DIPLOMA IN ENGINEERING
PROBIDHAN-2016

MARINE TECHNOLOGY (679)

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	67911	IC Engine Principle	2	3	3	40	60	25	25	150
2	67011	Basic Workshop Practice	0	6	2	0	0	50	50	100
3	66711	Basic Electricity	3	3	4	60	90	25	25	200
4	65911	Mathematics -1	3	3	4	60	90	50	0	200
5	65913	Chemistry	3	3	4	60	90	25	25	200
6	65811	Social Science	3	0	3	60	90	0	0	150
7	65812	Physical Education & Life Skill Development	0	3	1	0	0	25	25	50
Total			**14**	**21**	**21**	**280**	**420**	**200**	**150**	**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	67921	Diesel Engine Operation and maintenance	2	3	3	40	60	25	25	150
2	67922	Marine Engineering Materials	2	3	3	40	60	25	25	150
3	61011	Engineering Drawing	0	6	2	0	0	50	50	100
4	65912	Physics-1	3	3	4	60	90	25	25	200
5	65921	Mathematics-2	3	3	4	60	90	50	0	200
6	65711	Bangla	3	3	4	60	90	50	0	200
7	65712	English	2	0	2	40	60	0	0	100
Total			**15**	**21**	**22**	**300**	**450**	**225**	**125**	**1100**

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	67931	Fuels & Fuel Injection System	2	3	3	40	60	25	25	150
2	67033	Machine Shop Practice	1	3	2	20	30	25	25	100
3	66811	Basic Electronics	2	3	3	40	60	25	25	150
4	66611	Computer Application	0	6	2	0	0	50	50	100
5	65931	Mathematics-3	3	3	4	60	90	50	0	200
6	65922	Physics-2	3	3	4	60	90	25	25	200
7	65722	Communicative English	1	3	2	20	30	50	0	100
Total			**12**	**24**	**20**	**240**	**360**	**250**	**150**	**1000**

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	67941	Diesel Engine Overhauling & Record Keeping	2	6	4	40	60	50	50	200
2	68032	Welding	1	6	3	20	30	50	50	150
3	67044	Marine Mechanical Drawing	0	3	1	0	0	25	25	50
4	67042	Metallurgy	2	3	3	40	60	25	25	150
5	67952	Engineering Thermodynamics and Heat Transfer	2	3	3	40	60	25	25	150
6	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
7	67041	Engineering Mechanics	3	3	4	60	90	25	25	200
		Total	**12**	**24**	**20**	**240**	**360**	**200**	**200**	**1000**

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	67951	Marine Engines & Construction	2	6	4	40	60	50	50	200
2	69054	Environmental Studies	2	0	2	40	60	0	0	100
3	67056	Advanced Machine Shop	2	6	4	40	60	50	50	200
4	67054	CAD &CAM	1	6	3	20	30	50	50	150
5	67955	Instrumentation & Control	2	3	3	40	60	25	25	150
6	65851	Accounting Theory and Practice	2	3	3	40	60	50	0	150
		Total	**11**	**24**	**19**	**220**	**330**	**225**	**175**	**950**

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	67064	Strength of Materials	3	3	4	60	90	25	25	200
2	68053	Marine Refrigeration & Air Conditioning	2	3	3	40	60	25	25	150
3	67961	Ship Safety & Fire Fighting	1	6	3	20	30	50	50	150
4	67962	Marine Auxiliary System & Hydraulic Machinery	2	6	4	40	60	50	50	200
5	68021	Naval Architecture	2	3	3	40	60	25	25	150
6	67977	Maritime laws	2	0	2	40	60	0	0	100
7	65852	Industrial Management	2	0	2	40	60	0	0	100
		Total	**14**	**21**	**21**	**280**	**420**	**175**	**175**	**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	67971	Engine Testing & Installation	2	6	4	40	60	50	50	200
2	67972	Ship Propulsion System	2	3	3	40	60	25	25	150
3	67973	Marine Steam Power & Gas Turbine	2	3	3	40	60	25	25	150
4	67974	Ship Construction and Fittings	2	3	3	40	60	25	25	150
5	67963	Mechanical & Marine Estimating	2	3	3	40	60	25	25	150
6	67976	Marine Electrical & Electronic system	1	3	2	20	30	25	25	100
7	65853	Innovation & Entrepreneurship	2	0	2	40	60	0	0	100
		Total	**13**	**21**	**20**	**260**	**390**	**175**	**175**	**1000**

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	67981	Marine 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
Agargoan, Dhaka-1207.

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

MARINE TECHNOLOGY

TECHNOLOGY CODE: **679**

2nd SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

MARINE TECHNOLOGY (679)

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	
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2	67922	Marine Engineering Materials	2	3	3	40	60	25	25	150
3	61011	Engineering Drawing	0	6	2	0	0	50	50	100
4	65912	Physics-1	3	3	4	60	90	25	25	200
5	65921	Mathematics-2	3	3	4	60	90	50	0	200
6	65711	Bangla	3	3	4	60	90	50	0	200
7	65712	English	2	0	2	40	60	0	0	100
Total			**15**	**21**	**22**	**300**	**450**	**225**	**125**	**1100**

67921 DIESEL ENGINE OPERATIONS AND MAINTENANCE

T	P	C
2	3	3

AIMS

To be able to develop knowledge, skill and attitude in the area of diesel engine operation and maintenance with emphasis on:

Operating procedure of diesel engine such as -

- Pre-starting, starting, running and speed control.
- Reversing and others
- Maintenance, faults finding and trouble shooting of diesel engine.

SHORT DESCRIPTION

Operating principle of diesel engine; charging and supercharging of diesel engine; valve operating mechanism; operating speed in classification of marine of diesel engine; pre-starting procedure of diesel engine; cooling system; lubricating system; battery charging system; starting system of diesel engine; electrical starting system, air starting system of diesel engine; maintenance procedure of diesel engine; causes of troubles interfering proper operation of diesel engine; causes of troubles noticeable in running engine; causes of troubles in a partly dismantle engine; requirements for sure and quick starting; reversing of marine diesel engine.

DETAIL DESCRIPTION

Theory :

1. Operating principle of diesel engine

1.1 Define heat engine.
1.2 Explain the concept and function of diesel engine.
1.3 Describe the characteristics of diesel engine.
1.4 Explain the operating principle of diesel engine
1.5 Distinguish two-stroke and four-stroke cycle diesel engine.
1.6 Explain the difference between diesel engine and marine diesel engine.
1.7 Draw the actual and ideal diesel cycle.

2. Classification of marine diesel engine based on operating speed

2.1 Define speed factor, slow speed, medium speed and high speed engine.
2.2 Describe the different types of square engine.
2.3 Explain economical speed and critical speed of diesel engine.

3. Valve operating mechanism

3.1 Define valve mechanism and valve lapping.
3.2 Explain the types of valve mechanism.
3.3 Describe the correct procedure of valve timing of four stroke Diesel engine.
3.4 Describe the conception of valve clearance and tapped clearance.
3.5 Describe the types of valve lifter.
3.6 Describe Working principle of hydraulic type valve lifter.

4. Charging and supercharging of diesel engine

4.1 Define charging and scavenging of a diesel engine
4.2 Distinguish the charging procedure of diesel engine and petrol engine.
4.3 Define the terms natural aspiration and pressure charging
4.4 Describe supercharging and turbo-charging system.
4.5 List the types of supercharging, crankcase scavenging and turbo-charging
4.6 Explain the terms loop type, cross flow and uniflow scavenging.
4.7 Explain the advantages and disadvantages of super and turbo charging system.

5. Pre-starting procedure of diesel engine

5.1 Define engine warm up.
5.2 Outline pre-starting procedure.
5.3 Describe engine tune-up method.
5.4 Describe necessary operation before starting a diesel engine.
5.5 Describe the trouble shooting of starting system.

6. Starting system of diesel engine

6.1 Define engine starting system.

6.2 Describe the classification of engine starting system.
6.3 Describe the electrical starting system.
6.4 Mention mechanical faults of starting system and suggest their remedies.
6.5 Define compressor capacity.
6.6 Define air starting valve and control valve.
6.7 Mention the function of air compressor and air bottle.
6.8 Describe working principles of compressed air starting system with sketch.
6.9 List the safety equipments in air starting system for marine engine.
6.10 Describe the procedure of stopping a diesel engine.

7. Cooling system of diesel engine
7.1 Define cooling system.
7.2 Classify cooling system.
7.3 Mention the function of cooling system.
7.4 Define thermostat valve and its functions.
7.5 Classify thermostat valve.
7.6 Mention the uses of antifreeze solution of water cooling system.
7.7 Describe the different types of cooling system with necessary figure.

8. Lubricating system of diesel engine
8.1 Define lubricating system.
8.2 Classify lubricating system.
8.3 Mention the purpose of lubricating system.
8.4 Mention the function of crankcase ventilation.
8.5 Classify lubrication oil pump.
8.6 Describe working principle of different lubricating system.
8.7 Explain the trouble shooting of engine lubricating system.

9. Battery charging system of Marine Diesel engine
9.1 Define storage battery.
9.2 Describe battery Electrolyte.
9.3 Mention the construction of storage battery.
9.4 Mention the checking procedure of battery.
9.5 Distinguish between dry and wet cell battery.
9.6 Distinguish between dynamo and alternator.
9.7 Describe the operation of dynamo and alternator in charging system.
9.8 Describe the maintenance procedure of storage battery.

10. Maintenance procedure of diesel engine
10.1 Define maintenance schedule.
10.2 Mention “daily”, “weekly” and “monthly” maintenance schedule of a diesel engine.
10.3 Describe the maintenance procedure of an engine after running 50 hours, 200 hours, 500 hours, 1000 hours and 3000 hours.
10.4 Describe the necessary practices for smooth engine operation.

11. Causes of troubles interfering proper operation of diesel engine
11.1 Define governor, control rack, control system.
11.2 Describe the probable causes of an engine failure to start on compressed airin cold eather
11.3 Describe the causes of failure of an engine to come up to speed.
11.4 Mention the causes of irregular speed of an engine.
11.5 Describe the causes of over speeding of an engine.
11.6 Describe the causes of sudden stopping of an engine.
11.7 Explain the speed control device.
11.8 Explain the causes of insufficient fuel supply.

12. Causes of troubles noticeable in running engine
12.1 Define engine trouble shooting.
12.2 Mention the causes of smoky exhaust.
12.3 Mention the causes of abnormal cylinder pressure.
12.4 Describe the causes of abnormal exhaust gas temperature.
12.5 Mention the causes of incorrect cooling water temperature.
12.6 Mention the causes of excessive piston-cooling oil temperature.

12.7 Describe the causes of overheating of an engine.
12.8 Describe the causes of noisiness of the engine.
12.9 Describe the causes of the engine vibration.
12.10 Describe the causes of hot starting air-pipe.

13. Dismantle and assemble of Marine Diesel engine.
13.1 Define dismantle engine.
13.2 Describe the causes of piston and piston rings gummed up.
13.3 Describe the causes of carbonization of exhaust valve and fuel injector of a diesel engine.
13.4 Mention the causes of water in the crankcase.
13.5 Describe the maintenance procedure of crankshaft and camshaft.
13.6 Describe the maintenance procedure of bearing, liner, piston and cylinder.

14. Reversing system of marine diesel engine
14.1 Define reversing system of marine diesel engine.
14.2 Mention the types of reversing system.
14.3 Explain the requirement of engine reversing.
14.4 Describe the procedure of engine reversing.
14.5 Describe the different types of reversing system.

Practical :

1. Perform the specification of a diesel engine
1.1 Identify type and trade name of the engine.
1.2 Check the BHP of the engine.
1.3 Check the RPM of the engine.
1.4 Check the firing order of the engine.

2. Perform the identification the systems diesel engine
2.1 Identify charging system.
2.2 Identify fuel system.
2.3 Identify the cooling system.
2.4 Identify lubricating system.
2.5 Identify exhaust system.
2.6 Identify governing system and fuel control lever.
2.7 Identify starting system.

3. Perform the identification of moving parts of a diesel engine
3.1 Identify valves and valve mechanism
3.2 Identify valve gears.
3.3 Identify water pumps.
3.4 Identify fuel transfer pump.
3.5 Identify driven machinery.

4. Perform the steps to be taken before starting a diesel engine
4.1 Check for proper adjustment of all moving parts.
4.2 Check for proper alignment of all moving parts.
4.3 Examine lubrication of all moving parts.
4.4 Examine for loose nuts, broken bolts, loose connection of belts, cables, leaky jackets and hoses.
4.5 Check the lube oil level with deep stick.
4.6 Check the lubrication system for proper functioning.
4.7 Check the cooling system for proper functioning.
4.8 Turn the engine flywheel one or two times if the engine is idle for long period of time.
4.9 Check off-loads of the engine.

5. Perform the manual starting a diesel engine
5.1 Identify crank aids like handle, rope or lever.
5.2 Check the decompression lever in correct position to crank the engine.
5.3 Check the engine to sufficient speed.
5.4 Check the decompression lever in idle position to turn the engine for a while.

6. Perform the electrical starting a diesel engine

6.1 Identify the starting switch.
6.2 Check the battery terminal connection
6.3 Identify the motor starter.
6.4 Check the connection of the motor starter with the battery.
6.5 Check the earthling connection.
6.6 Press the starting switch to crank the engine to correct speed to start the engine.
6.7 Release the starting switch while engine is started.

7. Perform the air starting a diesel engine
7.1 Identify air compressor and air bottle.
7.2 Check the regulator for air pressure.
7.3 Identify the air starting valve and valve operating mechanism.
7.4 Operate the air starting valve to start the engine.
7.5 Cut off air supply to the engine while engine is started.
7.6 Check the compressor oil level.

8. Perform the warming up of diesel engine
8.1 Run the engine at idle speed for at least 5 minutes to warm up.
8.2 Observe the cooling water to ensure that the pumps are working properly and circulating proper amount of water.
8.3 Observe the lubrication pressure and feel the temp of each cylinder.
8.4 Observe the exhaust color and sound.

9. Perform the adjustment of valve operating system
9.1 Identify the valve mechanism of diesel engine.
9.2 Check for valve overlapping.
9.3 Check tappet clearance.
9.4 Adjust tappet clearance.
9.5 Check valve timing
9.6 Adjust valve timing.
10. Perform the reversing of marine diesel engine
10.1 Identify the components used to reverse the engine.
10.2 Identify the reverse gear with movable roller.
10.3 Identify the reverse gear with eccentric motion.

11. Perform the stopping of marine diesel engine
11.1 Move the fuel control lever to stop position
11.2 Run cooling water and piston cooling oil after the shutdown of the engine.
11.3 Cut off all switches and close the valves.

12. Perform the trouble shooting of air starting system
12.1 Identify the safety tools used in air starting system.
12.2 Identify the troubles in air starting system.
12.3 Check the components of the system to find out the faults.
12.4 Rectify the faults in the process.

13. Perform the trouble shooting of electric starting system
13.1 Identify the troubles in electric starting system
13.2 Check all components used for electric starting system and find out the faults.
13.3 Check the charge of battery used in electric starting system.
13.4 Check engine earthling.

REFERENCE BOOKS:

1. **ডিজেল ইঞ্জিন অপারেশন এন্ড মেইনটেনেন্স - মোঃ মহসিন আলী, প্রাক্তন অধ্যক্ষ, বিআইএমটি, নারায়নগঞ্জ**
2. Diesel Engine Operation and Maintenance -V. L. Maleev
3. Automotive Mechanics -W H Crouse & Anglin
4. Automobile Engineering (Volume 1 & 2) - Dr. Kripal Singh
5. **মেরিন ইঞ্জিন -এম.এ বারী**
6. Internal Combustion Engine -Obert

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

65912 PHYSICS-1

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

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 $e^x = 1 + \frac{x}{L^1} + \frac{x^2}{L^2} + \frac{x^3}{L^3} + \frac{x^4}{L^4}$ ..... to ∞
3.4 Solve problems of the followings types :
i) $1 + \frac{1}{L^2} + \frac{1}{L^4} + \frac{1}{L^6}$ + ... to ∞
ii) $\frac{1}{L^2} + \frac{1+2}{L^3} + \frac{1+2+3}{L^4} + \frac{1+2+3+4}{L^5}$ + ... 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) $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy}$.

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

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

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

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

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

5 Apply the principle of properties of triangles.

5.1 Prove the followings identities :

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

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

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

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

5.2 Establish the followings.

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

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

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

5.3 Solve the problems of the following types:

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

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

65711 BANGLA

T	P	C
3	3	4

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 প্রয়োগ:

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 সাহিত্য:

ক. কবিতা :

১.বঙ্গভাষা –মাইকেল মধুসূদন দত্ত
২. সোনার তরী – রবীন্দ্র নাথ ঠাকুর
৩. উমর ফারুক –কাজী নজরুল 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): মানুষ –মুনীর চৌধুরী

ঘ. উপন্যাস: লালসালু – সৈয়দ ওয়ালী উল্লাহ

ঙ.ছোট গল্প:

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 শিক্ষক/ছাত্রছাত্রীদের বরণ, গুরুত্বপূর্ণ ব্যক্তিবর্গের আগমন উপলক্ষে বক্তৃতা।

২. উপস্থিত বক্তৃতা :

বিষয়বস্তু উন্মুক্ত

৩.আবৃত্তি :

১. মানুষ - কাজী নজরুল ইসলাম
২. আকাশ নীলা - জীবনানন্দ দাশ
৩. পল্লী 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 সমাজেরঅবক্ষয়ের মূল কারণ
গতানুগতিক শিক্ষা নয় কর্মমুখি শিক্ষাই 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 ।

65712 ENGLISH **T P C**
2 0 2

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

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.

BANGLADESH TECHNICAL EDUCATION BOARD
Agargoan, Dhaka-1207.

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

MARINE TECHNOLOGY

TECHNOLOGY CODE: **679**

3rd SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

MARINE TECHNOLOGY (679)

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	67931	Fuels & Fuel Injection System	2	3	3	40	60	25	25	150
2	67033	Machine Shop Practice	1	3	2	20	30	25	25	100
3	66811	Basic Electronics	2	3	3	40	60	25	25	150
4	66611	Computer Application	0	6	2	0	0	50	50	100
5	65931	Mathematics-3	3	3	4	60	90	50	0	200
6	65922	Physics-2	3	3	4	60	90	25	25	200
7	65722	Communicative English	1	3	2	20	30	50	0	100
Total			**12**	**24**	**20**	**240**	**360**	**250**	**150**	**1000**

67931 FUELS AND FUEL INJECTION SYSTEM

T	P	C
2	3	3

AIMS

To be able to develop knowledge, skill and attitude in the area of Fuel and Fuel Injection with emphasis on:

- Fuels and their classification
  - Lubricants
  - Greases
- Fuel supply system :
  - Fuel injection system
  - Fuel nozzle and injectors
- Governor
- Modern fuel injection system

SHORT DESCRIPTION

Basic concept of fuels; Concept of CNG, IPG, LNG,HFO, LCG, Crude Oil, Hydrocarbon and Refining of Petroleum; Gasoline fuel, Diesel fuel, Jet fuel and Marine fuel; Lubricants and Greases; Separation of oil and water; Fuel system and fuel injection system of diesel engine; Strainers, filters and fuel transfer pump; Storage tanks, Fuel indicators and Fuel metering; Fuel nozzle and CAV / Unit injector; Mechanical, Airless and Solid fuel injection; Common rail and Distributor type fuel injection; Jerk pump and Cummins fuel injection system; Phasing, Calibration, Injector test and Governor; Modern fuel injection system

DETAIL DESCRIPTION

Theory:

1. Understand the Basic Concept of Fuels

1.1 Define fuel.
1.2 Classify fuel.
1.3 Mention the use of fuel.
1.4 Mention the composition of the various types of fuel.
1.5 Mention the heating value of the various types of fuel.
1.6 Mention the sources of coal in Bangladesh.
1.7 Describe the development and use of gaseous fuel in Bangladesh.
1.8 Mention the advantages and disadvantages of gaseous fuel.
1.9 Mention the storage and handling process of gaseous & Coal fuel.

2. Understand CNG, IPG, LNG,HFO, LCG, Crude Oil, Hydrocarbon and Refining of Petroleum

2.1 State the meaning of CNG, IPG, LNG, HFO and LCG fuel.

2.2 Mention the procedure of oil drilling.

2.3 Mention the possibility of crude oil in Bangladesh.

2.4 Mention the classification of crude petroleum.

2.5 Describe the most common separation operation of petroleum.

2.6 Explain briefly the schematic refining flow chart of petroleum.

2.7 Mention & Identify the typical boiling point ranges of several petroleum products.

2.8 Describe the purification process of petroleum products.

2.9 Mention the use of HFO.

3. Understand Gasoline Fuel, Diesel Fuel, Jet Fuel and Marine Fuel

3.1 List the gasoline fuel products and their uses .

3.2 Define Octane Number.

3.3 Describe the characteristics of gasoline fuel, jet fuel, marine diesel fuel and low speed engine's fuel.

3.4 Mention the additives used in gasoline.

3.5 Mention the specification of diesel fuel, jet fuel and gasoline.

3.6 Define ignition quality and cetane number of diesel fuel.

3.7 Describe the procedure to determine the cetane number of diesel fuel.

3.8 Define fire point and flash point.

3.9 Define jet engine fuel, heavy diesel fuel and cargo oil fuel.

3.10 Mention the importance of flush point temperature in the marine field.

3.11 List the flash point temperature of the hydrocarbon like petrol, kerosene, marine diesel fuel and boiler fuel oil.

4. Understand Lubricants and Greases

4.1 Define lubricating oil and grease .

4.2 Mention the classification of lubricating oil.

4.3 Mention the field of application of lubricants and grease.

4.4 Define viscosity and viscosity index .

4.5 List the various adhesive of lube oil .

4.6 Define SAE no. of lube oil .

4.7 List properties and purpose of lubricating oil and grease.

4.8 List the materials used in making grease.

4.9 Describe the manufacturing process of grease.

4.10 Mention the name of some synthetic lubricating oil.

5. Understand the Separation of Oil and Water

5.1 Mention the methods of purification of fuel and lubricating on board ship.

5.2 Describe the principle of filtration and centrifugal separation .

5.3 Describe the operating principle of disc and bowl type centrifuge.

5.4 Mention the function of oil-water separator on board ship.

5.5 Mention the application of extreme pressure lubricants.

5.6 Mention precautions to be taken on board ship to prevent accidental ignition of oils.

6. Understand the Fuel System and Fuel Injection System of Diesel Engine

6.1 Define the fuel system of diesel engine.

6.2 List the types of fuel system of diesel engine.

6.3 Mention the components of injection system of diesel engine.

6.4 Describe the working principle of diesel fuel system with Sketch.

6.5 Describe the working principle of pressure feed fuel system with Sketch.

6.6 List the types of fuel injection system.

6.7 Mention the necessity of fuel injection system.

6.8 Define fuel timing and air injection system.

6.9 Mention the rate of fuel injection.

6.10 Identify the components and draw backs of air injection system.

6.11 Mention the functions of spray valve and fuel cam.

6.12 Describe the working principle of air injection system.

7. Understand the Strainers, Filters and Fuel Transfer Pump

7.1 Define strainer, filter and fuel transfer pump.

7.2 Classify strainer and filter.

7.3 Describe the arrangement and cleaning procedure of metal edge strainers.

7.4 Describe bag type filters with sketch .

7.5 State the capacity of pump for unloading a tank.

7.6 List the type of pumps generally used for fuel oil tank.

7.7 Define booster pump.

7.8 Mention the use of feed pump.

7.9 Describe the operation of plunger type feed pump or fuel transfer pump.

8. Understand the Storage Tanks, Fuel Indicators and Fuel Metering

8.1 Define storage tank, day tank and capacity of a day tank .

8.2 Mention various parts of storage tank with sketch.

8.3 Mention the proper installing procedure of a storage tank to ensure clean fuel.

8.4 Classify the types of fuel indicators generally used in diesel plants and their functions.

8.5 Distinguish between high pressure and low pressure fuel line.

8.6 Define the fuel metering and fuel oil consumption.

8.7 Classify the fuel oil meters used in diesel engine.

8.8 Describe the Rota meter with sketch .

9. Understand the Fuel Nozzle , CAV and Unit Injector

9.1 Define fuel nozzle and orifice.

9.2 Classify fuel injection pump.

9.3 Classify hole type injector.

9.4 Define pintle and pintaux injectors.

9.5 List the types of CAV injector and unit injector.

9.6 Describe the Bosh or CAV type fuel pump and distributor type fuel pump.

9.7 Describe the unit injector system with sketch.

9.8 Describe the plunger control system .

9.9 List the parts of plunger mounted single element fuel pump.

9.10 Describe the dismantling procedure of CAV fuel injection pump.

9.11 Mention the advantages and disadvantages of unit injector and CAV injector.

9.12 Mention the faults and remedies of fuel injection pumps and nozzles.

10. Understand the Mechanical /Airless/Solid Fuel Injection

10.1 Define airless or mechanical fuel injection systems.

10.2 Classify mechanical fuel injection system.

10.3 Describe each type of mechanical injection system.

10.4 Mention the process of changing the rate of injection.

10.5 Mention the causes influencing the rate of injection upon the performance of an engine.

10.6 Mention the common Problems and Remedies of fuel injection pump .

11. Understand the Common Rail and Distributor Type Fuel Injection

11.1 Define common rail fuel injection system.

11.2 Mention the component of common rail fuel injection system .

11.3 Describe the working principle of common rail fuel injection system with sketch.

11.4 Mention the advantages and disadvantages of common rail system.

11.5 List the components of distributor system.

11.6 Describe the working procedure of distributor type fuel injection system.

11.7 Mention the advantages and disadvantages of distributor type fuel injection system.

12. Understand the Jerk Pump and Cummins Fuel Injection System

12.1 Define plunger, barrel, non-returning delivery valve and valve spring of jerk pump .

12.2 Define enclosed camshaft fuel injection system.

12.3 Classify jerk pump system.

12.4 List the essential parts in a jerk pump injection system.

12.5 Describe the working principle of jerk pump injection system with sketch.

12.6 Describe the causes of injection lag in a high pressure jerk pump.

12.7 Distinguish between flange mounted and enclosed camshaft type jerk pump.

12.8 Describe the plunger control system of a jerk pump.

12.9 Describe the setting of control rack and tooth quadrant of a jerk pump.

12.10 Describe the operating procedure of Cummins injector system.

12.11 Mention the advantages and disadvantages of Cummins injection system.

13. Understand the Concept of Phasing, Calibration, Injector Test and Governor

13.1 Define phasing and calibration of diesel engine.

13.2 Describe the procedure of phasing and calibration.

13.3 Describe the testing procedure of CAV injector pressure setting, back leakage, seat tightness and Spray test.

13.4 Define & Classify governor.

13.5 Mention the function of governor.

13.6 Describe the speed drop governor.

13.7 Mention the main characteristics of a governor in determining the degree of control of an engine.

13.8 Define sensibility hunting, promptness and power of a governor.

13.9 Describe the low limit governor and over speed governor.

13.10 Describe the working principle of a mechanical governor.

13.11 Describe the operation of a hydraulic governor.

13.12 Describe the operation of an electrical governor.

14. Understand the Modern Fuel Injection System

14.1 Define actuator.

14.2 Mention various modern fuel injection systems.

14.3 Mention the advantages of electronic fuel injection system (EFI).

14.4 Describe the working principle of DPA electric fuel injection system.

14.5. Describe electronically operated gasoline and diesel fuel injection system with sketch.

14.6. Mention the drawback of electronic fuel injection system used in low and medium speed diesel engine.

Practical:

1. Perform the Identification of Fuels and Lubricants

1.1 Identify various types of solid fuel and liquid fuel.

1.2 Identify various types of solid lubricants, semi-solid lubricants and liquid lubricants .

2. Perform the Job to Study Petroleum Refinery Flow Chart and to Analyze the Composition of coal

2.1 Draw the schematic diagram of a typical modern petroleum refinery showing main units with their byproducts.

2.2 Draw a simplified flow diagram for automated refinery showing main quality analysis for process units and blending area.

2.3 Determine the percentage of moisture, ash, volatile matter and fixed carbon of a simple coal by proximate analysis.

2.4 Determine the percentage of carbon, hydrogen, nitrogen, sulphur, oxygen and ash of a simple coal by ultimate analysis.

3. Perform the Job to determine the heating value of Fuels and Volatility of Fuel

3.1 Find the heating value of coal sample and a sample of diesel fuel by bomb calorimeter.

3.2 Find the heating value of natural gas by continuous flow gas calorimeter.

3.3 Find the volatility of gasoline, naphtha, kerosene, or similar petroleum product by ASTM distillation test apparatus.

3.4 Find the vapor lock tendency of a gasoline by the reid vapor pressure test (RVP).

4. Perform the Different Test of Fuels and Lubricants

4.1 Determine the Viscosity of Lubricants Oil by a Viscometer.

2.2 Determine the Pour Point and Cloud Point of Lubricating Oil by Pour Point Test Apparatus.

4.3 Determine the Flash Point and Fire Point of Kerosene or Gasoline by Abel's Apparatus or Pensky Marten's Flash Point Apparatus.

4.4 Determine the Carbon Residue of Lubricating Oil by Condradson's Apparatus.

4.5 Determine the Octane Number of Gasoline by CFR Research Method/Motor Method.

4.6 Make a typical Soap Grease by Cold Set Method.

4.7 Perform the Consistency Test of Grease by the Penetrometer.

4.8 Determine the Drop Test of Grease by the Drop Point Apparatus.

5. Perform the Remove and Installation of a High Pressure Pump of an engine

5.1 Select proper tools and equipment for the job and unscrew nuts from the fuel line of the injector at the cylinder head of the engine.

5.2 Separate fuel line from the pumps and unscrew nuts and bolts from the mountings of the fuel pump.

5.3 Select proper tools and equipment and remove high pressure pump from the engine.

5.4 Set the high pressure pump on the engine with its components.

5.5 Adjust the pump to the driving gear or coupling.

5.6 Fix the pump on the mountings with nut and bolts.

5.7 Connect the fuel lines of the pump to the injector at the cylinder head.

6. Perform Dismantling and Reassembling of an Inline High Pressure Pump (Individual Pump)

6.1 Select proper tools and equipment for the job and unscrew drain plug and drain lube oil.

6.2 Clamp the pump to the vice and remove low pressure pump.

6.3 Remove inspection cover, delivery valve and its spring.

6.4 Remove all the plunger and camshaft from the pump casing.

6.5 Check for proper adjustment and alignment of all moving parts.

6.6 Examine lubrication of all moving parts.

6.7 Examine for loose nuts, broken bolts, loose connection of belts, cables, Leaky jackets and hoses.

6.8 Check lube oil level with deep stick and the lubrication system for proper functioning.

6.9 Check the cooling system and fuel system for proper functioning.

6.10 Turn the engine flywheel one or two times if the engine is idle for long period of time.

6.11 Check the off-load engine.

7. Perform the Phasing and Calibration of Injection Pump on the Test Bench

7.1 Identify the starting switch and motor starter.

7.2 Check the battery terminal connection.

7.3 Check the connection of the motor starter with the battery.

7.4 Check the earthling connection.

7.5 Press the starting switch to crank the engine to correct speed to start the engine.

7.6 Release the starting switch while engine is started.

7.7 Set the pump to the test bench correctly and connect the fuel lines of the test bench to the injection pump.

7.8 Operate the test bench at different speed and record the quantity of fuel oil retained in the test after specified number of revolution.

7.9 Take step for repairing of the pump, if required

8. Perform the Test of Spray Pattern of Fuel Injector

8.1 Fix the fuel injector to the vice and loose protective nut.

8.2 Separate injector spring and nozzle from the injector.

8.3 Manipulate injector tester handle to adjust or repair it.

8.4 Read spray position.

9. Perform the Testing of Fuel Injector and Setting of Governor

9.1 Test fuel injector by pop tester or injector testing machine.

9.2 Perform back leakage test, seat tightness test and pressure setting test.

9.3 Study and complete spray test.

9.4 Adjust rack setting of governor.

9.5 Set governor, if required .

9.6 Check and adjust fuel timing.

10. Perform the Identification of the Electronic Fuel Injection (EFI) System and Sensor

10.1 Identify the different components of EFI and sensor.

10.2 Test the workability of injector and sensor.

10.3 Check and observe the system.

REFERENCE BOOKS

১। Diesel Engine Operation and Maintenance

- V. L. Maleev.

2. Fundamental of Automotive Mechanics

- Crause.

3. Fuels and Petroleum Processing

- B. K. SHARMA.

4. ফুয়েল ইনজেকশন সিস্টেম, ডিজেল ইঞ্জিন সিরিজ (২য় খন্ড)

- প্রকৌঃমোঃ মহসিন আলী, অধ্যক্ষ (প্রাক্তন), বাংলাদেশ ইনস্টিটিউট অব মেরিন টেকনোলজী, নারায়নগঞ্জ.

5. ফুয়েলস অ্যান্ড লুব্রিক্যান্টস

- মোঃ রেদওয়ানুর রহমান

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

<u>Theory</u> :

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.

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

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

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

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.)

BANGLADESH TECHNICAL EDUCATION BOARD

Agargoan, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

SYLLABUS (PROBIDHAN-2016)

MARINE TECHNOLOGY

TECHNOLOGY CODE: **679**

4th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

MARINE TECHNOLOGY (679)

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	67941	Diesel Engine Overhauling & Record Keeping	2	6	4	40	60	50	50	200
2	67952	Engineering Thermodynamics & Heat Transfer	2	3	3	40	60	25	25	150
3	67041	Engineering Mechanics	3	3	4	60	90	25	25	200
4	67042	Metallurgy	2	3	3	40	60	25	25	150
5	67044	Marine Mechanical Drawing	0	3	1	0	0	25	25	50
6	68032	Welding	1	6	3	20	30	50	50	150
7	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
Total			**12**	**24**	**20**	**240**	**360**	**200**	**200**	**1000**

67941 Diesel Engine Overhauling & Record Keeping

T	P	C
2	6	4

AIMS:

To able to develop knowledge, skills and attitude upon

- onboard-ship in marine diesel engine.
- offshore diesel engine
- power plants diesel engine.
- industries run by diesel engines.

SHORT DESCRIPTION:

Engine overhauling, understand tools and equipment used in diesel engine overhauling ,dismantling and assembling of diesel engine ,cylinder head servicing, servicing of piston , servicing of valve, valve spring and valve seats, servicing of camshaft ,cam follower and rocker arm, servicing of connecting rod, servicing of crankshaft, understand engine bearing, fuel pump, fuel valve ,engine performance monitoring ,engine cooling system, exhausting system, engine monitoring, log ,planned maintenance, safety precautions and survey .

DETAIL DESCRIPTION:

Theory:

1. Understand the Engine Overhauling

1.1 Define engine overhauling
1.2 State the necessity of engine overhauling
1.3 Classify engine overhauling
1.4 Define engine inspection
1.5 Define top overhauling and major overhauling
1.6 Distinguish top overhauling and major overhauling
1.7 State the precaution for engine overhauling.
1.8 Explain engine immobilization
1.9 Checking during engine overhauling.

2. Understand the Tools and Equipment used in Diesel Engine Overhauling.

2.1 Identify the tools and equipment used in engine overhauling.
2.2 Identify the tools and equipment used in marine IC engine overhauling.
2.3 Identify the servicing and diagnosis tools of engine overhauling.
2.4 Describe the functions of each type of diagnosis tools
2.5 Mention the care to be taken during and after using the various tools and equipment in diesel engine workshop.
2.6 List of precession tools and special tools inventory and tools calibration certificate
2.7 Follow maker's instruction before using tools.

3. Understand the Dismantling and assembling of Diesel Engine

3.1 Define dismantling and assembling of diesel engine
3.2 Describe the dismantling and assembling procedure of marine diesel engine
3.3 Describe survey and inspection procedure of marine diesel engine
3.4 Distinguish refitting and re-assembling
3.5 Before dismantling and assembling follow makers instructions.
3.6 Precautions for survey of diesel engines.

4. **Understand the Diagnosis and Rectification of Faults**
   - 4.1 Explain engine faults.
   - 4.2 Identify good and defective parts
   - 4.3 List the different measuring instruments to determine engine faults
   - 4.4 Mention categories of faults
   - 4.5 Describe the procedure to measure bore, stroke, displacement, depth, volume etc.
   - 4.6 Action after identifying faults as per manufacturer's instruction.
5. **Understand the Cylinder and Cylinder Head Servicing.**
   - 5.1 Describe the procedure of removing cylinder head and cylinder.
   - 5.2 Describe the cleaning procedure of cylinder head and cylinder.
   - 5.3 Describe the inspection procedure of cylinder head and cylinder.
   - 5.4 List the faults of cylinder head and cylinder after inspection and measurement.
   - 5.5 Describe the removing and refitting of both dry and wet type liner.
   - 5.6 Describe the refitting procedure of cylinder head.
   - 5.7 Describe cleaning procedure of engine block.
   - 5.8 Describe testing procedure to find out crack and leakage of engine block.
   - 5.9 Describe the procedure for cylinder head pressure test.
   - 5.10 Describe the procedure for cylinder liner calibration.
   - 5.11 Indication for cylinder liner crack.
6. **Understand the Servicing of Piston, Piston Pin and Piston Ring.**
   - 6.1 Describe the cleaning procedure of piston, piston ring and ring groove.
   - 6.2 List the faults of piston, piston ring and ring groove.
   - 6.3 Explain the inspection procedure of piston and piston pin.
   - 6.4 Describe checking procedure of piston wear.
   - 6.5 List the ring clearance of various pistons.
   - 6.6 Describe the procedure of removing and installing of piston ring.
   - 6.7 Describe the piston pressure test and crack test procedure.
   - 6.8 Describe piston overhauling procedure.
7. **Understand the Servicing of Valve, Valve Spring and Valve Seats.**
   - 7.1 Describe the procedure of removing engine valve, valve guide, spring and valve seats of a diesel engine.
   - 7.2 Describe the cleaning and measuring procedure of engine valve.
   - 7.3 Mention different dimensions of valve.
   - 7.4 Mention the valve troubles.
   - 7.5 Describe testing procedure of Mention different dimensions of valve.
   - 7.6 Describe the checking of valve spring and valve seat.
   - 7.7 Describe the refitting procedure of engine valve, valve guide, spring and valve seats.
   - 7.8 Explain the indication of valve leaking and valve burning.
   - 7.9 Explain the precautions for preventing valve burning.
8. **Understand the Servicing of Camshaft, Cam Follower and Rocker Arm.**
   - 8.1 Describe the procedure of removing camshaft and rocker arm assembly.
   - 8.2 Explain the cleaning procedure of camshaft and rocker arm assembly.
   - 8.3 Describe the measuring procedure camshaft journal.
   - 8.4 List the faults of cam follower.
   - 8.5 Items you will check during camshaft inspection.
9. **Understand the Servicing of Connecting Rod.**
   - 9.1 Describe the procedure of removing, cleaning and inspection of connecting rod.

9.2 Describe connecting rod alignment with sketch.
9.3 Describe the testing procedure of connecting rod.
9.4 Describe the procedure to fit pin with piston.
9.5 Describe the connecting rod bearing ovality test procedure.

10. Understand the Servicing of Crankshaft.

10.1 Describe the procedure of removing and cleaning the crankshaft.
10.2 Mention inspection procedure of crankshaft.
10.3 Describe the alignment procedure of crankshaft.
10.4 Describe the methods of inspecting crankshaft cracks.
10.5 Describe the procedure of measuring a crankshaft.
10.6 Describe the grinding procedure of a crankshaft.
10.7 Explain re-metal ling of crankshaft.
10.8 Mention the safety measures to be taken during grinding of a crankshaft.
10.9 Explain and draw different types of crankshaft.

11. Understand the Engine Bearing and Bearing Alignment.

11.1 List the type of bearings used in engine.
11.2 Mention clearances of main bearings and connecting rod bearings.
11.3 List the faults of engine bearings.
11.4 Describe the measuring procedure of inside diameter of main bearings.
11.5 Describe the Procedure to measure bearing clearance by plastic gauge and red lead wire.
11.6 Explain bearing crack test procedure (dye penetrate test).

12. Understand the Fuel Pump and Valve Timing.

12.1 Mention the necessity of valve timing.
12.2 Describe the Procedure of valve timing.
12.3 Describe the Procedure of fuel pump timing.
12.4 Explain the procedure fuel pump timing of two and four stroke diesel engine.
12.5 Describe with sketch the valve timing diagram of two and four stroke marine diesel engine.
12.6 Draw and explain “draw card”, “power card” and “light spring diagram.”
12.7 Explain how to advance and retard fuel pump timing.

13. Understand the Flushing of Engine Block and Engine Testing.

13.1 Mention the necessity of flushing and oil flushing.
13.2 Mention the necessity of engine testing.
13.3 List the engine diagnosis and testing steps.
13.4 Describe the performance of two stroke and four stroke diesel engine.

14. Understand the Servicing of Cooling, Fuel, Lubricating, Intake-Exhaust and Governing System’s Components.

14.1 Describe the procedure for removing and replacing different components of cooling system.
14.2 Describe the procedure for removing and replacing different parts of fuel system.
14.3 Describe the procedure for removing and replacing different parts of lubricating system**.**
14.4 Describe engine timing and governing of marine diesel engine system.
14.5 Discuss the causes of knocking and vibration of a diesel engine.
14.6 Describe the procedure for removing and replacing different components of intake-exhaust system.
14.7 Explain the indication, causes and remedy of one unit and all unit exhaust gas temperature high.

15. Understand the Engine Log and its Specification.

15.1 Define engine log.
15.2 Define log sheets and engine log books.

15.3 Describe the writing procedure of logs.
15.4 Explain the necessity of engine log book.
15.5 Define operating and maintenance log.
15.6 Describe the procedure of log book preparation.
15.7 Explain the concept of maintenance log.

16. Understand the Inspection and Maintenance Schedule.

16.1 Describe inspection procedure.
16.2 Define maintenance schedule.
16.3 Maintain the basic uses of schedule.
16.4 Prepare maintenance schedule of marine diesel engine.
16.5 Explain the concept of planned maintenance system (PMS).
16.6 Explain the advantage of PMS and disadvantage of breakdown maintenance.

17. Understand the Watch Keeping and Record Keeping of Marine Diesel Engine.

17.1 Define watch keeping.
17.2 Mention the necessity of record keeping.
17.3 Describe the procedure to maintain engine operating data.
17.4 Describe the best operating procedure of an engine.
17.5 Describe the procedure of watch keeping during engine operation
17.6 Explain the procedure for handing over and taking over watch.
17.7 Parameters checking during engine room round.

18. Understand the Inventory Record of an Engine Room.

18.1 Define inventory record.
18.2 Describe inventory records for consumable and non-consumable items.
18.3 Describe the procedure of engine room inventory procedure.
18.4 Explain the critical spares for machineries.

PRACTICAL:

1. **Perform the specification of a diesel engine.**
   1.1 Identify type and trade name of the engine.
   1.2 Check the BHP of the engine.
   1.3 Check the RPM of the engine.
   1.4 Check the firing order of the engine.
   1.5 Check Central cooling system.
2. **Perform the identification the systems diesel engine.**
   2.1 Identify charging system.
   2.2 Identify fuel system.
   2.3 Identify the cooling system.
   2.4 Identify lubricating system.
   2.5 Identify exhaust system.
   2.6 Identify governing system and fuel control lever.
   2.7 Identify starting system.
3. **Perform the identification of moving parts of a diesel engine.**
   3.1 Identify valves and valve mechanism
   3.2 Identify valve gears.
   3.3 Identify water pumps.
   3.4 Identify fuel transfer pump.

3.5 Identify driven machinery.
3.6 Identify lube oil pumps.
3.7 Identify gear pumps.

4. **Perform the steps to be taken before starting a diesel engine.**
   4.1 Check for proper adjustment of all moving parts.
   4.2 Check for proper alignment of all moving parts.
   4.3 Examine lubrication of all moving parts.
   4.4 Examine for loose nuts, broken bolts, loose connection of belts, cables, leaky jackets and hoses.
   4.5 Check the lube oil level with deep stick.
   4.6 Check the lubrication system for proper functioning.
   4.7 Check the cooling system for proper functioning.
   4.8 Check the fuel system for proper functioning.
   4.9 Turn the engine flywheel one or two times if the engine is idle for long period of time.
   4.10 Check the off-load the engine.
   4.11 Turning gear must be disengaged.
   4.12 Blow through engine and then close indicator cock.
   4.13 Check starting system.
   4.14 Check C/C doors sealing and nobody inside crankase.
   4.15 Nobody working under the flywheel.
5. **Perform the manual starting a diesel engine.**
   5.1 Identify crank aids like handle, rope or lever.
   5.2 Check the decompression lever in correct position to crank the engine.
   5.3 Crank the engine to sufficient speed.
   5.4 Check the decompression lever in idle position to turn the engine for a while.
6. **Perform the electrical starting a diesel engine.**
   6.1 Identify the starting switch.
   6.2 Check the battery terminal connection.
   6.3 Identify the motor starter.
   6.4 Check the connection of the motor starter with the battery.
   6.5 Check the earthling connection.
   6.6 Press the starting switch to crank the engine to correct speed to start the engine.
   6.7 Release the starting switch while engine is started.
   6.8 Battery must be charged at all times.
7. **Perform the air starting a diesel engine.**
   7.1 Identify air compressor and air bottle.
   7.2 Check the regulator for air pressure.
   7.3 Identify the air starting valve and valve operating mechanism.
   7.4 Operate the air starting valve to start the engine.
   7.5 Cut off air supply to the engine while engine is started.
   7.6 Check starting air line diagram.
   7.7 Check starting air line to prevent from explosion.
   7.8 Drain starting air bottle regularly.
   7.9 Overhaul starting air valve regularly.
8. **Perform the warming up of diesel engine.**
   8.1 Run the engine at idle speed for at least 5 minutes to warm up.
   8.2 Observe the cooling water to ensure that the pumps are working properly and circulating proper amount of water.

8.3 Observe the lubrication pressure and feel the temp of each cylinder.
8.4 Observe the exhaust color and sound.
8.5 Check any leakages of water lube oil, and fuel oil.
8.6 Check for any abnormalities.

9. Perform the adjustment of valve operating system.

9.1Identify the valve mechanism of diesel engine.
9.2 Check for valve overlapping.
9.3 Check tappet clearance.
9.4 Adjust tappet clearance regularly as per maker's instruction.
9.5 Check valve timing
9.6 Adjust valve timing.
9.7 Check rocker arm, push rod and tightness of all nut and bolts.
9.8 Do not interchange with suction valve and exhaust valve.

10. Perform the reversing of marine diesel engine.

10.1 Identify the components used to reverse the engine.
10.2 Identify the reverse gear with movable roller.
10.3 Identify the reverse gear with eccentric motion.
10.3 Check reversing servo working correctly.

11. Perform the stopping of marine diesel engine.

11.1 Move the fuel control lever to stop position.
11.2 Run cooling water and piston cooling oil after the shutdown of the engine.
11.3 Cut off all switches and close the valves.
11.4 Put clutch in neutral position.

12. Perform the recording data of a running engine in a log sheet.

12.1 Record the time of entering data.
12.2 Record engine load, rpm, fuel consumption.
12.3 Record exhaust temperature for each cylinder.
12.4 Record colors of exhaust such as "clear, little haze, light gray, gray, dark gray.
12.5 Record lubrication oil pressure and temperature.
12.6 Record temperature of cooling water at inlet and outlet.

13. Perform the trouble shooting of air starting system.

13.1 Identify the safety tools used in air starting system.
13.2 Identify the troubles in air starting system.
13.3 Check the components of the system to find out the faults.
13.4 Rectify the faults in the process.

14. Perform the trouble shooting of electric starting system.

14.1 Identify the troubles in electric starting system.
14.2 Check all components used for electric starting system and find out the faults.
14.3 Check the charge of battery used in electric starting system.
14.4 Check engine earthling.

REFERENCE BOOKS:

1. Diesel Engine Operation and Maintenance - V. L. Maleev
2. Fundamental of Automotive Mechanics - Crouse
3. ডিজেল ইঞ্জিন ওভারহলিং এন্ড রেকর্ড কিপিং - মোঃ মহসিন আলী, অধ্যক্ষ, বাংলাদেশ ইনস্টিটিউট অব মেরিন টেকনলজি, নারায়নগঞ্জ

67942 Engineering Thermodynamics & Heat Transfer

T	P	C
2	3	3

AIMS:

To be able to develop knowledge, skills and attitude in the area of engineering thermodynamics and heat transfer with special emphasis on:

- The Basic Concept of Thermodynamics and Thermodynamic Systems
- Laws of Thermodynamics and Properties and Laws of Perfect Gases
- Thermodynamic Processes of Perfect Gases
- Entropy and Enthalpy of Perfect Gases
- Aspect of Thermodynamic Cycles
- Aspect of Non-Conventional Thermodynamic Air Cycles
- Aspect of Conventional Air Cycles
- Modes of Heat Transfer
- Heat transfer by conduction, convection, radiation
- Heat Exchanger,
- Properties of vapour and steam.

SHORT DESCRIPTION

The Basic Concept of Thermodynamics; Aspect of Thermodynamic Systems, Laws of Thermodynamics; Properties and Laws of Perfect Gases; Thermodynamic Processes of Perfect Gases; Entropy and Enthalpy of Perfect Gases; Aspect of Thermodynamic Cycles; Aspect of Non-Conventional Thermodynamic Air Cycles; Aspect of Conventional Air Cycles; Modes of Heat Transfer; heat transfer by conduction; heat transfer by convection; heat transfer by radiation; Features of Heat Exchanger; properties of vapour and steam.

Theory

1. Understand the Basic Concept of Thermodynamics

1.1 Define thermodynamics
1.2 Outline the importance of thermodynamics in engineering
1.3 Mention different applications of thermodynamics in engineering field
1.4 Define heat, temperature, specific heat, thermal capacity, water equivalent and absolute zero of temperature and mention their units
1.5 Explain 'heat is a low grade energy and work is a high grade energy'
1.6 Describe the terms specific heat at constant pressure (C_p) and specific heat at constant volume (C_v) and relation between them
1.7 Explain the value of C_p, C_v, γ and molar specific heats for some common gases
1.8 State the Zeroth law of thermodynamics
1.9 Solve problems related to concept of thermodynamics

2. Understand the Aspect of Thermodynamic Systems

2.1 Define thermodynamic system, boundary, surrounding and pure substance
2.2 Describe the thermodynamic control volume
2.3 Define sensible heat and latent heat
2.4 List the values of different latent heat for water and ice in different units

2.5 Compute the formula to calculate sensible heat and latent heat
2.6 Solve problems on thermodynamic system, sensible heat, latent heat and total heat

3. Understand the Laws of Thermodynamics

3.1 Describe the laws of thermodynamics
3.2 Mention the corollaries of 1st law and 2nd law of thermodynamics
3.3 Mention the significance and limitations of 1st law of thermodynamics
3.4 Mention the application of 2nd law of thermodynamics in refrigeration cycle
3.5 Compare 1st law and 2nd law of thermodynamics
3.6 Solve problems on the laws of thermodynamics

4. Understand the Properties and Laws of Perfect Gases

4.1 Define perfect gas, ideal gas and internal energy.
4.2 Explain the variables of perfect gases
4.3 State Boyle's law, Charles' law, Joule's law and Avogadro's law
4.4 Explain general gas equation, characteristics of gas equation and universal gas constant
4.5 Explain the internal energy of gas heated at constant volume and constant pressure
4.6 Explain the derivation of the equation for increase in internal energy i.e. WCv(T2 - T1)
4.7 Solve problems using gas laws, gas equation and change of internal energy

5. Understand the Thermodynamic Processes of Perfect Gases

5.1 Define thermodynamic processes
5.2 Mention the classification of thermodynamic processes
5.3 List various thermodynamic processes of perfect gases
5.4 Describe the various thermodynamic processes with P-V and T-S diagrams
5.5 Distinguish between the adiabatic process and isentropic process of gases
5.6 Explain the steady and unsteady flow processes
5.7 Describe the steady flow energy equation
5.8 Solve problems on thermodynamic processes

6. Understand the Entropy and Enthalpy of Perfect Gases

6.1 Define entropy and enthalpy
6.2 Mention the units of entropy and enthalpy
6.3 Explain the relation between temperature and entropy
6.4 Solve problems on entropy and enthalpy of different thermodynamic processes

7. Understand the Aspect of Thermodynamic Cycles

7.1 Define thermodynamic cycle
7.2 List the assumption in thermodynamic cycle
7.3 Mention the classification of thermodynamic cycle
7.4 Explain carnot cycle, joules cycle and dual-combustion cycle.
7.5 Explain the reversible and irreversible cycles
7.6 State the meaning of air standard cycle, gas power cycle and vapor power cycle

8. Understand the Aspect of Conventional Air Cycles

8.1 List the conventional air cycles
8.2 Describe the conventional air cycles; Otto cycle, diesel cycle and dual cycle with P-V and T-S diagrams
8.3 Compare the Otto, diesel and dual cycle
8.4 Mention the application of Otto cycle, diesel cycle and dual cycle

8.5 Compare the theoretical Otto and diesel cycles with the actual Otto and diesel cycles
8.6 Solve problems on conventional air cycles (otto, Diesel & dual cycle)

9. Understand the Modes of Heat Transfer

9.1 Mention the different modes of heat transfer.
9.2 Explain the meaning of the terms conduction, convection and radiation.
9.3 Compare conduction, convection and radiation of heat
9.4 Describe the coefficient of thermal conductivity
9.5 Explain the term heat transfer co-efficient and overall heat transfer coefficient.
9.6 Explain the concept of log mean temperature difference.
9.7 Solve the problems on overall heat transfer co-efficient.

10. Understand the heat transfer by conduction.

10.1 State Fourier's law.
10.2 Define the thermal resistance in series.
10.3 Explain thermal diffusitivity.
10.4 Explain the conductive heat flow through flat surface/ plane wall and thick walled tube.
10.5 Solve the problems on heat transfer by conduction.

11. Understand the heat transfer by convection.

11.1 Define the heat transfer mechanism by convection.
11.2 Explain the determination of film co-efficient for convection.
11.3 Explain dimensional analysis.
11.4 Explain the application of dimensional analysis to heat transfer by convection.
11.5 Explain the heat flow by convection through tube
11.6 Solve the problems on heat transfer by convection.

12. Understand the heat transfer by radiation.

12.1 Define reflection absorptivity and reflectivity of a body.
12.2 Explain a black body and a gray body.
12.3 Explain Kirchhoff's Law.
12.4 Explain the mechanism of heat transfer by radiation.
12.5 Explain gas radiation.
12.6 State and explain the stefan-Boltzman law of radiation for black body
12.7 Solve the problems on heat transfer by radiation

13. Understand the Features of Heat Exchanger

13.1 Define heat exchanger
13.2 Mention the classification and functions of heat exchanger
13.3 Explain the operation of direct contact heat exchanger with example
13.4 Explain the operation of regenerative heat exchanger with example
13.5 Describe plate and tube heat exchangers and its function.
13.6 Solve the problems on heat exchanger.

14. Understand properties of vapour and steam.

15.1 Define steam, Wet steam; Supper heated steam; Sensible heat of water; Latent heat of aporization; Specific volume of steam.
15.2 Mention the properties of vapour.
15.3 Explain the internal energy of vapour.
15.4 Distinguish between vapour and steam.

16.3 Explain the conversion of water into steam at constant pressure.

16.4 Explain the conversion of water into steam at constant pressure by T-H diagram.

PRACTICAL:

1. Perform identification of thermodynamics system

1.1 Measure sensible heat of water between two temperatures

1.2 Compare different scales of temperature

1.3 Show sample of boundary, surrounding and pure substance

1.4 Measure latent heat of different materials

2. Proof the Laws of Thermodynamics

2.1 Perform a diagram of 1st law of thermodynamics

2.2 Perform a diagram of 2nd law of thermodynamics

2.3 Perform a diagram of Zeroth law

2.4 Identify perfect gas and ideal gas

2.5 perform prove of Boyle's law, Charle' law, Gay-Lussac law

2.6 Perform general gas equation characteristics.

3. Identify the Thermodynamic Processes of Perfect Gases

3.1 Show down thermodynamic processes of a perfect gas

a) constant volume process b) constant pressure process c) constant temperature process

3.2 Draw the various thermodynamic processes with P-V and T-S diagrams

3.3 Draw the flow processes and non-flow processes of gases

3.4 Draw the steady and unsteady flow processes

4. Perform drawing of the Thermodynamic Cycles

4.1 Draw carnot cycle.

4.2 Draw joules cycle.

4.3 Draw dual-combustion cycle.

5. Perform drawing of Non-Conventional and Conventional Thermodynamic Air Cycles

5.1 Draw the non-conventional air/gas power cycles

5.2 Draw the conventional air cycles

5.3 Draw the conventional air cycles (Otto cycle) with P-V and T-S diagrams

5.4 Draw the conventional air cycles (diesel cycle) with P-V and T-S diagrams

5.5 Draw the conventional air cycles (dual cycle) with P-V and T-S diagrams

5.6 Draw the conventional air cycles (Brayton cycle) with P-V and T-S diagrams

6. Identification the different Heat Transfer method

6.1 Identify terms conduction

6.2 Identify terms convection

6.3 Identify terms radiation.

6.4 Measure conductive heat flow through flat surface/ plane wall and thick walled tube.

6.5 Measure the film co-efficient for convection.

6.6 Measure the heat flow by convection through tube

6.7 Show a black body.

6.8 Show the energy emitted by a black body.

7. Perform identification the Heat Exchanger

7.1 Show skill to construct a double pipe heat exchanger.

7.2 Show skill in determining the heat transfer co-efficient in a double pipe heat exchanger without lagging and with lagging

7.3 Show skill to study a finned tube heat exchanger

7.4 Show a shell and tube heat exchangers with a neat sketch.

8 Identification of vapours and steam

8.1 Identify vapour.

8.2 Identify the external work done by vapour during evaporation.

8.3 Show the thermodynamic processes of vapours.

a) Constant volume process. b) Constant pressure process.

8.4 Perform the conversion of water into steam at constant pressure.

8.5 Perform the conversion of water into steam at constant pressure by T-H diagram.

8.6 Perform the steam table and its uses.

REFERENCE BOOKS:

1. Engineering Thermodynamics - R. S. Khurmi
2. Engineering Thermodynamics -R. P. Nag
3. Heat and Thermodynamics -Brij Lal and N. Subramonyam
4. Heat Transfer -Mc Adam
5. Thermodynamics - Kenneth Wark.
6. Engineering Thermodynamics - Gordon Rogers and Yon Mayhew.
7. Fundamentals of Classical Thermodynamics - Van Wylen and Sonntag.
8. Fundamentals of Heat and Mass Transfer -by F.P.Incropera and D.P.Dewitt
9. Principles of Heat Transfer, -by Kreith, ASIAN BOOKS/THOMPSON
10. Heat Transfer -by J.P.Holman, McGraw hill. 2nd edition

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, and 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, and 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.**
   10.1 Set a simple train of gears.
   10.2 Compare the velocity ratios of the same.
   10.3 Set a compound train of gears.
   10.4 Compare 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

67044 Marine Mechanical Drawing

T	P	C
0	3	1

AIMS:

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

- To enable in constructing sectional drawing of machine parts.
- To enable to draw auxiliary views.
- To enable to apply the ISO drawing conventions.
- To provide ability to draw screw threads and fasteners, welded and riveted components, pipes, gears and electrical circuits, coupling, bearing, spring and pulleys.

SHORT DESCRIPTION:

Constructing sectional drawing; Drawing screw threads and fasteners; Drawing auxiliary views, Drawing welded & riveted components, Electrical drawing pipe work drawing, Drawing of gears nut, Bolt and Stud. key and key way, coupling, spring, Bearing.

DETAIL DESCRIPTION

1. **Construct the sectional views of simple engineering parts**
   - 1.1 Draw the cutting planes on engineering drawing.
   - 1.2 Draw different types of sectional views from a selection of drawing (of industries).
   - 1.3 Draw the “Full” and “Half” sectional views of engineering components.
   - 1.4 Draw an ‘off-set’ section on an engineering drawing .
   - 1.5 Draw the ISO conventions for rivets, Lugs, spokes, bolts, ribs and arms.
   - 1.6 Draw the removed, revolved and broken out sections on an engineering drawing.
   - 1.7 Draw the appropriate sectional views from a selection of engineering drawings of different types.
2. **Prepare the drawing conventions of nut, bolt, stud and thread fastening devices.**
   - 2.1 Identify nut, bolt and stud.
   - 2.2 Draw bolt head and nut according to diameter of bolt
   - 2.3 Draw the threads showing terminologies.
   - 2.4 Draw the square/hexagonal headed bolt and nut with proper proportions showing conventional and simplified thread form.
   - 2.5 Draw different types of screw thread profile with correct proportions.
   - 2.6 Draw different bolt and stud according to measurement.
   - 2.7 Identify the symbols of nut bolt and stud.
3. **Prepare the drawings of riveted and welded components.**
   - 3.1 Identify rivet and rivet joints
   - 3.2 Draw the riveted and welded components using conventions and symbols.
   - 3.3 Draw a complete set of riveted joint and welded joint.
   - 3.4 Draw different rivet head and joints according to the measurement.
4. **Construct the schematic drawing of an electric circuit.**
   - 4.1 Draw symbols used in electric circuits.
   - 4.2 Draw a schematic electric circuits diagram of engine starting system

4.3 Draw a schematic electric circuits diagram of bridge room
4.4 Draw a schematic electric circuits diagram of navigation

5. Prepare the industrial pipe work drawing.
5.1 Draw the components used in industrial piping.
5.2 Draw the standard symbols used for piping.
5.3 Prepare a working drawing of a Pneumatic and a hydraulic oil piping.
5.4 Draw the industrial drawing of pipe work system.

6. Prepare the working drawing of Gears.
6.1 Draw the gear tooth profile.
6.2 Build up a working drawing of an involutes spur gear.
6.3 Perform the freehand sketching of different types of gears.

7. Perform the drawing of key and key way.
7.1 Identify key and key way with their used.
7.2 Draw different key according to the measurement.
7.3 Identify the materials of key.

8. Perform the drawing of coupling.
8.1 Identify coupling.
8.2 Identify different types of coupling.
8.3 Draw coupling according to the diameter of shaft.

9. Perform the drawing of bearings.
9.1 Identify bearing.
9.2 Identify different types of bearing.
9.3 Draw different types bearing according to the measurement.

10. Perform the drawing of spring and pulleys.
10.1 Identify spring and pulleys.
10.2 Identify different types spring.
10.3 Draw spring and pulley according to the measurement.
10.4 Identify different types of pulley.

REFERENCE BOOKS

1. প্রাথমিক ইঞ্জিনিয়ারিং ড্রয়িং - হেমন্ত কুমার ভট্টাচায
2. Mechanical Engineering Drawing - Ludig
3. Technical Drawing - Billiard
4. Engineering Drawing for Marine Engineers - HG. Beck, REEDS

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.

REFERENCE BOOKS

1. Modern Welding - Althouse/Tanquist/Bowditch GoodheatWillcox Co, Edition: Seventh.
2. Welding Skill and Practice - Giachino/Weeks/Brune American Technical Society, Edition: Third.
3. Science and Practice of Welding - A.C.Deviscambridge University Press, Edition: Eleventh.
4. Basic Arc Welding - Evan Griffin & Edward M. Roden, 1967.
5. Basic Oxy –Acetylene Welding - Evan Griffin & Edward M. Roden, 1967.
6. Learning Materials, Welding Unites 1 to 7 - Vocational Training Project, Assisted by SIDA.
7. Fabrication and Welding Engineering - Roger Timings.
8. Introduction to Welding - Miller.
9. The ABC's of arc welding and inspection - Kobe Steel, Ltd.
10. Health and safety in welding- Department of Labor, Wellington New Zealand, October 200

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)

MARINE TECHNOLOGY

TECHNOLOGY CODE: **679**

5th SEMESTER

DIPLOMA IN ENGINEERING

PROBIDHAN-2016

MARINE TECHNOLOGY (679)

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	67951	Marine Engines & Construction	2	6	4	40	60	50	50	200
2	67955	Instrumentation & Control	2	3	3	40	60	25	25	150
3	67054	CAD &CAM	1	6	3	20	30	50	50	150
4	67056	Advanced Machine Shop	2	6	4	40	60	50	50	200
5	69054	Environmental Studies	2	0	2	40	60	0	0	100
6	65851	Accounting Theory & Practice	2	3	3	40	60	50	0	150
Total			11	24	19	220	330	225	175	950

67951 Marine Engines & Construction

T	P	C
2	6	4

AIMS

* To be able to develop knowledge, skill and attitude on marine diesel engine and their constructional feature.
* To be able to develop knowledge, skill and attitude on the systems of marine diesel engine and their associated parts
* To be able to develop knowledge, skill and attitude in different parts of marine diesel engine

SHORT DESCRIPTION

Introduction of marine engine, concept of slow speed diesel engine in marine vessel, concept of design and construction of marine diesel engine, main parts of marine diesel engine, construction of the cylinder block and cylinder liner of marine diesel engine, constructional feature of the piston, piston pins, piston rings of marine diesel engine, construction of the connecting rod, piston of marine diesel engine, construction of the crankshaft of marine diesel engine, construction of the bearing of marine diesel engine, construction of the flywheel of marine diesel engine, construction of valve gear of marine diesel engine, operation and maintenance of modern marine diesel engine, Fuel Injection System of marine diesel engine, specification of marine diesel engine.

DETAIL DESCRIPTION

Theory:

1. Understand the Introduction of marine engine

1.1 Define marine engine.
1.2 Classify and explain the engine according to : fuel used, number of stroke, cylinder arrangement , thermodynamic cycle, types of compression , valve arrangement , ignition system, cooling system, governing system , acting of engine, field of use,air charging etc.
1.3 Mention the constructional features of marine engine.
1.4 Describe the causes of wide application of marine diesel engine.
1.5 Describe the advantages and disadvantages of each type of marine diesel engine.
1.6 Describe the advantages of marine diesel engine over other marine engines.
1.7 Distinguish between commonly used diesel engine and marine diesel engine.
1.8 Mention the factors to be considered in selecting a marine diesel engine.

2. Understand the concept of design and construction of marine diesel engine

2.1 Mention the advantages of slow speed diesel engine in marine vessel.
2.2 Mention the advantages of two stroke diesel engine operation in marine field.
2.3 Explain engine valve, valve lifter, rocker arm
2.4 Describe the cylinder arrangement of In-line, V-type and opposed piston type marine diesel engine.
2.5 Describe the materials used for construction of different parts of marine diesel engine.
2.6 Describe the procedure to finish the bore of cylinder liner.
2.7 Mention the factors to be considered in design and construction of marine diesel engine.

3. Understand the main parts of marine diesel engine

3.1 Enumerate the main parts of marine diesel engine.
3.2 Define frame, cylinder head and cylinder head cover.
3.3 Describe the constructional procedure of the frame of a marine diesel engine.
3.4 Define cylinder block and cylinder liner of marine diesel engine.
3.5 Classify cylinder liner and identify various parts of cylinder liner.
3.6 Mention the advantages and disadvantages of dry and wet type liner.
3.7 Mention the characteristics of rigid cylinder liner
3.8 Describe the advantages of mono block cylinder construction over individual cylinder Construction.
3.9 Describe the constructional procedure of inlet and exhaust manifold of marine diesel engine.

4. Understand the constructional feature of the piston, piston pins and piston rings of marine diesel engine

4.1 Define and classify piston, piston ring and identify the various parts of piston
4.2 Describe the functions and construction of different type's piston.
4.3 Distinguish between trunk piston and cross head piston.
4.4 Mention the advantages of two pieces piston and chrome plated piston ring.
4.5 Define wrist pin/gudgeon pin/piston pin
4.6 Mention the functions of piston pin and piston ring.
4.7 Mention the number of compression and oil scrapper ring used in marine diesel engine.
4.8 Describe the working principle of piston pin.
4.9 Mention the purposes of oil scrapper ring and identify the clearance of piston ring.

5. Understand the concept of connecting rod, piston rod of marine diesel engine

5.1 Define connecting rod and piston rod of cross head type engine.
5.2 Identify the connecting rod with sketch
5.3 Identify the piston rod with sketch
5.4 Define angularity of connecting rod
5.5 Mention the uses of crank pin bearing bolt.
5.6 Describe the constructional feature of connecting rod of cross head type engine with sketch.
5.7 Describe the constructional feature of piston rod of cross head type engine with sketch.
5.8 Mention the materials used to construct connecting rod and piston rod of marine diesel engine.

6. Understand the concept of the crankshaft of marine diesel engine

6.1 Define crankshaft
6.2 Identify the different components of crankshaft.
6.3 Mention the functions of main journal
6.4 Describe the arrangement of crankshaft throws of marine diesel engine
6.5 Mention the type of materials used to make a crankshaft.
6.6 Describe the causes of crankshaft failure
6.7 Mention the necessity of counter weight in a crankshaft
6.8 Describe the constructional feature of a crankshaft for a large marine diesel engine.

7. Understand the concept of the bearing and flywheel of marine diesel engine

7.1 Define, classify and functions of bearing used in marine diesel engine.
7.2 Distinguish between the slide contact bearing and rolling contact bearing.
7.3 Mention the materials used in marine diesel engine bearing
7.4 Mention the necessity of lubrication and clearance of marine diesel engine bearing.
7.5 Define flywheel
7.6 Mention the functions of flywheel

7.7 Mention the types of flywheel used in marine diesel engine
7.8 Describe the constructional feature of flywheel of marine diesel engine

8. Understand the valve gear of marine diesel engine

8.1 Define valve gear
8.2 Explain the main parts of valve gear mechanism.
8.3 Describe the function of camshaft, cam follower, push rod and rocker arm with sketch.
8.4 Describe the relation between camshaft and crankshaft speed
8.5 Describe the materials used to construct a camshaft.
8.6 Explain the valve clearance adjustment procedure of I, L, T and F head engine.
8.7 Distinguish between overhead valve and overhead camshaft mechanism.
8.8 Describe the procedure to measure valve and valve seat.
8.9 Analyze the workability of valve seat
8.10 Explain the procedure of engine valve, valve guide, spring and seats.

9. Understand the operation of modern marine diesel engine

9.1 Mention the necessity of ignition system of an IC engine
9.2 Explain the function of components used in ignition system
9.3 Explain firing order of IC engine
9.4 List the troubles in starting system of marine engine.
9.5 Define reversing of marine diesel engine and the requirement of engine reversing.
9.6 Describe different types of combustion chambers used in modern marine diesel engines.

10. Understand the Fuel Injection System of marine diesel engine

10.1 Mention various modern fuel injection system
10.2 Mention the advantages of VVT-i
10.3 Define actuator and VVT-i System and anti lock braking system (ABS)
10.4 Define VVTL-i (Variable Valve Timing and Lift intelligent system)
10.5 Describe VVT-iE (Variable Valve Timing - intelligent by Electric motor) and DVVT (Dynamic Variable Valve Timing)
10.6 Describe the Dual fuel engine and Gas diesel engine

11. Understand the specification of marine diesel engine

11.1 Define specification.
11.2 List the factors for marine diesel engine specification.
11.3 Mention the specification of water cooled LOVOL/PERKINS diesel engines
11.4 Mention the specification of CUMMINS and CATERPILLAR 4-stroke diesel engines
11.5 List the performance data of specification of marine diesel engine.
11.6 List the general data of specification of marine diesel engine.
11.7 Mention the advantages of specification

PRACTICAL:

1. Perform the operation of four stroke cycle marine diesel engine.

1.1 Identify the parts of four stroke cycle diesel engine.
1.2 Find the TDC and BDC mark, swept volume, clearance volume and total volume
1.3 Check the valve clearance and tappet clearance.
1.4 Verify the stroke and angularity of the connecting rod.

1.5 Observe the suction, compression, power and exhaust stroke of four stroke cycle marine diesel engine.
1.6 Check all requirements before starting and operate the engine.
1.7 Identify the tools necessary for marine diesel engine servicing

2. Perform the operation of two stroke cycle marine diesel engine.

2.1 Identify the parts of two stroke cycle marine diesel engine.
2.2 Find the TDC and BDC mark.
2.3 Find out the swept volume, clearance volume and total volume
2.4 Check the valve clearance and the tappet clearance.
2.5 Verify the stroke and angularity of the connecting rod.
2.6 Observe the suction, compression, power and exhaust stroke of two stroke cycle marine diesel engine.
2.7 Check all requirements before starting and operate the engine

3. Perform the identification of valve mechanism of marine diesel engine.

3.1 Identify the various parts of valve mechanism.
3.2 Identify the different parts of camshaft and the materials of camshaft.
3.3 Identify the intake and exhaust valves of marine diesel engine.
3.4 Identify the valve mechanism components
3.5 Fix valve timing
3.6 Check and adjust tappet clearance

4. Perform the verification of crankshaft of marine diesel engine.

4.1 Identify the crankshaft of marine diesel engine.
4.2 Identify the various parts of crankshaft of marine diesel engine.
4.3 Identify the materials of crankshaft of marine diesel engine.
4.4 Measure the journal of crankshaft of marine diesel engine.
4.5 Align the crankshaft.
4.6 Check alignment of the crankshaft and the clearing of main bearing
4.7 Check the clearance of big end bearing and replace it, if required

5. Perform the identification of cylinder block, cylinder head and combustion chamber of a marine diesel engine.

5.1 Identify the cylinder block, cylinder head , crankcase and combustion chamber of marine diesel engine.
5.2 Identify the constructional difference of normal engine to marine diesel engine block.
5.3 Identify materials and constructional features of cylinder block and cylinder head of marine diesel engine
5.4 Measure bore, stroke and swept volume of an engine cylinder.
5.5 Clean and de-carbonize the combustion chamber of marine diesel engine.

6. Perform the identification of piston, piston pin and piston ring of marine diesel engine.

6.1 Identify the piston, piston pin, piston ring and ring groove of marine diesel engine.
6.2 Verify the constructional feature of piston, piston pin, piston ring and ring groove of marine diesel engine.
6.3 Measure the piston diameter.
6.4 Check the piston ring clearance and the piston ring clearance of marine diesel engine.

7. **Perform the job of removing and refitting of connecting rod/piston rod/ flywheel / camshaft of marine diesel engine.**
   - 7.1 Identify connecting rod, piston rod and camshaft
   - 7.2 Remove and clean connecting rod, piston rod and camshaft.
   - 7.3 Check the alignment of connecting rod, piston rod and camshaft.
   - 7.4 Select the proper tools and equipment
   - 7.5 Find out the firing order TDC, BDC and FDC mark of marine diesel engine.
   - 7.6 Remove the flywheel from the engine crankshaft.
   - 7.7 Place the camshaft for alignment and set the camshaft gear for timing
   - 7.8 Check the cam lube oil condition and its height
8. **Perform the servicing of lubricating system/ cooling system/ lube oil pump/fuel system.**
   - 8.1 Identify lubrication system, cooling system, lube oil pump and fuel system
   - 8.2 Identify the components of lubrication, cooling, lube oil pump and fuel system
   - 8.3 Check lube oil level with deep stick and the quality of lube oil
   - 8.4 Remove the oil filter and replace, if required
   - 8.5 Change the lube oil of crankcase and refill with proper grade of lube oil
   - 8.6 Measure lubes oil level in crankcase after servicing
   - 8.7 Identify air and liquid cooling system
   - 8.8 Observe the action and temperature of cooling water of a running engine
   - 8.9 Observe the faults in the system and repair, if necessary
   - 8.10 Check the feed pump for proper operation
9. **Perform the job to measure clearance of bearing of marine diesel engine.**
   - 9.1 Identify the Plastic Gauge, Strain Gauge and Bridge Gauge.
   - 9.2 Measure the clearance of a bearing by using Plastic Gauge.
   - 9.3 Measure the clearance of a bearing by using Strain Gauge.
   - 9.4 Measure the clearance of a bearing by using Bridge Gauge.
10. **Perform the job of removing and refitting bearing without removing crankshaft of marine diesel engine.**
    - 10.1 Drain the lube oil
    - 10.2 Remove the oil pan and main bearing
    - 10.3 Clean the main bearing and check the surface of main bearing
    - 10.4 Replace the bearing, if required
    - 10.5 Refit the oil pan and fill the engine with lube oil up to the recommended level.
11. **Perform the identification of control panel of marine diesel engine.**
    - 11.1 Identify the control panel and the different gauges of control panel.
    - 11.2 Identify the emergency stop.
    - 11.3 Identify the starting and stopping switch.
    - 11.4 Check the control panel during operation.
    - 11.5 Observe the control panel during operation
12. **Perform the servicing of intake system/ exhaust and starting and stopping system.**
    - 12.1 Identify engine intake system and exhaust system
    - 12.2 Identify the components of engine intake system and exhaust system.
    - 12.3 Open air filter element and check air filter for servicing
    - 12.4 Check turbo-charger/blower/muffler/silencer for servicing
    - 12.5 Check the engine before starting and start an engine manually/by cranking motor

12.6 Run the engine at idle speed for a while and at low speed for a while
12.7 Run the engine at different speed and load
12.8 Stop the engine

13. Perform the steps to be taken before starting a diesel engine.

13.1 Check for proper adjustment of all moving parts.
13.2 Check for proper alignment of all moving parts.
13.3 Examine lubrication of all moving parts and for proper functioning.
13.4 Examine for loose nuts, broken bolts, loose connection of belts, cables, leaky jackets and hoses.
13.5 Check the lube oil level with deep stick.
13.6 Check the cooling system and fuel system for proper functioning.
13.7 Turn the engine flywheel one or two times if the engine is idle for long period of time.
13.8 Check the off-load the engine.

14. Perform the identification of Fuel Injection System of marine diesel engine.

14.1 Identify various modern fuel injection systems.
14.2 Identify various parts of electronic fuel injection system (EFI) and VVT-i
14.3 Identify the lambda (oxygen), air flow, temperature and pressure sensor
14.4 Identify actuator and VVT-i System, and anti lock braking system (ABS)
14.5 Identify each components of fuel injection system of marine diesel engine

15. Perform the identification of marine diesel engine used in industries/shipyard/dockyard in Bangladesh.

15.1 Identify the diesel engine industries in Bangladesh.
15.2 Visit a shipyard and identify the brand and country of origin of marine diesel engine.
15.3 Visit the ship industries /dockyard/shipyard in Bangladesh
15.4 Identify the engines used in ship industries /dockyard/shipyard in Bangladesh
15.5 Identify the drawback to establish of ship industries /dockyard/shipyard in Bangladesh

REFERENCE BOOKS

1 Diesel Engine Operation and Maintenance -V. L. Maleev
2 Fundamental of Automotive Mechanics -Crouse
3 Auto Mechanics Fundamentals -Martin W. Stockel & Martin T. Stockel
4 Automotive Engineering Volume 1 and 2- Kirpal Singh
5 Marine Engines and Construction (মেরিন ইঞ্জিনস এন্ড কনস্ট্রাকশন) - Engr. Md. Mohosin Ali, Principal, Bangladesh Institute of Marine Technology

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 Explain 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

67054 CAD & CAM

T	P	C
1	6	3

AIMS

- To be able to understand the basic concept, principle of design process and the role of CAD.
- To be able to understand the process of defining a model.
- To be able to understand the principle and techniques of geometric modeling.
- To be able to understand the principle of applying CAD model in design.
- To be able to understand the principle of design manufacturing interface.
- To be able to understand the link to machine control.
- To be able to acquire skills for drawing and designing using CAD software.
- To be able to acquire skills on part programming for NC and CNC machines.

SHORT DESCRIPTION

Basic concept of CAD and CAM; Principle of design process; Model definition; Three-dimensional modeling scheme; Model design; CNC machine tools & control system; Link to Machine control, Part programming and industrial robots.

DETAIL DESCRIPTION

Theory:

1. **Understand basic concept of CAD & CAM.**
   - 1.1 Define CAD & CAM
   - 1.2 Discuss the role of CAD & CAM
   - 1.3 Explain the benefits of CAD/CAM software.
   - 1.4 Explain the benefits of CAM, differentiate between CAD and CAM
   - 1.5 Introduce the concept, background, Software and hardware of CIM.
   - 1.6 Describe the relation between automation and CAD & CAM.
   - 1.7 Describe Design process.
   - 1.8 Explain the product cycle.
2. **Understand the Computer aided Drafting**
   - 2.1 Understand applications of CAD models.
   - 2.2 Introduce CAD software like Auto Cad, Solid Works, CATIA.
   - 2.3 Understand entity draw basic editing, dimensioning and area commands.
   - 2.4 Understand drawing a part.
   - 2.5 Understand the assembly of the parts.
3. **Understand Geometrical models and modeling techniques.**
   - 3.1 Define Geometrical solid models.
   - 3.2 Describe 2-D & 3-D model technic and dimension transformation.
   - 3.3 Explain the terms: Layer, Colors, Grids, Groups, Dragging, Clipping and transformation.
   - 3.4 Describe modify, annotations, blocks, inserts, hatches, layouts and template commands.
   - 3.5 Explaining View sets, Virtual realism.
   - 3.6 Discuss wireframe, B-Rep, CSG and Hybrid modeling.
   - 3.7 Discuss surface modeling- Analytical and Synthetic approaches
4. **Understand the computer Aided Manufacturing (CAM).**

4.1 Explain CAM concept.
4.2 Discuss CAD/CAM database.
4.3 Discuss rational for CAD/CAM.
4.4 Describe elements of CAM system.
4.5 Discuss NC system in CAM.
4.6 Discuss the advantages and application of CAM.

5. Understand the NC machine tool control.

5.1 State the principal of NC, DNC and CNC technology.
5.2 Describe the steps to be accomplished to utilize NC in manufacturing.
5.3 Describe the tooling and Nomenclature of CNC machine all type axis.
5.4 Describe the types of NC co-ordinate: Point – to – point, Straight Cut, and Contouring.
5.5 Describe the uses of NC part programming: G code and M-code. Reference Point (Machine Zero, Work zero, Tool zero & Tool offset).
5.6 Explain all APT motion commands and Macro subroutines.
5.7 Explain Simple part program for CNC lathe & milling machine.
5.8 Describe control mode of MDI, JOG and Tool geometry for CNC machine.

6. Understand CNC machine tools & control systems.

6.1 Define CNC machining centers.
6.2 Classify the machining centers.
6.3 Describe different types of CNC turning center.
6.4 Describe machine control unit.
6.5 Illustrate the organization of modern MCU function.
6.6 State the subsystem of the MCU.
6.7 Describe support unit of CNC machine.

7. Understand industrial robots.

7.1 Define industrial robot.
7.2 Describe types of robot configurations.
7.3 Discuss robotic sensor.
7.4 Describe motion system of robot.
7.5 Describe six degree's freedom of a robot.
7.6 Describe the important technical features of robot.
7.7 Describe the basic drive system of robot.

PRACTICAL:

1. Draw geometrical involving line, arc, and circle in two-dimensional environment.
2. Draw geometrical involving lines, curves, circle, ellipse, with given data.
3. Modify a given drawing (previously created) with new sets of data.
4. Annotate the given drawing with text and dimensions.
5. Draw a 3-D object using conventional process.
6. Draw a 3-D object using wire frame construction technique.
7. Draw a 3-D object using solid model technique.
8. Draw a 3-D object using constructive geometric technique.
9. Prepare different part program of different object for NC machine.
10. Prepare different part program of different object using 'G' and 'M' code.
11. Use CAM software for simulation of Dynamic Systems on CNC machine.
12. Prepare NC program: linear cutting, taper cutting, thread cutting, Chamfering and multiple diameter cutting.

REFERENCE BOOKS

1. CAD/CAM Computer aided design and Manufacturing – Groover Mikel P.
2. CAD/CAM, Theory and Practice – Ibrahim Zaid
3. CAD/CAM From principle to Practice - McMahon Chris, Jimmi Brown.
4. CAD/CAM principles & applications - Dr. P N Rao

CAD SOFTWEARES

1. Solid Works
2. CATIA - V5
3. Auto Cad

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; MasterCAM; 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 systemAndDistinguish 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.

REFERENCE BOOKS:

1. Workshop Process - R. T Prichard ELBS
2. Workshop Practice Volume-1 - H. K Hazara Chowdhory & A..K Hazara Chowdhory
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.

69054 Environmental Studies

T	P	C
2	0	2

AIMS

- To be able to understand the basic concepts of environment and environmental pollution.
- To be able to understand the concepts of ecology and ecosystems
- To be able to understand the basic concepts of environmental degradation relating to industrial production.
- To be able to understand the major environmental issues and problems.
- To be able to understand legislative measures to protect environment.

SHORT DESCRIPTION

Basic concepts of environment; natural resources; biogeochemical cycling; ecology and ecosystem; air; water; soil; solid waste management; development and environment; global environmental challenges; legislative protection of environment.

DETAIL DESCRIPTION

Theory:

1. **Understand the multidisciplinary nature of environmental studies.**
   - 1.1. Define environment, nature, pollution, pollutant, contaminant.
   - 1.2. Describe the scope of environmental studies.
   - 1.3. Describe the importance of environmental studies.
   - 1.4. Describe the formation and structure of the Earth.
   - 1.5. Describe the earth's natural system.
   - 1.6. Describe the changing attitudes to the natural world.
   - 1.7. Mention the main components of environment.
   - 1.8. Define natural and man-made environment.
   - 1.9. Distinguish between natural and man-made environment.
2. **Understand the natural resources.**
   - 2.1. Define natural resources.
   - 2.2. Classify natural resources.
   - 2.3. Describe forest resources.
   - 2.4. Describe water resources.
   - 2.5. Describe mineral resources.
   - 2.6. Describe food resources.
   - 2.7. Describe energy resources.
   - 2.8. Describe land resources.
   - 2.9. Describe environmental problem relating to resources use.
   - 2.10. Describe the role of an individual in conservation of natural resources.
3. **Understand the biogeochemical cycling.**
   - 3.1. Define biogeochemical cycle.
   - 3.2. Describe hydrologic cycle.

3.3. Describe carbon cycle.
3.4. Describe nitrogen cycle.
3.5. Describe oxygen cycle.
3.6. Describe phosphorus cycle.
3.7. Describe sulfur cycle.
3.8. Describe nutrient cycle.

4. Understand the ecology and ecosystem.

4.1. Define ecology and ecosystem.
4.2. Structure and function of an ecosystem.
4.3. Describe the components of ecosystem.
4.4. Explain the stability of ecosystem.
4.5. Describe ecological factors.
4.6. Describe interdependency between abiotic and biotic component.
4.7. Describe the meaning of following terms: species, population, community, ecological succession, community periodicity, climax community, ecological niche, habitat, plankton, nekton, ecological indicator, evolution, adaptation, producers, consumers, decomposers, food chains, food webs, ecological pyramids, bio-concentration, bio-magnification, biodiversity, threatened species, endanger species, extinct species, exotic species, biodiversity conservation and biogeography.
4.8. Describe energy flow in the ecosystem.
4.9. Describe the ecosystem of pond, ocean, estuary, grassland, cropland, forest, desert and mangrove.

5. Understand the air as a component of environment.

5.1. Define air.
5.2. Describe the composition of the clean dry atmospheric air at ground level.
5.3. Describe the atmospheric structure.
5.4. Define air pollution.
5.5. Describe major air pollutants and their impacts.
5.6. Describe the sources of air pollutants.
5.7. Explain the formation of photochemical smog and its effects.
5.8. Describe the effects of air pollution on vegetation, animal, human health and materials and resources.
5.9. Define sound and noise.
5.10. Describe the classification of sound.
5.11. Describe the effects of noise.

6. Understand the water as a component of environment.

6.1. Define water.
6.2. Describe the characteristics of water.
6.3. Describe the sources of water.
6.4. Describe the uses of water.
6.5. Explain that the water is a universal solvent.
6.6. Define water pollution, biological oxygen demand (BOD), effluent treatment plant (ETP).
6.7. Describe the sources of water pollution.
6.8. Describe the effects of water pollution.

7. Understand the soil as a component of environment.

7.1. Define soil.

7.2. Describe the constituents of soil.
7.3. Define soil pollution.
7.4. Describe causes soil degradation.
7.5. Describe the sources of soil pollution.
7.6. Describe the effects of soil pollution.

8. Understand the concept of solid waste management.

8.1. Define solid waste, refuse, garbage, rubbish, trashes, demolition and construction waste, e-waste, agricultural waste, pathological waste, radioactive waste, hazardous waste, 3R, 4R.
8.2. List the sources of solid waste.
8.3. Mention the classification of solid waste.
8.4. Mention the methods of collection of solid waste.
8.5. Describe the recycling of solid wastes.
8.6. Describe resource recovery from solid waste.
8.7. Describe the potential method of disposal of solid waste.
8.8. Describe control measures of urban and industrial wastes.

9. Understand the development and environment.

9.1. Define environmental ethics and environmental stress.
9.2. Describe environmental stress.
9.3. Define sustainable development.
9.4. Define urbanization.
9.5. Describe the causes of urbanization.
9.6. Describe the effects of urbanization on environment.
9.7. Define industrialization.
9.8. Describe the causes of industrialization.
9.9. Describe the effects of industrialization on environment.

10. Understand the global environmental challenges.

10.1. Define greenhouse gas and greenhouse effects.
10.2. Make a list of greenhouse gases and their contribution on greenhouse effects.
10.3. Describe the causes and consequences of greenhouse effects.
10.4. Describe acid rain.
10.5. Describe importance of ozone layer.
10.6. Define ozone depleting substances (ODS).
10.7. Describe ozone layer depletion mechanism.
10.8. Describe hazardous waste.
10.9. Describe chemicals pesticides.
10.10. Describe radioactive pollution.
10.11. Describe natural disaster.

11. Understand the legislative protection of environment.

11.1. Define environmental impact assessment (EIA) and environmental auditing (EA).

11.2. Mention environmental act and legislations prescribed for air, noise, water, soil and wild life protection.

11.3. Describe environmental conservation act 1995 in Bangladesh.

11.4. Describe the environment conservation rule 1997 in Bangladesh.

11.5. Describe the environmental framework in Bangladesh.

11.6. Describe The Montreal Protocol and The Kyoto Protocol.

11.7. Describe role of an individual in prevention of pollution.

REFERENCES:

1. Fundamentals of Environmental Studies, Mahua Basu and S. Xavier, Cambridge.
2. Ecology and Environment, P.D. Sharma, Rastogi Publications.
3. Basics of Environmental Science, Michael Allaby, Routledge.
4. Environmental Science, Jonathan Turk and Amos Turk, Sauders golden sunburst series.

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)

MARINE TECHNOLOGY

TECHNOLOGY CODE: **679**

6th SEMESTER

DIPLOMA IN ENGINEERING

PROBIDHAN-2016

MARINE 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	67961	Ship Safety & Fire Fighting	1	6	3	20	30	50	50	150
2	67962	Marine Auxiliary System & Hydraulic Machinery	2	6	4	40	60	50	50	200
3	67977	Maritime laws	2	0	2	40	60	0	0	100
4	67064	Strength of Materials	3	3	4	60	90	25	25	200
5	68021	Naval Architecture	2	3	3	40	60	25	25	150
6	68053	Marine Refrigeration & Air Conditioning	2	3	3	40	60	25	25	150
7	65852	Industrial Management	2	0	2	40	60	0	0	100
Total			**14**	**21**	**21**	**280**	**420**	**175**	**175**	**1050**

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 the additional 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

67962 Marine Auxiliary System & Hydraulic Machinery

T	P	C
2	6	4

AIMS

To be able to develop knowledge, skills and attitude in the area of Marine Auxiliary System and Machineries with special emphasis on:

- Concept of pump of a ship and of pumping system of a ship
- Concept of steering system of a ship
- Concept of rudder, mechanical, hydraulic and electric steering system of a ship
- Concept of cargo handling equipment and electricity generation and transmission
- Concept of anchor handling equipment of a ship
- Concept of mooring equipment of a ship
- Concept of bilge and ballast system, heat exchanger and air compressor of a ship
- Concept of water distillation system of a ship
- Concept of oil-water separator of ship
- Concept of sewage treatment plant, safety and fire fighting equipment on board ship.
- Concept of survival equipment on board ship.

SHORT DESCRIPTION

Concept of pump and pumping system; steering system; cargo handling equipment; electricity generation and transmission on board ship; anchor handling equipment; mooring equipment ; bilge and ballast system ; heat exchanger ; air compressor ; water distillation system ; oil-water separator of ship ; sewage treatment plant ; safety and firefighting equipment on board ship ; survival equipment on board ship.

DETAIL DESCRIPTION

Theory

1. **Understand the concept of pump of a ship and of pumping system of a ship**
   - 1.1 Define the pump and classify pump.
   - 1.2 Describe the different types of pumps used in ship with sketch.
   - 1.3 Derive the formula to calculate power of a pump.
   - 1.4 List the name of piping system and fittings of pumping system.
   - 1.5 Describe factors consider relating to pump and pumping system.
   - 1.6 Describe main engine cooling pumping system with sketch.
   - 1.7 Mention the function of cock, globe valve, butterfly valve, non-return valve, gate valve, reliefvalve and quick closing valve.
   - 1.8 Describe valve chest in piping system with its positioning
   - 1.9 Mention the function of mud box of piping system
   - 1.10 Describe the piping layout of fresh water in a ship with sketch.
2. **Understand the concept of bilge and ballast & cargo piping system of a ship**
   - 2.1 Define bilge and ballast.
   - 2.2 Classify bilge system.

2.3 List the name of bilge pumps used in the ship.
2.4 Describe the ring main bilge system with sketch.
2.5 Describe the individual suction bilge system with sketch.
2.6 Define ballasting and de-ballasting of ship.
2.7 Mention the necessity of ballasting and de-ballasting of ship.
2.8 Mention the position of ballast tank of a small ship as well as a large ship with sketch.
2.9 Describe the circuit of sea water for bilge, ballast and fire system.

3. Understand the concept of steering system of a ship

3.1 Define & classify steering system of a ship
3.2 Describe the function of steering system.
3.3 Describe the SOLAS regulation of steering system
3.4 Identify the three main parts of steering system
3.5 Describe the procedure of testing of steering gear for satisfactory operation.
3.6 Define mechanical, hydraulic and electric steering system
3.7 Describe the telemotor steering system with sketch.
3.8 Describe the procedure of charging fluid into the telemotor system & it's necessity.
3.9 Describe electro-hydraulic steering system with sketch
3.10 Define hunting gear, two ram and four ram steering process

4. Understand the concept of rudder of steering system of a ship.

4.1 Define rudder.
4.2 Classify rudder.
4.3 Mention the necessity of rudder.
4.4 Mention the swing angle of rudder.
4.5 Mention the time of swing of rudder.

5. Understand the concept of cargo handling equipment of a ship.

5.1 Define cargo winch, derrick, deck crane and davit.
5.2 Mention the purpose of cargo handling equipment.
5.3 Mention the function and necessity of cargo winch, derrick crane and davit.
5.4 Distinguish between derrick and deck crane.

6. Understand the concept of electricity generation and transmission on board ship.

6.1 Mention the sources of electricity on board ship.
6.2 Define standby generator and shaft generator.
6.3 Mention the necessity of standby generator and shaft generator.
6.4 Distinguish between standby generator and shaft generator.
6.5 Define electrical synchronizing.
6.6 Explain the condition of synchronizing of two AC generator and two DC generator.
6.7 Mention the necessity of electrical synchronizing.
6.8 Describe the procedure of generation of electricity on board ship and it's transmission system with sketch.

7. Understand the concept ofmooring and anchor handling equipment of a ship.

7.1 Define anchor handling equipment.
7.2 Define windlass, capstan and anchor.
7.3 Mention the necessity of windlass, capstan and anchor with their functions.
7.4 List the names of anchor.
7.5 Define mooring, anchor mooring, buoy mooring and mooring winch.

7.6 List the name of types of mooring.
7.7 Mention the purposes of mooring.
7.8 Mention the function and the necessity of mooring winch.
7.9 Distinguish between winch and windlass.

8. Understand the concept of heat exchanger of a ship.

8.1 Define heat exchanger.
8.2 List the name of different types of heat exchanger.
8.3 Describe parallel flow, counter flow, tube &platetype heat exchanger with sketch.
8.4 Mention the uses of heat exchanger.
8.5 List the usual causes of low performance of heat exchanger.
8.6 Describe the procedure of cleaning heat exchanger.
8.7 Mention the causes of corrosion occurred in heat exchanger.
8.8 Describe the procedure of protection from the effects of corrosion of heat exchanger.

9. Understand the concept of air compressor of a ship.

9.1 Define air compressor.
9.2 Define single stage, two stage and three stage air compressors.
9.3 Define air compressor bumping clearance.
9.4 Mention the purposes of the air compressor on board ship.
9.5 Describe the method of construction of large and small air reservoirs.

10. Understand the concept of water distillation system of a ship.

10.1 Mention the sources of water collection.
10.2 List the name of distillation system.
10.3 Mention the necessity of distillation plant.
10.4 Describe the Fresh water generator.

11. Understand the concept of oil-water separator of ship.

11.1 Define centrifugal, purifier and clarifier.
11.2 Distinguish between purifier and clarifier.
11.3 Describe the function of purifier with sketch.
11.4 Describe the function of clarifier with sketch.
11.5 State the necessity of purifier and clarifier in oil purification system.
11.6 Describe the oil purification system of a ship with sketch.

12. Understand the concept of sewage treatment plant of a ship.

12.1 Define sewage.
12.2 State the meaning of sewage treatment.
12.3 Explain the necessity of sewage treatment plant in a ship.
12.4 List the name of sewage treatment plant.

PRACTICAL:

1. Study and identification of generator and heat exchanger of a ship

1.1 Identify the types of heat exchanger.
1.2 Identify the components of heat exchanger.
1.3 Identify the various components of heat exchanger of your institute.
1.4 Draw and layout of generator room of your institute.

1.5 Study of the synchronizing process.
1.6 Indicate the parts of shaft generator.
1.7 Operate generator.

2. **Study and identification of pumps of a ship.**
   2.1 Test the performance of a centrifugal pump.
   2.2 Determine the discharge of pump through a pipe.
   2.3 Determine the servicing procedure of lube oil pump and fuel pump.
   2.4 Calibrate fuel pump, operate centrifugal & reciprocating pump.
3. **Identify components of hydraulic crank, anchor, winch, hatch and bulkhead of a ship.**
4. **Study and identification of steering system of a ship and institute workshop.**
   4.1 Draw a diagram of steering system of the launch of your institute/shipyard.
   4.2 Visit a shipyard/dockyard and observe the construction of steer of ship.
   4.3 Perform/identify the fitting of hydraulic steering.
   4.4 Repair/service the steering.
5. **Visit a ship and study the following.**
   5.1 Layout plan of steering system.
   5.2 Identify steering winch, crane and heat exchanger.
6. **Study and identification of rudder of a ship.**
   6.1 Identify rudder.
   6.2 studyof operating procedure of rudder.
   6.3 Observe rudder steel and buffer plate.
7. **Study and identification of pump and piping system of oil tanker of a ship.**
   7.1 Identify bilge pump, ballast pump, GS pump, sanitary pump, sea water pump, fresh water pump of ship.
   7.2 Identify bilge system, ballast system, lubricating system and fuel system of ship.
   7.3 Identify electrical and lighting system of ship.
   7.4 Study the overhauling procedure of air compressor.
8. **Study and identification of safety, firefighting and survival equipment of a ship.**
   8.1 Identify life boat, life raft, life buoy and life raft
9. **Study and identification of cargo handling, mooring and anchor of a ship**
   9.1 Identify anchor, windlass, mooring winch, cargo winch, deck crane and derbies.
   9.2 Identify shaft generator

REFERENCE BOOKS:

1. Marine Auxiliary Machinery - By H.D. McGeorge.
2. Hydraulic Machines, Fundamentals of hydraulic Power Systems – By P Kumar

67977 Maritime Laws

T	P	C
2	0	2

AIMS:

To be able of developing the knowledge in the area of Maritime Laws with special emphasis on:

- Concept of Maritime Laws, IMO, Ship Classification Society.
- Concept of Ship Construction Rules, Ship Survey Rules.
- Concept of SOLAS, MARPOL.
- Concept of Shipboard Management.

SHORT DESCRIPTION:

Concept of Maritime Laws, Rules of IMO, Ship Classification Societies, Rules of Ship Construction, Ship Survey Rules, Relevance the rules of ship safety, SOLAS Rules & Regulations, MARPOL Ruless & Regulations and Shipboard Management.

DETAIL DESCRIPTION:

Theory:

1. **Understand the Concept of Maritime Laws:**
   - 1.1 Define the Maritime Laws.
   - 1.2 Describe the Command Shipping Business Rules.
   - 1.3 Explain Ship owner, Ship rules and regulations.
2. **Understand the Rules of IMO:**
   - 2.1 Define IMO.
   - 2.2 Mention the name of various organizations under IMO.
   - 2.3 Explain the purpose of IMO.
   - 2.4 Explain the working Principle of IMO.
   - 2.5 Explain the function of IMO.
   - 2.6 Explain the IMO Convention.
   - 2.7 Mention the list of committee under IMO.
3. **Understand the Ship Classification Societies:**
   - 3.1 Define the Ship Classification Society.
   - 3.2 Explain the Ship Classification Society.
   - 3.3 Define IACS.
   - 3.4 Mention the name of Classification under IACS.
   - 3.5 Explain the Procedure of Ship classification.
   - 3.6 Explain the relation of Local Authorities & National Authorities with Classification Societies.
   - 3.7 Explain the procedure of registration of ship.
   - 3.8 Describe the procedure of certification and documentation.
4. **Understand the Basic design and constructional rule of ship:**
   - 4.1 Explain the general rules of ship construction.
   - 4.2 Explain the rules and regulations for the construction of hull structure such as keel, bottom, shell, deck, framing, superstructure, bulkhead, stern frame, stem, hatch cover, tank, engine room, cargo hold etc.

4.3 Explain the rules and regulation of main engine and Auxiliary machineries such as ship propulsion, rudder & steering, engine installation, safety system, electrical equipment system, pump & piping system, machineries and equipments installation, outfitting etc.

4.4 Explain the rules and regulation of safety system of ship such as fire control plans, fire safety system, fire fighters outfit, emergency escape breathing devices. Fire extinguishers, fixed emergency fire, fire pump, fire mains & hoses, carbon dioxide system, etc.

5. Understand the ship survey:

5.1 Define the survey of Ship.

5.2 Classify the survey of ship.

5.3 Explain the annual survey, intermediate survey, periodical survey, special survey, dry-docking survey, tail shaft survey, boiler survey.

5.4 Explain the inspection procedure of ship.

6. Understand the non-compliances of ship:

6.1 Define the STCW, ISM, ISPS, TSPP, SBT, IOPC, IGS, SOPEP, ODMC, SEEMP, GMDS and COW.

6.2 Define lifesaving appliances.

6.3 Mention the list of lifesaving appliances items.

6.4 Define the lifeboat, life jacket, life raft.

6.5 Define the distress signal.

7. Understand SOLAS Rule and regulation:

7.1 Define SOLAS

7.2 Mention the certificate issued by SOLAS.

7.3 Explain the International convention for safety of life at sea 1974.

7.4 Explain the rule of fire protection, fire detection and fire extinction.

7.5 Explain the laws of safety of crews on board ship.

7.6 Explain the life saving appliances and arrangement.

8. Understand the MARPOL:

8.1 Define the MARPOL.

8.2 Define MARPOL Annexs.

8.3 Define the MEPC.

8.4 Explain the International convention for the prevention of pollution from ship 1978.

8.5 Explain the regulation for the prevention of pollution by oil.

8.6 Explain the regulation for the prevention of pollution by Noxious Liquid substance.

8.7 Explain the regulation for the prevention of pollution by air.

8.8 Explain the regulation for prevention of pollution by sewage.

8.9 Explain the ballast water management.

9. Understand the Authority of Port and Flag:

9.1 Define port state control.

9.2 Explain the duties of port state control.

9.3 Define the Flag state control.

9.4 Explain the duties of Flag state control.

10. Understand the shipboard management:

10.1 Define the ISM Code.

10.2 Explain the working principal of ISM Code

10.3 Explain the objective of ISM Code.

10.4 Define DOC, ISO , QMS
10.5 Explain the Maritime Labour Convention- 2006(MLC- 2006)
10.6 Explain the function of SMS.
10.7 Explain the duties of Safety officer on board.
10.8 Explain the duties of deck officer on board.
10.9 Explain the duties of marine officer on board.

REFERENCE BOOKS:

1. Rule Books - GL, NKK, BV and IRS.
2. MARPOL 1973-1978 ((Latest edition) - IMO
3. SOLAS 2002 (Latest edition) - IMO

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

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.

DETAIL DESCRIPTION

Theory

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

7. Centre of gravity of ship

7.1 Define center of gravity and centroid.
7.2 Distinguish between centre of gravity and centroid.
7.3 Explain VCG and LCG.
7.4 Define KG and Kg.
7.5 Find out the shift in CG due to addition of mass.
7.6 Derive the formula for the shift in CG due to movement of mass.

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

8.1 Define stable, unstable and neutral equilibrium of a ship.
8.2 Explain stable, unstable and neutral equilibrium of a ship.
8.3 Define Metacenter with diagram.
8.4 Define righting moment and righting lever.
8.5 Explain the stability of a ship with respect to the position of metacenter.
8.6 Explain the stability of a ship with respect to the value of metacentric height.
8.7 Explain Inclining experiment of a ship to find out GM.
8.8 Solve problems related to GM, KG & KM.

9. Trim and changes in trim

9.1 Define trim, LCF, mean draught, MCTIcm, trimming moment, trimming lever.
9.2 Explain the change in trim due to addition of masses.
9.3 Derive the formula to determine trim.
9.4 Find out the change in mean draught due to change in density.
9.5 Find out the change in trim due to change in density.

10. Resistance of a moving ship through water

10.1 Define resistance of a ship & its units.
10.2 Classify resistance.
10.3 Explain frictional resistance.
10.4 State the influential factors of frictional resistance.
10.5 State Froude's formula to calculate frictional resistance.
10.6 State the formula to find out 'f'(a coefficient).
10.7 Solve problems regarding frictional resistance.
10.8 Explain residual resistance and its classification.
10.9 Explain Froude's Law of comparison to find out speed-length ratio.

11. Methods to calculate power of a ship to overcome resistance and Fuel consumption and fuel coefficient

11.1 Define effective power (naked) (epn).
11.2 Define SCF (Ship Correlation Factor).
11.3 Calculate effective power to overcome total resistance of a ship.
11.4 Define Admiralty coefficient.
11.5 Explain Admiralty coefficient to evaluate shaft power of a ship.
11.6 Solve problems to find out shaft power of a ship.
11.7 Define SFC (Specific Fuel Consumption).
11.8 State the formula to calculate fuel consumption/day in tonne.
11.9 Solve problems regarding fuel consumption /day for a ship

12. Propeller thrust, power & pressure

12.1 Define power thrust(tp), power & pressure
12.2 State the formula to calculate thrust.
12.3 Define mechanical efficiency, transmission efficiency, propeller efficiency, hull efficiency, QPC.
12.4 State the formulas for various efficiency.
12.5 Derive a formula to find out the relation among mean effective pressure, propeller pitch and rpm.
12.6 Define propeller, propeller pitch, pitch ratio, slip, real slip, apparent slip, positive apparent slip, negative apparent slip.
12.7 Define wake, wake fraction, speed of advance, projected area of propeller, developed area of propeller, BAR, DAR
12.8 Solve problems related to power, pressure & efficiency.

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.

REFERENCE BOOKS:

1. Reeds Naval Architecture for Marine Engineers, Vol-4 -E.A. Stokoe
2. Merchant Ship Construction -H.J.Pursey
3. Basic Ship Theory -Rawson & Tuper

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
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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

65852 Industrial Management

T P C
2 0 2

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

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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.সুফিয়া বেগম, মো: জাহেদুল হক ও সুপ্রিয়া ভট্টাচার্য্য-ব্যবস্থাপনা এর মৌলিক ধারণা,ব্যতিক্রম প্রকাশনী ঢাকা। Matz Usry-Cost Accounting: Planning & Control.