

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fifth Semester

Electrical and Electronics Engineering
20EEPC502 - POWER ELECTRONICS

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

Marks	K-Level	CO
1	K1	CO1

- In a Thyristor
 - The Holding current is greater than the Latching current
 - The Latching current is greater than the Holding current
 - Both the currents are equal
 - None of the above
- Which of the following terminals does not belong to the MOSFET?
 - Base
 - Drain
 - Source
 - Gate
- The GTO can be turned off
 - by a positive gate pulse
 - by a negative gate pulse
 - by a negative anode-cathode voltage
 - by removing the gate pulse
- Why resistor is used in Snubber circuit?
 - To minimize the discharging current
 - To minimize the charging current
 - To minimize the losses
 - All of these
- In a full controlled bridge converter
 - one SCR conducts at a time
 - two SCRs conduct at a time
 - three SCRs conduct at a time
 - four SCRs conduct at a time
- Each diode of a 3-phase, 6-pulse bridge diode rectifier conducts for
 - 60°
 - 90°
 - 120°
 - 180°
- In a 3-phase full wave converter, if V is the maximum value of line voltage at the input, then each SCR is subjected to a peak negative voltage of
 - V
 - 2V
 - 3V
 - $\sqrt{3}V$
- The effect of source inductance on the performance of a 3-phase controlled converter is to
 - increase the average load voltage
 - reduce the average load voltage
 - make the load current continuous
 - remove ripples from the load current
- A chopper may be thought as a/an
 - Inverter with DC input
 - DC equivalent of an AC transformer
 - Diode rectifier
 - DC equivalent of an induction motor
- Which device can be used in a chopper circuit?
 - BJT
 - GTO
 - MOSFET
 - All of the above.
- The load voltage of a chopper can be controlled by varying the
 - duty cycle
 - firing angle
 - reactor position
 - extinction angle
- Find the output voltage of the Boost converter if the supply voltage is 156 V and duty cycle value is 4.
 - 250 V
 - 260 V
 - 270 V
 - 280 V
- In inverter, what is the role of MOSFET?
 - It blocks the resistance
 - It blocks the forward voltage
 - It converts AC to DC power
 - It blocks the resistance
- In Voltage Source Inverter (VSI), the devices used are
 - Unipolar and Unidirectional
 - Unipolar and Bidirectional
 - Bipolar and Unidirectional
 - Bipolar and Bidirectional

- | | | | |
|---|---|----|-----|
| 15. In pulse width modulated inverters, the output voltage is controlled by controlling the | 1 | K2 | CO4 |
| (a) input frequency (b) modulating index | | | |
| (c) amplification factor (d) none of the mentioned | | | |
| 16. A three-phase bridge inverter requires minimum of _____ switching devices | 1 | K1 | CO4 |
| (a) 4 (b) 6 (c) 8 (d) 10 | | | |
| 17. In AC voltage controllers, the | 1 | K1 | CO5 |
| (a) variable ac with fixed frequency is obtained | | | |
| (b) variable ac with variable frequency is obtained | | | |
| (c) variable dc with fixed frequency is obtained | | | |
| (d) variable dc with variable frequency is obtained | | | |
| 18. The principle of three phase cycloconverter is to | 1 | K2 | CO5 |
| (a) add and remove number of SCRs | | | |
| (b) vary progressively the firing angle of the devices | | | |
| (c) keep the firing angle as 0° for all the devices | | | |
| (d) none of the mentioned | | | |
| 19. The AC voltage controllers are used in _____ applications | 1 | K1 | CO5 |
| (a) power generation (b) electric heating (c) conveyor belt motio (d) power transmission | | | |
| 20. A single-phase half wave voltage controller consists of | 1 | K1 | CO5 |
| (a) one SCR is parallel with one diode (b) one SCR is anti parallel with one diode | | | |
| (c) two SCRs in parallel (d) two SCRs in anti parallel | | | |

PART - B ($10 \times 2 = 20$ Marks)

Answer ALL Questions

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|---|---|----|-----|
| 21. Compare IGBT with MOSFET. | 2 | K2 | CO1 |
| 22. List the merits and demerits of GTO. | 2 | K1 | CO1 |
| 23. Express the displacement factor for two pulse converter. | 2 | K1 | CO2 |
| 24. Outline the role of freewheeling diode in a full converter. | 2 | K2 | CO2 |
| 25. What are the control strategies of chopper? | 2 | K2 | CO3 |
| 26. State the applications of chopper. | 2 | K1 | CO3 |
| 27. What is Space Vector Modulation? | 2 | K1 | CO4 |
| 28. Why thyristors are not preferred for Inverter? | 2 | K2 | CO4 |
| 29. Write few industrial applications of cycloconverters. | 2 | K1 | CO5 |
| 30. What is power factor control in AC voltage regulators? | 2 | K1 | CO5 |

PART - C ($6 \times 10 = 60$ Marks)

Answer ALL Questions

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|--|----|----|-----|
| 31. a) Illustrate the basic structure, working and the turn on and turn off processes of IGBT with its equivalent circuit. | 10 | K2 | CO1 |
| OR | | | |
| b) Summarize the various types of commutation circuits for SCR. | 10 | K2 | CO1 |
| 32. a) Describe the operation of three phase semi converter with R load and also draw the output voltage waveforms for 30° and 90° . | 10 | K2 | CO2 |
| OR | | | |
| b) Discuss the effect of series inductance on the performance of the single phase full converter indicating clearly the conduction of various thyristors during one cycle. | 10 | K2 | CO2 |
| 33. a) Explain the four quadrant operation of the class E chopper with neat diagram. | 10 | K2 | CO3 |

OR

- b) Draw and explain the schematic block of SMPS and mention its advantages over linear power supply. 10 K2 CO3
34. a) Describe the operation of 3 phase bridge inverter for 120 degree mode of operation with aid of relevant phase and line voltage waveforms. 10 K2 CO4
- OR**
- b) Outline the operation of single phase capacitor commutated CSI with R load. 10 K2 CO4
35. a) A single phase AC voltage controller has input voltage of 230V 50Hz and a load of $R=15\ \Omega$. For 6 cycles ON and 4 cycles OFF, calculate (i) RMS output voltage, (ii) Input power factor. 10 K3 CO5
- OR**
- b) Construct the 3 phase to 3 phase cycloconverter circuit, explain the working and develop the relevant waveforms of it. 10 K3 CO5
36. a) i) Compare the sinusoidal PWM and modified sinusoidal PWM techniques. 5 K2 CO4
- ii) Explain the need for multi stage sequence control of ac voltage controller. 5 K2 CO5
- OR**
- b) i) Discuss the induction heating principles. 5 K2 CO4
- ii) Describe the merits and demerits of the matrix converter. 5 K2 CO5