

**POWER ELECTRONICS & DRIVES
(AEIE 4102)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) A thyristor (SCR) is a
(a) P-N-P device (b) N-P-N device
(c) P-N-P-N device (d) P-N device.
- (ii) In forward blocking mode of SCR, the number of forward biased junction is
(a) 1 (b) 2 (c) 3 (d) 4.
- (iii) In a controlled rectifier a freewheeling diode is necessary if the load is
(a) inductive (b) resistive
(c) capacitive (d) all of these.
- (iv) Which of the following is not a current triggered device?
(a) Thyristor (b) BJT (c) Triac (d) MOSFET.
- (v) The average output voltage is maximum, when SCR is triggered at $\omega t =$
(a) π (b) 0 (c) $\pi/2$ (d) $\pi/4$.
- (vi) For a half wave bridge inverter, the output voltage
(a) $V_o = -V_s/2$ for $0 < t < T/2$ (b) $V_o = -V_s/2$ for $T/2 < t < T$
(c) $V_o = -V_s$ for $0 < t < T/2$ (d) $V_o = V_s/2$ for $T/2 < t < T$.
- (vii) A step-up chopper has V_s as the source voltage and k as the duty cycle. The output voltage for this chopper is given by
(a) $V_s (1 + k)$ (b) $V_s / (1 - k)$
(c) $V_s (1 - k)$ (d) $V_s / (1 + k)$.
- (viii) For a step down cyclo-converter the correct relation between the frequencies of the source voltage & output voltage is:
(a) $f_o = f_s/2$ (b) $f_o = f_s$
(c) $f_o = 2f_s$ (d) $f_o < f_s$.

- (ix) Power MOSFETs find applications in
(a) low power low frequency applications
(b) low power high frequency applications
(c) high power low frequency applications
(d) high power high frequency applications.
- (x) A cyclo-converter can be considered to be composed of two converters
(a) connected back to back (b) series connected
(c) parallel connected (d) series- parallel connected.

Group - B

2. (a) Explain the operation of Power BJT with a neat Diagram. How should the two junctions of a Power BJT be biased so that it can work as a switch?
(b) Why are VMOS and UMOS structures able to withstand a higher current than conventional MOSFET?
(4+4) + 4 = 12
3. (a) Draw the V-I characteristics of TRIAC.
(b) State the different advantages and disadvantages of TRIAC.
(c) State and explain some of the application of TRIAC.
4 + 4 + 4=12

Group - C

4. (a) Explain the two-transistor analogy of thyristor. Derive an equation for anode current.
(b) How do you protect the thyristor from over voltages and currents? Explain the various protection schemes available now-a-days.
(4+2) + (2+4) = 12
5. (a) What is thyristor? Give the constructional details of a thyristor and schematic diagram.
(b) How positive feedback takes place during turn on of SCR?
(2 + 6) +4=12

Group - D

6. (a) Explain single phase full controlled bridge rectifier for RL load with suitable voltage and current wave forms. Derive the expression for average output voltage and current.
(b) A single phase 230V, 1 Kw heater is connected across 1 phase 230V, 50Hz supply through an SCR. For firing angle delay of 45° and 90°, calculate the power absorbed in the heater element.
(4 + 2) +6=12

7. (a) What is meant by inverter? What are the main classifications of inverter? What are the applications of an inverter?

(b) Compare between CSI and VSI.

(3+3+3) +3=12

Group - E

8. (a) What is the function of a cyclo-converter? Explain the operation of single phase step down cyclo-converter.

(b) In which application of AC motor drive will you prefer inverter and which ones cyclo-converter? Justify.

(2+4) + 6= 12

9. (a) With neat circuit diagram explain a step up chopper with resistive load.

(b) A single -phase bridge type cyclo-converter has input voltage of 230 V, 50 Hz and load of $R = 10 \Omega$. Output frequency is one-third of input frequency. For a triggering angle of 30° , calculate (i) rms value of output voltage, (ii) rms current of each onverter, (iii) rms current of each thyristor and (iv) input power factor.

4 +(2+2+2+2)=12

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/OTMyNDgzNjcyODVa/a/Mjc0MDQyNjc1MMDMy/details