Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 17 – 12- 2025 **Time:** 01:00pm – 04:00pm

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	**24**	**24**	**12**	**14**	**26**

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	In a 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. Suggest the suitable semiconductor switching device in the design of Inverter	**2 Marks**	**L1**	**CO1**
2	Comment on forward break over voltage, if the doping level of middle layers of SCRs are increased?	**2 Marks**	**L1**	**CO1**
3	A three phase half controlled bridge with an input ac supply of three phase 400 V, 50 Hz and connected to a resistive load of 20 ohms. The firing angle of the converter is 30 degrees. Compute the approximate input power factor by neglecting the converter losses.	**2 Marks**	**L1**	**CO2**
4	In a wood cutting application, A DC shunt motor is controlled by a single phase controlled rectifier. The supply specifications are Single phase 230V, 50Hz. The motor specifications are Ra=10ohms, La=1mH and Eb=100V. Compute the minimum firing angle of the rectifier.	**2 Marks**	**L1**	**CO2**

5	If the value of load inductor is not large, what would be the nature of output current?	**2 Marks**	**L1**	**CO3**
6	List out the applications of AC Voltage regulator	**2 Marks**	**L1**	**CO4**
7	Phase control is used to control the AC Voltage Controller, Comment on the reactive power consumption in the system with respect to firing angle.	**2 Marks**	**L1**	**CO4**
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 full bridge inverter is used in the inverter. Compute the fundamental power delivered to the load.	**2 Marks**	**L1**	**CO5**
9	Mention the industrial Applications of Inverters	**2 Marks**	**L1**	**CO5**
10	In an oil mill, a centrifugal pump is controlled by a single phase half bridge inverter to pump the liquid. The input voltage of a single phase half bridge inverter is 440V DC. What would be the RMS value of output voltage.	**2 Marks**	**L1**	**CO5**

Part B

Answer the Questions. **Total Marks 80**

11.	**a.**	A battery operated vehicle is controlled by a chopper and is connected to separately excited DC motor. The battery pack is made up of Li-Ion of voltage 220V DC. The motor specifications are 375V, 950 rpm, 30A and Armature resistance of 0.5 ohms. **i)** If It is required to control the motor at full rated torque and 700 rpm, Compute the duty cycle of the chopper. **ii)** Comment on the value of duty cycle, if the motor operates at rated speed.	**10 Marks**	**L3**	**CO3**
	b	A single phase AC Voltage controller is fed with 230V, 50 Hz supply and connected to a 1 kW, 230V heater. Assume the Power controllers as unidirectional and bidirectional Ac Voltage controllers, **Compute the following for both the controllers on following parameters** I. Range of Voltage control II. RMS value of output voltages at the firing angle of 30^0 III. Input power factor at the firing angle of 30^0	**10 Marks**	**L3**	**CO4**

or

12.	**a.**	A Step down DC chopper has a resistive load of **20 Ω** and input voltage **Vs = 220 V**. When the chopper is ON, its voltage drop is **1.5 V** and the chopping frequency is **10 kHz**. If the duty cycle is **80%**, i) Compute the average output voltage and the chopper ON time. ii) Compute the maximum voltage obtained by the chopper iii) Comment on variation of average output voltage by varying the duty cycle.	**10 Marks**	**L3**	**CO3**
	b	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	**10 Marks**	**L3**	**CO4**

13.	**a.**	Draw the circuit diagram and explain the operation of single phase half bridge inverter with R Load with relevant waveforms.	**10 Marks**	**L2**	**CO5**
	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 RMS value of 3^{rd} Order harmonic component.	**10 Marks**	**L2**	**CO5**

or

14.	**a.**	Draw the circuit diagram of 3-phase VSI and explain in detail the operation of 120^0 mode of conduction with all relevant waveforms.	**20 Marks**	**L2**	**CO5**

15.	**a.**	A VS-VSK.230.PbF series SCR datasheet is provided to design a firing circuit to turn on the SCR. The specifications are as follows Maximum average on state current at 850 C is 230A Low level of thresh hold voltage – 1.03V High level of thresh hold voltage - 1.08V Maximum on state voltage drop - 1.59V 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	**20 Marks**	**L2**	**CO1**

		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.			

Or

16.	**a.**	i) Explain the constructions of SCR ii) Describe the different modes of operation of a thyristor with the help of its V-I characteristics	**20 Marks**	**L2**	**CO1**

17.	**a.**	A 220V, 10.5A, 1300rpm DC shunt motor is used for wood cutting application and its armature resistance is 0.5ohms, inductance is 5mH and back emf of 100V. The motor is controlled by a single phase fully controlled rectifier is fed from 1-ϕ 230V, 50Hz supply. While carving a wooden piece at half rated torque, T1, T2 are fired at $\omega t=10^0$ or $\alpha=10^0$. It is found that the thyristors couldn't be fired at that angle and successfully triggered for the values of firing angles greater than 180^0. **i)** Identify the problem in rectifier control circuit. **ii)** Compute the average output voltage of the rectifier, if the firing angle is 60^0	**20 Marks**	**L3**	**CO2**

Or

18.	**a.**	Draw the circuit diagram of single phase fully controlled rectifier with RL Load, sketch the relevant waveform and explain the operation in Rectifying mode and inversion mode. Derive the Average output voltage of the converter.	**20 Marks**	**L2**	**CO2**