

Code: A-26**Subject: POWER ELECTRONICS****Time: 3 Hours****June 2006****Max.****Marks: 100****NOTE: There are 9 Questions in all.**

- Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or best alternative in the following: (2x10)

- a. The latching current of a Thyristor is _____ the holding current.
- (A) much lower than (B) higher than
(C) slightly lower than (D) equal to
- b. The ripple frequency of a three-phase fully controlled full-wave rectifier is _____ times that of the supply frequency.
- (A) 6 (B) 3
(C) 9 (D) 12
- c. For a stepdown chopper with dc supply voltage = 100V, duty cycle = 0.75, the average load voltage is _____.
- (A) 75 V (B) 25 V
(C) 100 V (D) 50 V
- d. A complementary commutation circuit has load resistances $R_1 = R_2 = R = 10\Omega$, capacitance, $C = 10\mu\text{F}$, supply voltage = 100V. Circuit turn off time will be _____.
- (A) $34.7\mu\text{sec}$ (B) $69.3\mu\text{sec}$
(C) $17.3\mu\text{sec}$ (D) $138.6\mu\text{sec}$
- e. In a single phase ac controller with resistive-inductive load, load voltage will be sinusoidal if the delay angle, α is _____ the load angle θ .
- (A) less than (B) greater than
(C) equal to (D) double
- f. The MOSFET is a _____ controlled, _____ conducting device.
- (A) current; current (B) voltage; voltage
(C) current; voltage (D) voltage; current
- g. Inverter gain is defined as the _____

- (A) ratio of DC input voltage to AC output voltage
 (B) ratio of AC output voltage to DC input voltage
 (C) ratio of DC output voltage to DC input voltage
 (D) ratio of AC output voltage to AC input voltage
- h. Turn-off time of the thyristor should be always _____ turn-off time of the circuit.
 (A) equal to (B) greater than
 (C) less than (D) has no relation to
- i. Consider a single phase full wave rectifier with supply 200V, AC, load resistance 10Ω & firing angle 60° . The average voltage across the load will be _____ volts.
 (A) 135 V (B) 67.5 V
 (C) 270 V (D) zero
- j. In a thyristor, a lower value of the middle junction capacitance is _____ because it _____
 the chance of $\frac{dv}{dt}$ triggering.
 (A) undesirable; increases (B) desirable; increases
 (C) undesirable; decreases (D) desirable; decreases

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. Draw the V-I characteristics of a Thyristor and explain various regions of the characteristics with the help of a two-transistor model. (9)
- b. An UJT trigger circuit is used to fire a PNP device. It is supplied from a source across the thyristor to be triggered through a 10V Zener. The valley and peak point voltages are found to be 1V and 7V. Calculate the intrinsic stand-off ratio of UJT and the frequency of relaxation oscillator if $R = 1K\Omega$ and $C = 1\mu f$. (7)
- Q.3** a. Give the circuit and waveforms of a three-phase, full-wave half controlled bridge rectifier. (6+3)
- b. In the circuit shown in Fig.1 find the charging current when $\alpha = 90^\circ$. (7)

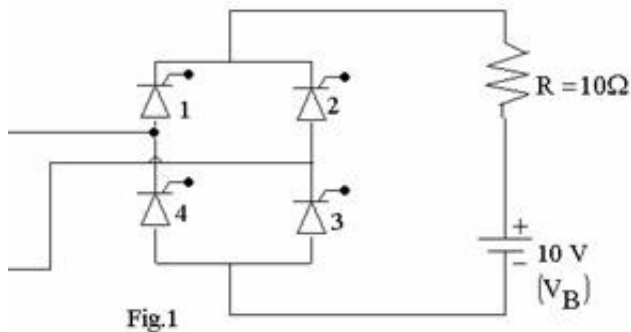


Fig.1

plain the elements of switching-mode regulators. Mention the elements. (7+1)

b. Explain the operation of a Buck-Boost regulator with the help of a circuit diagram and waveforms. (8)

Q.5 a. Discuss complementary commutation with a circuit diagram and waveforms. Also obtain the expression for the circuit turn-off time. (9)

b. For the circuit shown in Fig.2, obtain the proper values of commutating elements. Given; Load current to be commutated = 10A, turn-off time required = $40\mu\text{sec}$, supply voltage = 100 V. (7)

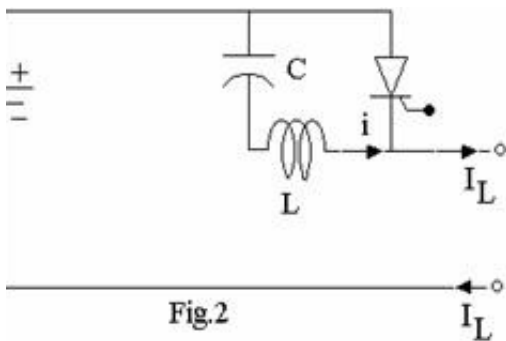


Fig.2

Q.6 a. Derive the expression for the rms output voltage of a single phase full-wave ac voltage controller. (7)

b. What are transformer tap changers? Explain a single phase circuit with suitable waveforms. (9)

Q.7 a. Give the circuit and describe the operation of a single-phase cycloconverter. Sketch the waveforms for a resistive load. (9)

b. How is the reduction of harmonics achieved in cycloconverters; explain in brief. (7)

Q.8 a. Explain the principle of operation of an inverter with waveforms and a circuit diagram. (1+8)

b. A single phase half-bridge inverter shown in Fig.3 has $R_L = 10\Omega$ and DC input voltage 220V. Find (i) the rms output voltage at the fundamental frequency (ii) the output power. (7)

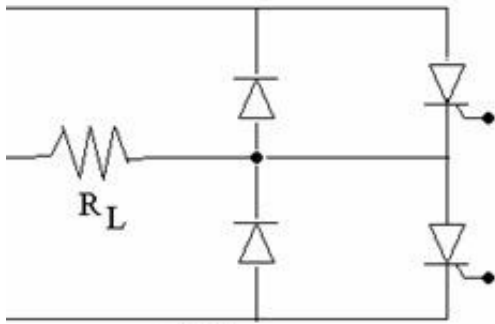


Fig.3

rating in

- (i) Motoring mode and
- (ii) Plugging mode.

(4+4)

b. Explain how the speed and torque of induction motor can be varied by rotor voltage control. **(8)**