



5493/5494

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

October / November - 2005

EC - 605 : Industrial Electronics

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

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

Name of the Examination :

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

Name of the Subject :

EC - 605 : Industrial Electronics

Subject Code No. :

5 4 9 3

Section No. (1, 2,.....) :

Nil

Seat No. :

Empty boxes for seat number

Student's Signature

- (2) Attempt all questions.
(3) Figures to the right indicate full marks.
(4) Assume suitable data wherever necessary.
(5) Answers to the two sections must be written in separate answer books.

1 (a) Explain different types of SCR triggering using two transistor models of SCR. 8

(b) A relaxation oscillator using an UJT is to be designed for triggering an SCR. The UJT has the following data : 6

n = 0.72, IP = 0.6 mA, VP = 18.0 V, Vv = 1.0V, IV = 2.5 mA, RBB = 5 kl, Normal leakage current with emitter open = 4.2 mA.

The firing frequency is 2KHz. For C = 0.04 uF.

Compute the values of R, R1 and R2.

(c) (1) For a pulse transformer, a square wave at the input terminal has to appear fully undistorted 4

then ratio L/RO should be

(i) L/RO < T/10 (ii) L/RO < 10T (iii) L/RO > 10T where

T = pulse width.

(2) The delay time of SCR is the time for anode voltage  $V_a$  goes from,

- (i)  $0.1 V_a$  to  $0.9 V_a$     (ii)  $0.9 V_a$  to  $V_a$   
(iii)  $V_a$  to  $0.9 V_a$     (iv)  $0.9 V_a$  to  $0.1 V_a$

2 (a) Explain working of single-phase half wave circuit with RLE load. 8

(b) A 230 V, 50Hz one-pulse SCR controlled converter is triggered at a firing angle of  $40^\circ$  and the load current extinguishes at an angle of  $210^\circ$ . Find the circuit turn-off time, average output voltage and the average load current for

(1)  $R = 5 \Omega$  and  $L = 2 \text{ mH}$

(2)  $R = 5 \Omega$ ,  $L = 2 \text{ mH}$  and  $E = 110 \text{ V}$ .

OR

2 (a) Explain working of  $3-\phi$  full converter with RLE load with appropriate waveform. 8

(b) (1) A 3-phase full converter charges a battery from a  $3-\phi$  supply of 230 V, 50 Hz. The battery emf is 200 V and its internal resistance is  $0.5 \Omega$ . On account of inductance connected in series with the battery, charging current is constant at 20 A. Compute the firing angle delay and the supply power factor. 8

(2) In case it is derived that power flows from dc source to ac load in part (1), find the firing angle delay for the same current.

3 Attempt any two : 16

(1) Describe Impulse commutation used for thyristors with appropriate current and voltage waveforms.

(2) Why is the cosine-firing scheme so popular ? Describe a Cosine-firing scheme for the triggering of thyristors.

(3) For a Resonant Pulse Commutation (class B commutation)  $C = 20 \mu\text{F}$  and  $L = 5 \mu\text{H}$ . Initial voltage across capacitor is  $V_S = 230 \text{ V}$ . For a constant load current of 300 A, calculate :

(a) Conduction time for the auxiliary thyristor

(b) Voltage across the main thyristor when it gets commutated and,

(c) The circuit turn-off time for the main thyristor.

## Instructions :

(1)

नीचे दृशविले निशानीवाणी विगतो उत्तरवडी पर अवश्य लपवी. Fillup strictly the details of signs on your answer book. Name of the Examination : <b>B. E. – III (Sem. VI) (EC/ECC)</b> Name of the Subject : <b>EC – 605 : Industrial Electronics</b> Subject Code No. : <b>5 4 9 4</b> Section No. (1, 2,.....) : <b>Nil</b>	Seat No. : <table border="1"> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table> Student's Signature						

- (2) Attempt **all** questions.
- (3) Figures to the **right** indicate full marks.
- (4) Assume suitable data wherever necessary.
- (5) Answers to the **two** sections must be written in **separate** answer books.

- 4 (a) Explain Morgan chooper. Draw the voltage and current waveform for it. **6**
- (b) Explain type D chopper. **4**
- (c) A voltage - commutated chopper feeds power to a battery-power electric car. The battery voltage is 60V, starting current is 60A. and thyristor turn-off time is 20  $\mu$  sec. Calculate the values of commutating capacitor C and commutating inductance L. **6**
- 5 (a) Explain the working of single phase full-bridge inverter. Draw the load voltage and load current waveforms under steady state condition for following loads connected to single phase full-bridge inverter **8**
- (1) R type load
- (2) RL type load
- (3) RLC type load (underdamped)
- (4) RLC type load (overdamped)
- (b) Explain sinusoidal pulse width modulation. **6**
- (c) What is an inverter ? List a few industrial applications of inverters. **2**

OR

- 5 (a) Give the concept of Electric drive. 3
- (b) Describe chopper drive. State its different control modes. Explain in detail motoring control mode. 7
- (c) A dc series motor, fed from 400 V dc source through a chopper, has the following parameters :  $r_a = 0.05 \Omega$ ,  $r_s = 0.07 \Omega$ ,  $k = 5 \times 10^{-3} \text{ Nm/amp}^2$ . 6

The average armature current of 200A is ripple free. For a chopper duty cycle at 50%, determine

- (1) input power from the source
- (2) motor speed and
- (3) motor torque.

6 Attempt any two :

18

- (1) Working of  $3 - \phi$  VSI  $120^\circ$  mode voltage source inverter. Write necessary equation and draw the necessary waveforms. (voltage waveforms)
- (2) Explain modified McMurray half-bridge inverter.
- (3) Explain voltage commutated chopper.