Make offset table of the Lines Plan.

7. Perform the Lines Plan Drawing of Chine Type Tugboat.

7.1 Draw Profile/sheer plan according to the GA of a Tugboat.

7.2 Draw Half-breadth Plan according to the GA of a Tugboat.

7.3 Draw Body Plan according to the GA of a Tugboat.

7.4 Make offset table of the Lines Plan.

REFERENCE BOOKS:

1. Reeds Engineering Drawing for Marine Engineers .Vol-II - H.G. Beck C. Eng.
2. Ship Construction - D.J. EYRES
3. Ship Construction SKETCHES & NOTES - Kemp & Yourg
4. Reeds Ship Construction for Marine Engineer - E.A. STOKOE.

68042 Shipyard Practice

T	P	C
2	3	3

AIMS:

To be able to develop knowledge, skill and attitude in the area of Shipyard Practice with special emphasis on:

- Shipyard and Shipbuilding.
- Mold lofting of different frames, bulkheads, lines plan and template
- Lines Plan Drawing, its related terms and Offset Table.
- Ship Survey and common Hull Repairing.

SHORT DESCRIPTION

Shipyard and modern shipyard; Layout of shipyard; Shipbuilding Methods ; Lines Plan Drawing and its related terms; Mold loft and its purpose; Mold lofting of Various Frames & Bulkheads; Template; Shipyard Management; Ship survey and common hull repairing; Mold lofting of ordinary and web frames; Mold lofting of Lines Plan of single chine , double chine and round bilge midship section.

DETAIL DESCRIPTION

Theory:

1. Understand the concept of Shipyard and Modern Shipyard.

1.1 Define shipyard.
1.2 Mention at least ten shipyards in Bangladesh.
1.2 Classify shipyard.
1.3 Explain the function and importance of a shipyard.
1.4 Describe the characteristics and facilities of a modern shipyard.
1.5 Explain the difference between shipyard and dockyard.
1.6Explain the difference between slipways and dry-dock.
1.7 Explain the safety precaution in shipyard & protective device

2. Understand the layout of a shipyard.

2.1 Define layout of a shipyard.
2.2 Explain the necessity of proper layout of a shipyard.
2.3 Describe layout plan of a shipyard.
2.4 Mansion the list of machineries and equipments of Shipyard.
2.5 Explain the berth.
2.6 Explain stockyard.
2.7 Explain the mooring system of a shipyard.

3. Understand shipbuilding methods.

3.1 Mention the methods of shipbuilding.
3.2 Classify the methods of shipbuilding.
3.3 Describe various methods of shipbuilding.
3.4 Explain the shipbuilding process.

4. Understand Lines Plan Drawing and its related terms.

4.1 Define Sheer plan, Half Breadth Plan and Body Plan with figures.
4.2 Identify and Define Buttock lines, Water lines and stations/frames with figures.

4.3 Define Offset and Offset table.
4.4 Mention the parameters of an Offset table in Lines Plan Drawing.
4.5 Describe the conditions of Buttock lines, Water lines and Stations/frames when they become curved in figures.

5. Understand the mold loft and its purpose.

5.1 Define mold loft.
5.2 Explain lofting floor.
5.3 Mention principal equipments of a mold loft.
5.4 Describe the purposes of a mold loft.

6. Understand the mold loft of Various Frames & Bulkheads.

5.1 Define Ordinary Frame & explain the lofting of ordinary frame.
5.2 Define Web Frame & explain the lofting of web frame.
5.3 Define Bulkhead & explain the lofting of bulkhead.

7. Understand the template.

6.1 Define template.
6.2 Mention principal equipments for making template.
6.3 Describe the necessity of template in measurement.

8. Understand the Shipyard Management.

7.1 Define Shipyard Management.
7.2 Explain the function of shipyard management.
7.4 Explain the procedure of shipyard management.
7.5 Explain the safety and health management of a shipyard.

9. Understand the concept of ship survey and hull repairing.

8.1 Define survey of ship.
8.2 Classify survey of ship.
8.3 Define docking and undocking.
8.4 Explain about hull Inspection and hull Repairing.
8.5 Explain about Inspection of Ship Painting.
8.6 Explain about Stern Frame Inspection and propeller.

PRACTICAL:

1. Perform the mold lofting of ordinary frame.

1.1 Identify ordinary frame.
1.2 Set up the mold lofting of the ordinary frame according to the measurement.
1.3 Make the template of ordinary frame from its mold lofting.

2. Perform the mold lofting of the web frame.

2.1 Identify web frame.
2.2 Set up the mold lofting of web frame according to the measurement.
2.3 Make the template of web frame from its mold lofting.

3. Perform the mold lofting of bulkhead.

3.1 Identify bulkhead.
3.2 Set up mold lofting of bulkhead frame according to the measurement.
3.3 Make template of bulkhead from its mold lofting.

4. Perform the mold lofting of lines plan of single chine midship section.

4.1 Identify single chine midship section.

4.2 Prepare mold lofting of single chine midship section according to the measurement.

4.3 Make template of single chine midship section from its mold lofting.

5. Perform the mold lofting of lines plan of double chine midship section.

5.1 Identify double chine midship section.

5.2 Prepare mold lofting of double chine midship section according to the measurement.

5.3 Make template of double chine midship section from its mold lofting.

6. Perform the mold lofting of lines plan of round bilge midship section.

6.1 Identify round bilge midship section.

6.2 Prepare mold lofting of round bilge midship section according to the measurement.

6.3 Make template of round bilge midship section from its mold lofting.

REFERENCE BOOKS:

1. Ship Construction - E. A Stokoe - Thomas Reeds Publication Ltd., 1975/Latest Edition.

2. Ship Construction - D.J.Eyres - Butterworth/Heineman,5th Edition/ Latest Edition.

3. Structural Design of Sea going Ship - Barnovy.

4. Rules for the Classification and Construction of Sea going Steel Ship - Polski Rejesten Stallkow,1961/ Latest Edition.

5. Modern Ship Design - Thomas C.Gillmart - Naval Institute Press, third Edition/ Latest Edition.

68043 Sheet Metal & Metal Forming

T	P	C
1	3	2

AIMS:

To be able to develop knowledge and skill in the areas of sheet metal and metal forming with special emphasis on:

- Concept of sheet metal and metal forming work
- Sheet metal tools and equipments
- Making different type of sheet metal product
- Layout the plan and fabrication of sheet metal work

SHORT DESCRIPTION:

Concept of sheet metal work, Sheet metal hand tools, Sheet metal machine, Sheet metal operation, sheet metal joints, Sheet metal fastener, Sheet metal soldering joints, laying out of drawing, metal forming, Cold-forming of metal, Cold forming press, punch and die.

DETAIL DESCRIPTION:

Theory:

1. **Understand the sheet metal work**
   - 1.1 Define sheet metal work
   - 1.2 Mention the application area of sheet metal work
   - 1.3 List the phases of sheet metal work
   - 1.4 Explain the phases of sheet metal work
   - 1.5 List the materials used in sheet metal work
   - 1.6 Explain the importance of sheet metal work
   - 1.7 Explain the safety precaution in sheet metal work & protective device
2. **Understand the sheet metal work hand tools**
   - 2.1 List the hand tools used for sheet metal work
   - 2.2 Classify the tools used for sheet metal work
   - 2.3 Explain the functions of each type of tool.
   - 2.4 Explain the function of groovier, rivet set and rivet gun
   - 2.5 Describe the various types of hand snips and their uses
3. **Understand the sheet metal machine**
   - 3.1 Mention the machines used for sheet metal work
   - 3.2 Explain the bar folding machine and types of job perform by the machine
   - 3.3 Explain the slip roll-forming machine and its function
   - 3.4 Describe Portable power shears and circle cutting machine
   - 3.5 Describe the polishing machine.
4. **Understand the sheet metal operation**
   - 4.1 Explain sheet metal operation.
   - 4.2 Explain turning, burring, raising, forming, grooving and griping operation.
   - 4.3 Explain difference between plain forming and roll-forming.
   - 4.4 Explain various types bending operation with stack.

5. **Understand the sheet metal joint**
   - 5.1 Define sheet metal joint.
   - 5.2 Explain types of sheet metal joints.
   - 5.3 Define the hems.
   - 5.4 Explain various types of hems.
   - 5.5 Define the seams.
   - 5.6 Explain various types of seams.

6. **Understand the sheet metal fastener**
   - 6.1 Define fastener.
   - 6.2 List the different types of fasteners used in sheet metal work.
   - 6.3 Explain sheet metal rivets, their sizes and shapes.
   - 6.4 Explain various types of sheet metal screws.
   - 6.5 Explain various types of installation fasteners.
   - 6.6 Describe the method of fixing the fasteners.

7. **Understand the sheet metal soldering.**
   - 7.1 Define soldering.
   - 7.2 Explain different types of solder and their composition.
   - 7.3 Explain the process of soft and hard soldering.
   - 7.4 Mention the soldering tools.
   - 7.5 Define flux.
   - 7.6 Explain the function of flux in soldering.

8. **Understand the laying out of drawing.**
   - 8.1 Define pattern and template.
   - 8.2 Explain parallel line development method.
   - 8.3 Explain radial line development method.
   - 8.4 Explain bending and wiring allowances for sheet metal.
   - 8.5 Mention the difference between paper pattern and template.

9. **Understand the metal forming.**
   - 9.1 Describe rolling, bending and twisting of metal.
   - 9.2 Explain universal bender.
   - 9.3 Explain die-acro bender.

10. **Understand the punch and die**
    - 10.1 Define punch and die.
    - 10.2 Explain the function of die and punch.
    - 10.3 Describe simple and compound die and punch
    - 10.4 Describe progressive die and punch
    - 10.5 Explain solid and hollow punches
    - 10.6 Distinguish between drill and punches holes

11. **Understand sheet metal welding.**
    - 11.1 Define sheet metal welding.
    - 11.2 Describe the working principle of sheet metal welding.
    - 11.3 List the sheet metal welding tools.
    - 11.4 List the sheet metal welding machines.
    - 11.5 Mention the types of sheet metal welding.
    - 11.6 Mention the purpose of sheet metal welding.

11.7 Mention the application of sheet metal welding.

PRACTICAL:

1. **Perform the identification of sheet metal hand tools**
   - 1.1 Identify common hand tools used in sheet metal workshop
   - 1.2 Inspect cutting tools to determine sharpness
   - 1.3 Identify tools according to functions
   - 1.4 Use tools and equipments for sheet metal work
2. **Perform the marking out and measurement in sheet metal work**
   - 2.1 Identify marking and layout tools
   - 2.2 Identify marking out and layout techniques in sheet metal working
   - 2.3 Perform the use of marking tools
   - 2.4 Use micrometer, vernier caliper and other gauges
   - 2.5 Perform measurement in sheet metal work
   - 2.6 Mark out a sheet metal job
3. **Perform the identification of common machinery of sheet metal work**
   - 3.1 Identify common sheet metal working machinery in the sheet metal shop
   - 3.2 Use sheet metal machinery
   - 3.3 Practice on cutting with different types of snips, cutting off inside and outside curve, cutting off notches
   - 3.4 Carry out maintenance procedure of machinery
4. **Perform the sheet metal processes.**
   - 4.1 Maintain safety rules in sheet metal work
   - 4.2 Perform seaming, wiring, bending, folding, riveting, and soldering
   - 4.3 Perform joining processes and edging processes
5. **Perform the sheet metal operation**
   - 5.1 Perform turning, burring, raising, forming, grooving and griping operation to make box, tray, funnel, duct etc with the help of drawing design
6. **Perform the sheet metal forming**
   - 6.1 Perform rolling operation
   - 6.2 Perform bending operation
   - 6.3 Perform scrolling and rolling operation by universal bender and die- arco bender
7. **Perform dieing and punching**
   - 7.1 Perform dieing operation
   - 7.2 Perform punching operation

REFERERNCE BOOKS:

1. Sheet Metal Shop Practice - Leoa Meyer - American Technical Society, 4th Edition
2. Technical Metal - Heralad V. Iohnson - Ches. A. Benett-Collncs
3. Basic Sheet Metal Practice - J. W. Giachinu
4. Sheet Metal and Metal Forming - Md. Monowar Hossain

67041 Engineering Mechanics

T	P	C
3	3	4

AIMS:

- To facilitate understanding the fundamental of units and their conversions.
- To provide the understanding of force, effect of the force, composition and resolution of forces and computing the resultant force & couple
- To provide the understanding of parallel forces, to provide understanding the centroid and enable to computing the center of gravity &the moment of inertia.
- To enable to understand the laws of friction and the coefficient of friction& the ability of computing frictional forces of reactions of surfaces.
- To provide to understanding of deriving support reactions and types of loading of beam and trusses.
- To facilitate the understanding of work, power, energy, projectile lifting machine and gear trains.

SHORT DESCRIPTION

Fundamental of mechanics and unit conversion, Composition and resolution of forces. Moment and their applications. Equilibrium of force and couples, centroid and center of gravity, moment of inertia. Friction, support reactions, frame and truss, projectiles, work, power and energy, lifting machine, gear trains.

Theory:

1. **Understand Fundamental of Mechanics.**
   - 1.1. Define mechanics.
   - 1.2. Classify applied mechanics.
   - 1.3. Importance of units in the engineering field.
   - 1.4. Discuss the conversion of units.
   - 1.5. Illustrate the fundamental mathematics (algebra, trigonometry & calculus) used in mechanics.
2. **Understand the composition and resolution of forces.**
   - 2.1. State the effect and characteristics of a force.
   - 2.2. Describe different system of forces.
   - 2.3. Describe resultant force and composition of forces.
   - 2.4. Find the resultant force graphically and analytically.
   - 2.5. State the laws of forces.
   - 2.6. Define resolution of a force.
   - 2.7. Deduce the formula for finding the rectangular components.
   - 2.8. Find the magnitude and position of the resultant force graphically and analytically
   - 2.9. Solve problems related to resultant force.
3. **Understand the aspects of moment of forces and couples.**
   - 3.1. Define moment of force and mention the units of moment.
   - 3.2. Identify the clockwise and anticlockwise moment.
   - 3.3. State the Varignon's principle of moments.
   - 3.4. State the laws of moments.
   - 3.5. Define and classify the lever.
   - 3.6. State and classify parallel forces.
   - 3.7. Define and classify a couple.
   - 3.8. Solve the problems related to couple.

3.9. Solve problems related to moment of forces and couple.

4. Understand the aspects of equilibrium of forces.

4.1. State the principles of equilibrium of forces.
4.2. State the Lama's theorem.
4.3. Express the derivation of Lama's theorem.
4.4. Describe different methods of the equilibrium of coplanar forces and non-coplanar forces.
4.5. Explain the conditions of equilibrium.
4.6. Mention the various types of equilibrium of forces.
4.7. Solve problems related to equilibrium of forces.

5. Understand the concept of centroid and center of gravity.

5.1. Define center of gravity and centroid.
5.2. Distinguish between center of gravity and centroid.
5.3. Explain the methods of finding out centroid of simple geometrical figure.
5.4. Identify the axis of reference and axis of symmetry.
5.5. Determine the centroid of rectangle, triangle, semicircle geometrically and by integration.
5.6. Determine the centroid of plain geometrical figure by principle of first moments.
5.7. Calculate the centroid of various composite areas.
5.8. Calculate the center of gravity of solid bodies.

6. Understand the application of moment of inertia.

6.1. Explain the term moment of inertia and the units of moment of inertia.
6.2. Express the derivation of the formulae for moment of inertia of an area.
6.3. Describe the methods for finding out the moment of inertia.
6.4. Find the moment of inertia of simple areas by the method of integration.
6.5. State and proof of the theorem of perpendicular axis as applied to moment of inertia.
6.6. State the parallel axis theorem in the determination of moment of inertia of areas.
6.7. Explain the radius of gyration and section modulus.
6.8. Define mass moment of inertia.
6.9. Application of mass moment of inertia.
6.10. Calculate the moment of inertia and section modulus of composite sections and simple solid bodies.

7. Understand the principles and application of friction

7.1. Define friction.
7.2. Advantage and disadvantage of friction.
7.3. Identify the types of friction.
7.4. State the laws of static and dynamic friction.
7.5. Explain the angle of friction.
7.6. Explain coefficient of friction.
7.7. Explain free body diagrams of a body lying on horizontal, inclined and vertical surfaces, ladder and wedge.
7.8. Determine the frictional force of a body lying on horizontal and inclined surfaces.
7.9. Identify the methods of solving the problems of ladder
7.10. Identify the methods of solving the problems of wedge.

8. Understand the fundamentals of support reaction on beams and Truss

8.1. Define support and support reactions.
8.2. Identify types of beam.

8.3. Explain the types of loading on beams.
8.4. Determine the support reactions of simple, overhanging and cantilever beam with different loading conditions.
8.5. Define frame.
8.6. Identify the frames and trusses with their end supports.
8.7. State the method of finding support reactions and forces on the member of the frame.
8.8. Identify the nature of force on the members of trusses.
8.9. Calculate the support reactions and forces on different end support of simple truss by joint method and section method.

9. Understand the features and principle of projectile.

9.1. Describe projectiles with example.
9.2. Describe the term relating to projectiles.
9.3. Identify the motion of a body thrown horizontally in the air.
9.4. Describe the motion of a projectile.
9.5. Derivation of the equation of the path of a projectile.
9.6. Derivation of the time of flight of a projectile on a horizontal plane.
9.7. Derivation of horizontal range of a projectile.
9.8. Derivation of the equation of maximum height of a projectile on a horizontal plane.
9.9. Derivation of velocity and direction of motion of a projectile after a given interval of time.
9.10. Solve problems related to projectiles.

10. Understand the aspects of work, power and energy.

10.1. Define work, power and energy.
10.2. State the units of work, power and energy.
10.3. Explain the work done in rotation.
10.4. Mention the types of engine power.
10.5. Define and classify engine efficiency.
10.6. Mention types of energy.
10.7. Explain the derivation of the equation of kinetic & potential energy.
10.8. State the law of conservation of energy.
10.9. Solve problems related to work, power and energy.

11. Understand the simple lifting machines.

11.1. Define lifting machine.
11.2. State Mechanical advantage, velocity ratio, input of a machine, output of a machine, efficiency of a machine.
11.3. Explain the relation between efficiency, mechanical advantage and velocity ration of a lifting machine.
11.4. Explain the maximum mechanical advantage of a lifting machine by using the equation of law's of machine.
11.5. Describe lifting machine such as simple wheel & axel, differential wheel & axel, Weston's differential pulley block and geared pulley block.
11.6. Solve the problems related to above specific objects.

12. Understand the various aspects of gear trains.

12.1. State what is meant by gear.
12.2. Identify the types of gears.
12.3. Identify the simple gear drive.
12.4. Express the derivation of the equation of velocity ratio of simple gear drive.

12.5. Identify the compound gear drive and gear train.
12.6. Identify the equation of power transmitted by simple and compound train.
12.7. Identify the epicyclical gear train.
12.8. Express the derivation of the velocity ratio of an epicyclical gear train.
12.9. Solve problems related to gear trains.

PRACTICAL:

1. Determine the resultant force by using force board.

1.1 Set up the force board.
1.2 Set up the accessories on the force board.
1.3 Find the resultant force.
1.4 Calculate the magnitude of resultant force.
1.5 Compare the calculated values with experimental values.

2 Determine the compression load using crane boom.

2.1 Set up the crane boom.
2.2 Set up the accessories on the crane boom.
2.3 Find the compression load on the jib.
2.4 Calculate the compression analytically.
2.5 Compare the experimental values with analytical values.

3 Determine the equilibrium force by using Kennon force table.

3.1 Set up the Kennon force table.
3.2 Set up the accessories on the Kennon force table.
3.3 Find the magnitude and direction of a force establishing equilibrium.
3.4 Calculate the magnitude and direction of equilibrium force.
3.5 Compare the calculated values with experimental values.

4 Determine the center of a triangular lamina.

4.1 Select a triangular lamina and a plumb bob.
4.2 Set up the plumb bob.
4.3 Find the center point of the triangular lamina.

5 Determine the center of gravity of solid body.

5.1 Select solid bodies such as solid rod, step rod and body with cut out holes.
5.2 Select a fulcrum.
5.3 Set up the fulcrum.
5.4 Find the center point.
5.5 Compare the analytical values with experimental values.

6 Determine the co-efficient of friction.

6.1 Set up the friction apparatus.
6.2 Select the materials of which coefficient of friction is to be determined.
6.3 Place the materials over each other.
6.4 Raise one end of the body until the other body slides down.
6.5 Find the angle of friction.
6.6 Find the co-efficient of friction.

7 Determine the action of load on the member of simple frame or truss.

7.1 Select two members of which one end roller and other end pin point.
7.2 Select a tension spring.
7.3 Make a unit as a simple frame or truss.
7.4 Apply the load.
7.5 Read the tension load on spring.

8 Determine the torque of engine by prony brake.

8.1 Set up the prony brake with the engine flywheel.

8.2 Tighten the hand wheel of prony brake.

8.3 Measure the length of torque arm.

8.4 Start the engine.

8.5 Take the reading of spring scale.

8.6 Find the torque of engine.

8.7 Compare the calculated values with the manufacturers' recommended values.

9 Determine the BHP of an engine by chassis dynamometer.

9.1 Place the vehicle on chassis dynamometer.

9.2 Start the vehicle engine.

9.3 Transmit power at different gear position.

9.4 Find the B. H. P. of the engine by chassis dynamometer at different speeds.

9.5 Compare the experimental value with the manufactures' recommended value.

10 Determine the velocity ratios among the driver and driven gears.

10.1Set a simple train of gears.

10.2Compare the velocity ratios of the same.

10.3Set a compound train of gears.

10.4Compare the velocity ratios of the same.

REFERENCE BOOKS

1 Applied Mechanics – R. S. Khurmi

2 Applied Mechanics – R. K. Jain

3 Applied Mechanics – Fairries

4 Analytical Mechanics – Faires & Nash

5 Mechanics of Materials – Morgan

67042 Metallurgy

T	P	C
2	3	3

AIMS:

- To be able to identify and classify the materials used for metallurgical engineering field.
- To be able to recognize the sources of various Metals.
- To be able to understand the characteristics of various ferrous and non-ferrous metals.
- To be able to understand the uses of different alloy.
- To be able to understand the application of Powder Metallurgy.

SHORT DESCRIPTION

Concept and Scope of Metallurgy; Uses of Metallic Ore; Production of Pig Iron; Production of Wrought Iron; Feature of Cast Iron ; Plain Carbon Steel; Bessemer, Open Hearth , Crucible Process for Making Steel; Process of making Steel by Electric Furnace; Aspect of Alloy Steel; Aspect of non-ferrous metals; Feature of Alloy of Metals; Application of Powder Metallurgy in Engineering Production.

DETAIL DESCRIPTION

1. **Understand the Concept and Scope of Metallurgy.**
   - 1.1 Define metallurgy.
   - 1.2 Mention the classification of metallurgy as applied to manufacturing engineering and production.
   - 1.3 Mention the use of metallurgical investigation in industry.
   - 1.4 Mention the physical and mechanical properties of metals.
2. **Understand the Uses of Metallic Ore**
   - 2.1 Define ores of metals.
   - 2.2 Mention the classification of ores of metals.
   - 2.3 Describe the processing of ores before melting.
   - 2.4 Name the metallic ores available in Bangladesh.
   - 2.5 Define refractory materials.
3. **Understand the Production of Pig Iron**
   - 3.1 Define pig iron.
   - 3.2 Describe the importance of blast furnace.
4. Mention the construction of blast furnace.
   - 4.1 Explain the operation of blast furnace.
   - 4.2 Describe the chemical reaction caused in the blast furnace for pig iron Production.
   - 4.3 Describe the elements of slag use in of blast furnace.
5. **Understand the Wrought Iron and its uses.**
   - 5.1 Mention the meaning of wrought iron.
   - 5.2 Describe the properties of wrought iron
   - 5.3 Mention the use of wrought iron.
6. **Understand the Feature of Cast Iron.**
   - 6.1 Define cast iron.
   - 6.2 Mention the manufacturing process of cast iron.
   - 6.3 List the types of cast iron.
   - 6.4 Explain the composition of various cast iron.
   - 6.5 Mention the properties of various cast iron.
   - 6.6 Mention the effect of sulphur, phosphorous, aluminum and silicon on the properties of cast iron.
   - 6.7 Explain the domestic and industrial uses of cast iron.

7. Understand the Plain Carbon Steel.

7.1 Name the types of plain carbon steel.

7.2 Explain the composition of plain carbon steel.

7.3 List the use of different plain carbon steel.

7.4 Mention the process of making steel adapted in Bangladesh.

8. Understand the Bessemer, Open Hearth & Crucible Processes for Making Steel.

8.1 Describe the construction of Bessemer converter.

8.2 Distinguish between the basic Bessemer process and acid Bessemer process of making steel.

8.3 Describe the construction of open hearth furnace.

8.4 Describe the steel production using open hearth furnace.

8.5 Mention the construction of crucible.

8.6 Mention the crucible process of making steel.

8.7 Explain the advantage of making steel by crucible process and other process.

8.8 State the reason of adopting the duplexing and triplexing process of makingsteel.

9. Understand the Process of making Steel by Electric Furnace.

9.1 Explain the construction of electric furnace.

9.2 Mention the classification of electric furnace.

9.3 Mention the process of making steel by direct arc electric furnace.

9.4 Describe the process of making steel by induction electric furnace.

9.5 Mention the reason for superiority of electric furnace steel than others.

10. Understand the Aspect of Alloy Steel.

10.1 Mention the classification of alloy steel.

10.2 Explain the difference between alloy steel and plain carbon steel.

10.3 Describe the manufacturing process of stainless steel, high speed steel and nickel steel.

10.4 Describe the composition of stainless steel, high speed steel, tungsten steel, molybdenum steel, chromium steel, nickel steel and silicon steel.

10.5 Describe the effect of manganese, tungsten, molybdenum, chromium, nickel, vanadium, copper, sulphur, phosphorous and silicon on the mechanical properties of alloy steel.

10.6 Describe the domestic and industrial uses of stainless steel, high speed steel, tungsten steel, molybdenum steel, chromium steel, nickel steel and silicon steel.

11. Understand the Aspect of Non-ferrous Metals and Alloy of Metals

11.1 Mention the important properties of Aluminum and Copper.

11.2 Describe the uses of Aluminum, Copper, Zinc, Tin and Lead.

11.3 Define alloy of metals.

11.4 Describe the compositions, properties and uses of important alloys of Aluminum, Copper, Zinc, Tin, Lead, Antimony and Nickel.

11.5 Describe the process of making alloys of Aluminum, Copper, Zinc, Tin, Lead, Antimony and Nickel.

12. Understand the Application of Powder Metallurgy in Engineering Production.

12.1 Define powder metallurgy.

12.2 List the importance of powder metallurgy.

12.3 Explain the methods of producing metal powder.

12.4 Mention the production method of metal powder components.

12.5 Describe the special properties of metal powder products.

12.6 List the major applications advantages of metal powder products.

PRACTICAL:

1. Show skill in identifying various types of metals.

1.1 Select different types of metal in the laboratory.

1.2 Sketch different types of metal on the basis of formation.

2. Show skill in workshop test of metals.

2.1 Perform Rockwell Hardness test.

2.2 Perform Brinell Hardness number using standard specimen.

3. Show skill in identifying various ferrous and nonferrous metals.

4. Identify different types of alloy steel.

5. Determine the internal structure of standard specimen using metallurgical microscope.

5.1 Select the specimen.

5.2 Preparation of specimen.

5.3 Perform final setting time of etching.

5.4 Observe and draw microstructure.

6. Identify mild steel, cast iron, copper, aluminum, tin by physical observation.

7. Show the construction and operation of electric furnace process of making steel.

REFERENCE BOOKS

1. Metallurgy - Johnson

2. Emergency Metallurgy - Frier.

3. Metallurgy - Jain.

4. Metallurgy - R S Khurmi

5. Introduction to Physical Metallurgy - Sidney H. Avner.

6. Material Science and Metallurgy - O P Khanna

67911 IC Engine Principles

T	P	C
2	3	3

AIMS:

To be able to develop knowledge, skills and attitude in the area of internal combustion engine with special emphasis on:

- Working principles of IC engines.
- Engine terms, types of engine, valve and valve mechanism.
- Systems of IC engine.
- Concept of Modern IC engine.

SHORT DESCRIPTION

Basic concepts of IC engine; Functions of IC engine; Constructional and operational feature of IC engine components; Working principles of IC engine; Types of IC engine; Engine terms; Valve and valve mechanism; Lubricating system; Cooling system; Ignition and Emission system; Starting, Charging and Supercharging system; Concept of Modern IC Engine.

DETAIL DESCRIPTION

Theory:

1. **Understand the basic concepts of IC engine.**
   - 1.1 Define engine and IC engine.
   - 1.2 Distinguish steam engine and heat engine.
   - 1.3 Differentiate between CI engine and SI engine.
   - 1.4 Describe the principle of IC engine.
   - 1.5 Mention the various uses of IC engine.
2. **Understand the functions of IC engine.**
   - 2.1 Describe the functions of IC engine.
   - 2.2 Explain the importance of the IC engine.
   - 2.3 Explain the role of IC engine as a prime mover in different sectors.
3. **Understand the constructional and operational features, types and function of IC engine components.**
   - 3.1 Identify cylinder head, cylinder block and crankcase of IC engine.
   - 3.2 Identify piston, piston ring, piston pin, connecting rod, crank shaft and camshaft.
   - 3.3 Name the moving and stationary parts of IC engine.
   - 3.4 Identify cylinder liner, water jacket, bearing, valve, valve lifter, manifold, flywheel, rocker arm, valve spring, valve seat, push rod of IC engine.
   - 3.5 Describe the functions of each part mention above.
   - 3.6 Mention the material used for various parts of IC engine.
4. **Understand the working principle of IC engine.**
   - 4.1 Define engine cycles.
   - 4.2 Define two stroke and four stroke cycle engines.
   - 4.3 Mention valve timing diagram and its importance for 2-stroke & 4-stroke IC engine.
   - 4.4 State the working principles of 2-stroke and 4-stroke cycle SI and CI engines.
   - 4.5 Distinguish between two stroke cycle and four stroke cycle engines.
   - 4.6 Distinguish between diesel cycle and auto cycle.
5. **Understand the types of IC engine according different features.**

5.1 Identify IC engine according to the number and arrangement of cylinders.
5.2 Explain the engine according to valve mechanism.
5.3 Name the engine according to cooling system.
5.4 Classify engine according to the type of fuels used.

6. Understand the basic engine terms.

6.1 List the basic terms of IC engine.
6.2 Define engine bore and stroke length.
6.3 Describe piston displacement, clearance volume, swept volume and compression ratio.
6.4 Compute mechanical efficiency, volumetric efficiency and torque.
6.5 Define mean effective pressure.
6.6 Describe air fuel ratio.
6.7 Determine Indicated Horse Power (IHP), Brake Horse Power (BHP) and Frictional Horse Power (FHP).
6.8 Solve the problem related to IHP, BHP and FHP.

7. Understand the valve and valve mechanism of IC engine.

7.1 Describe the functions of valves.
7.2 Explain different types of valve.
7.3 Describe valve mechanism of IC engine.
7.4 Describe the mechanism of valves according to different arrangement.
7.5 Compare L-head and I-head valve arrangement.
7.6 Describe the operation of hydraulic valve lifter.

8. Understand the lubricating system of IC engine.

8.1 Define lubricants.
8.2 Mention the purposes of lubricating system.
8.3 Classify lubricants and lubricating system.
8.4 Describe each type of lubricating system.
8.5 Name the components of lubricating system.
8.6 Describe the methods of bearing lubrication.
8.7 Distinguish between dry and wet sump lubricating system.
8.8 Describe gear type, lube type, vain type and plunger type lubricating pumps.

9. Understand the cooling system of IC engine.

9.1 Describe the necessity of cooling system.
9.2 Classify cooling system.
9.3 Describe each type of cooling system.
9.4 List the components of engine cooling system.
9.5 Mention the purposes of using antifreeze solution in cooling system.
9.6 Describe flushing of cooling system.
9.7 List the troubles of cooling system.
9.8 Mention the functions of thermostat valve, expansion tank, oil cooler.

10. Understand the Ignition and Emission system of IC engine.

10.1 Define ignition and emission system.
10.2 Define manifold, catalytic converter, muffler and silencer.
10.3 Describe the function of exhaust and intake system.
10.4 Explain the different types of scavenging system.
10.4 Describe the different types of air filters.
10.5 List the components of ignition system and emission system
10.6 Describe ignition system of CI engine with sketch.

11. Understand the Starting, Charging & Super Charging System of IC Engine.

11.1 Classify starting system of IC engine.
11.2 Describe the principles of starting of IC engine.
11.3 Describe manual starting system.
11.4 List the components of electric starting and air starting systems.
11.5 Describe the procedures of electric starting and air starting systems.
11.6 Describe the necessity of charging system.
11.7 Define supercharging.
11.8 Classify supercharger.
11.9 Describe the methods of supercharging and scavenging.
11.10 Describe the functions of turbocharger.

12. Understand the Concept of Modern IC Engine.

12.1 Define hybrid vehicle.
12.2 Meaning of VVT-i, VTEC, EFi, DOHC, DVVT.
12.3 Difference between VTEC and VVT-i.
12.4 Function of EFI in IC engine.
12.5 Explain the working procedure of VVT-i system in CI engine.

PRACTICAL:

1. Perform the identification of main components of IC engine.

1.1 Identify cylinder head, cylinder block, oil sump. Rocker arm, camshaft, valve spring
1.2 Identify crankshaft camshaft, feed pump, injector, cam follower.
1.3 Identify different types of engine bearings.

2. Perform the servicing, repairing, replacing and maintenance of lubricating and cooling system.

2.1 Identify fuel injection system of CI engine.
2.2 Identify pressure feed lubricating system.
2.3 Identify the components of lube oil system.
2.4 Change oil of crankcase and refill with proper grade of lube oil.
2.5 Remove the oil filter and fix it after proper servicing or replace it, if required.
2.6 Fill lube oil up to the recommended level.
2.7 Observe lube oil pressure in running condition.
2.8 Identify cooling system with its components.
2.9 Isolate the fan belt and replace it, if required.
2.10 Remove the thermostat from the system.
2.11 Check and replace the thermostat, if required.
2.12 Observe the cooling water in the system.
2.13 Observe the temperature reading in running engine.
2.14 Maintain personal safety in every cases of servicing, repairing etc.

3. Perform the operation of removing, fixing, dismantling and reassembling of fuel system and fuel injection system.

3.1 Identify the fuel system with its components.
3.2 Remove fuel pump from the system.
3.3 Test the pump and fix it up after necessary servicing.
3.4 Remove, fix up and adjust a carburetor.
3.5 Identify the different components of CI engine fuel injection system.
3.6 Remove a high-pressure pump from the system.
3.7 Dismantle, reassemble and test the injector in test bench.
3.8 Set the injection timing of a diesel engine.

13. Perform the identification of charging system.

4.1 Identify the charging system with its components.

4.2 Draw the flow diagram of the charging system.

4.3 Observe the actions of the components of charging system in running engine.

14. Perform the trouble shooting and fault finding of valve mechanism.

5.1 Check tappet clearance.

5.2 Adjust tappet clearance.

5.3 Check lubrication of valve mechanism.

5.4 Observe the operation of valve mechanism.

5.5 Manipulate the idea of fault finding and suggest remedies.

5.6 Find out problems of tappet clearance, overlapping valve mechanism and adjust the system.

REFERENCE BOOKS:

1. Diesel Engine Operation and Maintenance – V. L. Maleev, McGraw Hill Book Company, 1953
2. Diesel Fundamentals, Service Repair – William K. Toboldt, The GoodHeart-Willcox Company, INC.
3. Internal Combustion Engine – H.B. Keswani (2nd edition)
4. Fundamental of Service – John Deere, 1980.
5. Automotive Mechanics - William H. Crouse, 8th edition, McGraw Hill Publication Company.
6. Internal Combustion Engine – Edward F. Obert (3rd edition)

65841 Business Organization & Communication

T P C
2 0 2

AIMS:

- To be able to understand the basic concepts and principles of business organization.
- To be able to understand the banking system.
- To be able to understand the trade system of Bangladesh.
- To be able to understand the basic concepts of communication and its types, methods.
- To be able to perform in writing, application for job, complain letter & tender notice.

SHORT DESCRIPTION:

Principles and objects of business organization; Formation of business organization; Banking system and its operation; Negotiable instrument; Home trade and foreign trade. Basic concepts of communication Communication model & feedback; Types of communication; Methods of communication; Formal & informal communication; Essentials of communication; Report writing; Office management; Communication through correspondence; Official and semi- official letters.

DETAIL DESCRIPTION:

Theory:

1 Concept of Business organization.

1.1 Define business.
1.2 Mention the objects of business.
1.3 Define business organization.
1.4 State the function of business organization.

2 Formation of Business organization.

2.1 Define sole proprietorship, partnership, Joint Stock Company. and co-operative
2.2 Describe the formation of sole proprietorship, partnership, joint stock Company, & co operative.
2.3 Mention the advantages and disadvantages of proprietorship, partnership and Joint Stock Company.
2.4 State the principles of Co operative & various types of Co operative.
2.5 Discuss the role of co-operative society in Bangladesh.

3 Basic idea of Banking system and negotiable instrument.

3.1 Define bank.
3.2 State the service rendered by bank.
3.3 Describe the classification of bank in Bangladesh.
3.4 State the functions of Bangladesh Bank in controlling money market.
3.5 State the functions of commercial Bank in Bangladesh
3.6 Mention different types of account operated in a bank.
3.7 Mention how different types of bank accounts are opened and operated.
3.8 Define negotiable instrument.
3.9 Discuss various types of negotiable instrument.
3.10 Describe different types of cheque.

4 Home & foreign trade

4.1 Define home trade.
4.2 Describe types of home trade.
4.3 Define foreign trade.
4.4 Mention the advantages and disadvantages of foreign trade.
4.5 Discuss the import procedure & exporting procedure.
4.6 Define letter of credit.
4.7 Discuss the importance of foreign trade in the economy of Bangladesh.

5 Basic concepts of communication

5.1 Define communication & business communication.
5.2 State the objectives of business communication.
5.3 Describe the scope of business communication.
5.4 Discuss the essential elements of communication process.

6 Communication model and feedback.

6.1 Define communication model.
6.2 State the business functions of communication model.
6.3 Define feedback.
6.4 State the basic principles of effective feedback.

7 Types and Methods of communication.

7.1 Explain the different types of communication;-
   a) Two-way communication
   b) Formal & informal communication
   c) Oral & written communication
   d) Horizontal & vertical communication
   e) external & internal communication
   f) Spoken & listening communication.
7.2 Define communication method.
7.3 Discuss the various methods of communication.
7.4 Distinguish between oral and written communication.

8 Essentials of communication.

8.1 Discuss the essential feature of good communication.
8.2 Describe the barriers of communication.
8.3 Discuss the means for overcoming barriers to good communication.

9 Report writing.

9.1 Define report, business report & technical report.
9.2 State the essential qualities of a good report.
9.3 Describe the factors to be considered while drafting a report.
9.4 Explain the components of a technical report.
9.5 Prepare & present a technical report.

10 Office management.

10.1 Define office and office work.
10.2 State the characteristics of office work.
10.3 Define filing and indexing.
10.4 Discuss the methods of filing.
10.5 Discuss the methods of indexing.
10.6 Distinguish between filing and indexing.

11 Official and semi-official letters.

11.1 State the types of correspondence.

11.2 State the different parts of a commercial letter.

11.3 Define official letter and semi-official letter.

11.4 Prepare & present the following letters: Interview letter, appointment letter, joining letter and application for recruitment. Complain letters, tender notice.

REFERENCE BOOK:

1.উচ্চ মাধ্যমিক ব্যবসায়নীতি ও প্রয়োগ -মোহাম্মদ খালেকুজ্জামান

2.উচ্চ মাধ্যমিক ব্যাংকিং ও বীমা -প্রফেসর কাজী নুরুল ইসলাম ফারুকী

3.আধুনিক কারবার পদ্ধতি -লতিফুর রহমান

4.কারবার যোগাযোগ ও সচিবের কার্যপদ্ধতি -প্রফেসর লতিফুর রহমান ও প্রফেসর কাজী নুরুল ইসলাম ফারুকী

5.ব্যবসায়িক যোগাযোগ এবং অফিসের কর্মপ্রণালী –ড. এম, এ, মান্নান

6.ব্যবসায় যোগাযোগ – মোহাম্মদ খালেকুজ্জামান ও মোঃ মুশাররফ হোসেন চৌধুরী

7. Business organization & management- M.C. Shukla

8. Business organization & management- R.N. Gupta

BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Dhaka-1207

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

SYLLABUS (PROBIDHAN-2016)

SHIPBUILDING TECHNOLOGY

TECHNOLOGY CODE: **680**

5th SEMESTER

DIPLOMA IN ENGINEERING

PROBIDHAN-2016

SHIPBUILDING TECHNOLOGY (680)

5th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	67051	Hydraulics & Hydraulic Machineries	3	3	4	60	90	25	25	200
2	67056	Advanced Machine Shop	2	6	4	40	60	50	50	200
3	67955	Instrumentation & Control	2	3	3	40	60	25	25	150
4	68051	Estimating & Costing of Shipbuilding	2	3	3	40	60	25	25	150
5	68052	Shipbuilding Drawing -2	0	6	2	0	0	50	50	100
6	68053	Marine Refrigeration & Air-conditioning	2	3	3	40	60	25	25	150
7	65851	Accounting Theory & Practice	2	3	3	40	60	25	25	150
Total			**13**	**27**	**22**	**260**	**390**	**225**	**225**	**1100**

67051 Hydraulics & Hydraulic Machinery

T	P	C
3	3	4

AIMS

To be able to understand the concepts of technical terms used in hydraulics and hydraulic machineries and the techniques used in hydraulics and hydraulic machineries with special emphasis on:

- Properties of fluids
- Fluid pressure measurement
- Continuity equation
- Bernoulli's equation
- Orifice and mouthpieces
- Notches and Weirs
- Impact of jet
- Water pumps & turbines
- Hydraulic devices

SHORT DESCRIPTION

Properties of fluid; Fluid pressure measurement; Flow of fluids through pipes; Bernoulli's equation; Flow through orifices; Flow through mouthpieces; Flow through Notches and Weirs; Viscous flow; Impact of jets; Water turbine; Reciprocating pumps; Centrifugal pumps; Rotary pumps; Hydraulic devices.

DETAIL DESCRIPTION

Theory:

1. **Understand the scope of hydraulics.**
   - 1.1. Define fluid with types.
   - 1.2. Compare the liquid, vapor and gas.
   - 1.3. Define hydraulics and hydraulic machineries.
   - 1.4. Outline the importance of hydraulics and hydraulic machineries.
   - 1.5. Mention the branches of hydraulics.
   - 1.6. Identify different application of hydraulics and hydraulic machineries in engineering field.
2. **Understand the fluid properties and fluid pressure.**
   - 2.1 List the properties of fluids.
   - 2.2 Define density, specific weight, surface tension, capillary, viscosity and fluid pressure.
   - 2.3 State Pascal's law of fluid pressure.
   - 2.4 Show the proof of the Pascal's law of fluid pressure.
   - 2.5 Define atmospheric pressure, gauge pressure and absolute pressure.
   - 2.6 Mention the relation among atmospheric pressure, gauge pressure and absolute pressure.
   - 2.7 Express the derivation of the formulae for finding total pressure on immerged surface at horizontal, inclined and vertical position.
   - 2.8 Solve problems on static fluid pressure.
3. **Understand Buoyancy.**
   - 3.1 Define buoyancy and center of buoyancy.
   - 3.2 State the meaning meta-centre and meta-centric height.

3.3 Mention the conditions of equilibrium of a floating body.

4. Understand the features of fluid pressure gauges.

4.1 State the meaning of pressure gauge.
4.2 Mention the classification of pressure gauges.
4.3 Define manometer.
4.4 Distinguish between simple manometer and differential manometer.
4.5 Mention the working principle of different types of pressure gauges.
4.6 Mention the specific application of different pressure gauges.
4.7 Solve problems relating to measurement of fluid pressure by different manometers.

5. Understand the concept of fluid flow through pipes.

5.1 State different types of fluid flow.
5.2 State the equation of continuity of flow.
5.3 State flow rate or discharge.
5.4 Compute the formula of flow rate.
5.5 State the equation of continuity of flow.
5.6 Solve the problems on continuity of flow.

6. Understand the concept of Bernoulli's equation.

6.1 Define head, pressure head, velocity head, datum head and total head.
6.2 State and interpret the Bernoulli's equation for flowing liquid.
6.3 Mention the limitation of Bernoulli's equation.
6.4 Mention the function of venture-meter, orifice-meter and pitot tube.
6.5 Describe the construction and operation of venture-meter, orifice-meter and pitot tube.
6.6 Express the derivation of formula to measure the quantity of liquid flowing through venture-meter.
6.7 Express the derivation of formula to measure the quantity of liquid flowing through orifice-meter.
6.8 Express the derivation of formula to measure the velocity of flowing liquid by the pitot tube.
6.9 Solve the problems on fluid through pipe, Bernoulli's equation and venture-meter, orifice-meter and pitot tube.

7. Understand the concept of flow through orifices.

7.1 Define orifice.
7.2 Mention the classification of orifices.
7.3 State hydraulic coefficients.
7.4 Define jet of water, vena-contracta, coefficient of contraction (CC), coefficient of velocity (Cv), coefficient of discharge (Cd) and coefficient of resistance.
7.5 Relate the CC, Cv and Cd.
7.6 Calculate different hydraulic coefficients.
7.7 Express the deduction of formulae for finding out the discharge of liquid through various orifices
7.8 Solve problems relating orifices.

8. Understand the concept of flow through mouthpieces.

8.1 Define and classify mouthpieces.
8.2 Express the deduction of formulae to calculate discharge through different types of mouthpieces.
8.3 State head losses of flowing liquid in a pipe.

8.4 List the causes of head loss of flowing liquid.

8.5 Express the deduction of formulae to calculate loss of head due to friction, sudden enlargement, sudden contraction and obstruction in pipe.

8.6 Express the deduction of formulae to calculate loss of head due to friction (Darcy's and Cheay's formulae).

8.7 Solve problems relating head losses and discharge through mouthpieces.

9. Understand the concept of flow through notches and Weirs.

9.1 Define notches and Weirs.

9.2 Identify different types of notches and Weirs with sketches such as rectangular notch v-notch trapezoidal notch.

9.3 Outline the importance of using notches and Weirs.

9.4 Solve problems relating head losses and discharge through notches and Weirs.

10. Understand the concept of viscous flow.

10.1 Define viscosity.

10.2 Mention the units of viscosity.

10.3 Define ideal fluid, real fluid, Newtonian fluid and non-Newtonian fluids.

10.4 Distinguish between the laminar flow and turbulent flow.

10.5 State Reynold's number.

10.6 Solve problems relating to viscosity.

11. Understand the aspect of impact of jets.

11.1 State impact of jet.

11.2 Express the deduction of formula to calculate the force of a jet impinging on a flat fixed vertical plate, inclined plate and hinged plate.

11.3 Solve problems on impact of jets relating to flat fixed plate, inclined fixed plate and hinged plate.

12. Understand the features of water turbines.

12.1 State the meaning of water turbine.

12.2 Mention the classification of water turbine.

12.3 Describe the principle of impulse and reaction water turbine.

12.4 Compare the impulse and reaction turbine.

12.5 Describe the construction of Pelton, Kaplan and Francis water turbine.

12.6 Describe the operation of Pelton, Kaplan and Francis water turbine.

12.7 State the specific speed of turbine.

12.8 Describe the governing system of impulse and reaction turbines.

12.9 Define draft tube and its classification.

13. Understand the features of reciprocating pumps.

13.1 Define reciprocating pump.

13.2 Mention the classification of reciprocating pumps.

13.3 Describe the construction of various reciprocating pumps.

13.4 Describe the operation of different types of reciprocating pumps.

13.5 State the meaning of slip of reciprocating pumps.

13.6 Mention the function of air vessel in single acting reciprocating pump.

13.7 Describe the operation of suction side and discharge side air vessel in a single acting reciprocating pump.

13.8 Express the deduction of formula to calculate the discharge of reciprocating pumps.

14. Understand the features of centrifugal pumps.

14.1 State the meaning of centrifugal pump.
14.2 Mention the classification of centrifugal pumps.
14.3 Compare the centrifugal and reciprocating pumps.
14.4 Describe the construction of various centrifugal pumps.
14.5 Describe the operation of different types of centrifugal pumps.
14.6 State the meaning of cavitation of centrifugal pumps.
14.7 Express the deduction of formula to calculate discharge of centrifugal pumps.
14.8 Power required to drive a centrifugal pump.
14.9 Mention the efficiencies of centrifugal pump.

15. Understand the features of rotary pumps.

15.1 State what is meant by rotary pump.
15.2 Mention the classification of rotary pumps.
15.3 Describe the construction of various rotary pumps.
15.4 Describe the operation of different types of rotary pumps.
15.5 List the advantages and disadvantage of rotary pumps over centrifugal and reciprocating pumps.
15.6 Mention the application of rotary pumps.

16. Understand the features of hydraulic devices.

16.1 State hydraulic devices.
16.2 Identify the hydraulic devices.
16.3 Mention the function of hydraulic devices viz. hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift, etc.
16.4 Describe the construction of various hydraulic devices.
16.5 Describe the operation of different types of hydraulic devices.

PRACTICAL:

1. Calibrate a bourdon tube pressure gauge with a dead weight gauge.

1.1 Level the tester on a strong table top using sprit level and adjusting the level
1.2 Make sure 2/3 oil level in oil reservoir cup
1.3 Close the oil reservoir valve and make sure air is out from the system
1.4 Connect the pressure gauge in gauge connection using proper adapter
1.5 Open the oil reservoir until required height
1.6 Rotate the lifted weight slowly and compare the pressure gauge indication

2. Verify Bernoulli's equation by Bernoulli's apparatus equipped with hydraulic test bench.

2.1 Start the pump and initiate a flow through the test section
2.2 Regulate the flow to the inlet head tank
2.3 Measure the height of the water level in each manometer head
2.3 Measure the time taken to fill the measuring tank
2.4 Record the heights of liquid in the manometer tubes
2.5 Calculate the flow area ,flow rate, velocity, static head and total head.
2.6 Plot a graph.

3. Determine C_C, C_V, and C_d by orifice apparatus equipped with hydraulic test bench.
4. Determine the discharge through a pipe by the venturi meter or orifice meter equipped with hydraulic test bench.

5. Determine the loss of head due to sudden enlargement of pipe by the manometer.
6. Determine the loss of head due to friction by fluid friction apparatus.
7. Determine the fluid energy loss through various fittings (elbows, bends and valves).
8. Determine the moment force of a jet of water striking targets of different shape with the impact of jet apparatus.
   8.1 Fix the required diameter jet, and the vane of required shape in position and zero the force indicator
   8.2 Keep the delivery valve closed and switch on the pump
   8.3 Close the front transparent cover tightly
   8.4 Open the delivery valve and adjust the flow rate of water as read on the Rota meter
   8.5 Observe the force as indicated on force indicator
   8.6 Note down the diameter of the jet, shape of vane , flow rate and force and tabulate the results
   8.7 Switch off the pump after the experiment is over and close the delivery valve.
9. Test the performance of a reciprocating pump with the reciprocating pump test rig.
10. Test the performance of a centrifugal pump with the centrifugal pump test rig.
11. Test the performance of an impulse turbine with (Francis) turbine test rig.
    11.1 Prime the pump and start it with closed gate valve.
    11.2 Guide vanes in the turbine must be in closed position while starting the pump.
    11.3 Now slowly open the gate valve and open the chock fitted to the pressure gauge and see that the pump develops the rated head.
    11.4 If the develops the required head, slowly open the turbine guide vanes by rotating the hand wheel until the turbine attains the rated speed.
    11.5 Load the turbine slowly and take the readings.
12. Test the performance of reaction turbine with (Pelton wheel) turbine test rig.
    12.1 Connect the supply water pump-water unit to 3 ph, 440V, 30A, electrical supply, with neutral and earth connections and ensure the correct direction of the pump motor unit.
    12.2 Keep the Gate Valve and Sphere valve closed.
    12.3 Keep the Brake Drum loading at zero.
    12.4 Press the green button of the supply pump starter. Now the pump picks- up the full speed and becomes operational.
    12.5 Slowly open the Sphere Valve so that the turbine rotor picks the speed and conduct Experiment on constant speed.
    12.6 Note down the speed, load, and pressure gauge readings. Tabulate the readings.

REFERENCE BOOKS

1. Hydraulics and Hydraulic Machinery – Kings
2. Hydraulics and Hydraulic Machinery – Luiss
3. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines – R. S. Khurmi
4. Fluid Mechanics Hydraulics and Hydraulic Machines – K. R. Arora
5. Hydraulics, Fluid Mechanics, and Fluid Machines – S. Ramamrutham
6. Fluid Mechanics including Hydraulics Machines – K. Subramanya
7. Hydraulics and Fluid Mechanics – Dr. P. N. Modi & Dr. S. M Seth

67056 Advanced Machine Shop

T	P	C
2	6	4

AIMS

To be able to develop knowledge, skill and attitude in the area of advanced machine shop practice with special emphasis on:

- Advance hand tools.
- Advanced lathe operation, turret and capstan lathe.
- Milling machine, Indexing and milling spur gear.
- Helical milling and milling of rack teeth.
- Grinding machines.
- Computer numerical control
- CNC FUNDAMENTALS, Drawing Analysis &Simulation.
- CNC programming.
- Turning center and machining center.
- Electro discharged machining (EDM).

SHORT DESCRIPTION:

Advanced lathe operation; Turret and capstan lathe; Cutting data; Cutting tools; Milling machine; Milling attachments; Milling cutters; Milling process; Indexing of spur gear; Helical milling; Milling rack teeth; Precision grinding machine; Tool grinding; Crankshaft grinder; Boring machine; Computer numerical control; AutoCAD; Master CAM; Block format; CNC programming; CNC machining center; CNC lathe; Electro-discharge machining.

DETAIL DESCRIPTION:

Theory:

1. **Understand hand tools used in advance machine shop.**
   - 1.1 State different hand tools use in advance machine shop.
   - 1.2 Describe the procedure to use advance hand tools.
   - 1.3 Define different parameter such as surface speed, spindle speed, Taper Angle feed and depth of cut and calculate.
   - 1.4 Discus on clean and safe work Environment.
2. **Understand the features of cutting tools used in different operations.**
   - 2.1 Mention various type of cutting tools Geometry used in different operations.
   - 2.2 Mention the use of sintering to produce carbide cutting tools.
   - 2.3 Describe tool selection and cutting parameters.
   - 2.4 Describe machine safety.
3. **Understand the advanced lathe operations.**
   - 3.1 List the parameters use in lathe operations.
   - 3.2 Mention advanced operation on lathe machine.
   - 3.3 Describe the procedure to cut multi-start thread.
   - 3.4 Identify taper thread.
   - 3.5 Describe the procedure to make taper thread.
   - 3.6 Define taper boring. Describe the procedure to make taper boring.
   - 3.7 Describe the procedure to make internal thread.
   - 3.8 Identify turret and capstan lathe. Mention the advantages of turret lathe over center lathe.

3.9 Describe operation performed on turret lathe.

4. Understand the milling machine.

4.1 Describe concept of milling machine.
4.2 Mention the operations generally performed by different types of milling machine.
4.3 Mention the uses of various attachment of milling machine.
4.4 Describe the procedure to set the correct speed and feed for different types of milling operations with various materials.
4.5 Describe a procedure to make aspur gear with calculations.
4.6 Describe the procedure to setup a job and to produce helical gear teeth.
4.7 Describe safety precautions to be taken during working with milling machine.

5. Understand the precision grinding machine.

5.1 Mention the difference between rough grinding and precision grinding.
5.2 Define surface grinding and cylindrical grinder
5.3 Identify the parts of surface and cylindrical grinder.
5.4 Identify the principal components of cylindrical grinding machine.
5.5 Mention the operations generally performed by grinding machine.
5.6 Mention the specifications of grinding wheel.
5.7 Describe the dressing and turning of grinding wheel.
5.8 List the various setup/attachments of a tool grinder.
5.9 Identify the crankshaft grinder.
5.10 Explain procedure to be taken to grind a crankshaft by crankshaft grinder.

6. Types of CNC machine control

6.1 State CNC Machine, machine control unit (MCU) and coordinate measuring machine (CMM)
6.2 State Absolute and Incremental dimensioning system and Distinguish between them.
6.3 State Contour machines (continuous path).
6.4 Describe of Cartesian coordinate system.
6.5 Define control system, linear interpolation, circular interpolation and helical Interpolation.
6.6 Define reference point, feedback, machine zero point, part zero point and work piece coordinate system.
6.7 Define zero reference point and compensation

7. Understand the concept of block format and Programming.

7.1 Define various mode of operation in CNC Machine.
7.2 State and describe different type of code like M, G, S ,T etc.
7.3 Define miscellaneous functional code such as speed, feed, and spindle ON/OFF etc.
7.4 Describe a Program using word address like G, I, M, N, R, S, T etc.
7.5 Describe the tool setting, work setting and offset.
7.6 Describe the purposes of cutter radius compensation code like G 40, G 41, and G 42.
7.7 Define macros and its applications.
7.8 Explain necessity of macros in CNG programming.

8. Understand CNC machining center.

8.1 Stare CNC machining center.
8.2 Mention the types of CNC machining center.
8.3 Describe different parts of CNC machining center.
8.4 Describe servo system and tool changer of machining center.
8.5 List the types of operations performed by CNC machining center.

8.6 State the axes of CNC machining center.
8.7 Describe the operating procedure of CNC machining center.
8.8 Describe the tooling system and cutting tools of machining center.
8.9 Explain safety precautions to be taken during working with CNC machining center.

9. Understand CNC lathe.

9.1 State deferent parts of CNC lathe.
9.2 Mention the functions of servo system, turret and MCU of a CNC lathe.
9.3 List the types of operation performed by CNC lathe.
9.4 Explain the axes of CNC lathe.
9.5 Describe the operating procedure of CNC lathe.
9.6 Describe emergency stop.
9.7 Describe the tooling system and cutting tools of turning center.
9.8 Explain the safety precautions to be taken during working with CNC lathe.

10. Understand the Electro-discharge machining (EDM).

10.1 Define EDM machine.
10.2 Describe the working principle of electro-discharge machine
10.3 Name the types of EDM machine
10.4 Describe the components of EDM machine.
10.5 Mention the function of dielectric fluid in EDM machine.
10.6 Mention the purposes of servo-mechanism.
10.7 Mention the characteristics of a good wire electrode.

PRACTICAL:

1. Perform advanced machining on lathe machine(2Classes)

1.1 Set up a four jaw chuck with a work piece set eccentrically using dial indicator.
1.2 Set a compound gear train for cutting multi-start thread.
1.3 Grind the tool bit for cutting vee and square thread.
1.4 Face, turn and bore on a work piece sing face plate.
1.5 Cut the multi-start and square thread.
1.6 Set up the face plate on lathe spindle.
1.7 Set up a long cylindrical work piece between lathe centers to produce Morse taper by setting over tailstock.

2. Perform precision grinding.(1Classes)

2.1 Balance a grinding wheel.
2.2 Dress and true a grinding wheel.
2.3 Produce a flat surface by surface grinder.
2.4 Produce a cylindrical surface by using a center type grinder.
2.5 Sharp sides and faces of a cutter using mandrel, tooth stop/and cutting angle setting.

3. Perform the operation on milling machine.(2Classes)

3.1 Set up the machine vice to hold the work piece to produce a flat surface using proper end mill cutter.
3.2 Make the parallel, square and slotted work piece using appropriate cutters.
3.3 Set up a dividing head for indexing a job to various divisions.
3.4 Set the dividing head to produce hexagonal bolt head by milling machine.
3.5 Set a work piece on milling machine to produce spur gear.

4. Perform the helical milling to produce helical gear.(2Classes)

4.1 Select tools and equipment
4.2 Set the work piece on machine table
4.3 Set up the gear train for right hand helix or left hand helix as required.
4.4 Index the blank gear.
4.5 Cut the gear teeth in sequence and check and measure the teeth.

5. Perform AutoCAD and CAM Software Operations. (4Classes)

5.1 Input machining parameters (speeds, feeds, tool change information, etc.).
5.2 Create a process sequence to manufacture a particular part.
5.3 Create tool lists for a particular process sequence.
5.4 Select and design work-holding fixtures.
5.5 Generate computer tool paths.
5.6 Invoke post processor program.
5.7 Simulate tool path.
5.8 Edit tool path motion.
5.9 Delete and regenerate corrected tool path information.

6. Perform the facing and turning by CNC lathe(2Classes)

6.1 Read job orders and process sheets to determine tooling and setup information.
6.2 Install cutting tools in holders.
6.3 Load tools into turret.
6.4 Position and secure stock in work holding device.
6.5 Load program in computer.
6.6 Set work origin.
6.7 Dry run machine with machine locked.
6.8 Single block machine to verify cutter path or use simulator.
6.9 Machine first piece to verify accuracy of set up and program.

7. Perform the job of drilling, reaming and external thread cutting by CNC lathe.(2Classes)

7.1 Select proper tools and materials.
7.2 Set the job on the machine chuck.
7.3 Set the proper tool on the tool post or on the turret.
7.4 Set zero on the work piece as per instruction.
7.5 Make a program for drilling, reaming and external thread cutting.
7.6 Set up the safe tool position.
7.7 Check the program simulation.
7.8 Input the program.
7.9 Run the program to complete the operations.

8. Set Up a Computer Numerical Control (CNC) Mill(2Classes)

8.1 Read job orders and process sheets to determine tooling and setup information.
8.2 Mount work holding device.
8.3 Install cutting tools in holders.
8.4 Identify different types of retention knobs; select appropriate knob for application.
8.5 Position and secure stock in work holding device.
8.6 Load program in CNC machine control.
8.7 Set work origin.
8.8 Dry run machine, if required, or simulate operation.

8.9 Single block program to verify cutter path.

8.10 Verify accuracy of setup and program.

8.11 Verify accuracy of setup using measurement devices.

9. Perform Part Modifications on CNC Mill(1classes)

9.1 Change tool and work offsets.

9.2 Reposition stock on fixture if required.

9.3 Adjust speeds and feeds for optimum performance.

9.4 Identify and correct programming errors.

9.5 Update programs stored in memory.

10. Perform the job to form cavity by ram or die sinking EDM machine. (2Classes)

10.1 Select proper tools and materials.

10.2 Select proper dielectric/coolant.

10.3 Set appropriate electrode on the machine ram.

10.4 Fix the job on the machine table.

10.5 Input the program in the control panel.

10.6 Check the program simulation.

10.7 Input the program.

10.8 Run the program to make cavity on the work piece

10.9 Finish the operation and check for quality.

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1. Workshop Process - R. T PrichardELBS
2. Workshop Practice Volume-1 - H. K HazaraChowdhory&A..K HazaraChowdhory
3. Media Promotes and Publication Pvt. Ltd.
4. Machine tools Manufacturing Technology - Steve F. Krar, Mario Rapisarda&Albert F. Cheek - Delmar - Publishers 1998 on International Publishing Company.
5. Operational Manual, CNC Machining.

67955 Instrumentation & Control

T	P	C
2	3	3

AIMS

* Instrumentation engineering, the control system
* Measuring procedure of pressure, temperature, level and flow measurement
* measuring instrument, control theory, transmitter
* The centralized control, machine of control and bridge control
* The density/viscosity control
* The propeller speed control, frequency/ultra violet ray control

SHORT DESCRIPTION

Understand the instrumentation, control system, measuring procedure of pressure , the temperature measuring system, the procedure of level measurement, the flow measuring instrument, the measuring instrument, the control theory, transmitter and control action devices, the control unit and control system, the centralized control, machine of control and bridge control, the density control, viscosity control, chemical and mechanical properties control, the propeller speed control, frequency control, ultra violet ray control and exhaust gas control

DETAIL DESCRIPTION

Theory:

1. Understand the instrumentation

1.1 Define instrumentation and instrumentation engineering.
1.2 Mention the types of instrumentation system.
1.3 Mention the parameters (physical values) of instrumentation and
1.4 instrumentation symbol.
1.5 Explained the branches of instrumentation.
1.6 Discuss the characteristics of instrument.
1.7 Define panel boards display monitors and chart house.
1.8 Explain marine and industrial instrumentation system.

2. Understand the control system

2.1 Define control system.
2.2 Mention adative control, advanced process control and building Automation.
2.3 Discuss control theory, computer-automated design (CAutoD), control reconfiguration.
2.4 Describe intelligent control, model predictive control, nonlinear control, process control and optimal control.

3. Understand the measuring procedure of pressure

3.1 Explain the different types of pressure.
3.2 Explain with sketches the operating principle of different types of pressure measurement instrument.
3.3 Define manometer, pressure sensor and mention application.
3.4 Explain pressure sensing technology, dynamic and static pressure.
3.5 Describe barometer, bourdon pressure gauge or bourdon tube and bellows pressure gauge.

4. Understand the temperature measuring system

4.1 Mention the methods for measuring temperature.

4.2 Explain Thermocouples, Thermostats, Resistance Temperature Detector (RTD), Pyrometer, Langmuir probes (for electron temperature of a plasma), Infrared and other thermometers.

4.3 Explain with sketches the operating principle of different types of temperature measurement instrument.

4.4 Mention the thermostatic scale of temperature measurement instrument.

4.5 Define liquid in glass thermometers, liquid in metal thermometers and bimetallic strip thermometers.

4.6 Mention the function of radiation pyrometer.

5. Understand the procedure of level measurement

5.1 Discuss the liquid/fluid measurement technique.

5.2 Explain the Level Measurement Sensor Selection.

5.3 Discuss the function of direct and indirect level gauge.

5.4 Explain with sketches the operating principle of different types of level measurement instrument.

5.5 Define sight/gauge glass, 3D level scanner, RF transmission line methods and hydrostatic pressure.

5.6 Discuss the float operated level gauge.

5.7 Discuss the function of pneumatic gauge.

6. Understand the flow measuring instrument

6.1 Explain with sketches the operating principle of different pressure flow instrument.

6.2 Discuss the flow rate, flow meters and gear meter.

6.3 Describe the procedure of flow quantity measurement.

6.4 Describe the procedure of flow velocity measurement.

6.5 Describe the process of venture tube.

6.6 Discuss electromagnetic, ultrasonic.

7. Understand the measuring instrument

7.1 Explain with sketches the electrical pressure transducer using potentiometer.

7.2 Define moving coil meter, pressure transducer using the potentiometer strain gauge.

7.3 Discuss the function of moving coil meter and nozzle flapper.

7.4 Define meteorology, tachometer and salinometer.

7.5 Describe the electrical tachometer and mechanical tachometer.

7.6 Discuss the function of torsion meter and strain gauge, and differential transformer torsion meter.

7.7 Discuss the function of viscosity measuring instrument.

7.8 Discuss the function and characteristics of oxygen analyzer and oil in water monitor.

7.9 Describe the function of manometer.

8. Understand the control theory, transmitter and control action devices

8.1 Discuss pneumatic, electrical and hydraulic control system transmitters.

8.2 Discuss the force balance electronic transmitter.

8.3 Discuss two step or on off control system.

8.4 Discuss the function of controller.

8.5 Describe modern control theory.

8.6 Discuss control specification and main control strategies.

9. Understand the control unit and control system

9.1 Discuss the function of pneumatically control valve.

9.2 Discuss the operation of actuator.

9.3 Describe the control system of boiler water level.

9.4 Discuss the function of exhaust steam pressure and temperature control.

9.5 Discuss the procedure of boiler combustion and cooling water temperature control.

10. Understand the centralized control, machine of control and bridge control

10.1 Describe the procedure of electrical supply and integrated control system

10.2 Discuss the procedure of current, voltage (potential difference) and resistant control

10.3 Define the function of ammeter, voltmeter and register.

10.4 Define specific gravity radio cascade control rudder and steering control

10.5 Discuss rudder control, steering control, exhaust control

10.6 Discuss signal control, digital control, echo sounder, LED and RLCD.

11. Understand the density control, viscosity control, chemical and mechanical properties control.

11.1 Define digital density meter, Micrometer and viscometer.

11.2 Describe different viscometer

11.3Discuss chemicals versus chemical substances

12. Understand the propeller speed control, frequency control, ultra violet ray control and exhaust gas control

12.1 Mention the types and application of propeller

12.2 Explain propeller speed control system

12.3 Explain frequency control system

12.4 Define ultra violet ray and mention their types.

12.5 Mention the detection and measurement method of ultra violet ray.

12.6 Mention the harmful effects of ultra violet ray.

12.7 Explain frequency control system

PRACTICAL:

1. **Perform the identification of thermometer and pyrometer**

1.1 Draw different types of thermometer and label it

1.2 Measure exhausts gas temperature of an engine by pyrometer

2. Perform identification of level gauge

2.1 Identify float operated level gauge and its components

2.2 Use level gauge to measure level

2.3 Measure velocity of air by flow meter

2.4 Operate venture meter and observe its action

3. Measure engine speed by tachometer

3.1 Collect some data

3.2 Draw time versus speed graph

4. Measure fluid pressure by bourdon pressure gauge

5. Study manometer and engine

5.1 Measure pressure of water by manometer

5.2 Identify fuel control rack of an engine and observe its function

6. Study density control, viscosity control, chemical and mechanical properties control.

6.1 Identify digital density meter, Pyrometer and viscometer.
6.2 Study chemicals substances
6.3 Study signal control, digital control, echo sounder, LED, RLCD.

7. Study the signal control, rudder and steering control
7.1 Measure current and voltage of an electric circuit by ammeter and voltmeter
7.2 Identify and observe signal control, rudder and steering control

8. Study the propeller speed control, frequency control, ultra violet ray control and exhaust gas control
8.1 Identify the types of propeller and measure the propeller dimension
8.2 Measure the propeller speed or rpm
8.3 Study frequency and ultra violet ray
8.4 Detection ultra violet ray.

9. Study the following control systems
9.1 Study firefighting equipment and observe various control systems
9.2 Study and observe various control systems of fuel, lube oil and cooling systems of an engine

REFERENCE BOOKS

1. Instrumentation - F. W. Kirk
2. Instrumentation and Control Principles-
3. Introduction to Marine Engineering - D A Taylor

68051 Estimating & Costing of Shipbuilding

T	P	C
2	3	3

AIMS:

- Terms related to estimating and costing of shipbuilding.
- Estimating direct and indirect costs of different items of a ship.
- Measuring the quantity of materials, labor hour and other cost items in shipbuilding.
- Calculation of Estimating and costing of Hull, Machineries, Outfitting and Deck Equipment's and other related items.

SHORT DESCRIPTION:

Concept of estimating and costing of shipbuilding and its importance; Elements of shipbuilding cost; Estimating and costing of Hull Plate, Hull Supporting Structure, Outfitting, Machineries and Deck Equipment's, Cost of shipbuilding Project.

DETAIL DESCRIPTION

Theory:

1. Understand the estimating and costing.

1.1 Define estimating and costing.
1.2 Differentiate between estimating and costing.
1.3 Mention the objective of estimating and costing.
1.4. Describe the importance of estimating.
1.5 Describe estimating procedure.

2. Understand the elements of cost.

2.1 Define the elements of cost.
2.2 Classify cost.
2.3 Explain each type of elements of cost.
2.4 Calculate the area and volume of a triangle, rectangle, cone prism, cylinder ring, trapezium, polygon, sphere ,T-section, L-section, I-section, channel.
2.5 Describe the procedure to calculate the direct material cost.
2.6 Describe other cost items-electrode, gas, paint etc.

3. Understand the Elements of Shipbuilding estimating and costing.

3.1 Define the shipbuilding Estimating and costing.
3.2 Mention the element of shipbuilding estimating and costing.
3.3 Mention the main component of shipbuilding estimating.
3.4 Describe the procedure of shipbuilding estimating.

4. Understand the estimating and costing of ship's Hull Plate.

4.1 Define keel and keel plate.
4.2 Classify keel.
4.3 Describe estimating procedure of keel plates according to the measurement.
4.4 Define bottom plate.
4.5 Describe estimating procedure of bottom plate according to the measurement.
4.6 Define shell plate.
4.7 Describe estimating procedure of shell plate according to the measurement.
4.8 Define deck and deck plate.

4.9 Describe estimating procedure of various decks according to the measurement.

5. Understand the estimating and costing of Ship's Hull Supporting Structure.

5.1 Define frame.
5.2 Classify the frame
5.3 Describe estimating procedure of various frames according to the measurement.
5.4 Define Keelson and classify the keelson.
5.5 Describe estimating procedure of various keelsons according to the measurement
5.6 Define Floor.
5.7 Describe estimating procedure of Floor according to the measurement.
5.8 Define Side Stringer.
5.9 Describe estimating procedure of side stringer according to the measurement
5.10 Define Beam and Girder.
5.11 Describe estimating procedure of Beam and Girder according to the measurement.

6. Understand the estimating and costing of bulkhead.

6.1 Define bulkhead.
6.2 Classify bulkhead.
6.3 Describe estimating procedure of bulkheads according to the measurement.

7. Understand the estimating and costing of engine foundation.

7.1 Define engine foundation.
7.2 Define engine template.
7.3 Describe estimating procedure of engine foundation according to the measurement.

8. Understand the estimating and costing of rudder.

8.1 Define rudder.
8.2 Classify rudder.
8.3 Describe estimating procedure of rudder according to the measurement.

9. Understand the estimating and costing of tank.

9.1 Define tank.
9.2 Describe estimating procedure of various tanks according to the measurement.

10. Understand the estimating and costing of welding materials.

10.1 Define welding materials.
10.2 Describe estimating procedure of the quantification of electrode according to the measurement.
10.3 Describe estimating procedure amount of gas, oxygen and current according to the quantity of material.

11. Understand the estimating and costing of outfitting.

11.1 Define the outfitting of ship.
11.2 Mention the list of outfitting of ship.
11.3 Describe estimating procedure of outfitting.

12. Understand the estimating and costing of Machineries and Deck Equipment's.

12.1 Mention the list of machineries.
12.2 Describe estimating procedure of machineries.
12.3 Mention the list deck equipment's.
12.4 Describe estimating procedure of equipment's.

13. Understand the overhead Cost.

13.1 Define different components of overhead cost.

13.2 Describe the procedure to calculate labor hour and its costing.

13.3 Describe the procedure of costing of different components of overhead.

14. Understand the estimating and costing of shipbuilding project.

14.1 List the steps of estimating and costing of shipbuilding project.

14.2 Describe the steps of shipbuilding project.

PRACTICAL

1. Perform to calculate area volume and weight for article 2.4.
2. Visit and estimate the various section of a ship.
3. Visit and estimate the various plates used in shipbuilding.
4. Visit and Estimate engine foundation of a ship.
5. Visit and Estimate rudder of a ship.
6. Visit and Estimate machineries of ship.
7. Visit and Estimate deck equipment of ship.
8. Visit and Estimate outfitting of ship.
9. Perform the estimating and costing of a shipbuilding project

REFERENCE BOOKS

1. Reed's Engineering Drawing for Marine Engineering, Voll-II
   - H.G. Beck C. Eng
   - Thomas Reed, Publication Ltd., 1973
2. Macgibbon Pictorial Drawing Book for Marine Engineering
   - Hugh Barr M.I.Mar.E
   - Janaes Murno and Company Ltd.1965
3. Reed's Ship Construction for Marine Students.
   - E. A STOKOE
   - Thomas Reed Publications Ltd.

68052 Shipbuilding Drawing-II

T	P	C
0	6	2

AIMS:

- To able to draw the Midship Section Drawing, the Shell Expansion Drawing, the Superstructure Drawing, the Various Outfitting Drawing

SHORT DESCRIPTION:

Midship Section, Shell Expansion, Superstructure, Hatch cover, Engine Foundation, Rudder, Propeller& Propeller Shaft, Bollard, Piping and Mast.

DETAIL DESCRIPTION:

1. **Draw the Midship Section according to the measurement of a Ship.**
   - 1.1 Identify the Various Plates and level it.
   - 1.2 Identify the Various Transverse Structures and level it.
   - 1.3 Identify the Various Longitudinal Structures and level it.
   - 1.4 Identify the Various Brackets and level it.
2. **Draw the Shell Expansion according to the measurement of a Ship.**
   - 2.1 Mention the Various Plates size and level it.
   - 2.2 Identify the Various Transverse Structures and level it.
   - 2.3 Identify the Various Longitudinal Structures and level it.
   - 2.4 Identify the welding symbols.
3. **Draw the Superstructure drawing according to the measurement.**
   - 3.1 Identify the Plates Size and level it.
   - 3.2 Identify the Various Vertical Stiffeners and level it.
   - 3.3 Identify the Various Horizontal Stiffeners and level it.
4. **Draw the Hatch Cover drawing according to the measurement.**
   - 4.1 Identify the Hatch Cover Plates and level it.
   - 4.2 Identify the Hatch Cover Beam and level it.
   - 4.3 Identify the Hatch Cover Girder and level it.
5. **Draw the Engine Foundation drawing according to the measurement.**
   - 5.1 Identify the Face Plates and level it.
   - 5.2 Identify the Flange Plate and level it.
   - 5.3 Identify the Bracket and level it.
6. **Draw the Rudder drawing according to the measurement.**
   - 6.1 Identify the Rudder Plates and level it.
   - 6.2 Identify the Rudder Stiffeners and level it.
   - 6.3 Identify the Various Bearing, Various clamp and Coupling and level it.
   - 6.4 Identify the Rudder Stock and level it.
7. **Draw the Propeller& Propeller Shaft drawing according to the measurement.**
   - 7.1 Identify the Propeller Shaft and level it.

7.2 Identify the Stern tube and level it.
7.3 Identify the Propeller Boss and level it.
7.4 Identify the Propeller Blade and level it.
7.5 Identify the Various Packing Gland & Bearing and level it.
7.6 Identify the Various Coupling Flange and level it.

8. Draw the Bollard drawing according to the measurement.

8.1 Identify the Bollard Base Plates and level it.
8.2 Identify the Bollard Pipe and level it.
8.3 Identify the Bollard Rod and level it.

9. Draw the Piping drawing according to the measurement.

9.1 Identify the Bilge Line and level it.
9.2 Identify the Ballast Line and level it.
9.3 Identify the Sea Chest and level it.
9.4 Identify the Engine Cooling Line and level it.
9.5 Identify the Sea Water & Fresh Water Line and level it.

10. Draw the Mast drawing according to the measurement.

10.1 Identify Various Navigation Light and level it.
10.2 Identify the Mast Base Plate and level it.
10.3 Identify the Navigation Light Base Plate and level it.

REFERENCE BOOKS:

1. Reads Engineering Drawing for Marine Engineer.Vol-II - H.G. Beck C. Eng.
2. Ship Construction - D.J. EYRES
3. Ship Construction SKETCHES & NOTES - Kemp & Yourg
4. Reads Ship Construction for Marine Engineer - E.A. STOKOE.

68053 Marine Refrigeration & Air-Conditioning

T	P	C
2	3	3

AIMS

To be able to develop knowledge, skills and attitude in the area of marine refrigeration and air-conditioning with special emphasis on:

- Marine refrigeration and air-conditioning system and their classification
- Concept of thermodynamics applied to refrigeration and air-conditioning
- The refrigerants
- The vapor compression refrigeration system, absorption refrigeration system
- The control device in refrigeration and air-conditioning system
- The condenser, evaporator, compressor and the refrigerant accessories
- The multiple unit refrigeration process, motor control and electric circuits
- The tools, equipment, instruments, materials, servicing system
- The psychrometry , the air-conditioning
- The cold storage, refrigerated container in ship and cargo refrigeration.
- Ducting and piping used in air-conditioning system;
- Marine commercial refrigeration; marine advanced refrigeration

SHORT DESCRIPTION

History and classification of refrigeration and air-conditioning; The refrigerants; The feature of vapor compression refrigeration system, liquid refrigerant control device in refrigeration system, condenser, evaporator, compressor, refrigerant oil, accessories used in the refrigeration system, absorption refrigeration system, The multiple unit refrigeration process, motor control and electric circuits used in refrigeration and air-conditioning; The feature of tools, equipment, instruments and materials used in refrigeration and air-conditioning; servicing the refrigeration system; concept of psychometric; air-conditioning; cold storage; The concept of refrigerated container in ship, cargo refrigeration; ducting and piping used in air-conditioning system; marine commercial refrigeration; advanced refrigeration.

DETAIL DESCRIPTION

Theory:

1. Understand the development, classification and basic concept of thermodynamics applied to refrigeration and air-conditioning

1.1 Define refrigeration and air-conditioning
1.2 Discuss history of refrigeration and air-conditioning with its application
1.3 Classify different types of refrigeration and air-conditioning system used in ship.
1.4 Mention application fields of different types of refrigeration and air-conditioning system
1.5 Classify different types of air-conditioning system.
1.6 Mention the basic principle of different types of refrigeration and air-conditioning system
1.7 Describe the principle of thermodynamics applied to refrigeration and air-conditioning.
1.8 Define the thermodynamic terms (sensible heat, latent heat, internal energy, enthalpy, entropy and evaporation etc).

1.9 Mention the properties of saturated liquid, sub-cooled liquid, wet saturated vapor, superheated vapor, saturated temperature, evaporation and condensation.

1.10 Mention the meaning of heat pump, heat exchanger and evaporative cooling system

2. Understand the refrigerants

2.1 Define refrigerants, primary refrigerants and secondary refrigerants

2.2 Mention the properties of refrigerants.

2.3 Describe the different classifications of refrigerants and their application

2.4 Define CFC, ozone depleted system(ODS), ozone depleted potential (ODP), global warming potential (GWP).

2.5 Describe the rules for designation and chemical formula to express refrigerants

2.6 Define environment friendly refrigerants and give some examples

2.7 Describe the designation system of refrigerants

2.8 Describe the color code of different refrigerant cylinder

3. Understand the concept of psychrometry

3.1 Define psychrometry

3.2 Define the different psychrometric terms (dry air, moist air, saturated air, degree of saturation, humidity, absolute humidity, relative humidity, dry bulb temperature, wet bulb temperature, dew point temperature etc)

3.3 Explain the psychrometric chart

3.4 Mention the main factors affecting human comfort in respect of air-conditioning

3.5 Mention adiabatic mixing of moist air stream

3.6 Define adiabatic or evaporative cooling, sensible heating or cooling

3.7 Mention the main functions of humidistat and comfort chart

3.8 Solve problems related to psychrometry.

4. Understand the feature of air-conditioning

4.1 Define air-conditioning, central air-conditioning system and cooling load.

4.2 Explain refrigerant flow circuit and air flow circuit of window type and split type air-conditioner with sketch

4.3 Mention the main parts a window and split air-conditioning plant and their functions

4.4 Mention the main parts a central air-conditioning plant and their functions

4.5 Draw the primary refrigerant flow circuit, secondary refrigerant flow circuit and cooling tower water flow circuit of central air-conditioning plant

4.6 Mention the heat sources to be considered in estimating total cooling load

4.7 Mention the methods of transport air-conditioning

4.8 Mention the importance of transport air-conditioning

4.9 Solve problems related to air-conditioning and cooling load calculation

5. Understand the feature of vapor compression refrigeration system

5.1 Describe operating principle and flow diagram of vapor compression refrigeration system.

5.2 Mention the main parts of vapor compression refrigeration system and their functions

5.3 Describe the vapor compression refrigeration system with pressure-enthalpy diagram

5.4 Define standard refrigerating effect and standard ton of refrigeration

5.5 Distinguish between vapor compression and vapor absorption refrigeration system

6. Understand feature of condenser and evaporator used in refrigeration and air-conditioning

6.1 Mention the basic function of condenser and evaporator

6.2 Classify condenser and evaporator

6.3 Describe different types of condenser and evaporator.

6.4 Describe the construction and operation of evaporative condenser

6.5 Mention the uses of air-cooled and water-cooled condenser in different field
6.6 Define frosting, defrosting and non-frosting evaporator
6.7 Describe different types of defrosting method (natural air, hot gas and electric defrosting)
6.8 Describe the effect of pressure on evaporation and condensation
6.9 Mention the material used to prevent corrosion in marine condenser for refrigeration.

7. Understand the feature of compressor used in refrigeration and air-conditioning system

7.1 Mention the basic functions, types and operation of compressor.
7.2 Explain bore, stroke, swept volume, clearance and capacity of compressor
7.3 Describe the construction of different types hermatic, semi-hermatic, open type, rotary, centrifugal and screw compressor and uses of in different fields
7.4 Describe the procedure for checking the performance of a different compressor
7.5 Mention the properties and functions of refrigeration oil
7.6 Mention the criteria of selection proper refrigeration oil
7.7 List the common refrigeration oil with their brand names

8. Understand the feature of various control device, electric circuit and accessories used in Refrigeration and air-conditioning

8.1 Describe the construction and function of refrigeration system accessories(drier, receiver, accumulator, flush chamber, heat exchanger, strainer, pressure relief valve, service valve, oil separator, liquid indicator, solenoid valve, check valve etc.).
8.2 Mention the position of different accessories in refrigeration system.
8.3 Describe the construction and operation of automatic and thermostatic expansion valve.
8.4 Describe electric circuit diagram of a frost and no-frost type domestic refrigerator
8.5 Define, classify and operations of electric relay.
8.6 Mention the different types and main functions of liquid refrigerant control device.

9. Understand the feature of multiple unit refrigeration process

9.1 Define multiple unit refrigeration process, compound vapor compression system and cascade system of low temperature refrigeration
9.2 Describe the multiple evaporators at different temperature with single compressor individual pressure regulating valve and suction line check valve
9.3 Describe the multiple evaporators at different temperature with single compressor individual thermostat and individual solenoid stop valve
9.4 Describe two stage compression with water inter cooler and liquid sub cooler or with water inter cooler, liquid sub cooler and liquid flash chamber
9.5 Describe the basic principle of vapor absorption refrigeration system
9.6 Describe the operating principle of ammonia water and lithium bromide absorption refrigeration system.

10. Understand the features of servicing the refrigeration and air-conditioning system

10.1 Mention the methods to identify the refrigerant leakage
10.2 Describe the methods to check the compressor pumping capacity
10.3 Mention the reasons and procedure of evacuating and drying before charging line refrigerant in the system
10.4 Mention the different methods of charging refrigerant
10.5 Describe the charging procedure of service valve attached in refrigeration unit
10.6 Mention the possible consequences of the compressor of a refrigeration unit running Continuously without trip and its remedies
10.7 Mention the possible consequences of the compressor of a refrigeration unit running properly but unable to cool and its remedies

10.8 Describe the installation procedure of window and split type air-conditioner

11. Understand the features of cold storage, refrigerated container in ship and cargo refrigeration

11.1 Mention the functions and classification of cold storage
11.2 Mention the main parts of a cold storage and their functions.
11.3 Explain container cooling in ship and cargo refrigeration.
11.4 Explain the system for refrigerated container controlled by ship's refrigeration plant
11.5 Describe the circulation of cooling air in refrigerated container controlled centrally
11.6 Mention the meaning of container with self refrigeration unit and describe the design
11.7 Describe the cargo refrigeration by direct expansion system and by using chiller
11.8 Mention the drawbacks of direct expansion system in large cargo space
11.9 Mention the advantages of indirect expansion system(using chiller) in large cargo space
11.10 Mention the type of compressor and condenser generally used in cargo refrigeration

12. Understand the features of ducting and piping used in air-conditioning system

12.1 Define, classify, and use of duct in air-conditioning system
12.2 List the duct materials and duct insulation and different duct shape.
12.3 Mention the methods of measuring air-flow in duct and duct design.
12.4 Describe the equation of continuity of duct and pressure in duct
12.5 Mention the factors to be considered in air distribution system
12.6 Mention the methods of measuring pipe sizing
12.7 Mention the fittings and accessories required in piping
12.8 Mention the pipe handling methods in air-conditioning system
12.9 Mention the fans and blowers used in air-conditioning system

13. Understand the marine advanced refrigeration and air-conditioning

13.1 Explain Marine Direct Boat Refrigeration
13.2 Mention the factors to be considered in selecting a brine
13.3 Explain fishing vessel refrigeration
13.4 Explain the troubleshooting faults in Shipboard Refrigeration Systems
13.5 Mention the Safety Devices on the Refrigeration System of a Ship.
13.6 Explain Marine HVAC Systems for Boats of All Sizes

PRACTICAL:

1. Perform identification of hand tools, equipment, instruments and tube

1.1 Identify common hand tools used in refrigeration and air-conditioning works.
1.2 Identify special hand tools and equipment used in refrigeration and air-conditioning works
1.3 Identify instruments and gages used in refrigeration and air-conditioning works.
1.4 Cut tube with the tube cutter and hachsaw
1.5 Bend different size of tubes and angles with spring type tube bender and mechanical tube bender.
1.6 Swage and flare two pieces of copper tubing of same diameter.
1.7 Solder and braze joining copper tubing.

2. Perform operation of vapor compression refrigeration system and domestic refrigerator

2.1 Operate the vapor compression refrigeration system.
2.2 Measure the low side and high side pressures of the vapor compression system.
2.3 Identify the components of a domestic refrigerator and their functions.
2.4 Start the refrigerator and record the reading of the variables(volt, ampere, temperature).
2.5 Check the correct functioning of the refrigerator.

2.6 List the components of electric circuit of a domestic refrigerator.

3. Perform the operation of a window and split type air-conditioner

3.1 Identify the components of a window and split type air-conditioner.
3.2 Start the window and split type air-conditioner with appropriate wire, circuit breaker and other fittings and record the reading of the variables (volt, ampere, temperature).
3.3 Check the correct functioning of the window and split type air-conditioner.
3.4 Observe direct expansion of refrigerant (DX system) of window and split air-conditioner.
3.5 List the components of electric circuit of a window and split type air-conditioner

4. Perform identification of spares of different types of compressor

4.1 Dismantle and identify all the major working parts of a reciprocating compressor, rotary compressor and hermatic compressor.
4.2 Identify the terminals of a hermatic compressor.
4.3 Check for the short, ground and open circuit of a hermatic compressor.
4.4 Check the pumping of a hermatic compressor.
4.5 Identify different types of service valves used in a hermatic compressor.

5. Perform dismantling and assembling of expansion devices and accessories

5.1 Dismantle and reassemble thermostatic expansion valve
5.2 Dismantle automatic expansion valve to identify its spares and assemble it.
5.3 Check the service valve for valve stem in front seat, back seat and intermediate position.
5.4 Dismantle solenoid valve to identify its spares and assemble it.
5.5 Check the solenoid valve and observe the function of strainer and oil separator.

6. Perform the detection of leakage

6.1 Insert the test detector into AC power supply.
6.2 Turn the sensitivity knob to the right and allow one minute warm up.
6.3 Check the operation by turning the sensitivity knob quickly from one position to another to light the probe lamp.
6.4 Probe for leaks, starting with maximum sensitivity .
6.5 Reduce the sensitivity, if the probe lamp lights twice for each leak.
6.6 Recheck the suspected leaks for confirmation.

7. Perform the detection of leakage by halied–torch and electronic leakage detector method

7.1 Act on front-seat (close)/(open) the suction and discharge service valve.
7.2 Attach the charging manifold suction hose to the process valve.
7.3 Attach a drum of the proper refrigerant to the center port of the charging manifold.
7.4 Open the process valve and suction gauge valve and allow enough refrigerant to built up the pressure as high as possible.
7.5 Close the process valve and suction gauge valve, test the system with halied leakage detector and soap solution at all points.
7.6 Disconnect the refrigerant drum hose from the charging manifold if leak exist, open the suction valve and suction gauge hose to purge the refrigerant from the system.
7.7 Repeat the leak check until all leaks are found and repaired, close the suction valve and disconnect the charging manifold.

8. Perform the reporting on ducting and piping in air-conditioning system

8.1 Measure the air flow through duct and compare with the specification.
8.2 Identify common sheet to be used for duct work.
8.3 Identify conventional duct seams and joints
8.4 Make a rectangular /square duct

8.5 Make insulation on a duct
8.6 Identify different types of air terminals of a central air-conditioning plant
8.7 Draw piping system of a cold storage
8.8 Visit a central air-conditioning plant and prepare a report on piping, ducting and air distribution system

9. Perform the pump down and evacuating the refrigeration system

9.1 Steps to be followed to pump down the refrigeration system according to the manual
9.2 Steps to be followed to evacuating the refrigeration system according to the manual

10. Perform the reporting on central air-conditioning Plant

10.1 Visit a central air-conditioning Plant and make report on it.
- Type of compressor
- Type of condenser and cooling media
- Type of evaporation
- Use of chiller
- System of air duct and insulation method.
- Pumping of different cooling media
- Damper, Blower and other accessories

11. Perform the reporting on refrigeration plant of a cold storage, refrigerated container in ship and refrigerated cargo vessel

11.1 Visit a cold storage and make report on it.
- Type of compressor
- Type of condenser and cooling media
- Type of evaporation
- Use of multiple evaporators and multiple compressors
- System of air duct.
- Insulation of wall

11.2 Visit a ship of refrigerated container and make report on it.
11.3 Visit a refrigerated cargo vessel and make report on it.

12. Perform the reporting on marine refrigeration

12.1 Check workability of a bottle cooler.
12.2 Check performance of display freezer.
12.3 Check workability of a milk cooler
12.4 Make a dehumidifier
12.5 Prepare a piping diagram of block ice plant

REFERENCE BOOKS:

1. A text book of Refrigeration and Air-Conditioning -R S Khurmi and J K Gupta
2. Refrigeration and Air-Conditioning - Ballaney
3. Refrigeration and Air-Conditioning - C P Arora
4. Modern Refrigeration and Air-Conditioning - Althouse/Turnquish/Bracciano
5. Fundamentals of Refrigeration - Billy C Langley
6. Refrigeration and Air-Conditioning Technology - William C Whiteman/ William M Johnson
7. Principle of Refrigeration - Roy J. Dossat
8. Basic Refrigeration and Air-Conditioning -P N Ananthanarayanana

65851 Accounting Theory & Practice

T	P	C
2	3	3

AIMS

- To be able to understand the principles and practices of book keeping and accounting.
- To be able to understand the procedures of general accounting, financial accounting and their applications.
- To be able to understand the concept of income tax , VAT & Public works accounts.

Course Outlines

Concept of book keeping and accounting; Transactions; Entry systems; Accounts; Journal; Ledger; Cash book; Trial balance; Final accounts; Cost account & financial accounting; Income Tax; Public works accounts.

DESCRIPTION;

Theory

1. Concept of book keeping and accounting.

1.1 Define book keeping and accountancy.
1.2 State the objectives & of book keeping.
1.3 State the advantages of book keeping.
1.4 Differentiate between book keeping and accounting.
1.5 State the necessity and scope of book keeping and accounting.

2. Transactions Analysis.

2.1 Define transactions and business transaction.
2.2 Describe the characteristics of transaction.
2.3 Discuss the classification of transaction.

3. Entry system of Accounting.

3.1 State the aspects of transactions.
3.2 Define single & double entry system ..
3.3 Discuss the principles of double entry system.
3.4 Distinguish between single entry and double entry system of book keeping.
3.5 Justify whether double entry system is an improvement over the single entry system.

4. Classification of accounts.

4.1 Define accounts.
4.2 State the objectives of accounts.
4.3 Illustrate different type of accounts with example.
4.4 Define “Golden rules of Book keeping”.
4.5 State the rules for “Debit” and “Credit” in each class of accounts.
4.6 Define accounting cycle.

5. Journal .

5.1 Define Journal.
5.2 State the functions of Journal.
5.3 Mention the various names of Journal.
5.4 Interpret the form of Journal.

6. ledger.

6.1 Define ledger.
6.2 Interpret the form of ledger.
6.3 State the functions of ledger.
6.4 Distinguish between Journal and Ledger.
6.5 Explain why ledger is called the king of all books of accounts.
6.6 Explain the following terms: Balance, Balancing; Debit balance; credit balance.

7. Cash book & Its Classification.

7.1 Define cash book.
7.2 Classification of cash book.
7.3 Explain cash book as both Journal and Ledger.
7.4 Define discount.
7.5 Explain the different types of discount.

8. Trial balance.

8.1 Define trial balance.
8.2 State the object of a trial balance.
8.3 Discuss the methods of preparation of a trial balance.
8.4 Explain the limitations of a trial balance.
8.5 Prepare trial balance from given ledger balance. (practical)

9. Final accounts.

9.1 State the components of final account.
9.2 Distinguish between trial balance and balance sheet.
9.3 Select the items to be posted in the trading account, profit & loss account and the balance sheet.
9.4 State the adjustment to be made from the given information below or above the trial balance.
9.5 Explain the following terms: revenue expenditure; capital expenditure; depreciation; annuity method demnishing balance method, machine hour method

10. Cost and financial accounting.

10.1 Define financial accounting.
10.2 State the objectives of financial accounting.
10.3 Define cost accounting.
10.4 State the elements of direct cost and indirect cost.
10.5 Discuss the capital budgeting
10.6 Explain the following terms:
a. Fixed cost b. Variable cost c. Factory cost d. Overhead cost e. Process cost f. Direct cost g. Operating cost h. Standard cost

11. Income Tax

11.1 Define Income Tax.
11.2 State the objects of Income Tax.
11.3 Classification of assesses.
11.4.Taxable income of assesses.
11.5 Tax rebate.
11.6 Explain the following terms: Income tax year; assessment year,NBR.

12. Public works accounts.

12.1 State the important aspects of public works accounts.
12.2 Describe the main features of public works accounts.

12.3 Define Value Added Tex (VAT)

12.4 State the merits and demerits of VAT.

12.5 Explain the following terms :Revenue ; Grant ; Bill; Voucher.

PRACTICAL

1. Identify the transaction from given statements stating reasons.
2. Determine Debtor (Dr) and Creditor (Cr.) from given transactions applying golden rules.
3. Journalize from given transactions.
4. Prepare ledger from given transactions.
5. Prepare double column cash book from given transactions showing balances.
6. Prepare triple column cash book from given transaction and find out the balances.
7. Prepare analytical and imprest system of cash book.
8. Prepare trial balance from the given ledger balance.
9. Prepare trading account, profit & loss account and balance sheet from the given trial balance & other information.
10. Prepare cost sheet showing prime cost, factory cost, cost of production, total cost and selling price.

REFERENCE BOOKS

1. Book-keeping & Accounting - Prof. Gazi Abdus Salam
2. Principles of Accounting - Hafiz uddin
3. Cost Accounting - Prof. Asimuddin Mondol
4. হিসাবরক্ষণ ও হিসাববিজ্ঞান - পরেশ মণ্ডল
5. উচ্চ মাধ্যমিক হিসাববিজ্ঞান - হক ও হোসাইন
6. আয়কর - ড. মনজুর মোরশেদ

BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Dhaka-1207

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

SYLLABUS (PROBIDHAN-2016)

SHIPBUILDING TECHNOLOGY

TECHNOLOGY CODE: **680**

6th SEMESTER

DIPLOMA IN ENGINEERING

PROBIDHAN-2016

SHIPBUILDING TECHNOLOGY

6th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	68061	Ship Construction & Fittings	2	3	3	40	60	25	25	150
2	68062	Computer Aided Drawing in Shipbuilding	1	6	3	20	30	50	50	150
3	68063	CAM & CNC	1	3	2	20	30	25	25	100
4	67064	Strength of Materials	3	3	4	60	90	25	25	200
5	67066	Advanced Welding	1	6	3	20	30	50	50	150
6	67961	Ship Safety & Fire fighting	1	6	3	20	30	50	50	150
7	67976	Marine Electrical & Electronic System	1	3	2	20	30	25	25	100
8	65852	Industrial Management	2	0	2	40	60	0	0	100
Total			**12**	**30**	**22**	**240**	**360**	**250**	**250**	**1100**

68061 Ship Construction & Fittings

T	P	C
2	3	3

AIMS:

To be able of

- -Developing the knowledge, skill and abilities of shipbuilding.
- The basic ship concepts.
- The ship construction & fitting.
- Ship outfitting.
- Developing launching.

SHORT DESCRIPTION:

Concept of Ship & Ship Drawing, Ship terms, Principal Structural members, Ship framing, Ship's Parallel body construction, Ship's fore & aft construction, Ship's superstructure & Bulkhead, Ship's rudder& Engine Foundation, Ship's outfitting & piping, Ship's painting & corrosion prevention, Ship's launching.

DETAIL DESCRIPTION:

Theory:

1. **Understand the Concept of Ship & Ship Drawing:**
   - 1.1 Define the Ship.
   - 1.2 Classify the Ship.
   - 1.3 Describe the Various Types of Ship.
   - 1.4 Describe the Purpose of Various Types of Ship.
   - 1.5 Describe the Basic Drawing used in Ship construction.
   - 1.6 Describe the Construction Drawing used in Ship construction.
2. **Understand the Principal Structural Members of Ship:**
   - 2.1 Mention the Various Section used in Shipbuilding .
   - 2.2 Identify the Ship Structural Items such as Floor, Keelson, Bilge bracket, Side frame , Side stringer, Beam bracket, Various Deck beam, Various Deck Girder, Hatch Beam, various Stiffeners.
   - 2.3 Identify the Various Plate such as Keel Plate, Bottom plate, Margin plate, Bilge plate, Shell plate, Deck plate, Bulwark Plate, Hatch coaming plate, Hatch cover plate, Various Deck plate.
3. **Understand the Ship Framing Systems:**
   - 3.1 Define the frame of Ship.
   - 3.2 Describe the Transverse Framing System of Ship.
   - 3.3 Describe the Longitudinal Framing System of Ship .
   - 3.4 Describe the Combined Framing System of Ship .
4. **Understand the Parallel Body Construction of Ship:**
   - 4.1 Define the Double bottom &Tank top of Ship.
   - 4.2 Describe the Single Hull Construction with sketch.
   - 4.3 Describe the Double Hull Construction in Transverse Framing System.
   - 4.4 Describe the Double Hull Construction in Longitudinal Framing System.
   - 4.5 Describe the Double Hull Construction in Combined Framing System.

5. **Understand the Aft peak & Forepeak Construction of Ship:**
   - 5.1 Define the aft peak & Forepeak of Ship.
   - 5.2 Describe the Construction of Stern frame .
   - 5.3 Describe the Construction of Skeg.
   - 5.4 Describe the Cruiser stern Construction.
   - 5.5 Describe the Transom stern Construction.
   - 5.6 Define the Stem & Stem bar.
   - 5.7 Define the Bulbous Bow.
   - 5.8 Describe the Construction of Bulbous Bow.
   - 5.9 Describe the Bow thrust units.

6. **Understand the Bulkhead & Superstructure Construction of Ship:**
   - 6.1 Define the Bulkhead Stiffener.
   - 6.2 Describe the Construction of Bulkhead.
   - 6.3 Explain the Testing Procedure of Bulkhead.
   - 6.4 Define the Superstructure.
   - 6.5 Define the Forecastle Deck.
   - 6.6 Define the Poop Deck, Bridge Deck & Roof.
   - 6.7 Describe the Forecastle Deck Construction.
   - 6.8 Describe the Poop Deck, Bridge Deck & Roof Construction.
   - 6.9 Describe the Superstructure Wall Construction.

7. **Understand the Rudder & Engine Foundation Construction of Ship:**
   - 7.1 Define Rudder.
   - 7.2 Define Rudder Shaft.
   - 7.3 Define Rudder Stock.
   - 7.4 Define Rudder trunk.
   - 7.5 Define Rudder Pintle.
   - 7.6 Classify the Rudder.
   - 7.7 Describe the Construction of Various Type of Rudder.
   - 7.8 Define Engine Foundation.
   - 7.9 Describe the Construction of Engine Foundation.

8. **. Understand the Outfitting of Ship:**
   - 8.1 Define the Outfitting of Ship.
   - 8.2 Define the Bollard & Describe the Bollard Construction.
   - 8.3 Describe the Manhole & Manhole Cover.
   - 8.4 Describe the Mooring Equipment & Winch.
   - 8.5 Define Mast, Derrick, Deck Crane, Funnel, Derrick ring, Engine Casing, Sea box, Scuppers, Porthole, Sounding pipe, Air vent pipe, Hawse pipe, Chain locker, Cargo handling, Cargo Access & Rigging.
   - 8.6 Describe the Paneling & Insulation of Ship.
   - 8.7 Describe the Various Type of Hatch Cover.
   - 8.8 Describe the Various types of Doors & Windows.
   - 8.9 Describe the Ventilation System of Ship.

9. **Understand the Pipe Fitting of Ship:**
   - 9.1 Define the Ship Piping System.
   - 9.2 Describe the Ship Cargo Piping.
   - 9.3 Describe the Ship Bilge & Ballast Piping.

9.4 Describe the Ship Fresh water & Sea water Piping.

9.5 Describe the Ship Fire hydrant Pipe.

10. Understand the Painting System of Ship:

10.1 Define the Paint of Ship.

10.2 State the Composition & Characteristics of paint used in Ship.

10.3 Describe the Procedure of Surface Preparation before Painting.

10.4 Describe the Painting System of Ship.

10.5 Describe the Methods of Paint Protection.

11. Understand the Corrosion & Prevention in Ship Structure :

11.1 Define the Ship Corrosion.

11.2 Mention the Cause & Prevention of Corrosion in Ship structure.

11.3 Explain the Cathode Protection System.

11.4 Describe the Sacrificial Anode System.

11.5 Describe the Impressed Current System.

12. Understand the Launching of Ship:

12.1Define Launching of Ship.

12.2Mention the Procedure of Ship Launching.

12.3 Mention the Launching Sequences of Ship.

PRACTICAL

1. Perform the identification of Ship:

1.1 Visit the Ship.

1.2 Identify the types of Ship.

1.3 Check the General Arrangement plan of Ship.

1.4 Identify the Capacity of Ship

2. Perform the identification of major Ship Components:

2.1 Identify the Ship Hull.

2.2 Identify the All Machinery & Deck Equipment of Ship.

2.3 Identify the All Piping of Ship.

2.4 Identify the Propeller & Rudder of Ship.

2.5 Identify the Navigation System of Ship.

3. Perform the identification of major Ship Structural Components:

3.1 Identify the Ship Forward Structure.

3.2 Identify the Ship Aft Structure.

3.3 Identify the Ship Parallel Structure.

3.4 Identify the Ship Super Structure.

3.5 Identify the Various Bulkhead 0f Ships.

4. Drawing a diagram of Midship of Ship and identify the various plate and Longitudinal & Transverse Strengthening Structure .

5. Perform the identification of Ships Rudder& Engine Foundation:

5.1 Identify the Ship Rudder.

5.2 Identify the Engine Foundation of Ship.

6. Perform the identification of Ships Outfitting:

6.1 Identify the All Deck Equipment Fitting.

6.2 Identify the Bollard, Hatch & Manhole, Air vent Pipe, Railing, Mast, and Exhaust line.

6.3 Identify the Paneling & Insulation of Ship.

6.4 Identify the Various types of Doors & Windows Perform bending operation.

7. Perform the identification of Ship Paints:

7.1 Identify the Ship under water painting.

7.2 Identify the Ship above water painting.

8. Identify the Ship superstructure painting.

9. .Visit the Ship & Perform the Procedure of Ship Launching.

10. . Visit the Ship & Identify the Instrument in Control Panel of Ship.

11. .Visit the Ship & Prepare the Technical report in Ship Survey.

REFERENCE BOOKS:

1. Merchant Ship Construction
   -D.A. TAYLOR.
2. Ship Construction
   -D.J. EYRES
3. Ship Construction SKETCHES & NOTES
   -Kemp & Yourg
4. Reads Ship Construction for Marine Engineer
   -E.A. STOKOE.

68062 Computer Aided Drawing in Shipbuilding

T	P	C
1	6	3

AIMS

To be able to develop knowledge, skill and attitude in the area of computer aided drawing (CAD) with special emphasis on:

- Drawing of various geometric construction, editing and dimensioning
- Creating multi-view, sectional views, working drawing, 3D drawing, model making and printing of drawing by using AutoCAD package program.

SHORT DESCRIPTION

Concept of AutoCAD; Understand Zoom and pan; View ports; Drawing with AutoCAD; Geometric construction and editing; Dimensioning; Working drawing; 3D drawing; Solid modeling; shipbuilding drawing & Printing of Drawing.

DETAIL DESCRIPTION

Theory:

1. **Understand the concept of AutoCAD:**
   - 1.1 Define CAD.
   - 1.2 Define UCS.& Classify UCS.
   - 1.3 Mention the options of UCS.
   - 1.4 Create the text style.
   - 1.5 Explain the command TEXT and DTEXT.
   - 1.6 Explain the use of QTEXT command.
   - 1.7 Mention commands for sketching.
   - 1.8 Distinguish between SET and NEW layers subcommand.
   - 1.9 Define LT Scale and text height.
2. **Understand zoom, pan & viewport:**
   - 2.1 Define zoom.
   - 2.2 Mention the necessity of zoom.
   - 2.3 Define pan.
   - 2.4 Mention the necessity of pan.
   - 2.5 Identify viewport.
   - 2.6 Classify viewport.
   - 2.7 Describe the function of viewport
3. **Understand the drawing with AutoCAD:**
   - 3.1 Name the important parts of AutoCAD screen.
   - 3.2 List methods used to select AutoCAD commands.
   - 3.3 List methods to control cursor movement.
   - 3.4 Explain defaults.
   - 3.5 Describe prototype drawing.
   - 3.6 Define blips, grid, snap and ortho toggle.
   - 3.7 Define co-ordinate system, absolute coordinate, relative coordinate and polar coordinate.

3.8 Describe the procedure of controlling line weight by AutoCAD.

3.9 Describe the drawing steps of circle, polygon, ellipse, Triangle , polyline, spline, ,BLOCK & WBLOCK

4. Understand the geometric construction and editing:

4.1 Name the commands to create a filled or unfilled line of a specified width.

4.2 List the options of OSNAP command.

4.3 Distinguish between Erase and Break.

4.4 List options of CHANGE command.

4.5 Distinguish between Move and Copy command.

4.6 Mention the MIRROR, Offset, Array, Break & Trim, chamber, Fillet ,Rotate, Divide & Measure ,HATCH and BHATCH command.

4.7 Name the AutoCAD command used to create a template or symbol & section lines.

4.8 Mention the procedure of mirroring a block by INSERT command.

4.9 Identify the command to create a break line with AutoCAD..

5. Understand the dimensioning with AutoCAD:

5.1 Describe the procedure of dimension setting & style.

5.2 List the options to dimension radius, diameter of circle arc , curves, center mark.

5.3 Mention the importance of separate layer for dimensioning.

5.4 Describe the methods of setting the DIM Scale value.

5.5 Describe three types of geometrical model.

5.6 Mention the commands specific to AutoCAD 3D.

5.7 List the methods of using VPOINT commands.

5.8 Describe the procedure to obtain isometric, oblique and perspective view.

5.9 Describe the desktop publication related to engineering graphics.

6. Understand the details working drawing of shipbuilding , solid modeling & Printing:

6.1 Define GA and describe the procedure of GA drawing.

6.2 Describe the procedure of midship section drawing.

6.3 Define solid modeling.

6.4 Describe the procedure to create solid modeling by AutoCAD.

6.5 Mention the command used to control the wire density of displayed solids models.

6.6 Mention the commands used to create composite solid models.

6.7 Distinguish between printer and plotter.

6.8 Describe the steps to print a drawing.

PRACTICAL:

1. Perform the identification of AutoCAD:

1.1 Installation of AutoCAD SOFTWARE.

1.2 Open the computer to familiarize with the familiar version of AutoCAD.

1.3 Open a new drawing file by setting various options of start up dialog box.

1.4 Use the menu bar option or tool bar options to draw or to edit.

2. Perform the lettering, sketching and display changes:

2.1 Open a new drawing session.

2.2 Add and erase single and multiple lines of text to a drawing.

2.3 Change the text font.

2.4 Change the text height, slant height, rotation, angle and justification.
2.5 Create text at an oblique angle and in vertical orientation.
2.6 Change existing text style parameters.
2.7 Create special character in a string of text.
2.8 Create sketch using sketch command.

3. Perform the use of UCS:

3.1 Identify UCS icon.
3.2 Identify UCS.
3.3 Identify WCS (world co-ordinate system).
3.4 Use on/ off/ all/ no origin/ origin commands, if required.
3.5 Use the options of UCS command while drawing by AutoCAD

4. Perform the display changes:

4.1 Use sketch command with snap and ortho modes.
4.2 Create and control the display of layers.
4.3 Control the display of colors.
4.4 Change the line types.
4.5 Create the different types of lines.

5. Perform the zoom and pan:

5.1 Identify zoom action.
5.2 Use various commands of zoom as and when required.
5.3 Identify pan action.
5.4 Use various commands of pan for panning.

6. Perform the setting of view ports:

6.1 Identify view port.
6.2 Create different types of view ports.
6.3 Center the view in view ports.
6.4 Change the isometric view to top view /front view / side view.
6.5 Plot the view port in paper space.

7. Perform the drawing with AutoCAD:

7.1 Enter and exit the AutoCAD drawing editor.
7.2 Identify four important parts of AutoCAD screen.
7.3 Identify the methods to make AutoCAD commands and function selected.
7.4 Identify components of status line.
7.5 Identify three different methods of controlling cursor movement.
7.6 Identify four functions of the keyboard.
7.7 List six methods of entering data using AutoCAD.
7.8 Draw lines using grid, snap, absolute, polar and relative coordinate.
7.9 Draw circles, arcs, rectangle, polygon, sp-line, poly-line, ellipse, multi line and erase entities.
7.10 Use OSNAP command where necessary.
7.11 Use setup command to create sheet size and scale for drawing.
7.12 Choose letter size matching with scale of drawing.

8. Perform the geometric construction and editing by AutoCAD:

8.1 Place a point on drawing.
8.2 Create filled or unfilled lines of specifies width.

8.3 Create a connected sequence of lines and arc segments called poly-lines.
8.4 Edit poly-lines with command.
8.5 Create polygons and ellipses.
8.6 Create filled rings and circles.
8.7 Create hollow and solid quadrilaterals or triangles.
8.8 Edit existing entities including erasing, trimming, coping, mirroring stretching, arraying, exploding, inserting, dividing, extending, measuring breaking and changing some of the characteristics of entities.
8.9 Draw parallel and perpendicular lines.
8.10 Bisect and divide entities into equal parts.
8.11 Draw lines and circles tangent to existing entities.
8.12 Draw irregular curves and sp-lines.
8.13 Draw multi-line and poly-line
8.14 Create the new layers as required.

9. Perform the multi-view drawing by AutoCAD:

9.1 Create a drawing plan before starting a multi-view drawing.
9.2 Create a multi-view drawing of a design.
9.3 Create block to wblock.
9.4 Store block.
9.5 Retrieve and position a block on a drawing.
9.6 Edit a block.
9.7 Draw fillet, rounds, chamfer and run out.
9.8 Create break lines for partial view.

10. Perform the drawing of sectional views by AutoCAD:

10.1 Create and draw a cutting plane line.
10.2 Fill any enclosed polygon with a hatch pattern.
10.3 Erase a hatch pattern from a drawing.
10.4 Create full, half, offset, removed, revolved or broken out section view
10.5 Create orthographic assembly section.
10.6 Create thin parts for sections using conventional practices.
10.7 Select hatch for appropriate materials and apply.

11. Perform the dimensioning of a drawing by AutoCAD:

11.1 Place horizontal, vertical, aligned, rotated, baseline and continued dimensions.
11.2 Place angular, radial and diametric dimensions.
11.3 Control the dimension variables of AutoCAD such as dimension types size of characters and arrow types.
11.4 Place tolerance valves on dimensions.
11.5 Place geometric tolerance symbols on a drawing.
11.6 Place leaders and notes on a dimensioned drawing.
11.7 Dimension prism, pyramid, cone, cylinder, taper, chamfer, keyways, knurls necks, undercut and thread.
11.8 Place centre lines on hole, limit valves, finish mark and other symbols on a drawing.

12. Perform the GA drawing of Shipbuilding by AutoCAD:

12.1 Create the Elevation of Ship.
12.2 Create various Deck Plan.

12.3 Create the bottom plan.

13. Perform the Midship section drawing of Shipbuilding by AutoCAD.

14.Perform the creation of 3D drawing by AutoCAD:

14.1 Create 3D wire frame models of design.
14.2 Create 3D surface models of design using rev-surf, tab-surf, edge-surf, 3D face command.
14.3 Create 3D solid from 2D using extrude command.
14.4 Use primitives to create Pyramid, Wedge, Dome, Sphere, Cone, Torus, Dish and Mesh.

15. Perform the job to make solid modeling of a ship by AutoCAD:

15.1 Create and analyze a region model.
15.2 Create edit and analyze solid primitive shapes.
15.3 Create edit and analyze 3D extrude of a crankshaft.
15.4 Create edit and analyze 3D revolved piston and cylinder liner.
15.5 Create edit and analyze composite solid (Union, Intersection, Subtraction Extrusion, Revolution, Chamfer and filler).
15.6 Create 3D solid model the hull of ship drawing.

16.Perform the shading, rendering and printing:

16.1 Use 'CHANGE' command to change the properties and match the properties.
16.2 Use materials library to attach import material on the surface of the entity.
16.3 Use raster image, if required.
16.4 Use the printing command.
16.5 Print / Plot the image.

17.Perform the inquiry and calculation:

17.1 Select the entity to find length.
17.2 Select the entity to find area.
17.3 Select the entity to find volume and CG of a mass.
17.4 Use List command in inquiry and calculation.

REFERENCE BOOKS

1 AutoCAD for Engineering Graphics
– Gary R. Bertoline
Second Edition, Mamillan publishing company.
2 AutoCAD 2004 or 2007 or 2010 package program, Auto desk, Inc. USA.

68063 CAM & CNC

T	P	C
1	3	2

AIMS

To be able to develop knowledge, skill and attitude in the area of CAMand CNCwith emphasis on: Introduction to CAM and CNC, CAD/CAM interfacing, operating procedure of CNC, Perform CNC part programming, Controls and features of CNC machines.

SHORT DESCRIPTION

Fundamental of CAM and CNC; Constructional features of CNC machines; main parts of CNC turning center and machine center; main parts of CNC Router machine; CNC part programming; CAD/CAM interfacing; CNC machine control and robotic systems.

DETAIL DESCRIPTION:

Theory:

1. **Understand the Fundamental of CAM and CNC.**
   - 1.1 Define CAM and CNC.
   - 1.2 Differentiate among NC, CNC and DNC.
   - 1.3 Identify Parameters governing for selection of CNC Machines.
   - 1.4 Describe the advantages and limitations of CNC.
   - 1.5 Define machine control unit (MCU) and coordinate measuring machine (CMM).
2. **Understand the concept of Constructional features of CNC machines.**
   - 2.1 Types ofCNC machines
   - 2.2 Describes the Elements of CNC machines.
   - 2.3 Describes the working principles and constructional features of CNC machines.
   - 2.4 Explain the Spindle drives and axes drives of CNC machines.
   - 2.5 State Feedback devices (transducers and encoders),Automatic tool changer (ATC), Automatic Pallet changer (APC).
   - 2.6 Explain the importance of tool presetting concept.
   - 2.7 Define qualified tools and its advantages.
3. **Understand the main parts of CNC turning center and machining center.**
   - 3.1 Define CNC turning centers.
   - 3.2 Classify the machining centers.
   - 3.3 State CNC axes and motion nomenclature
   - 3.4 Describe the vertical and horizontal axis of turning center.
   - 3.5 Describe the vertical and horizontal axis of machining center.
   - 3.6 List features of specified CNC turning &machining center.
   - 3.7 Describes various work holding andtool holding devices.
   - 3.8 Describes various accessories of CNC.
4. **Understand the CNC part programming.**
   - 4.1 Describe the applications of G and M codes for turning and milling operation.
   - 4.2 Define of various positions: machine zero, home position, work piece zero and program zero.
   - 4.3 Describe the CNC machine control systems.
   - 4.4 Describe Programming format and structure of part programming.

4.5 Explain CNC part programming for CNC Lathe& milling operation.
4.6 Define and classify the compensations.
4.7 Describe the Tool length, Pitch error, Tool radius and Tool offset compensation.
4.8 Describe the advanced CNC part programming features of canned cycle, do loop, and subroutine system.

5. **Understand and select suitable standard for CAD/CAM interfacing.**
   5.1 Define and Explain CAD/CAM interfacing.
   5.2 Mention types and applications of interfacing.
   5.3 Describe about the interfacing standards for CAD/CAM.
   5.4 Describe operating technic of master CAM/CAM software.
   5.5 Explain Navigating through Master CAM/CAM software.
   5.6 Mention the functions and layouts of different Flexible Manufacturing System (FMS)
   5.7 State Computer Integrated Manufacturing (CIM)& its applications.

6. **Understand the main parts of CNC Router machine.**
   6.1 Define CNC Router.
   6.2 Describe the design and function of common CNC routers.
   6.3 Selectioncriteria of appropriate cutting tools.
   6.4 Explain the operational changes needed to integrate a CNC into a manufacturing operation.
   6.5 Describe the procedure to make a program for CNC Router using common G and M codes.

7. **Understand industrial robots.**
   7.1 Define industrial robot.
   7.2 Describe types of robot configurations.
   7.3 Explain basic elements of robot & its functions.
   7.4 State end effector, grippers, robotic joints.
   7.5 Discuss robotic sensor.
   7.6 Describe the basic drive system of robot.
   7.7 Advantage & disadvantage of robot.

PRACTICAL

1. **Perform the identification of MasterCAM/Solid woks/any CAM software.**
   1.1 Open the computer to familiarize with the familiar version of MasterCAM/CAM software.
   1.2 Open a new drawing file by setting various options of startup dialog box.
   1.3 Use the menu bar option or tool bar options to draw or to edit.

2. **Perform Simulation ofthe lathe operation of Facing, straight turning.**
   2.1 Prepare Drawing for facing & turning.
   2.2 Make a program for facing & turning
   2.3 CreateTool paths for Facing, & turning.
   2.4 Simulate a Tool path using Verify and Back plot.

3. **Perform the facing and straight turning by CNC lathe.**
   3.1 Select proper tools and materials.
   3.2 Set the job on the machine chuck.
   3.3 Set the proper tool on the tool post or on the turret.

3.4 Set zero on the work piece as per instruction.
3.5 Make & input a simple program on facing and turning
3.6 Set up the safe tool position.
3.7 Check the program with simulation.
3.8 Run the program for facing and turning with PPE.

4. **Perform Simulation of the lathe operation of drilling, reaming and external threadCutting.**
   4.1 Prepare Drawing for drilling, reaming and external thread **cutting.**
   4.2 Make a program.
   4.3 Create Tool paths for drilling, reaming and external thread cutting. Facing, Grooving, and Drill
   4.4 Simulate a tool path using verify and back plot.

5. **Perform the job of drilling, reaming and external thread cutting by CNC lathe.**
   5.1 Select proper tools and materials.
   5.2 Set the job on the machine chuck.
   5.3 Set the proper tool on the tool post or on the turret.
   5.4 Set zero on the work piece as per instruction.
   5.5 Make & input a program for drilling, reaming and external thread cutting.
   5.6 Check the program with simulation.
   5.7 Run the program to complete the operations with PPE.

6. **Simulationthe Milling operation of Facing, Contouring, Circle mill, drilling and Chamfer.**
   6.1 Prepare Drawing for Facing, Contouring, Circle mill, drilling and Chamfer
   6.2 Make a program for these operations.
   6.3 Create tool paths consisting of: Facing, Contour, Circle Mill, Drill & Chamfer
   6.4 Simulate a tool path using verify and back plot.

7. **Perform the Milling operation of Facing, Contouring, Circle mill, drilling and Chamfer.**
   7.1 Select proper tools and materials.
   7.2 Choose an appropriate clamping mechanism for CNC milling.
   7.3 Choose & set appropriate cutting tools.
   7.4 Set zero on the work piece as per instruction.
   7.5 Make & input a program for Facing, Contouring, Circle mill, drilling and Chamfer.
   7.6 Check the program with simulation.
   7.7 Run the program to complete the operations with PPE.

8. **Simulation of CNC router machine operation.**
   8.1 Design a program for CNC router machine.
   8.2 Make a program using common G and M code commands.
   8.3 Simulate a tool path using verify and back plot.

9. **Perform the job of routing by using CNC routing machine.**
   9.1 Select proper tools and materials.
   9.2 Choose an appropriate clamping mechanism for CNC Routing.
   9.3 Choose & set appropriate cutting tools.
   9.4 Set zero on the work piece as per instruction.
   9.5 Make & input a program for routing.
   9.6 Check the program with simulation.
   9.7 Run the program to complete the operations with PPE.

10.Perform the design of 2D wireframe in the Top C plane.

10.1 Design 2-D wireframe in the Top C-plane

10.2 Creating a Solid using: Solid Extrude, Create & Cut Body, Chamfer &Fillet

REFERENCE BOOKS:

1. CAD/CAM: computer aided design and manufacturing - Mikell P Groover, Emory Zimmers, Jr.
2. Workshop Practice Volume-1 - H. K Hazara Chowdhory, A. K Hazara Chowdhory
3. Operational Manual, Related CNC machine Manufacturing Company.
4. CNC Machines. - Pabla B.S, Adithan M. New Age International,
5. Computer Numerical ControlTurning and Machining centers. - Quesada Robert Prentice Hall
6. CAD/CAM - Sareen Kuldeep S.Chand
7. Introduction to NC/CNC Machines. - Vishal S. SK. Kataria & Sons.
8. Computer Aided Manufacturing. - RaoP N, Tiwari N K, Kundra

67064 Strength of Materials

T	P	C
3	3	4

AIMS

- To be able to understand the basic concepts & principles of simple stresses, Strains, principal stresses and strains, thermal stress & strain energy.
- To be able to understand the basic principles and techniques of drawing stress-strain, shear force & bending moment and stress diagram of different materials for different types of loads at different sections.
- To be able to understand the basic concepts and principles of properties of materials and appreciate the techniques of handling the testing machines for testing the mechanical properties of materials.

SHORT DESCRIPTION

Simple stress and strain; Principal stress; Strain energy; Thermal stresses & strain; Shear force and bending moment; Bending stress in beams; Shear stress in beams; Deflection of beam; Torsion; Riveted joint; Welded joint; Properties of materials; Testing of mechanical properties; Column & strut.

DETAIL DESCRIPTION

Theory:

1. **Understand simple stresses and strains.**
   - 1.1. Define stress and strain.
   - 1.2. Name different types of stresses and strain.
   - 1.3. Explain modulus of elasticity, modulus of rigidity, Hook's law, bulk modulus and distinguish their relation.
   - 1.4. Express Poison's ratio.
   - 1.5. Explain the stresses in composite bars.
   - 1.6. Solve problems related to stress and strain.
2. **Understand the principal stresses and maximum tangential stress.**
   - 2.1. Define principal stresses.
   - 2.2. Define principal plane
   - 2.3. Explain the methods for determination of principal stresses and tangential stress.
   - 2.4. Solve problems related to principal stress.
3. **Understand the thermal stresses and strains.**
   - 3.1. Define thermal stresses and strains.
   - 3.2. Explain the method of thermal stresses in simple bars, circular tapering section and bars of varying section.
   - 3.3. Explain thermal stresses in composite bar.
   - 3.4. Superposition of thermal stresses.
   - 3.5. Solve problems related to thermal stresses.
4. **Understand the strain energy and impact loading.**
   - 4.1. Define strain energy impact loading.
   - 4.2. Identify types of loading.
   - 4.3. Define resilience, proof resilience and modulus of resilience.

4.4. Explain strain energy stored stress in a body (loading is gradually, suddenly impact).
4.5. Solve problems related to strain energy.

5. Understand the analysis of the effects of loading on beam.

5.1. Define beams and classify it.
5.2. Distinguish between statically determinate and statically indeterminate beams.
5.3. Define bending moment and shear force.
5.4. Identify positive sign and negative sign of bending moment and shear force.
5.5. Express the relation between bending moment and shear force.
5.6. Define deformed sections, inflection point and locate their positions.
5.7. Draw shear force diagram and bending moment diagram of beams.
5.8. Solve problems related to beam.

6. Understand the analysis of bending stresses in beams.

6.1. State the theory of simple bending.
6.2. Explain bending stresses.
6.3. Identify position of neutral axis.
6.4. Define moment of resistance.
6.5. Define section modulus.
6.6. Solve problems related to bending stresses in beam.

7. Understand the plastic theory of bending.

7.1. Bending beyond the yield stress.
7.2. Define plastic theory.
7.3. Moment of resistance at a plastic hinge
7.4. Collapse loads
7.5. Combined bending and direct stress
7.6. Portal frames collapse loads
7.7. Solve problems related to plastic theory of bending.

8. Understand the analysis of shear stress in beams.

8.1. Explain shear stress at a section of beam.
8.2. Express the deduction of the formula for shear stress.
8.3. Identify the distribution of shear stress across the section.
8.4. Calculate shear stress in rectangular, triangular, circular and simple composite sections.
8.5. Solve problems related to shear stress.

9. Understand deflection of beams.

9.1. Explain the slope and deflection of a beam.
9.2. Define methods of finding slope and deflection of beam.
9.3. Determine slope and deflection of simple and cantilever beams.
9.4. Solve problems.

10. Understand the effects of torsion of solid and hollow shafts.

10.1. Explain torsion, torsion shear, resisting torque & couple of forces.
10.2. Define polar moment of inertia.
10.3. Derive formula for moment of inertia of solid & hollow shafts.
10.4. Explain strength of solid hollow shafts.
10.5. Express the deduction of formula for torque and angle of twist of solid & hollow shafts.
10.6. Solve problems related to solid and hollow shaft.

11. Understand the design of riveted joints.

11.1. Explain riveted joint.
11.2. Classify riveted joints.
11.3. Explain methods of failures of riveted joints.
11.4. Describe strength equation for lap & butt joint.
11.5. Determine the efficiency of butt joint.
11.6. Determine the efficiency of butt joints (e.g. double and triple riveted joint with equal & unequal pitch & cover plate).
11.7. Solve problems related to riveted joint.

12. Understand the welded joints.

12.1. Find different dimensions of welded joints.
12.2. Identify the advantages and disadvantages of welded joints.
12.3. Define strength equation of axially loaded and eccentrically loaded welded joints.
12.4. Solve problems related to welded joint.

13. Understand columns and struts.

13.1. Define column and strut.
13.2. Classify columns and struts.
13.3. Define slenderness ratio.
13.4. Explain end conditions of column.
13.5. State Euler's column theory.
13.6. Express the deduction of the formula for failures of column and equivalent length of column.
13.7. Express the deduction of the Ranking formula for columns.
13.8. Solve problems related to columns and struts.

14. Understand the properties of materials.

14.1. Mention the properties of materials.
14.2. Define different mechanical properties.
14.3. Describe the terms: proportional limit, yield point, ultimate strength & breaking strength.
14.4. Draw stress-strain diagram of mild steel bar.

15. Understand the test of mechanical properties of metals.

15.1. Define destructive test.
15.2. Discuss standard test specimen for tension test of bars, sheets, Brinell Hardness test, Rockwell Hardness test, Izod and Charpy Impact tests.
15.3. Identify machines for destructive tests.
15.4. Explain the working principle of testing machines (Universal Testing machine, Brinell and Rockwell hardness testing machines, impact testing machines).
15.5. Describe the following tests on mild steel specimen: Tensile, compression, shear, hardness, impact and bend.

PRACTICAL:

1. Perform tension test on MS rod.

1.1 Collect the specimen.
1.2 Mark the gauge length of specimen.
1.3 Set/Clamp the specimen to the machine.
1.4 Apply load.
1.5 Observe and record data (Yield load, Ultimate load, Breaking load & elongation).

1.6 Calculate stress and strain, percentage of elongation.
1.7 Draw stress-strain curve.
1.8 Remove the tested specimen and make the machine for further use.
1.9 Prepare report and submit.

2. Perform ultimate shear strength test by single shear test.

2.1 Collect the specimen.
2.2 Set the specimen & shear tool to the machine.
2.3 Apply load.
2.4 Observe and record data (Ultimate shear load).
2.5 Remove the tested specimen and make the machine for further use.
2.6 Calculate Shear stress.
2.7 Prepare report and submit.

3. Perform ultimate shear strength test by double shear test.

3.1 Collect the specimen.
3.2 Set the specimen & shear tool to the machine.
3.3 Apply load.
3.4 Observe and record data (Ultimate shear load).
3.5 Remove the tested specimen and make the machine for further use.
3.6 Calculate Shear stress.
3.7 Prepare report and submit.

4. Perform compressive strength test of wood, brick and concrete cylinder specimen.

4.1 Collect the specimen.
4.2 Set the specimen to the machine.
4.3 Apply load.
4.4 Observe and record data (Yield and Ultimate Compressive load).
4.5 Remove the tested specimen and make the machine for further use.
4.6 Calculate Compressive stress.
4.7 Prepare report and submit.

5. Perform bend test of mild steel specimen.

5.1 Collect the specimen.
5.2 Set the specimen to the machine.
5.3 Apply load due to 90^{o} or 120^{o} bend & as required.
5.4 Observe and record data (Ultimate Bending load).
5.5 Remove the tested specimen and make the machine for further use.
5.6 Calculate Bending stress, Modulus of elasticity.
5.7 Physically check and identify any crack or fracture in the bending point.
5.8 Prepare and submit report.

6. Perform the BHN (Brinell Hardness Number) test of Brass, Copper alloy, Aluminum alloy and mild steel specimens.

6.1 Collect the specimen & select indentor.
6.2 Set the specimen & indenter to the machine.
6.3 Apply load according to the metal.
6.4 Observe and record data (Load, dia of indentor & indentation).
6.5 Remove the tested specimen and make the machine for further use.
6.6 Calculate & compare Brinell hardness number to standards material & as required.

6.7 Prepare and submit report.

7. Perform the RHN (Rockwell Hardness Number) test of mild steel, Cast Iron, and High carbon steel specimens.

7.1 Collect the specimen & select indentor.
7.2 Set the specimen & indentor to the machine.
7.3 Apply load according to the metal.
7.4 Remove load
7.5 Observe and record data (RHN from C scale).
7.6 Remove the tested specimen and make the machine for further use.
7.7 Compare Rockwell Hardness Number to standards material & as required.
7.8 Prepare report and submit.

8. Perform torsion test of mild steel specimen.

8.1 Collect the specimen.
8.2 Set the specimen to the torsion test apparatus.
8.3 Apply torsion load.
8.4 Observe and record data (Torsion shear load).
8.5 Remove the tested specimen and make the apparatus for further use.
8.6 Calculate torsion shear strength, modulus of rigidity.
8.7 Prepare and submit report.

9. Perform IZOD impact test of mild steel specimen.

9.1 Collect the specimen.
9.2 Fix the izod striker/hammer in its respective position and place the izod test specimen on supports.
9.3 Lift the pendulum till it gets latched in its position at 90^o from its vertical axis.
9.4 Allow the pendulum to swing freely and break the specimen
9.5 Observe and record data (Izod impact energy).
9.6 Remove the tested specimen and make the apparatus for further use.
9.7 Calculate impact strength.
9.8 Prepare and submit report.

10. Perform Charpy impact test of mild steel specimen.

10.1 Collect the specimen.
10.2 Fix the charpy striker in its respective position and place the charpy test specimen on supports.
10.3 Lift the pendulum till it gets latched in its position at 90^o from its vertical axis.
10.4 Allow the pendulum to swing freely and break the specimen
10.5 Observe and record data (Charpy impact energy).
10.6 Remove the tested specimen and make the apparatus for further use.
10.7 Calculate impact strength.
10.8 Prepare and submit report.

11. Perform tension test on Plastic materials.

11.1 Collect the specimen.
11.2 Mark the gauge length of specimen.
11.3 Set/Clamp the specimen to the machine.
11.4 Apply load.
11.5 Observe and record data (Yield load, Ultimate load, Breaking load & elongation).
11.6 Calculate stress and strain, percentage of elongation.

11.7 Draw stress-strain curve.

11.8 Remove the tested specimen and make the machine for further use.

11.9 Prepare report and submit.

REFERENCE BOOKS

1. Strength of Materials − R. S. Khurmi
2. Strength of Materials − R. K. Jain
3. Strength of Materials − V. Singar
4. Strength of Materials − G.H. Ryder

67066 Advanced Welding

T	P	C
1	6	3

AIMS

- To be able to understand the concepts, principles and techniques of various welding such as TIG welding, MIG welding,Resistance welding, under water welding, thermit, plasma arc, friction, laser beam, ultrasonic, diffusion & explosion welding, Soldering,Brazing,G- position welding method.
- To be able to practice welding of various metals, such as steel, alloy steels and non-ferrous metals
- To be able to understand &cut metal by various cutting method such as plasma arc, gas tungsten arc, laser beam, oxy-lance, oxyfuel under water, oxy arc under water, chemical flux & powder cutting technic.
- To be able to perform different welding method.

SHORT DESCRIPTION

Scope and importance of TIG & MIG welding; Safety rules; Resistance welding; Principles of underwater welding process; Principle of plasma arc, friction, laser beam, ultrasonic, diffusion & explosion welding, Soldering, Brazing, G- position welding & various metal cutting processes.

DETAIL DESCRIPTION

Theory:

1. **Understand the TIG welding.**
   - 1.1 State TIG welding machines and equipment.
   - 1.2 Classify the TIG welding electrodes.
   - 1.3 Mention the field of application of TIG Welding.
   - 1.4 Describe the sequences of operation of TIG welding.
   - 1.5 Mention the importance of cleaning and preparation of TIG welding joints.
   - 1.6 Describe advantages & disadvantages of TIG over ordinary arc welding.
   - 1.7 Describe the safety to be taken for TIG welding.
2. **Understand the MIG welding.**
   - 2.1 Mention the field of application of MIG welding.
   - 2.2 Describe the power supply system in MIG welding.
   - 2.3 Describe the wire feed mechanism in MIG welding.
   - 2.4 List the shielding gases used in MIG welding.
   - 2.5 State the functions of the MIG welding gun.
   - 2.6 Describe the techniques of MIG welding process.
   - 2.7 Describe the specific advantages & disadvantages of MIG welding.
3. **Understand the resistance welding processes.**
   - 3.1 Define resistance welding.
   - 3.2 Describe the construction and operation of resistance welding machine.
   - 3.3 Classify the different types of resistance welding.
   - 3.4 Describe the different types of resistance welding processes.
   - 3.5 Outline the limitations of resistance welding process.

3.6 Distinguish between resistance welding with other welding processes.
3.7 Mention safety precautions of resistance welding.

4. Understand the techniques of underwater welding.

4.1 Define under water welding.
4.2 Mention the equipment used under water welding.
4.3 Describe the operational techniques of underwater welding.
4.4 Describe the importance of underwater welding.
4.5 Discuss the safety needed for under water welding.

5. Understand other welding processes.

5.1 State principle & Applications of thermit welding.
5.2 Describe Thermit welding processes.
5.3 State laser beam welding.
5.4 Describe friction welding.
5.5 Explain electron beam welding.
5.6 Describe ultrasonic welding.
5.7 State Diffusion & Explosion welding.
5.8 Describe soldering & brazing process.

6. Understand the various technic of metal cutting.

6.1 Mention the importance and applications of plasma arc cutting & laser beam cutting.
6.2 Describe the operational sequence of Plasma Arc cutting.
6.3 State the laser beam cutting process with equipments.
6.4 Describe the working procedure of oxygen lance cutting with equipments.
6.5 Describe the working principle of oxy-fuel under water cutting with equipment.
6.6 Describe the working principle of oxy-arc under water cutting with equipments.
6.7 Discuss the working principle of chemical flux cutting with equipments.
6.8 Explain the working procedure of metal powder cutting with equipments.

PRACTICAL

1. Perform setting of TIG welding machine, tools, equipments, accessories, current & voltage according to job requirements and techniques of holding electrode with PPE.

1.1 Mention the care and safety needed for various G-position plate and pipe welding.

2. Perform the straight bead welding in flat position by TIG welding.

2.1 Prepare the work piece.
2.2 Select& hold the electrode.
2.3 Regulate the gas pressure and gas flow.
2.4 Set control unit.
2.5 Perform weld the straight bead without filler rod.
2.6 Perform weld the bead with filler rod.
2.7 Check the weld.
2.8 Practice PPE & clean job - work place.

3. Perform butt joint of stainless steel platein flat position by TIG welding.
4. Perform fillet/lap joint of stainless steel plate in flat position by TIG welding process.
5. Perform butt joint of aluminum plate in flat position by TIG welding.
6. Perform fillet/lap joint of aluminum plate in flat position by TIG welding.

7. Perform setting of MIG welding equipment.

7.1 Identify the shielding gas cylinders.
7.2 Connect the regulators, flow meter and hose pipe.
7.3 Adjust current, gas flow rate and feed wire speed.
7.4 Identify the control switches.
7.5 Select and set the wire reel.
7.6 Select and set the control tip.
7.7 Set the welding gun.
7.8 Check the gas leakage.
7.9 Select & practice PPE.

8. Perform the straight bead in flat position by MIG welding.

8.1 Prepare the work piece.
8.2 Select and set the wire electrode.
8.3 Select the control tip.
8.4 Adjust the gas pressure.
8.5 Select and set the voltage.
8.6 Set current and the wire feed speed.
8.7 Perform the straight bead &Check the weld.
8.8 Practice PPE & clean job - work place.

9. Perform single & double Vee butt joint at flat position by MIG welding.

10. Perform fillet/lap joint at Flat position by MIG welding.

11. Perform the techniques of G- position welding.

11.1 Identify the G-position welding technique.
11.2 Perform 1G & 2G position pipe weldingby TIG welding process.
11.3 Perform 6G position pipe welding byTIG welding process.
11.4 Identify safety needed for various G-position welding.

12. Perform spot welding.

12.1 Select materials and spot welding set.
12.2 Select and hold electrode for spot welding.
12.3 Adjust current, cooling system of electrode& time.
12.4 Perform spot welding on a sheet metal with PPE.

13. Perform joining of broken shaft by thermit welding.

13.1 Select and prepare work piece.
13.2 Prepare thermit mixture within crucible.
13.3 Prepare mold on the joint.
13.4 Set crucible on the mold & open bottom plug of crucible.
13.5 Perform thermit welding with PPE and check.
13.6 Clean job &work place.

14. Perform the oxy-fuel cutting under water.

14.1 Identify oxy-fuel cutting tools and equipment.
14.2 Set control system.
14.3 Set regulator pressure.
14.4 Set the equipment.
14.5 Perform the cutting operation with PPE and check.

15. Perform the arc cutting under water.

15.1 Identify arc cutting tools and equipment
15.2 Adjust control system and regulator.
15.3 Set the equipment and piece the work piece to be cut.
15.4 Perform the cutting operation with PPE.

16. Perform the plasma arc cutting.

16.1 Identify tools and equipment of plasma arc cutting.
16.2 Adjust control unit.
16.3 Set the equipment and place the work piece to be cut.
16.4 Perform the cutting operation with PPEand check the quality of cutting.

17. Perform the gas tungsten arc cutting.

17.1 Identify tools and equipment of gas tungsten are cutting.
17.2 Identify different part of the equipment.
17.3 Adjust control unit and regulator.
17.4 Set the equipment for cutting operation.
17.5 Perform the operation with PPE and check.

18. Demonstrate under water welding technic.

18.1 Identify tools and equipment for under water welding
18.2 Study safety procedure for under water welding.
18.3 Demonstrate under water welding.

19. Perform the laser beam cutting.

19.1 Identify tools and equipment of laser beam cutting.
19.2 Identify different parts of the equipment.
19.3 Adjust the equipment for operation.
19.4 perform the cutting with PPEand check.

20. Perform the air plasma cutting.

20.1 Identify tools and equipment of air plasma cutter.
20.2 Adjust the equipment and air cylinder regulator.
20.3 Set the control unit and place the work piece to be cut.
20.4 Adjust the equipment for operation.
20.5 Finish the cutting and check.

REFERENCE BOOKS

1. Welding Engineering- RL Agarwal & Tahil Manghnani.
2. Manufacturing Technology- P N RAO.
3. A Text book of welding -O.P. Khanna.
4. Welding & Technology – Dr. RS Parmar.
5. Modern Welding. -Althouse/Tarnquist/Bowditch.
6. Welding Skill and Practice- Giachino/Weeks/Brune. -Americ
7. Learning Materials(TIG & MIG) welding Units-6-- Bangladesh Technical Education Board.
8. Production Technology-RK Jain

67961 Ship Safety & Fire Fighting

T	P	C
1	6	3

AIMS

To be able to develop knowledge and skill in the area of safety and fire fighting with special emphasis on

- Ship Safety
- Fire, fire hazard and fire prevention
- Response in fire and evacuation
- Safety equipment

SHORT DESCRIPTION

Concept of safety; Theory of fire; Fire prevention system; Fire fighting system; Fire fighting and evacuation; Fixed fire extinguishing system; Portable fire extinguishing system; Safety equipment in fire prevention; Personnel protective equipment(PPE); Lifting and handling of materials; First aid.

DETAIL DESCRIPTION

Theory:

1. Understand the ship safety.

1.1 Define safety.
1.2 Classify safety.
1.3 Describe the national and international safety codes, rules and regulation.
1.4 Describe the role of IMO, SOLAS and MARPOL for maintaining safety in marine field.
1.5 Define accident, incident, risk assessment, HSSEQ, properly damage and spillage etc.

2. Understand the personal protective equipment and survival equipment onboard ship

2.1 Mention the quality and nature/safety requirements of working clothes
2.2 Identify the quality and nature of safety helmet, goggles, face mask, ear defender,
2.3 Safety shoes, breathing apparatus and safety beltsdepending on the nature of work
2.4 Describe the maintenance procedure of personal protective equipment.
2.5 Mention the necessary precautions to be taken for using respiratory protective equipment.
2.6 Define survival equipment.
2.7 Define life boat, life raft, life buoy, immersion suit and life jacket.
2.8 Identify the requirements and nature of lifeboat depending on type of ship
2.9 Mention the importance of lifeboat, life raft and life buoy and life jacket.
2.10 Distinguish between lifeboat and life raft.

3. Understand the fireand fire prevention system.

3.1 Define fire.
3.2 Describe the fire triangle.
3.3 Classify fire
3.4 Mention the causes of fire spreading.
3.5 List the hazards of fire.
3.6 Mention the necessity of fire prevention.
3.7 Mention the role of safety to prevent fire.

3.8 Describe the role of storage and handling materials to prevent fire.

3.9 Describe various measures taken to prevent fire (fire prevention plan, fire detection systems, automatic alarms, fire safe doors, fire exits etc)

4. Understand the fire extinguishing system.

4.1 Classify fire extinguishing system.

4.2 Describe the fixed water / sprinkler fire extinguishing system.

4.3 Describe the fixed CO2 extinguishing system.

4.4 Describe the fixed foam fire extinguishing system.

4.5 Describe the fixed Hyper-Mist system.

4.6 Identify the hoses and nozzles.

4.7 Mention the operation of hose and nozzle.

4.8 Describe the operating procedure of portable foam extinguisher.

4.9 Describe the operating procedure of CO2and dry powder to extinguish fire.

5. Understand the safety on deck and deck equipment.

5.1 List appropriate protection to be taken against fire and explosion.

5.2 Describe the general causes of fire and explosion on board vessel.

5.3 Describe safety precautions against grounding and collisions.

5.4 Describe safety precautions against oil spillage,

5.5 Mention safety precaution while ballasting and de-ballasting of ships.

5.6 List protection against falling object.

5.7 Mention protection to be taken while working at heights

5.8 List the measures to be taken to reduce noise

5.9 List general safety of ropes, chains, slings, pulleys, blocks, hooks, shackles and ladders of a ship.

6. Understand the safety procedure of arc welding, gas welding and cutting and general electrical safety

6.1 Mention the arc welding safety procedure on board ship.

6.2 Describe the importance of inspection before arc/gas welding.

6.3 Mention the gas welding safety procedure.

6.4 Describe the safe placement of gas cylinder on board vessel.

6.5 Describe the competency requirement of personnel carrying out hot work (welding, cutting etc.) on board vessel.

6.6 List the safety precautions to be taken for electric wiring.

6.7 Mention the importance and procedure of proper earthling.

6.8 Describe circuit breaker and other electric safety devices (i.e: Reverse power relay, timers, AVR, sensors etc.)

6.9 Mention additional safety measures for working with High Voltage.

7. Understand thefirst aid, medical services, supervision and health organization.

7.1 Mention the necessity of occupational health services.

7.2 Mention the medical supervision and first aid equipment.

7.3 Mention the necessity of first aid.

7.4 State the duties and responsibilities of first aid personnel.

7.5 Mention the condition of first aid room.

7.6 Mention the function of safety officer.

7.7 Describe the necessity of welfare.

PRACTICAL:

1. **Perform the safety practice in shipyard/dockyard or on board ship**
   - 1.1 Clean and maintain the workplace properly.
   - 1.2 Use scaffolding and rigid staging.
   - 1.3 Check ladders, stairs, gangways, ramps properly before using.
   - 1.4 Maintain proper supervision before starting the work.
   - 1.5 Take precaution against fire and explosion.
   - 1.6 Take precaution against falling objects.
   - 1.7 Arrange rescue equipment against drowning.
   - 1.8 Use proper working clothes and maintain personal safety.
   - 1.9 Check the items stored inside a lifeboat and demonstrate the method of using emergency items.
2. **Perform the handling of lifting appliances**
   - 2.1 Use maximum safe working load of the lifting appliances.
   - 2.2 Install appliances properly with competent persons.
   - 2.3 Check drums and brakes for proper operation.
   - 2.4 Inspect every part of structure, working gear, anchoring and fixing appliances of every crane and other movable parts of crane.
   - 2.5 Check limit switch working properly
3. **Perform the docking of a vessel**
   - 3.1 Make a list of job that has to be done at dry dock
   - 3.2 3.2 Check the certificate from safety officer before docking.
   - 3.3 Inspect the vessel/tanker before entering into the dock.
   - 3.4 Close the dock for the persons not engaged in docking.
   - 3.5 Engage the crane to secure any inadvertent movement during docking or undocking.
   - 3.6 Check the stability with the help of dock manager in cooperation with competent ship officer.
   - 3.7 Close all openings securely at bottom or side of the ship.
4. **Perform the launching and moving of vessels on ship ways**
   - 4.1 Raise or lower the vessel on day light or under adequate light.
   - 4.2 Test the rail track for correct alignment before moving or launching vessel.
   - 4.3 Clean the track and working place from dirt, rubbish and extraneous object.
   - 4.4 Close all openings securely before launching.
   - 4.5 Maintain adequate light before launching.
   - 4.6 Clean and dry the slip way before launching.
   - 4.7 Verify the proper condition of slip way, launching equipment and the adjoining area of water as well as the drug slings and anchor chains.
   - 4.8 Maintain appropriate clearance between the hull and staging.
   - 4.9 Signal the areas of launching not enter any vessel in the area.
5. **Perform the safety equipment in fire prevention**
   - 5.1 Check the function of the detectors in fire prevention.

5.2 Use various types of detector.
5.3 Make a list of safety signs.
5.4 Practice the alarm system.
5.5 Check different types of fire detectors used in different areas of ship

6. Perform the fire prevention and fire fighting

6.1 Check the portable fire extinguishing system.
6.2 Check the fixed fire extinguishing system.
6.3 Drill on fire alarm system for smoke detection.
6.4 Drill on fire extinguishing system.
6.5 Drill on a fire yard to extinguishing fire.
6.6 Drill for rescue operation in smoke associated fire.
6.7 Demonstrate the use of EEBD and BA sets properly.
6.8 Use chemical powder to extinguish fire.
6.9 Detect the causes of fire.

7. Perform safety on board ship

7.1 Demonstrate emergency response duties and Muster List
7.2 Check the safety precaution to be taken for cargo ships.
7.3 Check theadditional safety precaution to be taken for oil tanker or carrying hazardous cargo.
7.4 Observe the safety precaution to be taken for a cruise/passenger vessel.
7.5 Demonstrate the safety precautions to be taken on offshore stationary platforms and rigs.

8. Perform the safety procedure to start machinery.

8.1 Demonstrate the safety procedure of starting an engine on board ship.
8.2 Participate the safety procedure of stopping an engine on board ship.
8.3 Demonstrate emergency start-stop procedure of every critical equipment on board (generators, air compressors, fire pumps etc.)
8.4 Check the safety of boiler
8.5 Check the safe conditions to be maintained in engine room

9. Perform the handling of pressure plant.

9.1 Check all working parts of boiler such as valves, cocks, injectors and pumps etc as per schedule.
9.2 Check the operation of automatic safety valve.
9.3 Inspect all working parts of the compressor including speed governor, safety valves and oil separator
9.4 Clean speed governor, safety valve and oil separator.
9.5 Store the combustion gas cylinders separately from oxygen cylinder.
9.6 Store minimum number of cylinders in small confined space.
9.7 Use pressure regulator and safety device for each acetylene cylinder to prevent from any flash back.

10. Learn to use first aid equipment and methods.

10.1 Mention the tools and equipment necessary for first aid.
10.2 Check pulse, consciousness and blood pressure of an injured person.
10.3 Perform artificial respiratory techniques on a fainted or injured person.
10.4 Carry an injured person safely (using stretchers or manually).
10.5 Perform treatment on light injury or wound.
10.6 Demonstrate the safety practice in hygiene.

REFERENCE BOOKS:

1. Safety and Health in Shipbuilding and Ship Repairing - ILO, Geneva-22, Switzerland. 1978.
2. Theory and Practice of seamanship – Graham Danton
3. Seamanship Technique – DJ House
4. IMO Model Course: 1.20, 1.13, 1.19, 3.26, 3.27, 1.21
5. SOLAS IMO. 1978.
6. MARPOL

67976 Marine Electrical & Electronic system

T	P	C
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AIMS:

To be able to develop knowledge, skill & attitude in the area of Marine Electro Technology with special emphasis on:

- D.C & AC Electrical Power Generation Principle, Construction of Electrical Machines & their Maintenance.
- Synchronizing Procedure of Three phase Alternator on Board Ship.
- D.C Motor & AC Motor Overhauling.
- Speed Control of D.C Motor & AC Motor on Board Ship.
- Synchronous motor, Converter, Inverter & Dynamo.
- Transformer, Navigation Light & Battery Charging System on Board Ship.

SHORT DESCRIPTION

D.C & AC Electrical Power Generation Principle, Synchronizing Procedure of Three phase Alternator, Electric motor overhauling, Speed Control of D.C Motor, Transformer, Battery charging system, Navigation Light, Synchronous motor, Converter, three point face plate starter, Direct on line starter, Star-Delta Starter, Handling of Electrical equipment in oil, Gas & Chemical Tanker, Star Connection & Delta Connection.

DETAIL DESCRIPTION

Theory:

1. **Understand A-C Three Phase Circuit.**
   - 1.1 Write down The Advantages of A.C Three Phase System
   - 1.2 State What is Meant by Frequency
   - 1.3 Distinguish between KVA and Kilowatt.
   - 1.4 Define power Factor.
   - 1.5 List the Disadvantages of low power Factor.
   - 1.6 Define Inductance and Impedance.
   - 1.8 Describe the Procedure of Three Phase Delta Connection.
   - 1.9 Calculate Power Factor of a Generator/motor.
2. **Understand Navigation Lightand Converter.**
   - 2.1 Define Navigation Light.
   - 2.2 Mention the Classification of Navigation Light.
   - 2.3 State the Necessity of Navigation Light.
   - 2.4 Draw the Wiring Diagram of Navigation Light Circuit.
   - 2.5 Define Converter.
   - 2.6 State the Classification of Converter.
   - 2.7 Name the Different Parts of Converter.
   - 2.8 Mention the Uses of Converter.
   - 2.9 Distinguish Between Converter and Inverter.

3. Understand The Handling of Electrical Equipment In oil Gas And Chemical Tanker.

3.1 Define Dangerous Spaces And Normal Safe Spaces.

3.2 Mention The Classes of Tanker And Their Dangerous Space .

3.3 Mention The Condition of Electrical Equipment to be Maintained using in Dangerous Spaces

3.4 Mention The Requirements of The Electrical Equipment Like General Cargo Handling Motor, Pump, Motor And Gas Compressed Motor used in Dangerous Spaces of A, B, C And D Type Tanker

3.5 Describe Intrinsically safe equipment used onboard tanker.

4 Understand DC Generator and AC Generator.

4.1 Define& Classify D.C Generator.

4.2 Define Residual Voltage.

4.3 Describe The Construction of D.C Generator.

4.4 List The Important Condition That Must be Fulfilled Before a Generator Can be Connected in Parallel.

4.5 How is The Ampere Load Divided in The Desired Proportion between two D.C Compound Generators operating in parallel.

4.6 Define A.C Generator.

4.7 State The Classification of A.C Generator.

4.8 Name The Different Parts of A.C Generator.

4.9 Describe The Working Principle of Brush less Alternator.

4.10 List The Important Condition that Must be Fulfilled Before An Alternator Can be Connected in parallel.

4.11 Define Synchronizing.

4.12 Describe The SynchronizingProcedure of Three Phase Alternator of Three Dark Lamp Method, Three Bright Lamps Method, &Synchroscope Method.

4.13 How is The Kilowatt load Divided in The Desired Proportion Between Two Alternators operating in parallel.

4.14 Generator safety alarm and Protection Trips.

5. Understand D.C Motor and A.C Motor.

5.1 Define& Classify D.C Motor.

5.2 Name The Different Parts of D.C Motor.

5.3 Describe The Working Principle of D.C Motor.

5.4 Define Back E.M.F.

5.5 Define D.C Motor overhauling.

5.6 Define & Classify A.C Motor.

5.7 Identify The Different Parts of A.C Motor.

5.8 Describe The Working Principle of Three phase Induction Motor.

5.9 Mention The uses of Three phase Induction Motor.

5.10 Define Counter E.M.F

6. Understand Direct On line Starter and Star Delta Starter.

6.1 Identify The Different parts of Direct on line Starter.

6.2 Describe The Operating Principle of Direct on line Starter

6.3 State The Using The Over load Relay.

6.4 Mention The uses of Direct on line Starter.

6.5 Mention the Necessity of Using Star Delta Starter.
6.6 Identify The Different parts of Star Delta Starter.
6.7 Describe The Operating Principle of Star Delta Starter.
6.8 Mention The uses of Star Delta Starter.

7. Understand Transformer.

7.1 Define& Classify Transformer.
7.2 Identify The Different parts of Transformer.
7.3 Define Auto Transformer.
7.4 Describe The Working Principle of Transformer
7.5 Calculate number of Turns and Transformers Turns Ratio .

PRACTICAL:

1. Perform The Insulation Test of a Three phase Alternator.

1.1 Sketch The Circuit Diagram For The Insulation Test of a Three phase Alternator.
1.2 List Tools equipment And Material Required For The Test.
1.3 PrepareThe Circuit According To The Circuit Diagram With Propar Materials And equipment.
1.4 Check The Circuit And Complete The Test.

2. Perform The Insulation Test of a D.C Generator .

2.1Sketch The Circuit Diagram For The Insulation Test of a D.C Generator.
2.2 Select proper Tools, Equipment And Materials For The Test.
2.3 Make The Circuit According To The Circuit Diagram Proper Equipment.
2.4 Check And Complete The Test.

3. Perform The Insulation Test of a Three phase Transformer.

3.1 Sketch The Circuit Diagram For The Insulation Test of a Three phase Transformer
3.2 List Tools equipment And Material Required For The Experiment.
3.3 Perpare The Circuit According To The Circuit Diagram With Proper Equipment.
3.4 Check The Circuit And Complete The Test.

4. Perform The Insulation Test of a Single phase Induction Motor.

4.1 Sketch The Circuit Diagram For one Insulation Test of a Single phase Induction Motor.
4.2 Select TheProper Tools, Equipment. And Materials for The Experiment.
4.3 Prepare The Circuit According To The Circuit Diagram With Proper Equipment.
4.4 Check The Circuit And Complete The Test.

5. Perform The Insulation Test of a Three phase Induction Motor.

5.1 Sketch The Circuit Diagram For The Induction Test of a Three phase Induction Motor.
5.2 Select Proper Tools, Equipment And Materials Required for The Test.
5.3 Make The Circuit According To The Circuit Diagram With Proper Equipment.
5.4 Test for Insulation of Thee Three phase Induction Motor.

6. Perform The Insulation Test of a D.C Motor.

6.1 Sketch The Circuit Diagram For The Induction Test of a D.C Motor.
6.2 Select TheProper Tools, Equipment. And Materials for The Test.
6.3 Make The Circuit According To The Circuit Diagram With Proper Equipment.
6.4 Check The And Complete The Test.

7. Perform The Continuity Test of Three phase Induction Motor.

7.1 Sketch The Circuit Diagram of Three phase Induction Motor.

7.2 List The Materials And Equipment Required for the Experiment.

7.3 Test The Connection of The Circuit By Megger.

8. Perform TheContinuity Test of D.C Motor.

8.1 Sketch The Circuit Diagram of D.C Motor

8.2 List The Materials And Equipment Required for the Experiment.

8.3 Test The Connection of The Circuit By Megger.

9. Perform The Continuity Test of Three phase Alternator.

9.1 Sketch The Circuit Diagram of Three phase Alternator.

9.2 List The Materials And Equipment Required for the Experiment.

9.3 Test The Connection of The Circuit By Megger.

10.Perform The Job To Measure The Power of An Electric Circuit.

10.1 Sketch The Necessary Circuit Diagram With an Electrical Load, Ammeter and Voltmeter.

10.2 List Tools, equipment And Materials Required ForThe Experiment.

10.3 Prepare The Circuit According To The Circuit Diagram Using Ammeter and Voltmeter.

10.4 Check The Circuit And Complete The Test.

10.5 Record The power Measured by The Voltmeter And Ammeter.

REFERENCE BOOKS

1. Principle of Electricity - By E. Hughes.
2. Electrical Technology - By Hughes.
3. Electrical Technology - By B.L. Theraja
4. Fundamentals of Electronic Systems Design – By Lienig,Jens,Bruemmer,Hans

65852 Industrial Management

T	P	C
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AIMS

- To be able to develop the working condition in the field of industrial or other organization.
- To be able to understand develop the labor management relation in the industrial sector.
- To be able to develop the management techniques in the process of decision making.
- To be able to manage the problems created by trade union.
- To be able to understand Planning
- To be able to perform the marketing.
- To be able to maintain inventory.

SHORT DESCRIPTION

Basic concepts of management; Principles of management; Planning, Organization, Scientific management; Span of supervision; Motivation; Personnel management and human relation; Staffing and manpower planning ; Training of staff; Concept of leadership; Concepts and techniques of decision making; Concept of trade union; Inventory control; Economic lot size ; Break even analysis; Trade Union and industrial dispute, Marketing;

DETAIL DESCRIPTION

Theory

1. Basic concepts & principles of management.

1.1 Define management and industrial management.
1.2 State the objectives of modern management.
1.3 Describe the scope and functions of management.
1.4 State the principles of management.
1.5 State the activity level of industrial management from top personnel to workmen.
1.6 Describe the relation among administration, organization & management.

2. Concept of Planning

2.1 Define Planning
2.2 Discuss the importance of Planning
2.3 Discuss the Types of Planning.
2.4 Discuss the steps in Planning

3. Concepts of organization and organization structure.

3.1 Define management organization.
3.2 State the elements of management organization.
3.3 Describe different forms of organization structure.
3.4 Distinguish between line organization and line & staff organization.
3.5 Distinguish between line organization and functional organization.
3.6 Describe the features, advantages and disadvantages of different organization structure.

4. Concept of scientific management.

4.1 Define scientific management.
4.2 Discuss the basic principles of scientific management.
4.3 Explain the different aspects of scientific management.

4.4 Discuss the advantages and disadvantages of scientific management.

4.5 Describe the difference between scientific management and traditional management.

5. Concept of span of supervision.

5.1 Define span of supervision and optimum span of supervision.

5.2 Discuss the considering factors of optimum span of supervision.

5.3 Discuss advantages and disadvantages of optimum span of supervision.

5.4 Define delegation of authority.

5.5 Explain the principles of delegation of authority.

5.6 Explain the terms: authority, responsibility and duties.

6. Concept of motivation.

6.1 Define motivation.

6.2 Discuss the importance of motivation.

6.3 Describe financial and non-financial factors of motivation.

6.4 Special Motivational Techniques.

6.5 Discuss the motivation theory of Maslow and Harzberg.

6.6 Differentiate between theory-X and theory-Y.

7. Concept of leadership.

7.1 Define leadership.

7.2 Discuss the importance and necessity of leadership.

7.3 Discuss the functions of leadership.

7.4 Describe the qualities of a leader.

8. Basic concepts and techniques of decision making.

8.1 Define decision making.

8.2 Discuss the importance and necessity of decision making.

8.3 Discuss different types of decision making.

8.4 Describe the steps in decision making.

9. Concept of personnel management and human relation.

9.1 Define personnel management.

9.2 Discuss the functions of personnel management.

9.3 Define staffing.

9.4 Define recruitment and selection of employees.

9.5 Describe various sources of recruitment of employees.

9.6 Describe the methods of selection of employees.

9.7 Define training and orientation of employee.

9.8 Discuss the importance and necessity of training.

9.9 Discuss the various methods of training of workmen, technicians and executive personnel.

10. Concept of inventory control & Economic lot size

10.1 Define inventory & inventory control.

10.2 Describe the function of inventory control.

10.3 Define Economic lot size and the Method of determination of economic lot size.

10.4Discuss the effects of over supply and under supply.

10.5 Explain the following terms: - Bin card or Bin tag. - Purchase requisition. - Store requisition. - Material transfer note. - First in first out (FIFO). - Last in first out (LIFO). -Safety stock -Lead time

11. Concept of Break Even Point (BEP)

11.1 Define Break Even Point and Break Even Chart.

11.2 Describe the method of determination of BEP

11.3 Explain the terms: - Break even analysis. - Fixed cost. - Variable cost

12. Concept of Marketing

12.1 Define marketing.

12.2 Discuss the function of marketing.

12.3 State the objectives of marketing.

12.4 Explain the terms: -Purchase, - Brand, - Producer. – Consumer, - Customer, - Copyright - Trade mark

12.5 Discuss product life -cycle and marketing strategies in different stages of a product life-cycle

13. Concept of trade union and industrial dispute

13.1 Define trade union.

13.2 Mention the objectives of trade union.

13.3 Discuss the function of trade union.

13.4 Describe different types of trade union.

13.5 Define industrial dispute

13.6 Discuss different type of industrial dispute

REFERENCE BOOKS

1. Dr. Md. Mainul Islam and Dr. Abdul Awal Khan-Principles of Management, Bangladesh Open University.

2. Mohammad Mohiuddin-Personnel Management and Industrial Relation, NIDS Publication Co. Dhaka.

3.সুফয়িা বগেম, মে◌া: জাহদেুল হক ও সুপ্রয়িা ভট্রাচার্য্য-ব্যবস্থাপনা এর মে◌ৌলকি ধারণা,ব্যতকি্রম প্রকাশনী ঢাকা। Matz Usry-Cost Accounting: Planning & Control.