Total No. of Questions : 8] SEAT No. :

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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 120^0 mode with 180^0 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 : $Vo = \frac{Vs}{(1-D)}$ 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 Ω , L = 7.5 mH and chopping frequency Fc = 1KHz. 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 vlotage controller has a resistive load of R = 10 Ω and the input voltage is Vs = 120 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 -ϕ semi-converter. The field current is also controlled by a 1-ϕ 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 Ra = 0.25Ω, field resistance R_f = 147Ω. The motor voltage constant Kv = 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 Eg

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-ϕ 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 125^0C. The thermal resistances are $\varnothing_{JC} = 0.16$, $\varnothing_{CS} = 0.08^0$C/W. for heat sink temperature of 70^0C, calculate total average power loss in thyristor - sink combination.

If heat sink temperature is reduced to 60^0C, 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]**