

Total No. of Questions : 8]

SEAT No. :

**P3921**

**[4758] - 543**

[Total No. of Pages : 4

**T.E. (E & TC Engineering)**  
**POWER ELECTRONICS**  
**(2012 Pattern) (Semester - II)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.*
- 2) Neat diagrams and wave forms must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Using of nonprogrammable calculator is allowed.*
- 5) Assume suitable data if necessary.*

- Q1)** a) Draw two transistor analogy of SCR and derive an expression for its anode current  $I_A$ ? [7]
- b) Draw & explain single phase fully controlled rectifier (full converter) for R-L load with various o/p voltage waveforms. [7]
- c) Single phase full bridge inverter is operated from 48V dc supply, it has a resistive load of  $R = 2.4\Omega$ . Find : [6]
- i) rms o/p voltage at fundamental frequency (VO1)
  - ii) rms o/p power
  - iii) rms o/p voltages at second & third harmonic (VO2 & VO3)

OR

- Q2)** a) Draw construction diagram of n-channel enhancement type MOSFET and explain its steady state characteristics. [7]
- b) Draw & explain three phase half controlled bridge converter for R load with o/p voltage waveforms. [7]

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- c) Compare  $120^\circ$  mode with  $180^\circ$  mode in three phase inverter for balanced star R load. [6]

**Q3) a)** Explain operation of step up chopper with circuit diagram and derive an expression for its o/p voltage :  $V_o = \frac{V_s}{(1-D)}$  where D is duty cycle. [6]

- b) A DC chopper with R-L load is operated from 220V dc supply. The load parameters are  $R = 5\ \Omega$  ,  $L = 7.5\text{ mH}$  and chopping frequency  $F_c = 1\text{KHz}$ . If peak to peak load ripple current is maximum, calculate : [6]

- i) Maximum instantaneous load current
- ii) Minimum instantaneous load current
- iii) Peak to peak load ripple current
- iv) Average load current

- c) Explain various control strategies in DC chopper. [6]

OR

**Q4) a)** Explain operation of four quadrant chopper with circuit diagram. [6]

- b) Explain with block schematic working of SMPS. What are its advantages over linear power supply. [6]

- c) A single phase full wave ac voltage controller has a resistive load of  $R = 10\ \Omega$  and the input voltage is  $V_s = 120\text{ V(rms)}$ , 50 Hz. The delay angles of thyristors T1 and T2 are equal :  $\alpha_1 = \alpha_2 = \pi/2$ . Determine [6]

- i) the rms output voltage
- ii) the rms output current
- iii) the input PF

- Q5) a)** Explain with block schematic working of On-line & off-line UPS. [8]
- b) The speed of a separately excited dc motor (armature) is controlled by a 1- $\phi$  semi-converter. The field current is also controlled by a 1- $\phi$  semi-converter and is set to its maximum possible value. The ac supply to both armature & field converters is single phase 208V, 60Hz. The armature resistance  $R_a = 0.25\Omega$ , field resistance  $R_f = 147\Omega$ . The motor voltage constant  $K_v = 0.7032$  V/A. rad/s, the armature & field currents are continuous & ripple free. If load torque  $T_L = 45$  N-m at 1000 rpm, calculate: [8]
- i) Field current  $I_f$
  - ii) Back emf  $E_g$
  - iii) Firing angle of converter in armature circuit
  - iv) Input power factor of armature circuit converter.

**OR**

- Q6) a)** Explain voltage & frequency control method for 3- $\phi$  induction motor drive in detail. [8]
- b) What are advantages of electronic ballast over conventional ballast? Explain working of electronic ballast with block schematic. [8]
- Q7) a)** What is EMI? Explain various sources & minimizing techniques of EMI. [6]
- b) For a thyristor, Maximum junction temperature is  $125^\circ\text{C}$ . The thermal resistances are  $\theta_{JC} = 0.16$ ,  $\theta_{CS} = 0.08^\circ\text{C/W}$ . for heat sink temperature of  $70^\circ\text{C}$ , calculate total average power loss in thyristor - sink combination. If heat sink temperature is reduced to  $60^\circ\text{C}$ , find new total average power loss in thyristor - sink combination. [4]
- c) Write a note on “over voltage protection” in power electronics. [6]

**OR**

- Q8)** a) What is the need of resonant converter? Explain ZCS resonant converter with circuit & waveforms. **[8]**
- b) Explain SLR half bridge dc-dc converter in low frequency with suitable waveforms. **[8]**

