BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Sher-E-Bangla Nagar
Dhaka-1207.

04-YEAR DIPLOMA IN ENGINEERING CURRICULUM
COURSE STRUCTURE & SYLLABUS
(PROBIDHAN-2022)

ELECTRONICS TECHNOLOGY

TECHNOLOGY CODE: 68

3rd SEMESTER

(Effective from 2022-2023 Academic Sessions)

DIPLOMA IN ENGINEERING CURRICULUM
COURSE STRUCTURE
(PROBIDHAN-2022)
TECHNOLOGY NAME: ELECTRONICS TECHNOLOGY (68)
(3RD SEMESTER)

Sl. No.	Subject		Period Per Week		Credit	Marks Distribution						Grand Total
						Theory Assessment			Practical Assessment			
	Code	Name	Theory	Practical		Continuous	Final	Total	Continuous	Final	Total	
1	25922	Physics -II	3	3	4	60	90	150	25	25	50	200
2	25931	Mathematics-III	3	3	4	60	90	150	25	25	50	200
3	28511	Computer Office Application	-	6	2	-	-	-	50	50	100	100
4	26731	Electrical Circuits-II	3	3	4	60	90	150	25	25	50	200
5	26831	Digital Electronics -I	2	3	3	40	60	100	25	25	50	150
6	26832	Power Electronics	2	3	3	40	60	100	25	25	50	150
	Total		**13**	**21**	**20**	**260**	**390**	**650**	**175**	**175**	**350**	**1,000**

Subject Code	Subject Name	Period per Week		Credit
25922	PHYSICS-II	T	P	C
		3	3	4

Rationale	Physics is the basic science for all engineering students as well as diploma engineering students. To develop a foundation in scientific principles and processes for the understanding and application of various technology. It will help the students to study in technical subject of diploma engineering students.
Learning Outcome (Theoretical)	After undergoing the subject students will be able: 1. Identify and classify various types of source of heat and temperature. Describe determination procedure temperature of materials and heat capacity of solid and liquid. 2. Describe second law of thermodynamics, heat engine. 3. Describe static electricity current electricity, magnetism, reflection of light. Refraction of light, photoelectric effect, structure of atom, Theory of relativity, semiconductor and electronics.
Learning Outcome (Practical)	After undergoing the subject (Practical) the students will be able to: 1. Compare the operation of common thermometers. 2. Determine the co-efficient of liner expansion of solid. 3. Measure the specific heat capacity of Bruss, steel etc. 4. Determine the latent heat of fusion of ice. 5. Verify the Ohm's Law. 6. Determine the Mechanical Equivalent of Heat by using Joule's Calorimeter. 7. Verify the laws of reflection. 8. Find out the focal length of a concave minor. 9. Determine the refractive index of a glass slab 10. Determine the angle of minimum deviation & refractive index of prism.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	THERMOMETRY 1.1 Define Heat & Temperature 1.2 Mention the unit of Heat & Temperature 1.3 Relate between different scale of Temperature 1.4 State the construction and graduation of mercury Thermometer 1.5 Define specific heat, thermal capacity and water equivalent 1.6 Mention units of specific heat, thermal capacity and water equivalent 1.7 Explain the principle of Calorimetry, 1.8 Discuss various kinds of specific latent heat	3	5
2	EFFECT OF HEAT ON MATERIALS 2.1 Define linear, superficial and cubical expansion of solid. 2.2 Define Coefficient of linear, superficial and cubical expansion of solid. 2.3 Relate between coefficient of linear, superficial and cubical	4	7

	expansion of solid.
	2.4 Explain the methods of heat transfer by conduction, convection and
	   Radiation with example.
	2.5 Define Thermal conductivity and Coefficient of the thermal conductivity
	2.6 List the factors which determine the quantity of heat (Q) flowing through a material
	   and Show that the quantity of heat flowing through a material can be found
	   from $Q = \dfrac{KA\,(\theta_H - \theta_C)t}{d}$
	2.7 State Stefan-Boltzman Law.
	2.8 State Newton's law of cooling.
	2.9 State wine's law.
	310 Explain Greenhouse effect.		

3	**NATURE OF HEAT AND MECHANICAL EQUIVALENT** 3.1 Describe the caloric theory and kinetic theory of heat 3.2 State the limitation of the caloric theory of heat 3.3 Explain the mechanical equivalent of heat 3.4 Explain the first law of thermodynamics 3.5 Explain Isothermal and adiabatic change. 3.6 Describe Specific heat of a gas, Molar specific heat or molar heat capacity. 3.7 Relate between pressure and volume of a gas in adiabatic change i, e; PV^{γ}=const. 3.8 Relate between C_P and C_V for and ideal gas (C_P-C_V=R)	4	6
4	**SECOND LAW OF THERMODYNAMICS** 4.1 Explain Reversible process and irreversible process. 4.2 Explain 2nd law of thermodynamics 4.3 Define heat engine 4.4 Explain the principle of Carnot's cycle 4.5 Mention the formula thermal efficiency of a heat engine 4.6 Distinguish between internal combustion engine and external combustion engine. 4.7 Describe Entropy 4.8 Mention the significant of entropy 4.9 Describe Change of entropy in a reversible and irreversible process.	4	6
5	**ELECTROSTATIC** 5.1 Define Charge and Nature of charge. 5.2 State the Law of attraction and repulsion of charge. 5.3 Explain the Coulomb's Law 5.4 Define Electric field and electric intensity. 5.5 Define Electric Potential and Potential difference 5.6 Relate between electric intensity and electric Potential. 5.7 Define Capacitor and capacitance. 5.8 Explain Energy of Capacitor. 5.9 Mention the Uses of capacitor.	3	5
6	**MAGNETISM** 6.1 Describe Earth's Magnetism. 6.2 Define Magnet, Magnetic Substance, Non-magnetic Substance, Magnetic Pole 6.3 Define Magnetic field, Magnetic Intensity. 6.4 Explain Magnetic Permeability, Magnetic Susceptibility 6.5 Explain Declination & inclination, Horizontal Component of	4	7

	Earth's Magnetic field B_H or H of Magnetic Elements of Earth 6.6 Classify Magnetic Materials 6.7 Compare among Diamagnetic, Paramagnetic and Ferromagnetic substance. 6.8 Describe Magnetic Domain.		
7	**REFLECTION OF LIGHT** 7.1 Define mirror (plane and spherical), image (real and virtual) and magnification. 7.2 Classify mirror and image 7.3 Describe the reflection of light 7.4 State the laws of reflection of right 7.5 Describe the verification of laws of reflection 7.6 Define pole, principal axis, center of curvature, radius of curvature, Principal focus in case of concave and convex mirrors 7.7 Express the general equation of concave and Convex mirror 7.8 Mention the uses of mirror and identify of Mirror.	3	6
8	**REFRACTION OF LIGHT** 8.1 Describe refraction of light 8.2 State the laws of refraction 8.3 Express the verification of laws of refraction 8.4 Describe critical angle and total internal refract reflection. 8.5 Relate between refractive index, minimum deviation of angle of the prism. 8.6 Define lens 8.7 Mention the kinds of lens. 8.8 Define center of curvature, radius of Curvature, Principal axis, first and second Principal focus, Optical center. 8.9 Derive general equation of the lens (Concave and convex) 8.10 Explain power of lens and equivalent of lens.	3	8
9	**PHYSICAL OPTICS** 9.1 Describe Electromagnetic Wave 9.2 Define Poynting Vector 9.3 Describe Electromagnetic Spectrum 9.4 Mention the wavelength of visible light spectrum 9.5 Define Light Year 9.6 Define Wave and Wave front 9.7 State the Huygens' Principle 9.8 Define Coherent Source 9.9 Define Interference of Light, Diffraction of Light and Polarization of Light. 9.10 Classify Interference of Light, Diffraction of Light and Polarization of Light.	4	8
10	**PHOTO ELECTRIC EFFECT** 10.1 Describe Electrical conductivity of gases. 10.2 Describe Discharge tube. 10.3 Define Cathode ray and X- Ray 10.4 Mention the properties of Cathode ray and X- Ray 10.5 Mention the use of X- Ray 10.6 Discuss photo electric effect 10.7 Derive Einstein's photo electric equation.	4	6

11	**STRUCTURE OF ATOM** 11.1 Describe the concept of structure of Atom 11.2 Discuss Thomson of Atomic models 11.3 Discuss Rutherford model of Atomic models 11.4 Discuss Bohr model of Atomic models 11.5 Derive the equation of Radius and Energy by using Bohr model 11.6 Explain Energy level of Electron 11.7 Derive the frequency of Photon by using Hydrogen atom Spectrum	3	6
12	**NUCLEAR PHYSICS** 12.1 Explain radioactivity 12.2 Describe radioactive rays 12.3 Deduce Radioactive decay law 12.4 Define half- life and mean-life of radioactive atom 12.5. Relate between half-life and radioactive decay constant 12.6 Describe Nuclear Reactor 12.7 Explain nuclear fission & fusion.	3	7
13	**MODERN PHYSICS** 13.1 Describe the concept of Modern Physics 13.2 Discuss about Reference frame 13.3 Explain Inertial and Non-Inertial Reference 13.4 Describe reference frame and Motion 13.5 Postulates of special Theory of Relativity 13.6 Explain the Galilean Transformation 13.7 Describe Lorentz Transformation 13.8 Define Black Holes and black body radiation.	3	7
14	**THEORY OF RELATIVITY AND ASTRO PHYSICS** 14.1 Describe Relativity 14.2 Discuss the types of Relativity 14.3 Explain Einstein's theory of Relativity 14.4 Describe the Relativity of time: Time Dilation 14.5 Discuss Relativity of Length : Length Contraction 14.6 Discuss Relativity of mass 14.6 Relate between mass and Energy $(E=mc^2)$	3	6
	Total	**48**	**90**

Detailed Syllabus (Practical)

Unit	Topics with Contents	Class (3 Period)	Continuous Marks
1	COMPARE THE OPERATION OF COMMON THERMOMETERS 1.1 Observe the different types of thermometer 1.2 Apply relation formula 1.3 Measure the temperature of liquid such normal water, hot water & ice 1.4 Calculate and compare the operation of thermometer 1.5 Maintain the record of the performance of experiment.	1	1

2	DETERMINE THE CO-EFFICIENT OF LINEAR EXPANSION OF A SOLID BY PULLINGER'S APPARATUS 2.1 Collect Pullinger's Apparatus , Thermometer and screw gauge 2.2 Apply heat to boil producer 2.3 Calculate the Linear expansion of solid 2.4 Maintain the record of the performance of experiment.	1	1
3	MEASURE THE SPECIFIC HEAT CAPACITY OF VARIOUS SUBSTANCES. (BRASS, STEEL) 3.1 Collect Calorimeter, Thermometer, Brass, Balance 3.2 Apply the formula for specific heat 3.3 Measure various terms according to formula 3.4 Calculate Specific heat capacity 3.5 Maintain the record of the performance of experiment.	1	2
4	DETERMINE THE LATENT HEAT OF FUSION OF ICE 4.1 Collect Calorimeter, Thermometer, Brass, Balance and ice 4.2 Apply the formula for latent heat of fusion 4.3 Measure various terms according to formula 4.4 Calculate latent heat of fusion 4.5 Maintain the record of the performance of experiment.	1	2
5	DETERMINE THE LATENT HEAT OF FUSION OF ICE 5.1 Collect Calorimeter, Thermometer, Brass, Balance and Vapor producer 5.2 Apply the formula for latent heat of Vapor 5.3 Measure various terms according to formula 5.4 Calculate latent heat of fusion 5.5 Maintain the record of the performance of experiment.	1	2
6	DETERMINE THE MECHANICAL EQUIVALENT OF HEAT BY USING JOULE'S CALORIMETER 6.1 Collect Joule's Calorimeter, Thermometer, Voltmeter 6.2 Apply Joule's formula for heat equivalent 6.3 Measure various terms according to formula 6.4 Determine the Mechanical Equivalent of Heat 6.5 Maintain the record of the performance of experiment.	2	2
7	VERIFY THE LAWS OF REFLECTION 7.1 Collect Plane mirror, pin and drawing board 7.2 Apply the laws of reflection 7.3 Measure the incident angle and reflection angle 7.4 Verify the laws of reflection 7.5 Maintain the record of the performance of experiment.	2	4
8	FIND OUT THE FOCAL LENGTH OF A CONCAVE MIRROR 8.1 Collect Optical bench & concave mirror 8.2 Apply focal length formula.	2	4

	8.3 Measure the object length & Image length		
	8.4 calculate the focal length by using formula		
	8.5 Maintain the record of the performance of experiment.		
9	DETERMINE THE REFRACTIVE INDEX OF A GLASS SLAB 9.1 Collect glass slab, pin, drawing paper and drawing board 9.2 Apply the Snell's law 9.3 Measure incident and refractive angle 9.4 calculate the refractive index 9.5 Maintain the record of the performance of experiment.	3	4
10	DETERMINE THE ANGLE OF MINIMUM DEVIATION AND REFRACTIVE INDEX OF A GLASS PRISM BY USING 1-D GRAPH 10.1 Collect prism, pin, drawing paper and drawing board 10.2 Apply the laws of minimum deviation 10.3 Measure incident angle and minimum deviation 10.4 Calculate the refractive index of prism 10.5 Maintain the record of the performance of experiment.	2	3
	Total	16	25

Recommended Books:

Sl	Book Name	Writer Name
	REFERENCE BOOKS: 1. Higher Secondary Physics - Second Part 2. A Text Book of Heat and Thermodynamics 3. A Text Book of Optics 4. Higher Secondary Physics - Second Part 5. Higher Secondary Physics -Second Part 6. Thermodynamics	- by Dr. Shahjahan Tapan - by N Subrahmanyam and Brij Lal - by N Subrahmanyam and Brij Lal - by Prof. Golam Hossain Pramanik - by Ishak Nurun Nabi - by K K Ramalingam

Website References:

Sl	Web Link	Remarks
1	www.nctb.gov.bd	

Subject Code	Subject Name	Period per Week		Credit
		T	**P**	**C**
25931	**Mathematics-III**	**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
		T	P	C
28511	**COMPUTER OFFICE APPLICATION**	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**	4	6

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.

	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 **3.2 Operate 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 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	**BANDWIDTH 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 $P_t = 3V_p I_p \cos \theta$ 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.**	**1**	**3**
	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.		
10	**CALCULATE LINE AND PHASE VOLTAGE AND CURRENT OF A 3-PHASE STAR AND DELTA CONNECTED CAPACITIVE LOAD.**	**1**	**3**
	10.1 Sketch 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.		
	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/Week		Credit
26831	**Digital Electronics – I**	T	P	C
		2	3	3

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skill on concept of number system, logic gates, Boolean algebra, combinational logic circuits, Simplification of logic circuits and Sequential circuits which are used in all digital system and the foundation of Microprocessor and Microcontroller.
Learning Outcome (Theoretical)	After Completing the subject, students will be able to: ☐ Describe Concept of digital electronics. ☐ State Number system, codes, conversion and binary arithmetic. ☐ Describe Logic gates and logic Family. ☐ State Simplification of logic circuits ☐ Explain Combinational logic circuits. ☐ Describe Encoder and Decoder. ☐ State Multiplexers and Demultiplexer. ☐ Explain Sequential logic circuits.
Learning Outcome (Practical)	After undergoing the subject, students will be able to: ☐ Verify the truth tables of logic gates (OR, AND, NOT, NAND & NOR). ☐ Verify the truth table of X-OR & X-NOR gate . ☐ Demonstrate the operation of NAND & NOR gate as universal gates. ☐ Construct a code converter circuit and observe its output operation. ☐ Verify the functions of half adder & half sub tractor. ☐ Verify the functions of full adder & full sub tractor. ☐ Verify the output operation of binary 4-bit parallel adder. ☐ Demonstrate the operation of encoder & decoder. ☐ Demonstrate the operation of a decoder driver & display operation using 7 segments Display. ☐ Demonstrate the operation of Multiplexer & Demultiplexer. ☐ Verify the truth table of different S-R & D flip-flops.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**Fundamentals of digital electronics.** 1.1 Define digital Electronics and digital signal. 1.2 Compare between digital and analog signal. 1.3 Describe logic level, Negative logic level and positive logic level, 1.4 Explain the parameter Frequency, Time period, Rise time, Fall time, Rising edge, falling edge, On time, Off time and Duty cycle of digital signal.	3	3
2	**Number systems and codes** 2.1 Define Number system and Base of number system. 2.2 Describe Decimal, Binary, Octal and Hexadecimal number system. 2.3 Convert Decimal, Binary, Octal and Hexadecimal number system. from each other. 2.4 Determine 1's & 2's complement of binary number. 2.5 Compute binary arithmetic. 2.6 Describe 8421, Excess–3code, Gray code, BCD code, Hamming code, ASCII code and Unicode. 2.7 Convert one code to another. 2.8 Describe the addition and subtraction of BCD coded number.	4	4
3	**Logic gates** 3.1 Define logic gate. 3.2 Classify logic gate. 3.3 Describe logic symbol, logic statements, truth table and Boolean equation of different logic gates. 3.4 Analyze the electrical circuit for basic gates. 3.5 Describe pin and signals of different gate IC.	2	4
4	**Simplification of logic circuits** 4.1 Define Boolean algebra. 4.2 Describe the laws and rules of Boolean Algebra. 4.3 State the DE Morgan's theorems. 4.4 Derive standard SOP and POS equation from truth table. 4.5 Explain shorthand notation $Y = m_1 + m_3 + m_4 + \ldots = \Sigma (1, 3, 4 \ldots)$ and $Y = m_1 . m_3 . m_4 . \ldots = \Pi (1. 3. 4 \ldots)$ 4.6 Simplify Boolean expression and logic circuit using Boolean algebra and DE-Morgan theorem. 4.7 Define Karnaugh map. 4.8 Describe the structure and simplification methods of Karnaugh map. 4.9 Simplify up to four variable standard and nonstandard Boolean expression using Karnaugh map.	5	8
5	**Digital IC and Logic Family** 5.1 Define Logic Family. 5.2 Classify digital IC based on scale of integration.	2	5

	5.3 List the advantages of using IC in digital system. 5.4 Mention the different types of IC logic families 5.5 Explain fan-in, fan-out, noise-margin, propagation delay, TTL and CMOS logic levels and power dissipation 5.6 Describe the TTL, DTL, CMOS circuitry of NOT, NAND & NOR gates.		
6	**Combinational logic circuits** 5.7 Define Combinational logic circuit. 5.8 Explain the operation of Binary comparator circuits. 5.9 Describe the Pin diagram of commonly used 4-bit comparator ICs. 5.10 Describe the operation of parity generator and detector circuit. 5.11 Describe the logic circuit error detection and correction with humming code.	3	7
7	**Arithmetic logic circuits** 7.1 Describe the operation of half adder, full adder and 4-bit parallel adder. 7.2 Explain the operation of half Sub tractor, full Sub tractor and 4-bit subtraction circuit. 7.3 Mention the Basic principle of ALU 7.4 Describe the pin and signals of ALU chips. 7.5 Explain the operation of shift and add multiplier circuit. 7.6 List the application of combinational logic circuit.	3	7
8	**Multiplexers and Demultiplexer** 8.1 Define multiplexers and demultiplexer. 8.2 Describe the operation of 2:1, 4:1 and 8:1 multiplexer with logic diagram. 8.3 Describe the operation of 1:2, 1:4 and 1:8 demultiplexers with logic diagram. 8.4 List the use of multiplexer & demultiplexer. 8.5 Describe the Pin diagram of commonly used 4-bit comparator ICs	2	6
9	**Encoder and Decoder** 9.1 Define Encoder and Decoder. 9.2 Explain the logic circuit of 4 to 2, 8 to 3 & priority Encoder. 9.3 Analyze the logic circuit of 2 to 4, 3 to 8 decoder circuit. 9.4 Describe the pins and signals of 74138 and 74154 decoder IC. 9.5 State the working principle of LCD, LED, Seven-segment and Dot matrix display. 9.6 Sketch the diagram of commonly used 4-bit BCD encoder/driver for seven segment display of common Anode/Cathode type. 9.7 Distinguish between Decoder and Demultiplexer.	3	6
10	**Sequential logic circuits** 10.1 Define sequential logic circuit. 10.2 Describe the operation of SR latch, D Latch with truth table and timing diagram. 10.3 Mention the disadvantages of SR Latch. 10.4 Discuss positive level, negative level and edge triggering. 10.5 Explain the operation of SR Flip-Flop, JK Flip-Flop, D Flip-Flop and	5	10

	Master-slave Flip-Flop with truth table and timing diagram.		
	10.6 Define three state logic.		
	10.7 Describe the pin and signals of 7474,7476, 74273 and 74573 IC		
	10.8 List the application of different types of Flip-Flops.		
	10.9 Describe internal block diagram of 555 timer IC.		
	10.10 Explain the operation of Clock generator circuit using 555timer.		
	Total	**32**	**60**

Detailed Syllabus (Practical)

Unit	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	**Verify the truth tables of logic gates.** 1.1 Select logic gate ICs. 1.2 Select appropriate required tools, equipment's and materials. 1.3 Connect and checked the circuits as per diagram on trainer board. 1.4 Switch on the DC power supply, 1.5 Verify the truth tables.	2	2.5
2	**Observe the functions of adder & subtractor.** 2.1 Select ICs. 2.2 Draw the pin diagram and internal connection. 2.3 Draw appropriate circuits. 2.4 Select required tools, equipment and materials. 2.5 Connect and checked the circuits as per diagram on trainer board. 2.6 Switch on the DC power supply. 2.7 Verify the truth tables.	2	2.5
3	**Verify the output operation of binary 4-bit parallel adder.** **3.1 Select appropriate ICs.** 3.2 Draw the pin diagram and internal connection. 3.3 Draw appropriate circuits. 3.4 Select required tools, equipment and materials. 3.5 Connect the circuits as per diagram on trainer board. 3.6 Switch on the DC power supply, 3.7 Verify the truth tables.	1	2.5
4	**Verify the operation of binary comparator** 4.1 Draw appropriate circuits. 4.2 Select required tools, equipment and materials. 4.3 Connect and checked the circuits as per diagram on trainer board. 4.4 Switch on the DC power supply. **4.5 Verify the truth tables.**	1	2.5
5	**Observe the operation of Encoder & Decoder.** 5.1 Select appropriate ICs. 5.2 Draw the pin diagram and internal connection.	2	2.5

	5.3 Draw appropriate circuits.		
	5.4 Select required tools, equipment and materials.		
	5.5 Connect and checked the circuits as per diagram on trainer board.		
	5.6 Switch on the DC power supply.		
6	**Construct a 7 segment display driver** 6.1 Select appropriate ICs. 6.2 Draw the pin diagram and internal connection. 6.3 Select required tools, equipment and materials. 6.4 Connect and check the circuits as per diagram on trainer board. 6.5 Switch on the DC power supply, 6.6 Verify the truth tables.	**1**	**2.5**
7	**Observe the operation of Multiplexer & Demultiplexer.** 7.1 Select appropriate ICs. 7.2 Draw the pin diagram and internal connection. 7.3 Select required tools, equipment and materials. 7.4 Connect and checked the circuits as per diagram on trainer board. 7.5 Switch on the DC power supply. 7.6 Verify the truth tables.	**2**	**2.5**
8	**Verify the truth table of different S-R & D flip-flops.** **Select appropriate ICs.** 8.1 Select appropriate ICs. 8.2 Draw the pin diagram and internal connection. 8.3 Select required tools, equipment and materials. 8.4 Connect and checked the circuits as per diagram on trainer board. 8.5 Switch on the DC power supply. 8.6 Verify the truth tables. 8.7 Make D flip flop from SR Flip-Flop.	**2**	**2.5**
9	**Verify the truth table of different J-K flip-flops.** 9.1 Draw the pin diagram. 9.2 Draw appropriate circuits. 9.3 Select required tools, equipment and materials. 9.4 Connect and check the circuits as per diagram on trainer board. 9.5 Switch on the DC power supply, 9.6 Verify the truth tables. 9.7 Make D and T Flip-Flop from JK Flip-Flop	**1**	**2.5**
10	**Construct a clock generator circuit** 10.1 Draw appropriate circuits. 10.2 Select required tools, equipment and materials. 10.3 Connect and checked the circuits as per diagram on trainer board. 10.4 Switch on the DC power supply, 10.5 Observe the output wave shape.	**2**	**2.5**
	Total	**16**	**25**

Necessary Resources (Tools, Equipment and Machinery):

Sl. No.	Item Name	Quantity
1	*DC power Supply, Function generator, Oscilloscope,Digital Electronics Trainer, Power project board/ bread board*	**30 Nos**
2	7400, 74002, 7404, 7408, 7432, 7483, 7485, 7486, 7441, 7442, 7446, 7447, 7474, 7476, 74137, 74138, 74141,74157, 4511.	**10 Nos each**
3	7-segment Display Module, 555IC	**10 Nos each**
4	Resin, Soldering lead, Soldering tip, Fixable wire, Wire Brush,	**As required**

Recommended Books:

Sl No.	Book Name	Writer Name	Publisher Name & Edition
1	A Text Book of Digital Electronics	R. S. Sedha	Chand
2	**Modern Digital Electronics**	R P JAIN	
3	Digital Fundamentals	Thomas L. Floyd	
4	**Digital Electronics**	**D. R. Kaushik**	**Dhanpat Rai Publication Company**

Website References:

Sl. No.	Web Link	Remarks
1	https://www.tutorialspoint.com/	
2	https://www.electronics-tutorials.ws/	
3	https://www.youtube.com/channel/	
4	https://youtu.be/qsWkA-5grogo	
	https://youtu.be/eXyGIPrD5Qk	
	https://you.be/f-WiulYIrow	

Subject Code	Subject Name	Period per Week		Credit
26832	**Power Electronics**	**T**	**P**	**C**
		2	**3**	**3**

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skills on concept of power diode, Power transistor, Power switching devices such as IGBT, MCT, GTO, Inverter, Chopper, Cycloconverter, AC and DC drives, Photo Transistor, LDR, Solar Power system, UPS, IPS, AVR, safety & Security system which are used in about all electronic system.
Learning Outcome (Theoretical)	After Completing the subject, students will be able to: ☐ Describe Power Electronics and Power diode. ☐ State the features of power diode & Transistor. ☐ Mention the features of IGBT, MCT & GTO. ☐ Illustrate the features of Inverter. ☐ Explain the features of Choppers. ☐ State the features of Cycloconverter. ☐ Describe the features of AC and DC drives. ☐ Describe Solar Power System. ☐ State features of induction and dielectric Heating. ☐ Explain the Features of SMPS, UPS and IPS. ☐ Illustarte the features of safety system.
Learning Outcome (Practical)	**After undergoing the subject, students will be able to:** ☐ **Determine the V-I characteristics of series and parallel connected diodes.** ☐ **Determine the V-I characteristics of IGBT.** ☐ **Determine the V-I characteristics of GTO.** ☐ **Observe the operation of inverter circuit.** ☐ **Construct the step-down & step-up DC choppers and observe the operation of the choppers.** ☐ **Observe the operation of Cycloconverter.** ☐ **Determine the V-I characteristics curve of photo diode/photo transistor.** ☐ **Demonstrate the operation of a Solar system.** ☐ **Demonstrate the operation of SMPS.** ☐ **Demonstrate the operation of UPS and IPS.**

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 Mention the scope and application of power electronics. 1.3 Classify power semiconductor devices. 1.4 Describe the basic block diagram of power electronic. 1.5 Explain the Switching characteristics of different types of Power diode. 1.6 Mention the V-I characteristics of series connected diodes. 1.7 Mention the V-I characteristics of parallel connected diodes.	3	6
2	**Power Transistor** 2.1 Classify power Transistor. 2.2 Describe the construction and operation of IGBT. 2.3 Distinguish between IGBT and MOSFET. 2.4 Mention the application of IGBT. 2.5 Describe the construction and operation of MCT 2.6 Describe the construction and operation of GTO. 2.7 Explain the turn-on & turn-off process of GTO. 2.8 Mention the Advantages and disadvantages of GTO and SCR.	4	8
3	**Inverter** 3.1 Define inverter. 3.2 Mention the types of inverter. 3.3 Describe the operation of single-phase line-commutated inverter. 3.4 Describe the operation of three-phase line-commutated full-controlled inverter. 3.5 Explain single-phase parallel-capacitor commutated inverter. 3.6 Describe the operation of single-phase series inverter. 3.7 Describe the operation of three phase forced-commutated bridge inverter.	3	6
4	**Chopper** 4.1 Define Chopper. 4.2 Mention the types of Chopper. 4.3 State the principle and operation of Chopper. 4.4 Describe the operation of voltage step-down Chopper. 4.5 Explain the operation of voltage step-up Chopper. 4.6 Explain the operation of ac Chopper.	3	5
5	**Cycloconverter** 5.1 Define Cycloconverter. 5.2 Mention the types of Cycloconverter. 5.3 Describe the operation of single-phase mid-point and bridge configuration Cycloconverter. 5.4 Explain the operation of three phase circulating and noncirculating type Cycloconverter. 5.5 List the Advantages and disadvantages of different types of Cycloconverter. 5.6 Differentiate between Cyloconverter and Variable Frequency Drive (VFD).	3	5
6	**Electric drive** 6.1 Define electric drive. 6.2 Mention the types of electric drive. 6.3 List the elements of electric drive using power electronic converter. 6.4 State the basic performance equation of dc motor. 6.5 Explain the operation of single phase Half wave converter drive and	3	5

	full wave full converter drive.		
	6.6 Explain the operation of three phases Half wave converter drive (b) full wave full converter drive.		
7	**Solar Power System** 7.1 Define Photovoltaic (PV) effect. 7.2 Mention the types of PV power system. 7.3 Illustrate the principle of photo Diode and photo Transistor 7.4 Describe the operation of a solar cell. 7.5 List the materials used in solar cell. 7.6 Discuss series and parallel operation of solar cell in solar panel. 7.7 Describe the block diagram of solar energy system. 7.8 Describe the operation of various types of charge controllers.	3	5
8	**Induction and Dielectric Heating.** 8.1 Define induction and dielectric heating. 8.2 Describe the principle of induction and dielectric heating. 8.3 List the effects of frequency on induction and dielectric heating. 8.4 Mention the effects of source voltage on induction and dielectric heating. 8.5 Describe the factors for choosing frequency of induction and dielectric heating. 8.6 List the advantages and applications of Induction and dielectric heating.	4	8
9	**SMPS, UPS and IPS** 9.1 Define SMPS, UPS and IPS. 9.2 Describe the operation of SMPS with block and circuit diagram. 9.3 Explain the operation of UPS with block diagram. 9.4 Describe the operation of IPS with block diagram. 9.5 Explain the operation of automatic voltage regulator (AVR).	3	6
10	**Safety & security system** 10.1 Define electronic safety and security system. 10.2 Mention the types of fire sensors. 10.3 State the principle of electronic fire system. 10.4 Explain the operation of the fire detection system with block diagram. 10.5 Describe the operation of touch and non-touch type person (thief) detector using infrared detection system with block diagram	3	6
	Total	**32**	**60**

Detailed Syllabus (Practical)

Unit	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	**Determine the V-I characteristics of series and parallel connected diodes.** 1.1 Select an appropriate circuit, required materials, tools and equipment for the experiment. 1.1 Connect the circuit as per diagram with meters. 1.2 Check the circuit and switch on the power supply. 1.3 Record the data for V-I curve. 1.4 Plot the curve	1	5
2	**Determine the V-I characteristics of IGBT.** 2.1 Select an appropriate circuit, required materials, tools and equipment for the experiment.	1	5

	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.		
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	5
4	**Contract an inverter circuit and observe the output wave shape.** 4.1 Select an appropriate circuit for inverter. 4.2 Select required tools, equipment and materials. 4.3 Connect the circuit as per diagram with Oscilloscope. 4.4 Check the connection and switch on the power supply. 4.5 Observe the output wave shapes of the circuit.	1	5
5	**Construct a dc chopper and measure the input and output voltage** 5.1 Select an appropriate circuit for experiment. 5.2 Select required tools, equipment and materials. 5.3 Connect the circuit as per diagram. 5.4 Check the connection and switch on the power supply. 5.5 Measure the input and output voltage.	1	5
6	**Observe the operation of Cycloconverter.** 6.1 Select a Cycloconverter . 6.2 Select required tools, equipment and materials. 6.3 Connect appropriate tools, equipment and materials with Cycloconverter as per diagram. 6.4 Check the connection and switch on the power supply. 6.5 Measure the input and output frequency with frequency counter.	1	5
7	**Determine the V-I characteristics curve of photo diode and photo transistor.** 7.1 Select an appropriate circuit, required materials, tools and equipment for the experiment. 7.2 Connect the circuit as per diagram with meters. 7.3 Check the circuit and switch on the power supply. 7.4 Record the data for I-V curve with different light intensity. 7.5 Plot the curve.	1	5
8	**Observe the operation of a Solar system.** 8.1 Select an appropriate Solar system. 8.2 Select required tools, equipment and materials. 8.3 Connect appropriate tools, equipment and materials as per diagram. 8.4 Check the connection. 8.5 Observe output condition.	1	5
9	**Demonstrate the operation of SMPS.** 9.1 Select an appropriate SMPS. 9.2 Select required tools, equipment and materials. 9.3 Switch on the power supply. 9.4 Regulate input voltage and observe output voltage.	1	5
10	**Demonstrate the operation of UPS/IPS.** 10.1 Select an appropriate UPS/IPS. 10.2 Select required tools, equipment and materials. 10.3 Switch on the power supply. 10.4 Disconnect main supply and observe output condition	1	5
	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, chopper, IGBT, GTO, Photo diode, Photo Transistor, VFD, Soler panel, SMPS, UPS, IPS.	**30 Nos**

Recommended Books:

Sl No.	Book Name	Writer Name	Publisher Name & Edition
1	Power electronics	H. Rashid	Pearson
2	Power Electronics	Dr. P.S. Bimbhra	Chand
3	ELEMENTS OF POWER ELECTRONI	Philip T. Krein	OXFORD UNIVERSITY PRESS
4	Basic Electronics (Solid State)	B. L. Theraja	Chand

Website References:

I. No.	Web Link	Remarks
1	**https://www.youtube.com/channel/**	
2	**https://youtu.be/qsWkA-5grogo**	
3	**https://youtu.be/eXyGIPrD5Qk**	
4	**https://you.be/f-WiulYIrow**	
5	www.electrical4u.com	
6	www.tutorialspoint.com	