



RI-7089-7090

B. E. III (Sem. VI) (ECC) Examination

April / May - 2007

Industrial Electronics

Time : 3 Hours]

[Total Marks : 100

RI-7089

Instructions :

(1)

नीचे दशांशके निशानीवाणी विगतो उत्तरवही पर अवश्य लपवी.  
Fillup strictly the details of signs on your answer book.

Name of the Examination :  
B. E. 3 (Sem. 6) (ECC)

Name of the Subject :  
Industrial Electronics

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

Seat No. :  
[ ] [ ] [ ] [ ] [ ] [ ]

Student's Signature

- (2) Attempt all questions.
- (3) Figures to right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Use scientific calculator Casio Fx 82/83 or equivalent.

1 (a) Answer the following :

10

- (1) During overlap angle  $\mu$  in single phase fully controlled rectifier, \_\_\_\_\_ devices are conducted at a time.
- (2) Thyristor is \_\_\_\_\_ layer and \_\_\_\_\_ junction device.
- (3) In single phase semiconductor the average output voltage is given by \_\_\_\_\_.

- (4) In single phase half wave rectifier with RLE load the firing angle can be varied between \_\_\_\_\_ and \_\_\_\_\_.
- (5) For inductive load in controlled rectifier the value of extinction angle is \_\_\_\_\_ than  $\pi$  (grater, less)
- (6) (State True / False)
- (1) In semiconductor the average output voltage is negative for firing angle is more than 90 degree.
- (2) The SCR requires continuous gate pulse.
- (7) In three phase controlled rectifier with R-L load, average output voltage is zero at the firing angle equal to \_\_\_\_\_.
- (8) Single phase semiconverter is one quadrant converter. Justify the statement.
- (9) The average o/p voltage of 3 phase full converter in terms of line to line voltage  $V_{LL}$  is given by \_\_\_\_\_.

(b) (1) Explain working of Snubber circuit and derive equation for its design. 5

(2) Explain ideal dual converter with wave forms. 5

2 (a) String of four series-connected thyristors is provided with static and dynamic equalizing circuits. This string has to withstand an off-state voltage of 10 kV. The static equalizing resistance is 25000  $\Omega$  and the dynamic equalizing circuit has  $R_C = 40 \Omega$  and  $C = 0.08 \mu F$ . The leakage currents for four thyristors are 21 mA, 25 mA, 18 mA and 16 mA respectively. Determine voltage across each SCR in the off state and the discharge current of each capacitor at the time of turn-on. 6

- (b) Explain basic structure of IGBT. Also explain working of it using equivalent circuit. 6
- (c) Discuss the condition which must be satisfied for turning-on an SCR with a gate signal. 3

OR

- 2 (a) A relaxation oscillator, using a UJT is to be designed for triggering an SCR. The UJT has the following data :  $\eta = 0.7$ ,  $I_p = 0.5 \text{ mA}$ ,  $V_p = 15.0 \text{ V}$ ,  $V_v = 0.8 \text{ V}$ ,  $I_v = 2 \text{ mA}$ ,  $R_{BB} = 6 \text{ k}\Omega$ , normal leakage current with emitter open = 3 mA, the firing frequency is 1.5 kHz. For  $C = 0.5 \mu\text{F}$ , compute the values of charging resistor and the external resistor connected in the base circuits. Also calculate the maximum and minimum values of  $R$  and the corresponding frequencies. 10
- (b) Classify different methods of commutations for thyristors. Explain class A commutation. 5
- 3 (a) For three phase full converter bridge derive the expression with source inductance effect 10

$$\cos(\alpha + \mu) = \cos \alpha - \frac{2W L_S I_0}{\sqrt{2} V_{LL}}$$

$\mu$  = overlap angle

$\alpha$  = firing angle

$L_S$  = source inductance.

- (b) Draw the circuit diagram and waveform for single phase semiconverter for discontinuous conduction for  $\beta < \pi$  and  $\pi < \beta < \pi + \alpha$ . The load is RLE. 5

OR

- 3 (a) A dc battery is charged through a resistor  $R$  using single phase half wave controlled rectifier. Derive an expression for the average value of charging current in terms of  $V_m$ ,  $E$ ,  $R$  etc on the assumption that SCR is fired continuously. 10
- (a) For an ac source voltage of 230 V, 50 Hz find the value of average charging current for  $R = 8 \Omega$  and  $E = 150 V$ .
- (b) Find the power supplied to battery and that dissipated in resistor.
- (c) Calculate supply power factor.
- (b) Explain center-tapped single phase full wave converter with RL load continuous conduction. Draw the waveform for output voltage, load current, voltage across thyristors. 5

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Name of the Examination :  
B. E. 3 (Sem. 6) (ECC)

Name of the Subject :  
Industrial Electronics

Subject Code No. : 7 0 9 Section No. (1, 2,.....) : 2

Seat No. :

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Student's Signature

- (2) Attempt all questions.
- (3) Figures to right indicate full marks.
- (4) Assume suitable data if necessary.
- (5) Use scientific calculator Casio FX 82/83 or equivalent.

4 Answer the following :

10

- (a) (1) In single pulse width modulation the frequency of control signal controls the frequency of output  
[state True/False]
- (2) In dc choppers, the wave forms the input and output voltages are respectively \_\_\_\_\_.
- (3) A step-up chopper has  $V_s$  as the source voltage and  $\alpha$  as the duty cycle. The o/p voltage for this chopper is given by \_\_\_\_\_.
- (4) In dc chopper, per unit ripple is maximum when duty cycle  $\alpha$  is \_\_\_\_\_.
- (5) State True/ False :  
Mc Murray full bridge inverter uses natural commutation.

(6) In class A chopper input voltage is \_\_\_\_\_ than output.

(7) Chopper converts \_\_\_\_\_ to \_\_\_\_\_.

(8) In voltage commutated chopper \_\_\_\_\_, commutation is applied.

(9) State True / False :

(i) In a series inverter the first thyristor must be turned off before the second thyristor is triggered otherwise source would be short circuited.

(ii) A half bridge inverter needs a 3 wire dc supply, but a full bridge inverter does not need a 3 wire supply.

(b) Explain single phase semiconverter DC drives. 10

5 (a) Explain voltage commutated chopper with neat waveform. 10

(b) An RLE load is operating in a chopper circuit from a 500 V dc source. For the load  $L = 0.06$  H, and  $R = 0$ . For a duty cycle of 0.2, find the chopping frequency to limit the amplitude of load current excursion to 10 A.

OR

5 (a) Explain the Steady State time domain analysis of type A chopper. 10

(b) A DC chopper has an input voltage of 200 V and a load of 8 ohm resistance. The voltage drop across thyristor is 2 V and the chopping frequency is 800 Hz. The duty cycle is 0.4. Find : (a) average output voltage (b) rms output voltage (c) chopper efficiency (d) input resistance seen by the source. 5

6 (a) State various methods for the control of output voltage 10  
of inverters. Explain in detail external control of ac  
output voltage. Explain any one method of internal  
control.

(b) What is full bridge inverter ? Explain it with RL load. 5

OR

6 (a) Explain 180° mode of operation of three phase inverter. 10

(b) What is sinusoidal pulse modulation ? Explain 5  
with necessary waveform.