

6E3112

Roll No. \_\_\_\_\_

Total No. of Pages : 4

6E3112

B.Tech VI Sem. (Main/Back) Exam. April-May, 2012

Electrical Engineering

6EE4 Advanced Power Electronics

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

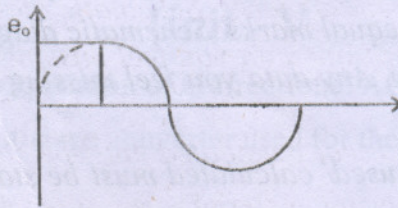
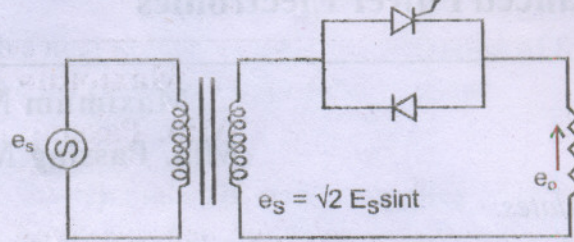
1. Nil \_\_\_\_\_ 2. Nil \_\_\_\_\_

### Unit - I

- Q1. (a) Analyse the output waveform of a single phase a.c. regulator (converter) into various harmonics with Fourier series and find the expression for the amplitude of  $n^{\text{th}}$  harmonic,  $E_{nm}$  and its phase  $\phi_n$ . (8)
- (b) A 3- $\phi$ , 3 wire bidirectional controller supplies a star-connected R load of  $R = 5 \Omega$  and the line-to-line input voltage of 210v (rms) at 50Hz. The firing angle  $\alpha = \frac{\pi}{3}$ . Determine.
- rms output-phase voltage,  $E_0$
  - input power factor,  $P_f$ , and
  - expression for the instantaneous output voltage of phase a. (8)

Or

- Q2. (a) Discuss the Operation of a 1 -  $\phi$  AC controller with RL load, when the firing angle  $\alpha$ , is less than, or equal to, load phase angle  $\phi$ . Also, show that for  $\alpha$  less than  $\phi$ , the output voltage of the AC controller cannot be regulated. (8)
- (b) A single - phase half-wave AC controller of given figure feeds power to a resistive load of  $6\Omega$  from 230 V, 50 Hz source.



The firing angle of SCR is  $\frac{\pi}{2}$ . Calculate. (8)

- (i) rms value of output voltage
- (ii) input power factor
- (iii) average input current

## Unit - II

Q3. A 3- $\phi$  bridge inverter is operated in  $180^\circ$  conduction mode. Draw the output line voltage waveforms and obtain:

- (i) Fourier series for the line voltage.
- (ii) RMS value of  $n^{\text{th}}$  harmonic-line voltage.
- (iii) RMS value of fundamental component of line voltage.
- (iv) RMS value of line voltage.

(v) Distortion and harmonic factor. (16)

Or

- Q4. (a) What is the need for controlling the output at the output terminals of an inverter? Also, Discuss briefly and compare the various methods employed for the control of output voltage of inverters. (8)
- (b) A capacitor commutated 1- $\phi$  bridge inverter is operated at 50Hz with resistive load of  $5\Omega$ . Thyristor turn-off time is  $62\ \mu\text{sec}$ . Find
- Commutating Capacitor 'C' for successful commutation of SCR.
  - Load current
  - F critical
  - R critical
- (8)

### Unit - III

- Q5. (a) A 3- $\phi$  to 1- $\phi$  cycloconverter employs a three pulse positive and negative group converters. Each converter is supplied from delta/star transformer with per phase turns ratio of 3:1. The supply voltage is 410V, 50 Hz. The load  $R_L$  has  $R = 4\Omega$  and at low output frequency,  $\omega_0 L = 3\Omega$ . The commutation overlap and thyristor turn-off time, limits the firing is inversion mode to  $160^\circ$ . For this, Calculate :
- the value of fundamental RMS output voltage
  - RMS output current
  - Output power
- (10)
- (b) Draw and explain the control circuit block diagram for a cycloconverter with non-circulating current mode. (6)

Or

- Q6 (a) Discuss why a 3- $\phi$  to 1- $\phi$  cycloconverter requires positive and negative group phase-controlled converters. Under what conditions, the group works as inverter or rectifier? How should the firing angles of two convertors can be controlled? (10)
- (b) A 3- $\phi$  cycloconverter feeds a 1- $\phi$  load of 190 V, 45 A at power factor of 0.7 (lagging). Determine :
- the required supply voltage
  - thyristor rating, and
  - power factor of supply current
- (6)

3084  
24  
Q7.

## Unit - IV

- (a) Derive an expression for voltage transfer ratio  $V_o/V_s$  in terms of transformer turns ratio and duty cycle for flyback converter, operating with continuous load current. (8)
- (b) Explain the operation of Resonant - DC power supply. (8)

Or

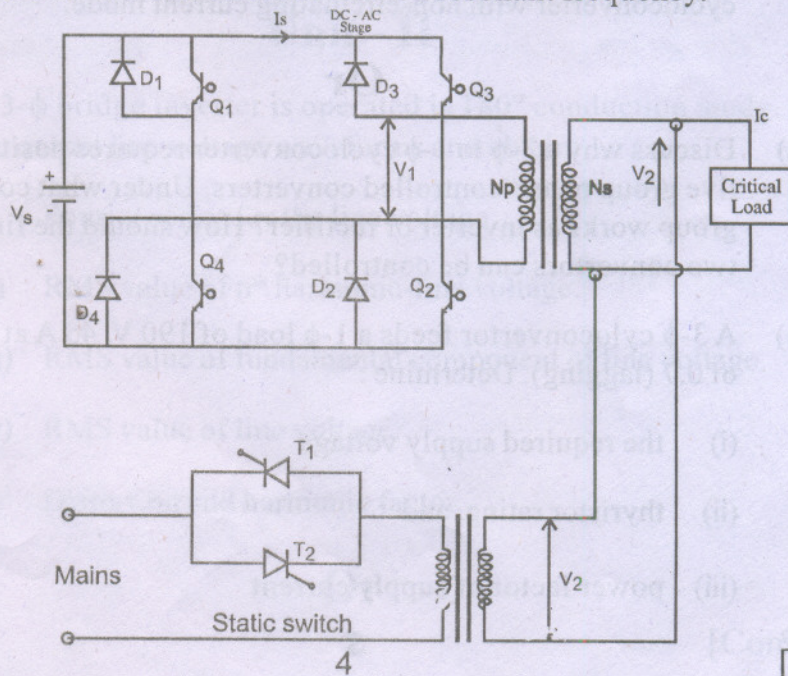
- Q8. (a) With a neat sketch, explain the operation of forward converter and derive the equation for its output voltage. (8)
- (b) Write a short note on :- (8)
- (i) Switch mode DC power supplies
  - (ii) Bi-directional power supplies

## Unit - V

- Q9. (a) Discuss the operation of bidirectional AC power supplies. (8)
- (b) Discuss multistage converter used for the conditioning of power factor. (8)

Or

- Q10. The load resistance of ac power supplied in the given figure is  $R = 1.5 \Omega$ . The dc input voltage is  $V_s = 24v$ . The input inverter operates at a frequency of 400 Hz with a uniform PWM of eight pulses per half-cycle & the width of each pulse is  $\delta = 20^\circ$ . The ON-state voltage drops of transistor switches & diodes are neglected. Turns ratio of transformer is 4. Determine rms load current. Neglect the losses in T/F and effect of load on resonant frequency. (16)



6E3112

4

[7650]