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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations JANUARY-2025** |
| **Date:** 10- 01-2025 **Time:** 09:30 am – 12:30 pm |

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

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

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | While designing a Chopper for a battery-operated vehicle, the features of high input impedance and low on state power loss are desirable. Identify a suitable semiconductor device which is suitable in the power converter. | **2 Marks** | **L1** | **CO1** |
| **2** | The capacitance of reversed biased junction J2 in a thyristor is CJ2 = 20 pF and can be assumed to be independent of the off-state voltage. The limiting value of the charging current to turn on the thyristor is 18 mA. What is the critical value of dv/dt? | **2 Marks** | **L1** | **CO1** |
| **3** | In a medium voltage drive application, three phase 6-pulse rectifier is used as a front-end rectifier. The input frequency to the rectifier is 50Hz. What will be the ripple frequency of average DC output voltage of the rectifier? | **2 Marks** | **L1** | **CO2** |
| **4** | A three phase fully controlled converter is fed from three phase 400V,50Hz Delta connected transformer. Calculate the maximum average output voltage of the converter? | **2 Marks** | **L1** | **CO2** |
| **5** | In route 18, TRAM cars are used for urban transportation in Kolkata. If the DC-DC converter is to control the traction motor in the TRAM, suggest the better method to control the output voltage. | **2 Marks** | **L1** | **CO3** |
| **6** | An induction heater is controlled by a single phase fullwave AC voltage controller connected to heat the metal piece. The specifications of the source are single phase 230V, 50Hz, AC supply and load is 3kW. What would be the average value of thyristor current? | **2 Marks** | **L1** | **CO3** |
| **7** | A single phase 230V, 50Hz fullwave AC voltage controller is connected a load of R=10ohms and L= 10mH and controlled by using phase control technique. Suggest a suitable firing angle for successful operation of the controller. | **2 Marks** | **L1** | **CO3** |
| **8** | 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. What would be the RMS value of output voltage | **2 Marks** | **L1** | **CO4** |
| **9** | Justify why Thyristors are not preferred for Inverters? | **2 Marks** | **L1** | **CO4** |
| **10** | Identify the parameter in which the RMS value of output voltage of single-phase full bridge inverter depends on? | **2 Marks** | **L1** | **CO4** |

**Part B**

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| **Answer the Questions. Total Marks 80** | | | | | |
| **11.** | **a.** | Draw the circuit diagram of Step-Down chopper with R Load and explain the operation with relevant waveforms. | **15 Marks** | **L2** | **CO3** |
|  |  | 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 period of the converter are 100micro sec 200micro sec respectively. Compute the average DC output voltage of the converter, if the turn on time is reduced to four times. | **10 Marks** | **L2** | **CO3** |
| **or** | | | | | |
| **12.** | **a.** | Draw the circuit diagram of Single phase half 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 half 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.   1. Suggest the optimal firing angle of the two SCRs. 2. Compute the RMS value of output voltage for the firing of 800. | **10 Marks** | **L3** | **CO3** |
|  |  |  |  |  |  |
| **13.** | **a.** | A single phase full bridge inverter has a resistance of 10Ω and input DC voltage of 100V.   1. Compute the output power delivered to the load and %THD of the converter. 2. Compute the RMS value of 5th Order harmonic component. | **25 Marks** | **L2** | **CO4** |
| **or** | | | | | |
| **14.** | **a.** | Draw the circuit diagram of 3-phase VSI and explain in detail the operation of 1200 mode of conduction with all relevant waveforms. | **25 Marks** | **L2** | **CO4** |

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| **15.** | **a.** | 1. Explain the construction of MOSFET and its switching characteristics in detail. 2. When the gate – to – source voltage (VGS) of a MOSFET with threshold voltage of 400 mV, working in saturation is 900 mV, the drain current is observed to be 1 mA. Neglecting the channel width modulation effect and assuming that the MOSFET is operating at saturation, Compute the drain current, if the VGS of 1400 mV is applied. | **15**  **Marks** | **L** | **CO1** |
| **Or** | | | | | |
| **16.** | **a.** | 1. Mention the different turn on methods employed to turn on SCR. 2. Sketch and describe switching characteristics of SCR in Detail. | **15**  **Marks** | **L2** | **CO1** |

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| **17.** | **a.** | A single phase full converter feeds power to RLE load with R= 6Ω, E=60V. The full load inductance value is very large so as to maintain the load current continuous and ripple free .The ac source voltage is 230V and 50Hz. Find the average value of the output voltage for a firing angle delay of 50°. | **15**  **Marks** | **L2** | **CO2** |
| **Or** | | | | | |
| **18.** | **a.** | Draw the circuit diagram of single phase half controlled rectifier with RL Load, sketch the relevant waveform and explain the operation in Rectifying mode. Derive the Average output voltage of the converter and Comment on the variation of output voltage with firing angle. | **15**  **Marks** | **L2** | **CO2** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***