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	