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RM-7089

B. E. - III (Sem. VI) (EC/ECC) Examination

May / June – 2010

Industrial Electronics

Time : **3** Hours] [Total Marks :

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 3 (Sem. 6) (EC/ECC)**

Name of the Subject :

☛ **Industrial Electronics**

☛ Subject Code No. : **7 0 8 9** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Attempt all questions.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

SECTION - I

1 (a) Answer the following :

(i) The full form of IGBT is _____.

(ii) What is the function of free-wheeling diode?

(iii) State the different modes of operation of thyristor.

(iv) What is the need of series opertion of SCR_S?

(v) SCRs with fast turn-off time are called_____ grade SCRs.

(vi) Define holding current.

(vii) True/False : Once SCR starts conducting a forward current, its gate losses control over anode circuit voltage and current.

(viii) Explain overlap angle.

(ix) Snubber circuit is used for _____ protection.

(x) In a single phase full controlled converter average output voltage is given by _____.

(b) (i) Explain the thyristor turn-on methods. **7**

(ii) explain dv/dt protection of thyristor. **3**

2 (a) Classify different methods of communication for thyristor. Explain each in brief. 8

(b) Latching current for an SCR, inserted in between a dc voltage source of 250 v and the load, is 100 mA. Compute minimum width of gate pulse current required to turn-on this SCR in case the load consist of (a) L = 0.2 H, (b) R = 20 Ω in series with L = 0.2 H and (c) R = 20 Ω in series with L = 2.0 H. 7

OR

2 (a) Explain construction and operation in various modes of TRIAC. 8

(b) It is required to operate 200-A SCR in parallel with 300-A SCR with their respective on-state voltage drops of 1.6 V and 1.2 V. Calculate the value of resistance to be inserted in series with each SCR so that they share the total load of 500-A in proportion to their current ratings. 5

(c) Explain in brief a process of commutation failure. 2

3 Attempt any **three** : 15

(i) Explain ideal dual converter.

(ii) A 230 V - 50 Hz, one pulse SCR controlled converter is triggered at a firing angle of 50 and the load current extinguishes at an angle of 210°. Find the circuit turn-off time, average O/P voltage and average load current for

(a) R = 5 Ω and L = 2mH

(b) R = 5 Ω, L = 2mH and E = 110 V.

(iii) Explain principle of phase control. Find average load current for single phase half-wave circuit.

(iv) A 3-phase half-wave controlled converter is fed from 3-phase, 400 V, 50 Hz source and is connected to load taking a constant current of 36A. Thyristor have a voltage drop of 1.4 V.

(a) Calculate average value of load voltage for a firing angle of 30° and 60°.

(b) Determine average and rms current ratings as well as PIV of thyristors.

(c) Find the average power dissipated in each thyristor.

SECTION - II

4 Attempt all questions in brief and precisely. **14**

(i) Define and explain, briefly current limit control for choppers. **2**

(ii) To get double output voltage what should be value of duty cycle for step up choppers? **2**

(iii) Justify : Sinusoidal pulse width modulation based inverter is better compared to a single and multi pulse width modulation based inverters. **2**

(iv) Differentiate voltage fed inverter and current fed inverters. **2**

(v) Define commutation in thyrister and explain its significance. **2**

(vi) Why load commutation is also called as self or resonant commutation? **2**

(vii) A chopper has Vs = 200 V as source voltage, R as load resistance = 10 ohm and α = 0.6 is the duty cycle. What is average and rms value of thyristor currents? **2**

5 Atttempt any **three** : **18**

(i) Describe the principel of step-up chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle. Clearly state assumptions made. sketch the input voltage, input current, output voltage and output current wave forms.

(ii) Explain load commutated chopper with the help of neat diagram, waveforms and taking reference of different modes of operation.

(iii) For type a chopper circuit, source voltage Vs = 220 V, chopping frequency f = 500 Hz, Ton = 900 μ s, R = 1.5 ohm, L = 1 mH and E = 85 volts.

(a) Find whether load current is continuous or not.

(b) Calculate the values of average output voltage and average output current.

(c) Compute the maximum and minimum values of steady state output current.

(d) Sketch the time variations of gate signal i_g, load current i_o, load voltage v_o, thyristor current i_T. Free wheeling diode current i_{fd} and voltage across thyristor v_T.

(iv) The voltage-communtated chopper has the following parameters : V_s = 200 volts Load R = 1 ohm, L = 2.0 mH and E = 40 volts.

Communication circuit parameters : L = 20 μ H, C = 50 μF, Ton = 700μs, T = 2500 μs.

For a constant load current of 80A, compute the following :

(a) Effective on period, (b) Peak currents through main thyristor T1 and auxiliary thyristor TA. (c) Turn off times for T1 and TA. (d) Total Communication interval. (e) capacitive voltage, 150 μs after : TA is triggered. (f) Time needed to recharge the capacitor to voltage Vs.

6 (a) Decribe multiple pulse modulation inverters with the help of neat diagram and waveforms; explain method of generating multiple pulses for inverter. Derive expression for width of pulse for this case, in terms of reference signal amplitude and carrier signal amplitude. **9**

(b) A single-phase full bridge inverter is connected on to an RL load. For a DC source voltage of Vs and output frequency f = 1/T, obtain expressions for load current as a function of time for the first two half cycles of output voltage. Also, derive expression for steady state current. For such inverter R = 25 ohm, L = 0.2 H obtain current expressions for load current in case source voltage is 240 V dc and frequency of output voltage is 50 Hz. **9**

OR

6 (a) Explain modified McMurray half bridge inverter, with the help of neat diagram and taking reference of different mode of operation. Draw necessary waveforms and neat sketch. **9**

(b) For a single-phase full bridge inverter, Vs = 230 V DC, T = 1.5 ms. The load consist of R,L,C in series with R=1 Ohm X_L = 5 ohm, X_c = 8 Ohm.

(i) Draw the waveform for load voltage, fundamental component of load current, source current and voltage across thyristor. Indicate clearly devices under conduction.

(ii) Find power delivered to load due to fundamental component, derive formula used.