



BANGLADESH TECHNICAL EDUCATION BOARD
Agargoan, Dhaka-1207.

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

POWER TECHNOLOGY

TECHNOLOGY CODE: **671**

3rd SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

POWER TECHNOLOGY (671)

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	67131	Engineering Thermodynamics	3	3	4	60	90	25	25	200
2	67033	Machine Shop Practice	1	3	2	20	30	25	25	100
3	66611	Computer application	0	6	2	0	0	50	50	100
4	65931	Mathematics -3	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	66822	Electronic Engineering Fundamentals	2	3	3	40	60	25	25	150
Total			15	21	22	300	450	200	150	1100

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of engineering thermodynamics with special emphasis on.

- Heat, temperature and pressure
- Application of heat
- Thermodynamic systems
- Thermodynamic laws and processes
- Properties of gas, vapor and steam
- Thermodynamic cycles
- Transmission of heat

SHORT DESCRIPTION

Fundamentals of thermodynamics; specific heat of gases; laws of perfect gases; laws of thermodynamics; Internal energy and enthalpy of gases; thermodynamic processes of perfect gases; entropy of perfect gases; properties of vapor and steam, aspects of thermodynamic cycles, thermodynamic air cycles, thermodynamics vapor cycles, refrigeration and heat pumps and heat transfer.

THEORY:**1. Understand the fundamentals of thermodynamics.**

- 1.1 Define thermodynamic, system, boundary, surroundings and the universe.
- 1.2 Mention types of systems- close, open, isolated, flow, non-flow systems with examples.
- 1.3 Identify different applications of thermodynamics in the engineering field.
- 1.4 Define thermodynamic state, path, process, reversible & irreversible process, thermodynamic equilibrium, point function, path function, control volume.
- 1.5 Define heat, temperature and pressure.
- 1.6 Explain different types of heat, temperature scale and pressure.
- 1.7 Mention units of heat, temperature scale and pressure.
- 1.8 Convert one unit to another unit of heat, temperature scale and pressure.
- 1.9 Solve problems on heat, temperature scale and pressure.

2. Understand the concept of specific heat of gases.

- 2.1 Define specific heat, thermal capacity and water equivalent.
- 2.2 Describe the terms specific heat at constant pressure (C_p) and specific heat at constant Volume (C_v).
- 2.3 Mention Regnault's law.
- 2.4 Relate two specific heats (C_p and C_v).
- 2.5 Explain the ratio of two specific heats (γ)
- 2.6 Mention the standard value of C_p , C_v , and γ for some common gases.
- 2.7 Explain the molar specific heats of a gas.
- 2.8 Solve problems on C_p , C_v , and γ .

3. Understand the laws of perfect gases.

- 3.1 Define perfect gas.
- 3.2 Explain the variables of perfect gases.
- 3.3 State Boyle's law, Charles' law and Gay-Lussac law, Avogadro's law.
- 3.4 Explain the general gas equation, characteristic gas equation and universal gas constant or molar constant.
- 3.5 Solve problems using gas laws and equations.

4. Understand the laws of thermodynamics.

- 4.1 State the laws of thermodynamics.
- 4.2 Explain the 1st law of thermodynamics and its limitation.
- 4.3 Mention the corollaries of 1st law of thermodynamics.
- 4.4 Explain the 2nd law of thermodynamics and its limitation.
- 4.5 Mention the corollaries of 2nd law of thermodynamics.
- 4.6 Mention the physical significance of 1st and 2nd law of thermodynamics.
- 4.7 Explain the 3rd law of thermodynamics.
- 4.8 Explain the Zeroth law of thermodynamics.
- 4.9 Solve problems on the laws of thermodynamic.

5. Understand the internal energy and enthalpy of gases.

- 5.1 Define internal energy.
- 5.2 Define enthalpy & specific enthalpy.
- 5.3 Explain the internal energy of a gas heated at constant volume and constant pressure.
- 5.4 Relate between internal energy and enthalpy.
- 5.5 Explain Joule's law.
- 5.6 Solve problems on change of internal energy and enthalpy of gases.

6. Understand the thermodynamic processes of perfect gases.

- 6.1 Define thermodynamic processes.
- 6.2 Explain the flow processes and non-flow processes of gases.
- 6.3 Describe the various non-flow thermodynamic processes with P-V and T-S diagrams.
- 6.4 Determine the work done by the gases during the above process.
- 6.5 Explain the steady and unsteady flow processes.
- 6.6 Describe the steady flow energy equations.
- 6.7 Solve problems on thermodynamic processes.

7. Understand the entropy of perfect gases.

- 7.1 Define entropy.
- 7.2 Mention the importance of entropy.
- 7.3 Describe the principle of increase of entropy.
- 7.4 Establish the relation between heat & entropy.
- 7.5 Explain the general expression for change of entropy of a perfect gas during various thermodynamic processes.
- 7.6 Solve problems on entropy of different thermodynamic processes.

8. Understand the properties of vapor and steam.

- 8.1 Name the three-state of a substance.
- 8.2 Distinguish between the steam and vapors.
- 8.3 Discuss the triple point of a substance.
- 8.4 List the properties of vapors.
- 8.5 Explain the formation of steam at constant pressure.
- 8.6 Describe the important terms for steam (wet steam, dry saturated steam, superheated steam, dryness fraction, specific volume of steam, etc)
- 8.7 Explain the method of using steam table.
- 8.8 Find out the different properties of steam from a steam table at a certain pressure and temperature.

9. Understand the aspects of thermodynamic cycles.

- 9.1 Define thermodynamic cycle.
- 9.2 Classify the thermodynamic cycle
- 9.3 List the assumption in thermodynamic cycles.
- 9.4 Explain the reversible and irreversible cycles.
- 9.5 State the meaning of air standard cycle. Gas power cycle and vapor power cycle.

10. Understand the thermodynamic air cycles.

- 10.1 Describe the Carnot cycle with P-V and T-S diagrams.
- 10.2 Determine air standard efficiencies of Carnot cycles.
- 10.3 Describe the conventional air cycles i, e Otto cycle, Diesel cycle with P-V and T-S diagrams.
- 10.4 Determine the air standard efficiency of Otto cycle, Diesel cycle, Dual cycle and Brayton /Joule cycle.
- 10.5 Compare Otto, Diesel and Dual cycles.
- 10.6 Compare the theoretical Otto and Diesel cycles with the actual Otto and Diesel cycles.
- 10.7 Solve problems on different air cycles.

11. Understand the aspects of thermodynamics vapor cycles.

- 11.1 Define vapor cycle.
- 11.2 Describe the Rankin cycle with incomplete evaporation and modified Rankine cycle with superheated steam.
- 11.3 Define reheat, regenerative and reheat-regenerative vapor cycles.
- 11.4 Explain the reheat, regenerative and reheat-regenerative vapor cycles with P-V and T-S diagrams.
- 11.5 Compare the reheat, regenerative and reheat-regenerative vapor cycles.

12. Understand the features of refrigeration and heat pumps.

- 12.1 State the meaning of heat engine, refrigeration and heat pump.
- 12.2 Describe the reverse cannot cycle with P-V and T-S diagrams.
- 12.3 Describe the vapor compression mechanical refrigeration cycle.
- 12.4 Determine the Coefficient of performance COP (heating & refrigerating)
- 12.5 Describe the capacity of the refrigerating machine.
- 12.6 Describe the vapor absorption refrigeration cycle.
- 12.7 Solve problems on COP and TR.

13. Understand the heat transfer.

- 13.1 Explain the three modes of heat transfer with examples.
- 13.2 Compare conduction, convection and radiation of heat.
- 13.3 Explain Fourier's law of thermal conductivity.
- 13.4 Explain Newton's law of cooling for convective heat transfer.
- 13.5 Define heat exchanger.
- 13.6 Mention the classification of the heat exchangers.

PRACTICAL:

1. Verify Boyle's law with Boyle's law test apparatus, i.e. $P_1V_1=P_2V_2$ = constant.
2. Verify Gay – Lussac law by measuring gas pressure in a cylinder or refrigerant cylinder in different temperature at (ambient and ice-cooling) i.e. $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ = constant.
3. Observe the 4-stroke Otto Cycle with a model.
4. Observe the 4-stroke Diesel Cycle with a model.
5. Observe the 2-stroke diesel Cycle with a model.
6. Determine the mechanical equivalent of heat by Joule's apparatus to verify the first law of thermodynamics.
7. Observe the heat transfer modes (Conduction, convection and radiation) with refrigerator or an engine.
8. Observe Rankine cycle with a steam engine/steam turbine model.
9. Observe the refrigeration cycle to verify the second law of thermodynamics.
10. Study and compare various heat exchangers such as, radiators, evaporators, condensers, plate heat exchangers.
11. Verify that "a black body is a good heat absorber as well as a good heat emitter".

Reference Books: -

Author	Title	Publisher
Mahesh M Rathore	Thermal Engineering	Tata McGraw HillPublication
A R Basu	Thermal Engineering Heat Power	DhanpatRai andCo.(P)Ltd, New Delhi
R. S. Khurmi and J. K. Gupta	A Text book of ThermalEngineering	S. Chand and Co.Ltd
P K Nag	Basic and applied thermodynamics	Tata McGraw HillPublication
Rai&Sarao	Applied Thermodynamics	SatyaProkashan
Dr. D.S. Kumar	Heat &Mass Transfer	S.K. Kataria& sons
A.S. Sarao	Thermal Engineering	SatyaProkashan
H.B. Kaswani	Heat and Mass Transfer	SatyaProkashan
Brijlal N. Subrahmanyam P.S. Hemen	Heat Thermodynamics and Statistical Physics	S. Chand and Co.Ltd.

T	P	C
1	3	2

OBJECTIVES

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

SHORT DESCRIPTION

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

DETAIL DESCRIPTION

Theory :

- 1 Understand the concept of machine tools.**
 - 1.1 State machine tools.
 - 1.2 Classify commonly used machine tools.
 - 1.3 Distinguish between tools and machine tools.
 - 1.4 State general safety precautions to be observed in machine shop.
- 2 Understand the application of Lathe machine.**
 - 2.1 State the principle of Lathe machine.
 - 2.2 Identify different types of lathe machines.
 - 2.3 Identify major components of lathe machine.
 - 2.4 Explain the function of different parts and attachments of lathe machine.
 - 2.5 Carry out basic calculations for speed, feed and taper 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 Identify 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 Identify 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.

Practical :

- 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.

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 **Printer** 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 through 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

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.
- Hexagon
 - 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.

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

5 Apply the concept of volume of a rectangular solid.

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

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

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

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

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

CO-ORDINATE GEOMETRY

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

- Explain the co-ordinates of a point.
- State different types of co-ordinates of a point.
- Find the distance between two points (x_1, y_1) and (x_2, y_2) .
- Find the co-ordinates of a point which divides the straight line joining two points in certain ratio.
- Find the area of a triangle whose vertices are given.
- 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.

- Define locus of a point.
- Find the locus of a point.
- Solve problems for finding locus of a point under certain conditions.
- Describe the Equation $x=a$ and $y=b$ and slope of a straight line.
- Find the slope of a straight line passing through two point (x_1, y_1) and (x_2, y_2) .
- Find the equation of straight lines:
 - Point slope form.
 - Slope Intercept form.
 - Two points form.
 - Intercept form.
 - Perpendicular form.
- Find the point of intersection of two given straight lines.
- Find the angle between two given straight lines.
- Find the condition of parallelism and perpendicularity of two given straight lines.
- 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.

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01	G. V. Kumbhojkar	Companion 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

Objectives:

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

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

Section - 01 (Physical and Inorganic Chemistry)**1. Atomic Structure and Chemical Bond**

- 1.1 Definition of Element, Atoms, Molecules, Fundamental Particle of Atom, Their Mass, Charge, Location.
- 1.2 Definition of Atomic Number, Mass Number, Isotope, Isotone and Isobar.
- 1.3 Electronic Configuration Based on Hund's Rule, Aufbau's Principle, Pauli's Exclusion Principle
- 1.4 Definition Of Atomic Weight, Equivalent Weight of An Element, Molecular Weight, Mole In Terms of Number, Mass, Volume.
- 1.5 Define Symbol, Valency And Formula.
- 1.6 Explain Chemical Bond, Octet Rule.
- 1.7 Explain Formation of Various Types of Chemical Bonds: Covalent, Ionic, Co-Ordinate Bond.
- 1.8 Explain The Bonding Along With Example CH_4 , H_2 , O_2 , NaCl , MgCl_2 .
- 1.9 Explain Quantum Number, Orbit And Orbital.

2. Ionic Equilibrium

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

3. Chemical Reaction, Oxidation and Reduction.

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

4. Water Treatment

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

5. Corrosion And Alloy

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

Section -2 (Organic Chemistry)

6. Organic Chemistry and Introduction to Polymers:

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

Section -3 (Industrial Chemistry)

7. Glass and Ceramic:

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

8. Soap and Detergent:

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

9. Cement, Pulp And Papers:

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

Section - 4 (Practical Chemistry)

1. Use Of Laboratory Tools And Safety Measures
2. **Observation And Measurement :**
 - 2.1 Determine the Strength of Hcl Solution Using 0.1N Na_2CO_3
 - 2.2 Determine The Strength of Naoh By Using 0.1N Hcl Solution.
3. **Qualitative Analysis Of Known And Unknown Salts :**
 - 3.1 Identification of Known Salt (Sample Copper, Iron, Aluminum, Led, Ammonium and Zinc Salt.)
 - 3.2 Identification of Unknown Basic Radical (E.G. Led, Copper, Iron, Zinc, Aluminum, Ammonium)
 - 3.3 Identification of Unknown Acid Radicals (E.G. Chloride, Nitrate, Sulphate, Carbonate)

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

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SOCIAL SCIENCE

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OBJECTIVE

To provide opportunity to acquire knowledge and understanding on :

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

SHORT DESCRIPTION

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

Part-1 (Civics)

1. Understand the meaning and scope of civics and inter relations of social sciences.

- 1.1 Define civics and social science.
- 1.2 Explain the importance of civics in the personal and social life of an individual.
- 1.3 Describe the relationship of all social science (civics, Economics, political science, Sociology, ethics)

2. Understand the relationship of the individual with the society, Nationality and nation, Rights and duties of a citizen.

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

3. Appreciate the relationship between the state and government, law and organs of government.

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

4. Understand and the classification of constitution

- 4.1 Define the Constitution.
- 4.2 Explain the deferent form of Constitution
- 4.3 Explain state the salient feature of Bangladesh constitution.
- 4.4 Define the fundamental rights of Bangladesh constitution.
- 4.5 Meaning of human rights.

5. Understand the role of UNO in maintaining world peace

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

6. Understand the role of Ethics values and good governance

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

Part-2 (Economics)

1. Understand the fundamental concepts of economics.

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

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

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

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

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

4. Understand national income.

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

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

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

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

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

Part-3 ((Bangladesh: History& Culture)

সংক্ষিপ্ত বিবরণী

ইতিহাস

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

সংস্কৃতি

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

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OBJECTIVES

- To provide understanding soldering technique and color code.
- To provide understanding and skill on the basic concept of semiconductor 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 oscillator.
- To provide the understanding skills on Multivibrator.

SHORT DESCRIPTION

Color code and soldering; Semiconductor; P-N junction diode; Special diodes and devices; Power supply; Transistor; Transistor amplifier; Oscillator, Multivibrator.

DETAIL DESCRIPTION**Theory:****1 Soldering and Color Code.**

- 1.1 Define soldering.
- 1.2 List the materials needed in soldering.
- 1.3 Mention the properties of a good soldered joint.
- 1.4 Multi layered Printed circuit board.
- 1.5 Mention the function of resistor, capacitor and inductor in electronic circuits.
- 1.6 Describe the procedure of determining the value of Capacitor, & Resistor using numeric and color code.

2 Semiconductor

- 2.1 Define Conductor, Semiconductor and Insulator.
- 2.2 Describe Semiconductor with atomic structure.
- 2.3 Explain the energy band diagram of Conductor, Semiconductor and Insulator.
- 2.4 Classify Semiconductor.
- 2.5 Describe the formation of P-type & N-Type Semiconductor material.
- 2.6 Explain the majority & minority charge carrier of P-type & N-Type Semiconductor.

3 P-N Junction Diode

- 3.1 Define PN junction diode
- 3.2 Describe the formation of depletion layer in PN junction.
- 3.3 Mention the behavior of PN junction under forward and reverse bias.
- 3.4 Explain the forward & reverse current voltage (IV) characteristics of PN junction diode.
- 3.5 Describe the operation of Zener diode.
- 3.6 Describe the application of Zener diode in voltage stabilization.
- 3.7 Describe the construction operation and application of (i) varactor diode (ii) LED (iii) LCD (viii) photo diode (ix) Solar cell.
- 3.8 Describe the construction operation and application of (i) DIAC (ii) TRIAC and (iii) SCR.

4 DC power supplies.

- 4.1 Define (i) dc power supply (ii) Regulated and Unregulated Power Supply.
- 4.2 Describe the block diagram of a typical regulated dc power supply.
- 4.3 Explain the operation of Half wave, Full wave and Bridge rectifier.
- 4.4 Mention ripple factor of Half wave, Full wave and Bridge rectifier.
- 4.5 Explain the operation of different types filter circuits with wave shape.

5 Bipolar Junction Transistor (BJT)

- 5.1 Define Transistor.
- 5.2 Describe the construction PNP and NPN Transistor.
- 5.3 State the biasing rules of BJT.
- 5.4 Explain the mechanism of current flow of PNP and NPN Transistor.
- 5.5 Draw the three basic transistor configuration circuits (CB, CC, CE).
- 5.6 Describe the characteristics of transistor in CB, CE, CC configuration.
- 5.7 Describe current amplification factor α , β and γ .
- 5.8 Establish the relation among α , β and γ .
- 5.9 Solve problem related to I_E , I_C , I_B , α , β and γ .

6 Transistor biasing and load line.

- 6.1 Mention the needs for biasing of transistor
- 6.2 State the conditions for proper biasing of transistor.
- 6.3 Describe the methods of drawing load line of transistor.
- 6.4 Explain the Effect of the location of operating point on the output signal.
- 6.5 Describe the various methods of transistor biasing.

7 Transistor 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 single stage common emitter (CE) Amplifier.
- 7.4 Draw DC & AC equivalent circuits of the CE amplifier circuit.
- 7.5 Explain the operation of RC coupled and transformer coupled multistage amplifier.
- 7.6 Describe the operation of Push-Pull amplifier.

8 Field-Effect Transistor(FET).

- 8.1 Define field effect transistor(FET).
- 8.2 Mention the types of FET
- 8.3 Describe the construction and operation Junction Field Effect Transistor (JFET).
- 8.4 Explain characteristics of JFET .
- 8.5 Describe the parameters of JFET.
- 8.6 Establish the relationship among FET parameters.
- 8.7 Describe the DC biasing of JFET and its load line.
- 8.8 Describe the Construction and operation of DE and E-Only MOSFET.

9. Sinusoidal Oscillators.

- 9.1 Define feedback
- 9.2 Describe different types of feedback with block diagram.
- 9.3 Calculate the gain of amplifier with feedback (positive and negative).
- 9.4 Mention the advantages and disadvantages of negative feedback.
- 9.5 Explain the principle of operation of an oscillatory tank circuit.
- 9.6 Describe the essentials of feedback LC oscillators.
- 9.7 Explain the principle of operation of Hartly, Colpitt and Wein-bridge oscillators.
- 9.8 Explain the principle of operation phase shift & crystal oscillators.

10. Multivibrator circuits.

- 10.1 Define time base circuit.
- 10.2 Mention the methods of generating time base waveform.
- 10.3 Explain the generation of saw-tooth wave using charging and discharging of a capacitor.
- 10.4 Understand the features of multivibrator circuits.
- 10.5 State what is meant by multivibrator.
- 10.6 Explain the operation of astable, monostable and bistable multivibrator circuits with wave shapes.
- 10.7 Mention the principle of operation of Schmitt trigger circuit.

Practical : (Using Real component and Simulation Software)

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 potentiometers with their values, & wattage.
- 1.4 Identify the different types of capacitors with their values, dc working voltages and types.
- 1.5 Identify the different types of diodes & rectifiers with the numbers and specifications.
- 1.6 Identify the different types of transistors and thyristors with their number and specifications.
- 1.7 Identify the different types of LED's, IC's and miniature relays with their number & specification.
- 1.8 Identify different types of transformer with their specification.
- 1.9 Identify different inductors with their values & 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 for determining the values of different resistors and capacitors with the help of color code.

- 2.1 Select color code resistors & capacitors of different values.
- 2.2 Identify the colors and their numerical numbers.
- 2.3 Determine the value of resistors with tolerance.
- 2.4 Determine the value of capacitors and dc working voltage.
- 2.5 Write a report on above activities.

3 Show skill in performing soldering.

- 3.1 Select wires (single strand and multi strand) and cut wires to required length.
- 3.2 Select soldering iron, soldering tag and soldering lead.
- 3.3 Remove wire insulation to required length.
- 3.4 Clean and tin both iron and work piece.
- 3.5 Use a tinned iron in order to transfer adequate heat to the joint.
- 3.6 Joint two singles & multi stranded wires mechanically and solder.

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

- 4.1 Select electronic components, wires and PCB.
- 4.2 Determine the rating of the soldering iron suitable for the work piece.
- 4.3 Clean and tin both iron & work piece.
- 4.4 Feed new soldering materials to the tinned and heated joint, in order to produce a correctly soldering.
- 4.5 Check the quality of soldering.
- 4.6 Clean and tin iron and de-solder the joint and components.
- 4.7 Use solder suckers and solder braid for de-soldering.
- 4.8 Write a report on the Job.

5 Show skill in checking the semi-conductor diode.

- 5.1 Collect a range of semi-conductor diodes and manufactures literature.
- 5.2 Select the digital multi-meter and set the selector switch to ohm range.
- 5.3 Determine the specification of semi-conductor diode.
- 5.4 Compare the determined specification with that of manufactures literature.
- 5.5 Measure forward & reverse resistances of the diode.
- 5.6 Identify p and n side of the diode.
- 5.7 Determine the condition of the diode.

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

- 6.1 Select meter, power supply, components and materials.
- 6.2 Complete circuit according to circuit diagram for forward bias.

- 6.3 Check all connections.
- 6.4 Measure forward bias and corresponding forward current.
- 6.5 Record results in tabular form.
- 6.6 Connect circuit according to circuit diagram of reverse bias.
- 6.7 Measure reverse bias and corresponding reverse current.
- 6.8 Record results in tabular form.
- 6.9 Sketch the curves from data.

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

- 7.1 Select meter, component, oscilloscope and materials.
- 7.2 Complete circuit of a half wave rectifier according to circuit diagram.
- 7.3 Check the circuit before operation.
- 7.4 Measure the input and output voltage and observe wave shapes in the oscilloscope.
- 7.5 Sketch the output voltage wave shape.

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

- 8.1 Select meter, component, oscilloscope and materials.
- 8.2 Complete a full wave rectifier circuit according to circuit diagram.
- 8.3 Check the circuit supply & polarity of supply.
- 8.4 Measure the input & output voltages and observe wave shapes in the oscilloscope.
- 8.5 Sketch the output voltage wave shape.
- 8.6 Compare the result with half-wave rectifier circuit.

9 Show skill in constructing full wave bridge rectifier.

- 9.1 Select meter, component, oscilloscope and materials.
- 9.2 Build the circuit according to the circuit diagram.
- 9.3 Check the circuit.
- 9.4 Measure the input and output voltage.
- 9.5 Observe wave shape.
- 9.6 Compare the result with other rectifiers.

10 Show skill in identifying the terminals of bipolar junction transistor.

- 10.1 Select pnp & npn bipolar junction transistors.
- 10.2 Take AVO meter and manufacture's literature of transistor.
- 10.3 Identify transistor legs.
- 10.4 Measure base-emitter, base-collector, forward and reverse resistance.
- 10.5 Determine the specifications with help of manufacturer's literatures.
- 10.6 Identify pnp & npn transistor.

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

- 11.1 Select component, AVO meters, circuit board and required materials.
- 11.2 Construct the circuit.
- 11.3 Adjust the biasing voltage to appropriate point.
- 11.4 Record input and output voltage and current.
- 11.5 Plot the curve with recorded data.

12 Show skill in measuring operating points (VCE and IC) for Transistor circuit.

- 12.1 Select a fixed bias transistor circuit materials.
- 12.2 Select required equipment.
- 12.3 Prepare the circuit.
- 12.4 Check the connections
- 12.5 Adjust the circuit.

13. Demonstrate the operation of a Hartly, Colpitt and R-C oscillator.

- 13.1 Draw the circuit diagram.
- 13.2 Select tools, equipment and materials.
- 13.3 Connect the circuit diagram.

- 13.4 Check and energize the circuit.
- 13.5 Observe the output for different frequencies

**14. Study the operation of a transistor astable, monostable & bi-stable multivibrator circuit.
Select an experiment circuit.**

- 14.1 Select the required tools and materials.
- 14.1 Build up the circuit as per diagram.
- 14.1 Switch on the power supply.
- 14.1 Switch on the trigger signal.
- 14.1 Observe the wave shapes at each collector & base of the transistor

REFERENCE BOOKS :

- 1. A Text Book of Applied Electronics - R.S. SEDHA
- 2. Principles of Electronics - V. K. Mehta