Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Make Up Examinations – December 2025

Date: 26 – 12- 2025 **Time:** 9:30am – 12:30pm

School: SOE	**Program:** B. Tech (EEE)	
Course Code: EEE2019	**Course Name:** Power Electronics	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**19**	**19**	**31**	**31**	**-**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1	A power converter is designed for battery operated vehicle which is intended to feed the power back to the source during braking operation. Identify the suitable semiconductor device which is suitable in the power converter.	**2 Marks**	**L1**	**CO1**
2	In the cement industry, three phase inverter is used to control the speed and torque characteristic of induction motor. The inverter is operated using carrier based PWM techniques where the carrier frequency is greater than 100 kHz. List the suitable semiconductor switching device in the design of Inverter	**2 Marks**	**L1**	**CO1**
3	In a paper mill, A DC motor is controlled by a three phase fully controlled rectifier. During the process of rolling the paper sheet, the motor has to produce positive torque and positive speed. State the quadrant of operation of converter.	**2 Marks**	**L1**	**CO2**
4	In steel rolling mills, a DC shunt motor is controlled by a three-phase controlled rectifier, and it is required to rotate the spindle which is connected to a shaft of motor in anticlockwise direction with the positive torque. List the suitable power converter for the application.	**2 Marks**	**L1**	**CO2**

5	A battery-operated vehicle is controlled by a Chopper. It is required to operate the vehicle in Forward motoring, forward braking, reverse motoring and reverse braking mode. Identify a suitable chopper for designing the motor drive.	**2 Marks**	**L1**	**CO3**
6	In a single-phase PV grid interfacing, A step up DC-DC converter is used, and the input voltage of the converter is 200V. The turn on time and total time of the converter are 100micro sec to 200micro sec respectively. Calculate the average DC output voltage of the converter, if the turn on time is reduced to four times	**2 Marks**	**L1**	**CO3**
7	A single phase full-wave AC voltage controller is connected to an electric heater of 1kW and controlled by using phase control technique. Calculate the minimum value of RMS output voltage, if the supply voltage is single phase 230V, 50 Hz supply?	**2 Marks**	**L1**	**CO3**
8	The Inverter which is used in domestic application is connected to a 230 V DC source which is feeding a R load of 10 ohms. A single-phase half bridge inverter is used in the inverter. Calculate the fundamental power delivered to the load.	**2 Marks**	**L1**	**CO4**
9	In an oil mill, a centrifugal pump is controlled by a single-phase full bridge inverter to pump the liquid. The input voltage of a single-phase full bridge inverter is 440V DC. Calculate the RMS value of output voltage	**2 Marks**	**L1**	**CO4**
10	Comment on the %THD values of single-phase half bridge and full bridge inverters.	**2 Marks**	**L1**	**CO4**

Part B

Answer the Questions. **Total Marks 80**

11.	**a.**	Draw the circuit diagram of Step-UP chopper with R Load and explain the operation with relevant waveforms.	**10 Marks**	**L2**	**CO3**
	b.	Assume the DC series motor is controlled by a step-up chopper, if the input voltage to a chopper is 375V DC. What would be the minimum voltage of the chopper and compute Average output voltage at a duty cycle of 0.5.	**15 Marks**	**L2**	**CO3**

or

12.	**a.**	Draw the circuit diagram of Single-phase full wave AC Voltage controller with RL Load and explain the operation of the converter with relevant waveform. Comment on the RMS value of output voltage with the variation of firing angle.	**15 Marks**	**L2**	**CO3**
	b.	In an industrial application, single phase full wave AC voltage controller is used to heat the coil to melt the iron piece. If it is required to heat the metal piece to its maximum temperate. i) Suggest the optimal firing angle of the two SCRs.	**10 Marks**	**L2**	**CO3**

		ii) Compute the RMS value of output voltage for the firing of 60^0.			

13.	**a.**	Draw the Circuit Diagram of single phase full bridge converter with R Load and explain the operation with relevant output voltage and current wave forms.	**10 Marks**	**L2**	**CO4**
	b.	A single phase half bridge inverter has a resistance of 2.5Ω and input DC voltage of 50V. i) Compute the output power delivered to the load and %THD of the converter. **ii)** Compute the ratio of RMS value of fundamental to 5th Order Harmonic	**15 Marks**	**L2**	**CO4**

or

14.	**a.**	Draw the circuit diagram of 3-phase VSI and explain in detail the operation of 180^0 mode of conduction with all relevant waveforms.	**25 Marks**	**L2**	**CO4**

15.	**a.**	A SCR is having following specifications mentioned by manufacturer as follows. Maximum holding current -500mA Maximum latching current- 1000mA. Minimum gate pulse width-100µ Sec Gate pulse voltage-10V For an application, If the SCR represented in data sheet is failed to trigger when the gate pulse magnitude of 10V and gate pulse width of 80µ sec are applied when connected to a load of L= 2H and DC source voltage of 200V. Identify the problem to trigger the SCR and suggest the value of minimum gate pulse width required to trigger the SCR. Compute the gate pulse width, if load is R=100Ω, L=10mH	**15 Marks**	**L3**	**CO1**

Or

16.	**a.**	i) Explain the construction of IGBT and its switching characteristics in detail. **ii)** When the Gate to Emitter voltage of IGBT with the thresh hold voltage of 500mV working in saturation is 1000mV. If the collector current is 1mA, neglecting modulation effect, assuming IGBT to operate at saturation, Compute the value of $V_{GE.}$	**15 Marks**	**L2**	**CO1**

17.	**a.**	Draw the circuit for single phase half wave controlled rectifier with RL load and explain the operation with relevant wave forms. Derive an expression for the average value output voltage of output voltage, also comment on variation of output voltage with the firing angle.	**15 Marks**	**L2**	**CO2**

Or

18.	**a.**	A 30A, 470V and 875rpm Crompton DC shunt motor is used in steel rolling mills for coiler operation. This motor is controlled by three phase fully controlled converter. The value of armature winding resistance is 1Ω and inductance is 1mH. The supply specifications are 3-ϕ, 440V, 50 Hz supply. It is required to rolling the sheet by rotating the spindle at a speed of 600 rpm and -800rpm. i) Suggest the range of firing angle, if the speed of the motor is negative. ii) Compute the average value of output voltage, if the firing angle is $120^{0.}$ iii) Draw the output voltage and output current quadrant diagram	**15 Marks**	**L3**	**CO2**

***** BEST WISHES *****