BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Sher-E-Bangla Nagar

Dhaka-1207.

04-YEAR DIPLOMA IN ENGINEERING CURRICULUM

COURSE STRUCTURE & SYLLABUS

(PROBIDHAN-2022)

ELECTRICALTECHNOLOGY

TECHNOLOGY CODE: 67

3rd SEMESTER

(Effective from 2022-2023 Academic Sessions)

DIPLOMA IN ENGINEERING CURRICULUM

COURSE STRUCTURE

(PROBIDHAN-2022)

TECHNOLOGY NAME: ELECTRICAL TECHNOLOGY (67)

(3RD SEMESTER)

Sl. No.	Subject		Period Per Week		Credit	Marks Distribution						
						Theory Assessment			Practical Assessment			Grand Total
	Code	Name	Theory	Practical		Continuous	Final	Total	Continuous	Final	Total	
1	25931	Mathematics-III	3	3	4	60	90	150	25	25	50	200
2	25913	Chemistry	3	3	4	60	90	150	25	25	50	200
3	28511	Computer Office Applications	-	6	2	-	-	-	50	50	100	100
4	26731	Electrical Circuits-II	3	3	4	60	90	150	25	25	50	200
5	26732	Electrical Appliances	2	3	3	40	60	100	25	25	50	150
6	26833	Industrial Electronics	3	3	4	60	90	150	25	25	50	200
Total			**14**	**21**	**21**	**280**	**420**	**700**	**175**	**175**	**350**	**1,050**

Subject Code	Subject Name	Period per Week		Credit
25931	Mathematics-III	T	P	C
		3	3	4

Rationale	To be able to understand the binomial expansion. To enable to calculate the areas of regular polygons, hexagons, octagon, hydraulic mean a 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 understand the Laplace transformation
Learning Outcome (Theoretical)	Express Binomial expansion. To able to find the area triangle, quadrilateral, parallelogram, regular polygon & circle volume of solid Shaped. Able to solve problems related to area & volume of various type of shaped.
Learning Outcome (Practical)	**Able to solve problems related to area and volume of various type of shaped.**

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**MENSURATION(Area of Triangle):** 1.1 Find the area of triangle in the form, A= $\frac{\sqrt{3}}{4}a^2$, a = length of a side of equilateral triangle. A= $\frac{c}{4}\sqrt{4a^2-c^2}$, where a = length of equal sides, c = third side. 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.	**4**	**8**
2	**MENSURATION (Areas of quadrilateral, Parallelogram, 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**	**6**
3	**MENSURATION(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, Octagon when length of side is given.	**3**	**6**

Unit	Topics with Contents	Class (1 Period)	Final Marks
	3.4 Solve problems of the following's 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	**MENSURATION(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.	**3**	**6**
5	**MENSURATION(Area & 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 5.2 & 5.3.	**3**	**5**
6	**MENSURATION(Surface area & volume of a prism):** 6.1 Define a prism. 6.2 Explain the formulae for areas of curved surfaces of prism. 6.3 Explain the formulae for volume of prism when base and height are given. 6.4 Solve problems related to 6.2, 6.3	**3**	**5**
7	**MENSURATION (Area & volume of Parallelepiped and cylinder):** 7.1 Define a parallelepiped and a cylinder. 7.2 Explain the formulae for areas of curved surfaces of parallelepiped and cylinder. 7.3 Explain the formulae for volume of parallelepiped and cylinder when base and height are given. 7.4 Solve problems related to 7.1, 7.2, 7.3	**3**	**5**
8	**MENSURATION (Surface area & volume of pyramid):** 8.1 Define pyramid. 8.2 Explain the formula for areas of curved surfaces of pyramid. Explain the formula for volumes of pyramid. 8.3 Solve problems related to 8.2, 8.3	**2**	**4**
9	**MENSURATION (Surface area & volume of cone and sphere):** 9.1 Define cone and sphere. 9.2 Explain the formula for areas of curved surfaces of cone and sphere. 9.3 Explain the formula for volumes of cone and sphere. 9.4 Solve problems related to 9.2, 9.3	**3**	**5**
10	**GEOMETRY:** **Conic or conic sections:** 1.1 Define Conic, Focus, Directorix and Eccentricity. 1.2 Find the equations of Parabola, Ellipse and Hyperbola. 1.3 Solve problems related to Parabola, Ellipse and Hyperbola.	**3**	**5**
11	**CALCULAS (Differential Equations of first order and first degree):** 11.1 Define differential equation, ordinary & partial differential equation.	**4**	**7**

Unit	Topics with Contents	Class (1 Period)	Final Marks
	11.2 Define order and degree of differential equation. 11.3 Solve the differential equations of the form: Variable separable.		
12	**CALCULAS (Differential Equations of first order and first degree of homogeneous equations):** 12.1 Define Homogeneous equation & Homogeneous differential equation. 12.2 Define order and degree of differential equation. 12.3 Solve the differential equations of the form: Homogeneous equation.	**3**	**5**
13	**CALCULAS (First order and first degree of Exact differential equations):** 13.1 Define Exact differential equation. 13.2 Define integrating factor. 13.3 Solve problems related to Exact differential equations.	**3**	**5**
14	**CALCULAS (First order and first degree of Linear differential equations):** 14.1 Define Linear differential equation. 14.2 Define integrating factor, Bernoulli's equation. 14.3 Solve problems related to Linear differential equations.	**4**	**8**
15	**CALCULAS (Laplace Transformation):** 15.1 Define Laplace transformation in the form $F(S) = \int_0^{\infty} f(t)e^{-st}dt$ 15.2 Express the deduction of Laplace transformation of the following functions. (i) Constant (ii) t (iii) t^n (iv) e^{at} (v) sinat (vi) Cosat (vii) e^{at} t^n (viii) e^{at} sinbt (ix) e^{at} cosbt 15.3 Define inverse Laplace transformation 15.4 Solve problem related to 15.1, 15.2, 15.3	**4**	**8**
	Total	**48**	**90**

N.B. Marks allotted per chapter above may be rearranged if necessary.

Detailed Syllabus (Practical)

SL	Experiment name with procedure	Class (3 Period)	Continuous Marks
01	Find out the area of triangle	1	2
02	Find out the areas of quadrilateral, parallelogram, rhombus & trapezium	2	3
03	Calculate the areas of regular polygon	1	2
04	Calculate the areas of circle, sector and segment	2	3
05	Find out the area & volume of a rectangular solid	1	2
06	Calculate the surface area & volume of a prism	2	3
07	Find out the area & volume of cylinder	1	2
08	Calculate the surface area & volume of pyramid	2	2
09	Find out the surface area & volume of cone and sphere	1	2
10	Solve the problems related to conic sections & differential equation	3	4

SL	Experiment name with procedure	Class (3 Period)	Continuous Marks
01	Find out the area of triangle	1	2
02	Find out the areas of quadrilateral, parallelogram, rhombus & trapezium	2	3
03	Calculate the areas of regular polygon	1	2
04	Calculate the areas of circle, sector and segment	2	3
05	Find out the area & volume of a rectangular solid	1	2
06	Calculate the surface area & volume of a prism	2	3
07	Find out the area & volume of cylinder	1	2
08	Calculate the surface area & volume of pyramid	2	2
09	Find out the surface area & volume of cone and sphere	1	2
10	Solve the problems related to conic sections & differential equation	3	4
	Total	**16**	**25**

N.B. Marks allotted per chapter above may be rearranged if necessary.

Necessary Resources (Tools, equipment's and Machinery):

SL	Item Name	Quantity
01	Scale	1 no
02	Geometric Box	1 no

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
1.	Companion to basic Maths	G. V. Kumbhojkar	Phadke Prakashan
2.	Co-ordinate Geometry & Vector Analysis	Rahman & Bhattacharjee	H.L. Bhattacharjee
3.	Higher Mathematics	Md. Nurul Islam	Akkhar Patra Prakashani
4.	Mathematics for Polytechnic Students	S. P Deshpande	Pune Vidyarthi Graha Prakashan
5.	Mathematics for Polytechnic Students (Volume I)	H. K. Das	S.Chand Prakashan
6.	Engg.Maths Vol I & II	Shri Shantinarayan	S.Chand & Comp
7.	Higher Mathematics	Dr. B M Ekramul Haque	Akshar Patra Prakashani
8.	Differential & Integral Calculus	Md. Abu Yousuf	Mamun Brothers

Website References:

SL	Web Link: www.youtube.com	Remarks

Subject Code	Subject Name	Period per Week		Credit
25913	CHEMISTRY	T	P	C
		3	3	4
Rationale	**Chemistry is the branch of science that deals with study of matter, its composition, physical and chemical properties and applications. It is important for diploma engineers to have knowledge of chemistry as those may face problems in fields as diverse as design and development of new materials, quality control and environmental engineering that are basically chemistry oriented in nature. Chemistry is the backbone in designing and understanding the nature of various engineering materials. Many advances in engineering and technology either produce a chemical demand. The subject covers atomic structure, chemical reaction, ionic equilibrium, organic and vocational chemistry to understanding and application. The emphasis will be more on teaching practical aspect rather than theory.**			
Learning Outcome (Theoretical)	**After undergoing the subject, students will be able to:** **Describe Atomic Structure** **Describe Symbol, valency and radical** **Describe Properties of gas and its law** **Different types of bonds** **Define Acid, base and salt** **Describe Buffer solution, pH and its application** **State Different types of reaction and catalyst** **Calculate oxidation and reduction number** **Describe Hardness of water and its removing process** **Illustrate Electrolysis process** **State organic chemistry** **Describe Various type of hydrocarbon** **State Different types of alcohol** **Describe Aromatic compound and its use** **Explain Food security and processing**			
Learning Outcome (Practical)	**After undergoing the subject, students will be able to perform:** **Use laboratory equipment's and safety measure** **Perform Preparation of various strength of solution** **Calculate the strength of unknown solution** **Identify Nature of different type of solution** **Perform Qualitative analysis of radicals and salt** **Perform Preparation of vinegar and sanitizer**			

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**ATOMIC STRUCTURE** 1.1 Define Element, atoms and molecules. 1.2 Define molecular mass, atomic number, mass number, mole and Aveogadro's number. 1.3 Distinguish between atom and molecule. 1.4 Describe Fundamental particle of atom. 1.5 Define isotope, isobar and isotone. 1.6 Define Orbit and Orbital. 1.7 Explain Quantum number. 1.8 Describe Electronic configuration based on Aufbau principle, Hunds rule and Paulis exclusion principle.	6	10
2	**SYMBOL, VALENCY AND FORMULA** 2.1 Define Symbol, Valency and formula. 2.2 Discuss the variations of valency. 2.3 Describe active and latent valency. 2.4 Describe Radicals.	3	6
3	**GAS** 3.1 Define gas and vapor. 3.2 Mention the Characteristic of gas. 3.3 Distinguish between gas and vapor. 3.4 Define STP, NTP and Absolute temperature. 3.5 Mention the Boyle's, Charle's and Avogadro's law. 3.6 Establish the ideal gas equation (PV=nRT)	4	7
4	**CHEMICAL BOND** 4.1 Define Chemical Bond. 4.2 Define Octet rule. 4.3 Explain Ionic bond, Covalent bond and Co-ordinate covalent bond. 4.4 Mention the Characteristic of ionic and covalent compound. 4.5 Differentiate between ionic and covalent compounds.	3	7
5	**ACID, BASE AND SALT** 5.1 State Modern concept of Acid and Base. 5.2 List the properties of acid and base. 5.3 Classify Salt 5.4 Explain Basicity of an acid and acidity of a base.	3	6
6	**IONIC EQUILIBRIUM** 6.1 Explain pH and pH scale. 6.2 Define Normality, Molarity and Molality. 6.3 Define Primary and Secondary Standard Substances. 6.4 Define Standard Solution, Titration and Indicator. 6.5 Define Buffer Solution and Its Mechanism. 6.6 Describe Importance of pH in Agriculture and Chemical Industries.	3	6

7	**CHEMICAL REACTION** 7.1 Define Exothermic and endothermic reaction. 7.2 Define Chemical Reaction 7.3 Classify Chemical Reaction. 7.3 Describe Catalyst and Catalysis. 7.5 Mention the uses of Catalyst in Industries.	**3**	**7**
8	**OXIDATION AND REDUCTION** 8.1 Describe Modern concept of Oxidation and Reduction. 8.2 Define Oxidizing agent and Reducing agent. 8.3 Describe Simultaneous process of Oxidation and Reduction. 8.4 Explain the Oxidation number / state. 8.5 Distinguish Between Oxidation number and Valency.	**3**	**6**
9	**WATER** 9.1 Define Hard and Soft water. 9.2 Define Hardness of water. 9.2 Describe permutit process to removal the hardness of water. 9.3 Mention the Advantage and disadvantage of Soft and Hard water. 9.4 Describe Reverse Osmosis process.	**3**	**6**
10	**ELECTRO-CHEMISTRY** 10.1 Define Electrolyte, Electrolysis and Electrode. 10.2 State the Mechanism of Electrolysis process. 10.3 Mention the Process of Chrome Electro-plating. 10.4 Define Galvanizing. 10.5 Mention the importance of Galvanizing.	**3**	**5**
11	**Basic concept of organic chemistry** 11.1 Define organic chemistry. 11.2 Classify organic compound 11.3 Mention the Catenation properties of Carbon 11.4 Distinguish between organic & inorganic compound 11.5 Explain homologous series of organic compound 11.6 State molecular & structural formula of methane, ethane, propane & butane. 11.7 Describe functional group of organic compounds	**3**	**6**
12	**Aliphatic Hydrocarbon** 12.1 Define hydrocarbon, saturated and unsaturated hydrocarbon 12.2 Describe nomenclature of alkane, alkene and alkyne IUPAC system. 12.3 Mention the uses of hydrocarbon methane, ethane and ethyne.	**3**	**4**
13	**Alcohol** 13.1 Define alcohol. 13.2 Describe the classification of alcohol. 3.3 Define absolute alcohol, rectified sprit and power alcohol. 4.4 Define enzyme and fermentation.	**3**	**4**
14	**Aromatic Compound** 14.1 Define aromatic compound. 14.2 Define aromaticity and Hackle's Theory. 14.3 Describe Synthesis Benzene from phenol, acetylene and benzoic acid. 14.4 Mention the uses of benzene.	**3**	**5**
15	**VOCATIONAL CHEMISTRY** 15.1 Define Food security, Natural and approved chemical preservatives.	**2**	**5**

	15.2 Describe canning process of Mango and Pineapple. 15.3 Describe canning process of Fish and Meat.		
	Total	**48**	**90**

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Marks (Continuous)
1	Safe Use of Laboratory and Familiar with instrument 1.1 Follow Laboratory Rules and OSH 1.2 Wear Apron, Safety Glass, Mask and Gloves. 1.3 Use of Conical flask, Wash bottle, Burette, Pipette 1.3 Use Flammable substance according to instruction 1.4 Importance of minimum use of chemical. 1.5 Use of Fast aid box. 1.6 Follow DO's or Don't in laboratory.	**2**	**2**
2	Perform Preparation of decimolar (0.1M) Na_2C0_3 Solution	**1**	**2**
3	Determine the strength of H_2SO_4 Solution by decimolar (0.1M)	**1**	**2**
4	Perform Preparation of decimolar (0.1M) NaOH Solution.	**1**	**2**
5	Determine the strength of Hydrochloric acid (HCl) Solution by decimolar (0.1M) NaOH Solution	**1**	**2**
6	Measure the pH value of unknown solution using pH meter and paper.	**1**	**3**
7	Identify Radicals: Cu^{2+}, Al^{3+}, Fe^{2+}, Fe^{3+}, Ca^{2+}, Zn^{2+}, NO_3^-, Cl^-, SO_4^{2--}, CO_3^{2-}	**3**	**3**
8	Identify salt: ($Cu(NO_3)_2$, $AlCl_3$, $FeSO_4$, $FeCl_3$, $CaCO_3$, $ZnCl_2$)	**4**	**4**
9	Perform Preparation of vinegar from Acetic acid	**1**	**2**
10	Perform Preparation of Sanitizer using Isopropyl Alcohol	**1**	**3**
	Total	**16**	**25**

Necessary Resources (Apparatus and equipment's):

Sl	Item Name	Quantity
01	Test tube, Test tube holder, Test tube Stand, Test tube brush, Bunsen burner , Cork borer, Spatula, Droper, Clamp	
02	Beaker, Conical flask, Round bottomed flask, Volumetric flask, Distillation flask , Pneumatic trough	
03	Porcelain basin, Crucible, Mortar and pastle	
04	Thistle funnel, Buchner funnel, Common funnel, Dropping funnel	
05	Woulfsbottle, Wash bottle, Reagent bottle,	
06	Retort, Gas gar, Gas chamber, War gauge, Watch glass, Capillary tube, Platinum wire, Copper wire,	

07	Tripod stand, Burette stand, Ring stand, Crucible tong, Gas generator/ Gas Cylinder	
08	Burette, Pipette, Measuring cylinder, Glass rod	
09	Digital balance, Analytical balance, Weight box, pH meter, pH paper, Litmus paper, Filter paper, Kipp's apparatus	
10	Safety glass, Gloves, Apron, Mask, Fire estighguser, First aid box	

Required Chemicals:

Sl	Item Name (Consumables Materials)	Quantity
01	Distilled water, Petrol, Grease etc	
02	Different type of acid : HCl, H_2SO_4, HNO_3, H_3PO_4, CH_3C00H etc.	
03	Different type of base such as NaOH, KOH, $Ca(OH)_2$, $Al(OH)_3$, NH_4OH, etc	
04	Different type of salt :[$Cu(NO_3)_2$, $AlCl_3$, $FeSO_4$, $FeCl_3$, $CaCO_3$, $ZnCl_2$, NH_4Cl etc]	
05	Different type of indicator	
06	Different type of reagent such as Potassium Ferro cyanide, Potassium iodide , Nessler's solution, Potassium pyroantimonate solution, Ammonium oxalate solution, etc	

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
01	Higher secondary chemistry	Dr. Sarozkantishinghahazari	Hasan book house
02	Higher secondary chemistry	Mahbub hasnlinkon	Akharpatro
03	Engineering chemistry	Uppal	Khanna publishers
04	Chemistry practical	Dr. Sarozkantishinghahazari	Hasan book house

Website References:

Sl	Web Link	Remarks
01	www. researchgate. net	

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Subject Code	Subject Name	Period Per Week		Credit
28511	COMPUTER OFFICE APPLICATION	T	P	C
		0	6	2

Rationale	**This is a generic course for all diploma programs required to enable the graduates to use and work with ICT competently. It includes typing in Bangla and English, using the internet for e-communication & e-interaction, operating a computer and allied devices, Operating Word Processing, Spreadsheet Analysis, and Presentation software. This course also enables a graduate to adopt further study in upper-level courses using IT and other sectors. This course is designed to emphasize practical aspects rather than theory.**
Course Learning Outcome	**After undergoing the subject, students will be able to:** • **type Bangla and English smoothly** • **use internet for e-communication & interaction** • **operate a computer and allied devices** • **perform the operation of Word Processing App, Spreadsheet Application, and Presentation Package.**

Detailed Syllabus (Practical)

CLO	Experiment name with the procedure	Class (3 Periods per class)	Marks
1	**TYPE TEXT AND DOCUMENTS IN ENGLISH AND BANGLA.** **1.1 Startup and Shutdown of a computer.** 1.1.1 Identify Basic ***Computer Hardware*** devices ***Computer Hardware*****:** System Unit, Motherboard, Processor, Power supply, SSD, Hard Disk, RAM, ROM 1.1.2 Check Peripherals and connect with the system unit. ***Peripherals*****:** Monitor, Keyboard, Mouse, Modem, Scanner, Printer, Multimedia Projector 1.1.3 Connect Power cords/adapter properly with computer and power outlets socket. 1.1.4 Switch on the Computer gently. 1.1.5 Arrange and customize PC ***Desktop / GUI settings*** as per requirement. ***Desktop / GUI settings***: Icons, Taskbar, View, Resolutions 1.1.6 Close Unsaved files and folders 1.1.7 Close Open software and switch off hardware devices. 1.1.8 Switch off Computer gently. 1.1.9 Switched off Power at the respective power outlets. **1.2 Install the Typing Tutor software.**	**3**	**5**

	1.2.1. Identify Required *Hardware* and *software* of typing Tutor software. ***Software****:* Operating System, Microsoft Office, Open Office, Typing Tutor, Bangla Typing Software, Google doc, Avro, Bijoy. 1.2.2. Install English and Bangla Typing tutor software. 1.2.3. Install Bangla Unicode Typing Tutor Software. 1.2.4. Install Required fonts for typing of Bangla and English. **1.3 Practice text Typing in English and Bangla.** 1.3.1 Start Typing tutor software. 1.3.2 Practice English Home key drilling systematically. 1.3.3 Practice Typing in English as per Standard procedure (30 WPM). 1.3.4 Install Specialized Bangla Typing tutor software. 1.3.5 Practice systematically Bangla Home key typing. 1.3.6 Type Bangla document as per standard procedure (20 WPM). 1.3.7 Type Text documents repeatedly to increase typing speed in both English and Bangla. **1.3 Maintain the record of the performed job.**		
2	**USE THE INTERNET FOR E-COMMUNICATION & INTERACTION** **2.1 Access resources from the internet** 2.1.1. Interpret ***Internet Terms*** and their uses. ***Internet Terms:*** Browser, web page, URL, HTML and http/https, E-mail, social media, IP, Download, Malware, Router, Bookmark, E-commerce 2.1.2. Select and install Appropriate ***internet browsers*** ***Internet browsers:*** Microsoft Edge, Google Chrome, Internet Explorer, Opera, Safari, QQ Browser, UC, Yandex 2.1.3. Carry out ***Browser Settings*** for smooth operation. ***Browser Settings:*** Synchronization, Privacy and Security, Auto fill, Appearance, Language, Download, Accessibility 2.1.4. Open the Internet browser and write/select a web address / URL in /from the address bar to access ***Information.*** ***Information:*** Text Information, Graphics, Video 2.1.5. Use ***Search engines*** to access information. ***Search engines:*** Google, Yahoo, Alta Vista, Msn, Bing 2.1.6. Use internet resources (Free and Paid Platform) 2.1.7. Share/download/upload Video / Information From/to web site/***social media.*** ***social media:*** Facebook, Twitter, LinkedIn, YouTube 2.1.8. Communicate using social media and professional's Media. 2.1.9. Search and follow Netiquette' (or web etiquette) Principles. **2.2 Use Web Services.**	**4**	**6**

	2.2.1. Identify ***Web Services*** and service provider as per job requirement. ***Web Services:*** Communication (Zoom, Bip, Meet), Storage (Drop box, Mega, One Drive, Google Drive) 2.2.2. Interpret the Function of the web services 2.2.3. List Information for creating an account in web Services. 2.2.4. Identify ***Google services***. ***Google services:*** Drive, Calendar, Map, Translator, Docs, Sheets, Slide, Forms, Search, Contact, Classroom, Image Search, Blogger, Meet 2.2.5. List Functions of Google services. 2.2.6. Demonstrate Google Services. **2.3 Use and manage E-mail.** 2.3.1 Identify and select ***E-mail services*** to create a new e-mail address. ***E-mail services:*** Free mail services (Gmail, Yahoo, Hotmail), Webmail Services 2.3.2 Compose E-mail and attach prepared document. 2.3.3 Send E-mail to different types of recipients using the CC and BCC option. 2.3.4 Read, forward, reply, and delete E-mail as per requirement. 2.3.5 Create and manipulate custom email folders. 2.3.6 Print E-mail message. **2.4 Maintain the record of the performed job.**		
3	**OPERATE A COMPUTER AND ALLIED DEVICES** **3.1 Perform Basic Setting** 3.1.1 Change power options properties as per requirement. 3.1.2 Terminate Non-responding application as specified. 3.1.3 Identify and adjust System information, operating system version, date & Time display system, color settings, and available RAM as per job requirement. 3.1.4 Set Keyboard Language according to the instructions. 3.1.5 Install Fonts following standard procedures. 3.1.6 Adjust Screen Resolution as per job requirement. 3.1.7 Identify Basic ***Hardware and Software problems*** and take the remedy. ***Hardware and Software problem***: Can't Open, Slow, Hang, Display Problem, Setting Problem, Keyboard and Mouse Problem, Sound Problem, Input devices are not working, No network, Slow internet, Printer is not working, Software installation problem **3.2Operate Computer** 3.2.1 Create Files and folders 3.2.2 ***Manipulate*** Files and folders as per requirement. ***Manipulated***: Opened, Copied, Renamed, Deleted, Sorted. 3.2.3 View and search Properties of files and folders. 3.2.4 Practice Control panel settings. 3.2.5 Format and defragment ***Storage devices*** as per requirement. ***Storage devices***: Hard drive, Flash Drive, Flash Memory 3.2.6 Take Backups as required. 3.2.7 use and change Password as per job requirement	**3**	**5**

	3.3 Manage Security of Hardware and Software. 3.3.1 Installed Custom software and Antivirus software according to standard operating procedure. 3.3.2 Scan Storage devices using antivirus software. 3.3.3 Scan Folders and Files using the current version of Software. 3.3.4 Update Scanning software or virus definition regularly. 3.3.5 Identify ***Cyber Security issues*** or hardware and software. ***Cyber Security issues***: Hacking, Phishing, Data Leakage, Threat 3.3.6 Recognize and avoid Cyber threats and attacks. **3.4 Manage Printer and Printer settings** 3.4.1 Install Printers on the computer according to the manufacturer's instructions. 3.4.2 Print Documents from an application. 3.4.3 Print, pause, restart, or cancel using print manager. **3.5 Maintain the record of performed job**		
4	**OPERATE WORD PROCESSING APPLICATION** **4.1 Create documents.** 4.1.1. Open ***Word-processing application.*** ***Word-processing application***: MS Word, Open Office 4.1.2. Create ***Documents.*** (Word documents, Standard CV with different text & Fonts, image, and table, Application / Official letter with proper paragraph and indenting, spacing, styles, illustrations, tables, header & footers and symbols, Standard report/newspaper items with column, footnote, and endnote drop cap, indexing and page numbering) 4.1.3. Add Text and Data according to information requirements. 4.1.4. Use Document templates as per the job required. 4.1.5. Use ***Formatting Tools*** when creating the document. ***Formatting Tools***: (Bold, Italic, Underline, Strikethrough, Subscript, Superscript, Change case, Text highlight color, Font color, Font, Font size, Clear formatting, Format painter, Illustrations and styles, Text, Table, Symbols, Header & footer, Text alignment) 4.1.6. Insert and edit Equation as per job requirement. 4.1.7. Save Documents are as per job requirements. **4.2 Customize basic settings to meet page layout conventions** 4.2.1 Adjust Page layout to meet information requirements 4.2.2 Open and use User interface and ***toolbars*** as per job requirement. ***Toolbars:*** File tab, Title bar, Ribbon, Ruler, Status bar, View button, Zoom control, Document area, Dialog box launcher, Backstage view 4.2.3 Change ***Font Format*** to suit the purpose of the document. ***Font Format:*** Times New Roman, Arial, Nikosh, NikoshBan, Kalpurush,	**8**	**16**

SutonnyMJ, Century, Century gothic, Vrinda

4.2.4 Change ***Alignment*** and line spacing according to document requirements.

Alignment: Left, Right, Center, Top, Text direction, Cell margins

4.2.5 Modify Margins to suit the purpose of the document.

4.3 Format documents

4.3.1 Use formatting features, Symbols, and styles as per requirement.

4.3.2 Highlight and Copy Text from other areas in the document or form another active document.

4.3.3 Insert headers and footers to incorporate necessary data.

4.3.4 Save Documents in another ***file format***

file format: .doc, .docx, .pdf, . xps , .xml

4.3.5 Save and close document to ***Storage device.***

Storage device: Flash Drive, Hard Disk Drive, Memory Card, CD/DVD

4.4 Create a table.

4.4.1 Insert the standard table into the document.

4.4.2 Split and /or merge the cells to meet the Information requirement.

4.4.3 Insert, delete, modify and move columns and rows if Necessary.

4.4.4 Insert Text into the table.

4.4.5 Operation carried for ***Data Handled*** as per job Requirement.

Data Handled: Sort, Repeat Header row, convert to Text, Formula, Autofit.

4.4.6 Use Styling tools according to style requirements.

4.4.7 Add formula to the table as per job requirement.

4.5 Add illustrations

4.5.1 Insert appropriate ***illustrations*** into the document and Customize if necessary.

Illustrations: Picture, clip art, Shapes, Smart Art, Chart

4.5.2 Position and resize images according to the Document formatting requirements.

4.6 Perform mail merge operation

4.6.1 Determine sender and recipients as per job Requirements.

4.6.2 Follow preparatory steps for mail merge.

4.6.3 Add recipients for mail merge.

4.6.4 Perform Mail merge operation.

4.6.5 Send mail.

4.7 Create references

4.7.1 Plan Footnote, endnote, and citation.

4.7.2 Create Footnote and endnote.

4.7.3 Create citation.

4.8 Print information

4.8.1 Connect ***printer*** with computer and power outlet Properly.

Printer: Dot matrix printer, Laser Printer, Inkjet printer

4.8.2 Switch on power at both the power outlet and

	printer. 4.8.3 Install and add printer. 4.8.4 Select correct printer settings and print the document or selected part as per job requirements. 4.8.5 View or cancel print from the printer spool. **4.9 Maintain the record of the performed job.**		
5	**OPERATE SPREADSHEET APPLICATION** **5.1 Create spreadsheets** 5.1.1. Open ***Spreadsheet Application***, 5.1.1. Create spreadsheet files and enter numbers, text, and symbols into cells according to information requirements. 5.1.2. Enter simple ***formulas and functions*** using cell Referencing where required. ***Formulas:*** SUM, AVERAGE, IF, MAX, MIN, COUNT, RANK, Date and Time, Math and Trig, AND, OR, NOR, Between, ABS, Greater than, less than ***Functions:*** Mathematics, Logical, Simple statistical 5.1.3. Correct formulas when error messages occur. 5.1.4. Use a range of common tools during spreadsheet development. 5.1.5. Edit columns and rows within the spreadsheet. 5.1.6. Use the auto-fill function to increment data where required. 5.1.7. Save spreadsheet file to directory or folder. **5.2. Customize basic settings:** 5.2.1. Adjust page layout to meet user requirements or special needs. 5.2.1. Open and view different toolbars. 5.2.2. Change font settings so that they are Appropriate for the purpose of the Document. 5.2.3. Change ***alignment*** options and line spacing according to spreadsheet formatting features. ***Alignment: Right, Left, Centre, Top, Middle, Bottom*** 5.2.4. ***Format*** cell to display different styles as required. ***Format:*** Bold, Italic, Underline, Font size, color, change case, Alignment, and intend 5.2.5. Modify margin sizes to suit the purpose of the spreadsheets. 5.2.6. View multiple spreadsheets concurrently. **5.3. Format spreadsheet:** 5.3.1. Use formatting features as per job requirements. 5.3.2. Copy selected formatting features from another cell in the spreadsheet or from another active spreadsheet. 5.3.3. Use formatting **tools** as required within the spreadsheet. 5.3.4. Align information in a selected cell as required. 5.3.5. Insert headers and footers using formatting features. 5.3.6. Save the spreadsheet in another format. 5.3.7. Save and close the spreadsheet to the storage device. **5.4. Sort and filter data in worksheet** 5.4.1. Create worksheets. 5.4.2. Insert data into the sheet. 5.4.3. Sort data with different criteria. 5.4.4. Filter data with different conditions, 5.4.5. Print sorted or filtered data **5.5. Incorporate object and chart in the spreadsheet:**	**6**	**10**

	5.5.1. Import an object into an active spreadsheet. 5.5.2. Manipulate imported objects by using formatting features. 5.5.3. Create a chart using selected data in the spreadsheet. 5.5.4. Display selected data in a different chart. 5.5.5. Modify chart using formatting features. **5.6. Create worksheets and charts** 5.6.1. Create Worksheets as pre-requirement. 5.6.2. Enter Data as per job requirement. 5.6.3. use function for calculating and editing logical operations. 5.6.4. Format ***Sheets*** as per requirement. ***Sheets:*** Salary Sheet with sorting, filtering, and chart, Mark/Grade/Tabulation sheets for simple result processing. 5.6.5. Create ***Charts and Graphs*** as per job requirements. ***Charts and Graphs:*** Column, Pie, Line, Bar, Table, Scatter 5.6.6. Preview and print Charts/ Sheets. **5.7. Print spreadsheet:** 5.7.1. View spreadsheet in print preview mode. 5.7.2. Select basic printer options. 5.7.3. Print spreadsheet or selected part of the spreadsheet. 5.7.4. Submit the spreadsheet to the appropriate person for approval or feedback. **5.8. Maintain the record of the performed job.**		
6	**OPERATE PRESENTATION PACKAGE:** **6.1. Create presentations:** 6.1.1 Open ***Application package*** for presentation and create a simple design for a presentation according to organizational requirements. ***Application package***: PowerPoint, Prezi 6.1.2 Open a blank presentation and add text and graphics using the user interface and toolbar. 6.1.3 Apply existing styles within a presentation. 6.1.4 Use presentation templates and slides to create a presentation. 6.1.5 Use various ***Illustrations,*** audio, video, and ***effects*** in the presentation. ***Illustrations***: Picture, Clip art, Photo, Shape, Smart art, Chart ***Effects***: Entrance, Emphasis, Exit, Motion path, Sound 6.1.6 Add design, transition, and animation as per job requirement 6.1.7 Save the presentation to the correct directory. **6.2 Customize basic settings:** 6.2.1 Adjust display to meet user requirements. 6.2.2 Open and view different ***toolbars*** to view options. 6.2.3 Ensure ***font settings*** are appropriate for the purpose of the presentation. 6.2.4 Select necessary font tools as per job requirements. 6.2.5 View multiple slides at once. **6.3 Format presentation** 6.3.1 Use and incorporate organizational charts, bulleted lists and modify as required. 6.3.2 Add and manipulate ***objects*** to meet presentation purposes. ***Objects***: image, chart, worksheet, equation, slide 6.3.3 Import and modify ***objects*** for presentation purposes. 6.3.4 Modify slide layout, including text and colors to meet presentation requirements. 6.3.5 Use ***formatting tools*** as required within the presentation. 6.3.6 Duplicate slides within and/or across a presentation. 6.3.7 Record the sequence of slides and/or delete slides for presentation purposes.	**4**	**8**

	6.3.8 Save the presentation in another ***format.*** 6.3.9 Save and close presentation to disk. **6.4 Add Slide show effects** 6.4.1 Incorporate animation and multimedia effects into the presentation as required to enhance the presentation and present the presentation. 6.4.2 Add ***Slide transition effect to*** ensure a smooth presentation. 6.4.3 Test the presentation for overall impact 6.4.4 Use on-screen navigation tools to start and stop slide shows or move between different slides. **6.5 Create a template using a master slide** 6.5.1 Open Blank presentation and click the slide master form view tab. 6.5.2 Create slide layout and/or customized as per requirements. 6.5.3 Add Theme based colors, fonts, effects, backgrounds and style to the presentation. 6.5.4 Set page orientation for all of the slides. 6.5.5 Save and close presentation **6.6 Print presentation and notes** 6.6.1 Select the appropriate print format to print presentation. 6.6.2 Select preferred slide orientation. 6.6.3 Add notes and slide numbers. 6.6.4 Preview slide and check spells before presentation. 6.6.5 Print selected slides. **6.7 Maintain the record of performed job.**		
	Total	**28**	**50**

Necessary Resources (Tools, equipment's and Machinery):

Sl	Item Name	Quantity
01	Computer System / Laptop	01 per student
	Accessories	
02	Extra Key Board	05 Piece
03	Extra Mouse	05 Piece
04	Extra System / Laptop Unit	02 Piece
05	Extra Mother Board	02 Piece
06	Extra RAM	05 Piece
07	Extra Hard Disk	02 Piece
08	Extra SSD	02 Piece
09	Multimedia Projector	01 Piece
10	Multimedia pointer	01 Piece
11	Potable wireless Sound System	01 set
12	Network Adapter	02 Piece
13	VGA cable	02 Piece
14	Printer (LASER)	01 Piece
15	Printer (Dot Matrix)	01 Piece
16	Printer (Inkjet)	01 Piece
17	Printer Cable	01 Piece
18	Monitor	01 Piece
19	Modem	01 Piece
20	Scanner	01 Piece

21	Power cords/Power adapter	01 Piece
22	UPS/ IPS	01 Piece

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
01	MOS 2010, Study Guide	Joan ambert, Joyce Cox	**Up-to-date Edition**
02	Computer Application in Business	R. Parameswaran	

Website References:

Sl	Web Link	Remarks
01	**https://teachers.tech/microsoft-office-tutorials/**	
02	**https://www.javatpoint.com/ms-word-tutorial**	
03	**https://www.tutorialspoint.com/word/index.htm**	

Subject Code	Subject Name	Period/Week		Credit
26731	Electrical Circuit-2	T	P	C
		3	3	4

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skill on concept of RLC parallel circuit, power calculation on AC circuit, resonance in series and parallel circuit, bandwidth and Q-factor in series resonance and parallel resonance, poly phase power system, phase sequence poly phase power system, star connected power system, delta connected power system, unbalanced power system, non-sinusoidal waves, power factor of non-sinusoidal waves. As such the knowledge of Electrical circuit-2 the pre-requisite for these fields for effective discharge of their duties. These necessities of electrical engineering subjects in the curriculum of Diploma in engineering. After completion of this course student will be able to measure the power of single phase parallel circuit, different types of ac power measurement, series resonance, parallel resonance, phase sequence of poly phase system, verify relation between line voltage and phase voltage as well as line current and phase current in star and delta system. Student also able to measure 3 phase power and neutral current in balance and unbalance load. Have been given more emphasis on practical aspect rather than theory in teaching learning approach.
Learning Outcome (Theoretical)	After Completion of the subject, students will be able to: ▪ Describe RLC parallel circuit. ▪ Calculate AC power. ▪ Analyze resonance in series and parallel circuit. ▪ Outline bandwidth and Q factor in resonance circuit. ▪ Illustrate Principles of Poly phase system. ▪ Enumerate the relation between line voltage and phase voltage &Line current and phase current. ▪ Explain Non sinusoidal wave ▪ Mention Harmonics non-sinusoidal waves.
Learning Outcome (Practical)	After completion of the subject, students will be able to: ▪ Measure the single-phase power of ac circuit. ▪ Determine resonance in RLC series and parallel circuit. ▪ Measure the Band width and Q factor. ▪ Demonstrate poly phase system. ▪ Determine the Phase sequence. ▪ Calculate the value of line voltage, phase voltage, line and phase current in star and delta system. ▪ Measure 3 –phase power of balance and unbalance load

Detailed Syllabus (Theory)

Unit	Topics with contents	Period	Marks
1.	**RLC PARALLEL CIRCUIT** 1.1 Mention the parameters of RLC parallel circuit in rectangular form of notation and polar form of notation. 1.2 Draw vector diagram of RLC parallel circuit. 1.3 Solve problems on RLC parallel circuit. 1.4 Define admittance, Susceptance and Conductance. 1.5 Mention the units of Admittance, Susceptance and Conductance 1.6 Find the impedance, admittance, current and voltage in RLC parallel circuit. 1.7 Draw impedance/admittance triangle of RLC parallel circuit. 1.8 Solve problems on series and parallel AC circuit in rectangular form of notation and polar form of notation.	5	10
2	**POWER CALCULATION ON AC CIRCUIT** 2.1 Derive the Expression of power applying in complex form. 2.2 Calculate VAR applying in complex form. 2.3 Explain the conjugate method of calculating Apparent, Active & Reactive power. 2.4 Sketch wave diagram for power of different AC circuits.	3	6
3	**RESONANCE IN SERIES CIRCUIT** 3.1 Define resonance. 3.2 Describe resonance in series circuit. 3.3 Mention ways of securing resonance in series circuit. 3.4 Describe resonance curve when varying frequency. 3.5 Determine resonance frequency in series circuit. 3.6 Solve problems on resonance frequency in series circuit.	4	8
4	B**ANDWIDTH AND Q-FACTOR IN SERIES RESONANCE** 4.1 Describe the resonance curve and bandwidth in series resonance. 4.2 Explain the effects of frequency upon reactance in the series resonance circuit. 4.3 Illustrate the graphical representation of series resonance. 4.4 Describe resonance curve when varying inductance. 4.5 Explain resonance curve when varying capacitance. 4.6 Define Q-factor of a series resonance circuit. 4.7 List the applications of series resonance. 4.8 Solve problems related to series resonance.	4	6
5	**RESONANCE IN PARALLEL CIRCUIT** 5.1 Define resonance in parallel circuit. 5.2 Describe the resonance curve and bandwidth in parallel resonance. 5.3 Determine the resonance frequency in parallel circuit with R-L and RC branch. 5.4 State the condition for resonance in parallel circuit with L & R-L in one branch and C only in other. 5.5 Illustrate the graphical representation of parallel resonance. 5.6 List the applications of parallel resonance.	3	6

6	**BANDWIDTH AND Q-FACTOR IN PARALLEL RESONANCE.** 6.1 Define dynamic impedance and current magnification. 6.2 Describe the effects of Q-factor and bandwidth in parallel resonance circuit. 6.3Explain the effects of frequency upon reactance in the parallel resonance circuit. 6.4 Derive mathematical deduction of the exact and approximate formula for parallel resonance. 6.5 Describe resonance curve when varying inductance. 6.6 Explain resonance curve when varying capacitance. 6.7 Distinguish between series and parallel resonance circuit. 6.8 Solve problems on parallel resonance.	**3**	**6**
7	**POLY PHASE POWER SYSTEM** 7.1 Define poly phase system. 7.2 Distinguish between poly phase and single-phase power system. 7.3 Describe the poly phase emf generation system. 7.4 Sketch the wave diagram for a poly phase power system. 7.5 Draw vector diagram for a poly phase power system. 7.6 Describe the possible ways of interconnection of 3-phase power system.	**3**	**6**
8	**PHASE SEQUENCE OF POLY PHASE POWER SYSTEM** 8.1. Describe double subscript of notation. 8.2. Illustrate the phase sequence of poly-phase system. 8.3. State the effects of reverse phase sequence. 8.4. Explain the methods of checking phase sequence. 8.5. Sketch the phase sequence diagram of 3-phase power system.	**3**	**6**
9	**STAR CONNECTED POWER SYSTEM** 9.1 Sketch the circuit diagram of star connected 3-phase 3-wire system. 9.2 Draw the vector diagram of 3-phase 3-wire star connected power system. 9.3 List the application of 3-phase 4-wire star connected power system. 9.4 Derive the relation between line and phase voltage and line and phase current in a balanced 3-phase 4-wire star connected power system. 9.5 Define neutral wire in a 3-phase 4-wire star connected system. 9.6 Describe the current in the neutral wire in an unbalanced 3-phase 4-wire star connected system. 9.7 Calculate volt-ampere, power and power factor in a balanced 3-phase 4-wire star connected power system. 9.8 Solve problems on star connected (balanced and unbalanced) power system.	**5**	**8**
10	**DELTA CONNECTED POWER SYSTEM** 10.1 Sketch the circuit diagram of 3-phase delta connected power system. 10.2Draw the vector diagram of a 3-phase delta connected power system.	**5**	**8**

	10.3 List the application of 3-phase Delta connected power system. 10.4 Enumerate the relation between line and phase current & Voltage in a Delta connected power system. 10.5 Calculate the volt-ampere, power and power factor in a 3-Phase Delta connected power system. 10.6 Distinguish between star connected system with delta Connected power system. 10.7 Solve problems on delta connected balanced power system.		
11	**UNBALANCED POWER SYSTEM** 11.1 Describe Fortescue`s theorem. 11.2 Explain the positive sequence of power system. 11.3 Mention the negative sequence of power system. 11.4 Explain the zero sequence of power system. 11.5 Illustrate the neutral current of unbalanced system. 11.6 Solve problems related to unbalanced system	**4**	**6**
12	**NON-SINUSOIDAL WAVES** 12.1 Define non-sinusoidal waves. 12.2 Explain non-sinusoidal waves as the sum of sine and Cosine waves of different frequencies. 12.3 Mention the types of Non sinusoidal waves 12.4 Illustrate graphical and mathematical representation of non sinusoidal waves.	**2**	**5**
13	**HARMONICS IN NON-SINUSOIDAL WAVES** 13.1 Define harmonics. 13.2 Describe harmonics in the **Y**-system. 13.3 Explain harmonics in the - system 13.4 Calculate effective value of non-sinusoidal wave. 13.5 Explain the types of power due to non-sinusoidal voltage and Current. 13.6 Calculate volt-amperes due to non-sinusoidal voltage and current.	**2**	**5**
14	**POWER FACTOR OF NON-SINUSOIDAL WAVES** 14.1 Define power factor due to non-sinusoidal waves. 14.2 Describe equivalent sine wave of non-sinusoidal wave. 14.3 Explain addition and subtraction of non-sinusoidal wave. 14.4 Solve problems related with non-sinusoidal wave.	**2**	**4**
	Total	**48**	**90**

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Marks
1	**MEASURE THE DIFFERENT TYPES OF POWER IN SINGLE-PHASE AC CIRCUIT** 1.1Draw the circuit diagram for power triangle of lagging and leading load. 1.2 Select tools, equipment and materials for the experiment.	**1**	**2**

	1.3 Connect the circuit diagram 1.4 Check all connection points before actual operation. 1.5 Record the readings from the meter applying power supply to the circuit. 1.6 Measure the power and power factor. 1.7 Maintain the record of performed task		
2	**CALCULATE RESONANCE FREQUENCY FROM RLC SERIES CIRCUIT BY CHANGING FREQUENCY, INDUCTANCE AND CAPACITANCE.** 2.1 Sketch the circuit diagram for RLC series resonance. 2.2 Select tools, equipment and materials for the experiment. 2.3 Connect the circuit according to the sketch. 2.4 Check all connection points before actual operation. 2.5 Record the readings from the meter applying power supply to The circuit. 2.6 Find the value of current, resistance, inductive reactance, Capacitive reactance and impedance. 2.7 Draw the curve for RLC series resonance 2.8 Maintain the record of performed task.	**1**	**3**
3	**PERFORM RESONANCE FREQUENCY IN RLC PARALLEL CIRCUIT AND DRAW THE RESONANCE CURVE** 3.1 Sketch the circuit diagram for RLC parallel resonance. 3.2 Select tools, equipment and materials for the experiment. 3.3 Connect the circuit according to the sketch. 3.4 Check all connection points before actual operation. 3.5 Record the data from the meter while applying power supply To the circuit. 3.6 Find current, resistance, inductive reactance, capacitive Reactance and impedance. 3.7 Sketch the resonance curve with the frequency as abscise and current, resistance, inductive reactance, capacitiv reactance and impedance as ordinate. 3.8 Maintain the record of performed task.	**1**	**2**
4	**DEMONSTRATE POLY-PHASE SYSTEM AND PHASE SEQUENCE** 4.1 Sketch the circuit diagram of poly-phase system and phase Sequence. 4.2 Select tools, equipment and materials for the experiment. 4.3 Switch on the poly-phase system of your laboratory. 4.4 Measure the phase voltages by voltmeter. 4.5 Observe the phase voltages by oscilloscope. 4.6 Compute phase sequence. 4.7 Maintain the record of performed task.	**1**	**2**
5	**MEASURE LINE AND PHASE VOLTAGE & CURRENT IN 3-PHASE 4-WIRE STAR CONNECTED INDUCTIVE LOAD.**	**1**	**3**

	5.1 Sketch the circuit diagram for 3-phase star connected load. 5.2 Select the tools, Equipment and materials required for the Experiment. 5.3 Connect the circuit according to the circuit diagram. 5.4 Check all connection points before connecting the power Supply to the circuit. 5.5 Record the readings of the instruments. 5.6 Compare the recorded values with calculated values. 5.7 Maintain the record of performed task.		
6	**MEASURE LINE AND PHASE CURRENT & VOLTAGE IN 3-PHASE DELTA CONNECTED INDUCTIVE LOAD.** 6.1 Sketch the circuit diagram for 3-phase delta connected load. 6.2 List the tools, equipment and materials required for the Experiment. 6.3 Connect the circuit according to the circuit diagram. 6.4 Check all connection points before connecting the power Supply to the circuit. 6.5 Record the readings of instruments. 6.6 Compare the recorded values with calculated values. 6.7 Maintain the record of performed task.	**1**	**2**
7	**MEASURE CURRENT, VOLTAGE AND POWER IN A BALANCED 3-PHASE STAR CONNECTED INDUCTIVE LOAD.** 7.1 Sketch the circuit diagram for measuring power by 3-watt Meters method in a 3-phase star connected system. 7.2 Select tools, equipment and materials required for the Experiment. 7.3 Connect the circuit according to the circuit diagram using Proper equipment. 7.4 Check all connection points, equipment and instruments Before actual operation. 7.5 Record the readings from the meters connected in the Circuit. 7.6 Calculate the power from the formula $P_t = W_1 + W_2 + W_3$ and $P_t = 3V_pI_p \cos\theta$ 7.7 Draw the vector diagram using relevant data as obtained. 7.8 Maintain the record of performed task.	**1**	**3**
8	**DETERMINE CURRENT, VOLTAGE AND POWER IN A BALANCED 3-PHASE DELTA CONNECTED INDUCTIVE LOAD.** 8.1 Sketch the circuit diagram for measuring power by 3-watt meter method in a 3-phase delta connected load. 8.2 Select tools, equipment and materials for the experiment. 8.3 Connect the circuit according to the circuit diagram. 8.4 Check all connections before actual operation. 8.5 Record the reading from the meters used in the circuit. 8.6 Calculate the power from the formula $P_t = W_1 + W_2 + W_3$	**1**	**2**

	and $P_t = \sqrt{3}\, V_L I_L \cos\theta$ 8.7 Draw the vector diagram using relevant data. 8.8 Maintain the record of performed task		
9	**MEASURE POWER AND NEUTRAL CURRENT IN A 3-PHASE, 4-WIRE UNBALANCED LOAD.** 9.1 Sketch the circuit diagram for measuring power and neutral Current in 3-phase 4-wire unbalanced load. 9.2 Select tools, equipment and materials for the experiment. 9.3 Construct the circuit according to the circuit diagram. 9.4 Check all connections & instruments before actual operation. 9.5 Record the readings from the meters used in the circuit. 9.6 Calculate the power and neutral current. 9.7 Calculate the phase angles. 9.8 Maintain the record of performed task.	**1**	**3**
10	**CALCULATE LINE AND PHASE VOLTAGE AND CURRENT OF A 3-PHASE STAR AND DELTA CONNECTED CAPACITIVE LOAD.** 10.1Sketch the circuit diagram for measure the line and phase voltage & line and phase current. 10.2 Select tools, equipment and materials required for the experiment. 10.3 Construct the circuit as per diagram with proper instrument. 10.4 Record the readings from the meters used in the circuit. 10.5 Calculate the line and phase voltage & current from the formula $I_L = I_P$ and $V_L = 3\sqrt{V_P}$ for star connection 10.6 Calculate the line and phase voltage and current from the formula $V_L = V_P$ and $I_L = \sqrt{3} I_P$. for delta connection 10.7 Draw the vector diagram using relevant data 10.8 Maintain the record of performed task.	**1**	**3**
	Total	**10**	**25**

Necessary Resources (Tools, Materials, equipment's and Machineries):

Sl	Item Name	Quantity
01	Screw drivers, Neon tester,	Each item 25 no's
02	Ammeter, Voltmeter, Ohm meter, AVO meter, Wattmeter, Frequency meter, Power factor meter,	Each item 10 no's
03	Resistor, Inductor, Capacitor	Each item 30 no's
04	Different types of Wires and Cables (1.0 to 3.5rm)	5 coils of different sizes
05	Two pin socket, Tree pin socket, Combined switch and socket, two pin plug, three pin Plug,	Each item 10 no's
06	Dc power supply unit, Voltage stabilizer, ac single phase and three phase variac	Each item 10 no's
07	Oscilloscope, Signal generator	Each item 5 no's
08	Dry cells (1.5v, 2.2v, 3.0v, 6.0v, 9.0v), Graph papers	Each item 10 no's

Sl	Book Name	Writer Name	Publisher Name & Edition
01	Electrical Circuits and Networks	Monica Mehrotra, Deepak Balody	October' 2020, Tata Mcgrohill
02	Fundamentals of Electric Circuits	Charles k. Alexander & Matthew Sadiku	February'2019
03	A text book of Electrical Technology	B. L. Theraja	S.Chand, 2021
04	Electrical Circuits	B. H. Deshmukh	Nirali Prakashan, Feb, 2021
05	Schaum's Outline of Electric Circuit	Joseph A Edminister and Mahmood Nahvi	McGraw-Hill, Fourth Edition.

Website References:

Sl	Web Link	Remarks
01	http//www.electricalengineering.org	
02	http//www.electrical-installation.org	
03	http//www.eetiimes.eu	
04	http//www.interestingengineering .com	

Subject Code	Subject Name	Period per Week		Credit
26732	ELECTRICAL APPLIANCES	T	P	C
		2	3	3

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skill on concept of different daily Electric Appliances. By the completion of this course student will be able to disassemble and reassemble different types of Electric Appliances like Electric Iron, Rice Cooker, Electric Kettle, Geyser, Oscillatory Fan, Electric Blower, Vacuum Cleaner, Blender, Washing Machine, Refrigerator, Microwave Oven, Induction Cooker, Electric Oven etc. These necessities the introduction of Electrical Appliances in the curriculum of Diploma in Engineering level. The subject covers only such topics which will enable the Diploma Engineers to identify different parts of Electrical Appliances. This course structure has been given more emphasis on practical aspect rather than theory in teaching learning approach.
Learning Outcome (Theoretical)	After Completion the subject students will be able to: ▪ Mention various types of Electrical Appliances. ▪ Describe the function of various Electrical Appliances. ▪ State the operating principle of various Electrical Appliances. ▪ Describe inner parts of Electrical Appliances. ▪ State disassembling and reassembling procedure of Electrical Appliances. ▪ Illustrate working theory of Electrical Appliances.
Learning Outcome (Practical)	After Completion the subject students will be able to: ▪ Identify various parts of Electrical Appliances. ▪ Identify the types of Electrical Appliances. ▪ Perform disassemble and assemble of Electrical Appliances. ▪ Identify faults and causes in Electrical Appliances. ▪ Remedy the faults of Electrical Appliances. ▪ Operate the Electrical Appliances.

Detailed Syllabus (Theory)

Unit	Topics with content	Class (1 Period)	Final Marks
1.	**Basic Principle of Electrical Appliances** 1.1 State the meaning of Electric Appliances. 1.2 List the names of appliances based on Heating Principles. 1.3 Mention the name of motor driven Appliances.	**1**	**2**
2.	**Electric Iron** 2.1 Define Electric Iron. 2.2 List different types of Electric Iron. 2.3 Mention different parts of an Electric Iron. 2.4 State the operating principles of an Electric Iron. 2.5 Explain the operation of thermostat in an automatic Electric Iron. 2.6 List the faults, causes and remedies of an Electric Iron.	**2**	**7**
3.	**Rice Cooker & Induction Cooker** 3.1 Define Rice Cooker & Induction Cooker. 3.2 Describe the function of a Rice Cooker & Induction Cooker. 3.3 List the main parts of a Rice Cooker & an Induction Cooker. 3.4 Mention the faults, causes and remedies of Rice Cooker & Induction Cooker.	**4**	**6**
4.	**Electric Kettle & Geyser** 4.1 State the operation of electric Kettle & Geyser 4.2 List deferent parts of electric Kettle & Geyser 4.3 List the faults, causes and remedies of an electric Kettle & Geyser.	**3**	**6**
5.	**Table fan and Pedestal fan** 5.1 Define Table fan and Pedestal fan. 5.2 Describe the function of a Table fan and Pedestal fan. 5.3 List different parts of a Table fan and Pedestal fan. 5.4 State the operation of an electronic fan regulator. 5.6 List the faults, causes and remedies of a Table fan/Pedestal fan.	**4**	**7**
6.	**Electric blower & Vacuum cleaner** 6.1 State the operation of an Electric Blower & Vacuum cleaner. 6.2 Name the different parts of an Electric Blower & Vacuum cleaner. 6.3 List the faults , causes and remedies of an Electric Blower & Vacuum cleaner.	**4**	**7**
7.	**Blender** 7.1 State the operation of a Blender. 7.2 List the different parts of a Blender. 7.3 List the faults, causes and remedies of a blender.	**2**	**3**

Unit	Topics with content	Class (1 Period)	Final Marks
8.	**Washing Machine** 8.1 Define washing machine. 8.2 List the different types of Washing Machine. 8.3 State the operation of a Washing Machine. 8.4 List the different parts of a Washing Machine. 8.5 Explain operation mood of a Washing Machine. 8.6 List the faults, causes and remedies of a Washing Machine.	**4**	**7**
9.	**Refrigerator** 9.1 Define refrigerator. 9.2 List of different components of refrigerator. 9.3 State the function of different components of refrigerator 9.4 List the faults, causes and remedies of a refrigerator.	**4**	**7**
10.	**Electric oven & Microwave oven** 10.1 Describe the function of an Electric Oven & Microwave Oven. 10.2 List the main parts of an Electric oven & Microwave Oven. 10.3 Describe the function of heat control and timer in an Electric oven & Microwave oven. 10.4 List the faults, causes and remedies of an Electric Oven & Microwave Oven.	**4**	**8**
	Total	**32**	**60**

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1.	**Perform maintenance and servicing an Electric Iron.** 1.1 Select the equipment and tools necessary for disassembling and servicing an Electric Iron. 1.2 Disassemble the Electric Iron. 1.3 Identify different parts of the Electric Iron. 1.4 Observe the heating element and operation of thermostat in the Electric Iron. 1.5 Identify the possible faults in the Electric Iron. 1.6 Repair or replace the defective parts, if any. 1.7 Reassemble the parts and connect the Iron to the power source. 1.8 Maintain the record of performed task.	**1**	**2**

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
2.	**Perform repair and maintenance of a rice cooker.** 2.1 Disassemble the parts of the rice cooker. 2.2 Sketch the main parts of the rice cooker. 2.3 Identify possible troubles with causes and remedies of a rice cooker. 2.4 Assemble the parts of the rice cooker. 2.5 Connect the cooker in to the power source. 2.6 Maintain the record of performed task.	**1**	**2**
3.	**Perform the operation of a Geyser** 3.1 Select the necessary tools for disassemble & assemble the components of Geyser 3.2 Sketch the diagram 3.3 Check the faults. 3.4 Select the different ranges of Geyser. 3.5 Connect the Geyser to the power source. 3.6 Observe the operation. 3.7 Maintain the record of performed task.	**1**	**2**
4.	**Perform the operation and maintenance of an Electric Kettle.** 4.1 Select the necessary hand tools for disassemble and assemble the electrical components of the electric kettle. 4.2 Disassemble and assemble the electric kettle. 4.3 Check the faults. 4.4 Sketch the diagram. 4.5 Connect into the power source. 4.6 Observe the operation. 4.7 Maintain the record of performed task.	**1**	**2**
5.	**Perform repair and maintenance of an oscillatory type fan.** 5.1 Disassemble the different parts of the table fan/pedestal fan. 5.2 Observe the oscillatory mechanism of the oscillating type of fan. 5.3 Sketch the different parts of the fan. 5.4 Check the faults. 5.5 Assemble the fan and connect to the power supply. 5.6 Observe the operation. 5.7 Maintain the record of performed task.	**2**	**2**

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
6.	**Perform repair and maintenance of an electric Blower & Vacuum cleaner** 6.1 Disassemble the parts of the electric blower & vacuum cleaner 6.2 Sketch the main parts of the electric blower & vacuum cleaner 6.3 Check the faults. 6.4 Repair or replace the defective parts, if any. 6.5 Reassemble the parts. 6.6 Connect the appliances to the power source. 6.7 Observe the operation. 6.8 Maintain the record of performed task.	**2**	**4**
7.	**Perform repair and maintenance of a Blender.** 7.1 Disassemble the blender. 7.2 Sketch the main parts. 7.3 Identify the major faults generally occurred in a blender. 7.4 Assemble the blender. 7.5 Connect the blender to the power supply. 7.6 Observe the operation. 7.7 Maintain the record of performed task.	**1**	**2**
8.	**Perform repair and maintenance of a Washing Machine.** 8.1 Identify the main parts of the washing machine. 8.2 Sketch the main parts of the washing machine. 8.3 Sketch the electrical circuit of the washing machine. 8.4 Draw the complete washing cycle of washing machine. 8.5 Dissemble the major components. 8.6 Make a visual observation. 8.7 Check the faults. 8.8 Reassemble the parts. 8.9 Connect the washing machine to the power supply. 8.10 Observe the operation. 8.11 Maintain the record of performed task.	**2**	**2**
9.	**Perform repair and maintenance of electrical components of a refrigerator.** 9.1 Identify the different parts of the refrigerator. 9.2 Identify the electrical components of the refrigerator. 9.3 Sketch the wiring circuit showing electrical control system. 9.4 Note down the maintenance procedure of a refrigerator. 9.5 Disassemble and assemble the thermostat control. 9.6 Check the faults. 9.7 Connect into the power source. 9.8 Observe the operation. 9.9 Maintain the record of performed task.	**3**	**3**

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
10.	**Perform maintenance and servicing of an electric oven & microwave oven** 10.1 Disassemble the electric oven & microwave oven. 10.2 Sketch the main parts of the electric oven& microwave oven. 10.3 Make a visual study and test the different parts. 10.4 Sketch the electrical circuit diagram of the electric oven & microwave oven. 10.5 List possible troubles with causes and remedies of an electric oven & microwave oven. 10.6 Assemble the parts and connect the oven to the power source. 10.7 Observe the operation of electric & microwave oven. 10.8 Maintain the record of performed task.	**2**	**4**
	Total	**16**	**25**

Necessary Resources (Tools, Equipment's and Machinery):

Sl	Item Name	Quantity
1.	Flat Screw drivers, Star Screw drivers, Neon tester, Combination Pliers, Electrician Knife, Hammer, Mallet, Soldering Iron, Wire strippers, Poker, Plumb bob, Adjustable Wrench, AVO meter, Extension Cord/Multi-plug, Electrical Iron, Megger	Each item 10 no's
2.	Electric Iron, Rice Cooker, Electric Kettle, Geyser, Oscillatory Fan, Electric Blower, Vacuum Cleaner, Blender, Washing Machine, Refrigeration, Microwave Oven, Infrared Cooker, Electric Oven, Gas Leak Detector, Oil Pump Charger	Each item 05 no's
3.	AVO meter/Multi-meter , Megger , Infrared Thermometer	Each item 05 no's

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
1.	Household Electricity and Appliances	Sc. Bhargava	BS Publication, 2021
2.	Study of Electrical Appliances and Devices	K.B. Bhatia	Khanna, 2021
3.	Electrical Appliances: The complete guide to the maintenance	Graham-Dixon	Haynes, 2021
4.	A text book of Electrical Technology	B. L. Theraja	S.Chand, 2021
5.	Basic Electricity	Charles W. Ryan	S.Chand, 2021
6.	Basic Electrical theory and Practice	E. B. Babler	S.Chand, 2021
7.	Solved Examples in Electrical Calculation	D. K. Sharma	S.Chand, 2021

Website References:

Sl	Web Link	Remarks
1.	http//www.electricalengineering.org	
2.	http//www.electrical-installation.org	
3.	http//www.eetiimes.eu	
4.	http//www.interestingengineering .com	
5.	http//www.electrical-engineering-portal.com	
6.	http//www.electrical4u.com	

Subject Code	Subject Name	Period per Week		Credit
26833	Industrial Electronics	T	P	C
		3	3	4

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skills on concept of power diode ,MOSFET,IGBT,UJT,GTO, OP-Amp, Thyristor, DIAC ,TRIAC, AC to DC Conversion , Chopper ,Inverter, Cycloconverter, AC voltage controller, Induction and Dielectric Heating, Power Supply, safety & Security system which are used in about all electronic system.
Learning Outcome (Theoretical)	**After Completing the subject, students will be able to:** • State the Power Electronics and Power diode. • Describe the features of power Transistor (MOSFET, IGBT). • Describe the features of UJT &GTO. • Describe the features of OP-Amp. • Describe the features of Thyristor. • Describe the features of DIAC and TRIAC. • Describe the features of Single & Three phase AC to DC Conversion. • State the features of Chopper. • State the features of Inverter. • State the features of Cycloconverter. • State the features of AC voltage controller. • State the features of Induction and Dielectric Heating. • State the Features of Power Supply. • State the features of safety system.
Learning Outcome (Practical)	**After undergoing the subject, students will be able to:** • Determine the V-I characteristics of series connected diodes. • Determine the V-I characteristics of IGBT. • Determine the V-I characteristics of GTO. • Observe the operation of relaxation oscillator by using UJT. • Perform the operation of SCR as a single phase control. • Determine the V-I characteristics curve of DIAC & TRIAC. • Observe the step down & step-up operation of DC Choppers. • Perform the operation of Inverter Circuit. • Observe the operation of Cycloconverter. • Observe the operation of SMPS/UPS.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**Power Electronics and Power diode** 1.1 Define power electronics. 1.2 Explain the block diagram of a basic power electronic system. 1.3 Define power diode. 1.4 List the types of power semiconductor diode. 1.5. Explain the V-I characteristics of Power diode. 1.6 Explain the Switching characteristics of different types of Power diode. 1.7 Mention the V-I characteristics of series connected diodes. 1.8 Mention the application of Power diode.	3	5
2	**MOSFET and IGBT** 2.1 Define MOSFET and IGBT 2.2 Classify the power transistor. 2.3 Describe the construction and operation of MOSFET. 2.4 Describe the construction and operation of IGBT. 2.5 Mention the V-I Characteristics, Switching characteristics of MOSFET and IGBT. 2.6 Compare between MOSFET and IGBT	4	5
3	**UJT and GTO** 3.1 Define UJT and GTO. 3.2 Describe the construction and operation of UJT. 3.3 Describe the construction and operation of GTO. 3.4 Mention the turn-on & turn-off process of GTO. 3.5 Analyze the operation relaxation oscillator using UJT. 3.6 Mention the application of UJT and GTO.	4	5
4	**Operational Amplifier (Op-Amp)** 4.1 Define operational amplifier. 4.2 State the basic principle of Op-Amp. 4.3 List the characteristics of an ideal Op-Amp. 4.4 Explain the operation of Op-Amp in inverter, scale changer, unity follower, comparator, phase shifter, adder, subtractor, differentiator, integrator, ramp generator.	4	8
5	**Thyristor** 5.1 Define Thyristor. 5.2 Describe the construction and operation of SCR. 5.3 Mention the V-I characteristics of SCR, 5.4 Explain the turn on/off process of SCR. 5.5Describe the operation of phase control circuit by using SCR.	2	8
6	**DIAC and TRIAC** 6.1 Define of DIAC and TRIAC. 6.2 Describe the construction and operation of DIAC and TRIAC. 6.3 Mention the V-I characteristics of DIAC and TRIAC. 6.4 Describe the commutation process of TRIAC.	2	5
7	**Single phase AC to DC conversion** 7.1 state the process of AC to DC conversion**.**	3	8

	7.2 Describe the Half wave rectification with power diode using inductive and resistive load. 7.3 Illustrate the Half wave rectification with Thyristor using inductive and resistive load. 7.4 Interpret the Full wave rectification with diode and Thyristor using resistive and inductive load. 7.5 Explain the Single phase semi-converter and full converter		
8	**Three phase AC to DC conversion** 8.1 Describe the Operation of Three phase AC to DC conversion using diode. 8.2 Explain the Operation of Three phase bridge rectification with diodes. 8.3 Describe the Three phase full converter using controlled rectifier. 8.4 Mention the application of three phase converter.	**3**	**8**
9	**Choppers.** 9.1 Define Chopper. 9.2 List the classification of Chopper 9.3 Mention the principle of operation of Chopper. 9.4 Describe the operation of Step up and Step down Chopper. 9.5 Describe the Chopper with DC motor as load 9.6 Explain the operation of AC Chopper.	**3**	**5**
10	**Inverter** 10.1 Define Inverter. 10.2 List the types of Inverter. 10.3 Describe the operation of single-phase line-commutated Inverter. 10.4 Describe the operation of three-phase line-commutated full-controlled Inverter. 10.5 Explain single-phase parallel-capacitor commutated Inverter. 10.6 Describe the operation of single-phase series Inverter. 10.7 Describe the operation of three phase forced-commutated bridge Inverter	**4**	**5**
11	**Cycloconverter.** 11.1 Define Cycloconverter. 11.2 List the types of Cycloconverter. 11.3 Describe the operation of single-phase mid-point and bridge configuration Cycloconverter. 11.4 Analyze the operation of three phase circulating and non-circulating type Cycloconverter. 11.5 Mention the advantage and disadvantage of Cycloconverter.	**3**	**8**
12	**AC voltage controller** 12.1 Define electric drive. 12.2 List the types of electric variable speed drive. 12.3. Mention the block diagram of AC electric drive. 12.4 Explain the operating principle of single phase Half wave converter drive and full wave Full converter drive. 12.6 Explain the operating principle of three phases Half wave converter drive and full wave Full converter drive.	**4**	**5**
13	**Induction and Dielectric Heating.** 13.1 Define induction and dielectric heating. 13.2 Describe the principle of induction and dielectric heating. 13.3 List the effects of frequency on induction and dielectric heating.	**4**	**5**

	13.4 Mention the effects of source voltage on induction and dielectric heating. 13.5 Describe the factors for choosing frequency of induction and dielectric heating. 13.6 List the advantages and applications of Induction and dielectric heating.		
14	**Power Supply** 14.1 Illustrate the principle and operation of SMPS with block and circuit diagram. 14.2 Explain the principle and operation of UPS and IPS with block diagram. 14.3 Explain the principle and operation of Automatic Voltage Regulator (AVR).	**3**	**5**
15	**Safety & Security system.** 15.1 Define electronic safety and security system. 15.2 Mention the types of Fire Sensors. 15.3 State the principle of electronic fire system. 15.4 Explain the operation of the Fire detection system with block diagram. 15.5 Describe the operation of touch and non-touch type person (thief) detector using infrared detection system with block diagram	**2**	**5**
	Total	**48**	**90**

Detailed Syllabus (Practical)

Unit	Experiment name with procedure	Class (3 period)	Continuous Marks
1	**Determine the V-I characteristics of series connected diodes.** 1.1 Select an appropriate circuit, required materials, tools and equipment for the experiment. 1.2 Connect the circuit as per diagram with meters. 1.3 Check the circuit and switch on the power supply. 1.4 Record the data for V-I curve. 1.5 Plot the curve.	**1**	**2**
2	**Determine the V-I characteristics of IGBT.** 2.1 Select an appropriate circuit, required materials, tools and equipment for the experiment. 2.2 Connect the circuit as per diagram with meters. 2.3 Check the circuit and switch on the power supply. 2.4 Record the data for I-V curve. 2.5 Plot the curve.	**1**	**2**
3	**Determine the V-I characteristics of GTO.** 3.1 Select an appropriate circuit, required materials, tools and equipment for the experiment. 3.2 Connect the circuit as per diagram with meters. 3.3 Check the circuit and switch on the power supply. 3.4 Record the data for I-V curve. 3.5 Plot the curve.	**1**	**3**

4	**Demonstrate the Operation of Relaxation Oscillator by using UJT.** 4.1 Select an appropriate experiment circuit, required materials, tools and equipment. 4.2 Connect the circuit as per diagram with meters. 4.3 Check the circuit and switch on the power supply. 4.4 Observe Input Output wave form	**2**	**3**
5	**Perform the operation of SCR as a single phase control.** 5.1 Select an appropriate experiment circuit. 5.2 Select required tools, equipment and materials. 5.3 Connect the circuit as per diagram with Oscilloscope. 5.4 Check the connection and switch on the power supply. 5.5 Observe the wave shapes at relevant points of the circuit. 5.6 Maintain the record of performed job.	**1**	**2**
6	**Determine the characteristics curve of DIAC & TRIAC.** 6.1 Select an appropriate experiment circuit, required materials, tools and equipment. 6.2 Connect the circuit as per diagram with meters. 6.3 Check the circuit and switch on the power supply. 6.4 Record the data for I-V curve. 6.5 Plot the curve.	**2**	**3**
7	**Operate the step down & step-up operation of DC Choppers.** 7.1 Select an appropriate circuit for experiment. 7.2 Select required tools, equipment and materials. 7.3 Connect the circuit as per diagram. 7.4 Check the connection and switch on the power supply. 7.5 Measure the input and output voltage.	**2**	**3**
8	**Perform the operation of inverter circuit.** 8.1 Select an appropriate circuit for experiment. 8.2 Select required tools, equipment and materials. 8.3 Connect the circuit as per diagram with Oscilloscope. 8.4 Check the connection and switch on the power supply. 8.5 Observe the output wave shapes of the circuit.	**2**	**3**
9	**Perform the operation of Cycloconverter.** 9.1 Select an appropriate circuit for experiment. 9.2 Select required tools, equipment and materials. 9.3 Connect the circuit as per diagram. 9.4 Check the connection and switch on the power supply. 9.5 Measure the input and output frequency with frequency counter.	**2**	**2**
10	**Perform the operation of SMPS and UPS.** 10.1 Select an appropriate SMPS and UPS. 10.2 Select required tools, equipment and materials. 10.3 Switch on the power supply. 10.4 Regulate input voltage and observe output voltage.	**2**	**2**
	Total	**16**	**25**

Necessary Resources (Tools, Equipment and Machinery):

Sl. No.	Item Name	Quantity
1	AVO Meter, Flat screw driver, Philips screw driver, Cutting pliers, Nose pliers, Automatic multifunction wire stripper. Tester, Electrical Knife, Power extension board.	30 Nos
2	DC power Supply, Function generator, Oscilloscope, Analog Electronics Trainer, Power project board/ Bread board, Center tap Transformer (220/12V, 2A, 5A), Input and output transformer.	10 Nos
3	Power Diode, MOSFET, IGBT, GTO, SCR, UJT, DIAC, TRIAC, SMPS, UPS, IPS.	50 Nos

Recommended Books:

Sl No.	Book Name	Writer Name	Publisher Name & Edition
1	Power electronics	Muhammad H.Rashid, Ph.D.	Elsevier
2	Power Electronics	Dr. P.S. Bimbhra	S. Chand
3	Principles of Electronics	V. K. Metha	S. Chand
4	Basic Electronics (Solid State)	B. L. Theraja	S. Chand

SSS Website References:

Sl. No.	Web Link	Remarks
1	ps://www.youtube.com/channel/	
2	ps://youtu.be/qsWkA-5grogo	
3	ps://youtu.be/eXyGIPrD5Qk	
4	ps://youtu.be/f-WiulYIrow	