6E3112

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# B. Tech. VI Semester (Main/Back) Exam. May/June 2013

## ELECTRICAL ENGINEERING # 6EE4

# ADVANCED POWER ELECTRONICS

**Time : 3 Hours** **Min. Passing Marks : 24** **Maximum Marks : 80**

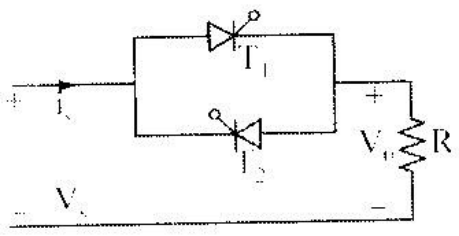
*Instruction to Candidates :*

*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.)*

## Unit–'I'

**1.** (*a*) What are the steps involved in determining the output voltage waveforms of three-phase bidirectional controllers? **[8]**

(*b*) An ac voltage controller in figure has a resistive load of R = 10 Ω the root-mean square (rms) input voltage is $V_s$ = 120V, 60$H_z$. The thyristors switch is on for n = 25 cycles and is off for m = 75 cycles. Determine (a) the rms output Voltage $V_o$. (b) the input power factor (PF), and (C) the average and rms current of thyristors. **[8]**




**OR**

**1.** (*a*) What is the control range of the delay angle for single-phase unidirectional controller? **[8]**

(*b*) The load of an ac voltage controller is resistive with R = 1.5Ω. The input voltage is $V_s$ = 120V(rms). 60$H_z$. Plot the PF against the delay angle for single phase half wave and full wave controllers. **[8]**

## Unit–'II'

**2.** (*a*) With the help of neat circuit diagram & waveforms, explain briefly the operation of transistorized three-phase bridge inverter with resistive load in 120° conduction mode. **[10]**

(*b*) Explain why a PWM inverter is superior to a square-wave inverter. **[6]**

**OR**

**2.** (*a*) State the need for reduction of harmonics in inverters. Outline the various methods for reduction of harmonics or the improvement in waveshape. **[8]**

(*b*) Design a self commutated inverter circuit to operate at a frequency of 3KHz with an optimum distortion. The load Specifications are as follow: R = 5Ω, L = 5mH, $E_{dc}$ = 100V. Also compute the output power. **[8]**

## Unit–'III'

**3.** (*a*) Draw and explain the control circuit block diagram for a cycloconverter with non-circulating current mode. **[8]**

(*b*) What is a load commutated cycloconverter? How does it differ from line commutated cycloconverter? **[8]**

**OR**

**3.** (*a*) Describe the control scheme for a cycloconverter using voltage sensing principle of converter group selection. **[8]**

(*b*) A three pulse cycloconverter feeds a single phase load of 190V, 45A at a power factor of 0.7 lagging. Determine: **[8]**

(i) The required supply voltage

(ii) Thyristor rating

(iii) Power factor of the supply current.

## Unit–'IV'

**4.** (*a*) Explain the operation of Bi-directional power supplies. **[8]**

(*b*) With a neat sketch, explain the operation of flyback converter & derive the equation for its output voltage. **[8]**

**OR**

**4.** (*a*) Explain the operation of Resonant-DC power supply. **[8]**

(*b*) Write a short note on: **[8]**

(i) Full bridge converter.

(ii) Switch mode DC power supplies.

## Unit–'V'

**5.** (*a*) Explain resonant AC power supply. **[8]**

(*b*) With a neat sketch, explain multistage conversions. **[8]**

**OR**

**5.** (*a*) Write short note on: **[8]**

(*i*) Voltage mode control

(*ii*) Bi-directional AC power supplies.

(*b*) The load resistance of the ac power supply in figure is R = 2.5Ω. The dc input voltage is $V_s$ = 100V. The input inverter operates at a frequency of 20KHz with one pulse per half cycle. The on-state voltage drops of transistor switches and diodes are negligible. The turns ratio of the transformer is a = $N_s/N_p$ = 0.5. The output inverter operates with a uniform PWM of four pulses per half cycle. The width of each pulse is δ = 18°. Determine the rms load current. The ripple voltage on the output of the rectifier is negligible. Neglect the losses in the transformer, and the effect of the load the losses in the transformer, and the effect of the load on the resonant frequency is negligible. **[8]**