

AMIETE – ET (New Scheme)

Time: 3 Hours

June 2018

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- 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 the best alternative in the following: (2×10)

- a. A GTO is turned off by applying
(A) Negative voltage at the anode and cathode
(B) Negative current through gate
(C) Voltage obtained from commutation circuit
(D) By applying zero voltage
- b. In full wave bridge controlled rectifier ____ pulses, _____ ° apart are applied to each SCR in a cycle.
(A) Two, 60 (B) Six, 60
(C) Two, 120 (D) Two, 180
- c. Disadvantages of PFM control in case of DC chopper is/are
(A) Increase in output current ripple (B) Heating in load
(C) Lower output voltage (D) All of these
- d. With safety factor of 1.5, what will be PIV rating of an SCR connected across a 220 V AC source?
(A) 311 (B) 440
(C) 466.5 (D) 330
- e. The following is/are true for a cycloconverter.
(A) It is basically a dual converter (B) Used in aircraft
(C) frequency changer (D) All of these
- f. A Schottky diode is
(A) Low-voltage device (B) Highspeed device
(C) Both (A) and (B) (D) None of these

- g. For a full-wave controlled center -tap rectifiers with inductive load, average value of load voltage is given by
 (A) $V_o = (2V_m/\pi) * \cos\alpha$
 (B) $V_o = (2 V_m /\pi) * (1+\cos\alpha)$
 (C) $V_o = (V_m /\pi) * \cos\alpha$
 (D) $V_o = (2 V_m /\pi) * (1+\cos\alpha)$
- h. In full-wave half controlled bridge rectifier with FWD, the output voltage contains six pulses per cycle, the output current is always continuous, the voltage never becomes negative - this will be possible with a delay angle
 (A) $\alpha \leq 120^\circ$, (B) $\alpha \leq 60^\circ$,
 (C) $\alpha \geq 60^\circ$, (D) $\alpha \geq 120^\circ$,
- i. Pulse width modulated inverters uses
 (A) Transistor (B) GTO
 (C) TRIAC (D) Both (A) and (B)
- j. For loads with short time constant, _____ control is preferred.
 (A) Integral cycle control (B) Phase control
 (C) Any can be used (D) None of above.

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

- Q.2** a. Discuss operating principal of IGBT in detail. (8)
 b. Explain conduction loss w.r.t. a transistor. (4)
 c. Compare Power BJT with Power MOSFET. (4)
- Q.3** a. Explain the operation of an SCR using the two-transistor model. (8)
 b. How an SCR can be turned off? (4)
 c. Draw symbol of a GTO. What are the main advantages of a GTO over a conventional SCR? (4)
- Q.4** a. A half wave controlled rectifier is connected to a 120 V source. Calculate the firing angle necessary to deliver a 150 w of power to a 10 Ω load. (6)
 b. Describe operation of a full-wave bridge rectifier with FWD with necessary wave forms. (10)
- Q.5** a. Explain, how FWD helps to sustain continuous output current in case of Full Wave Half Controlled Bridge Rectifier? (8)

- b. A 3- ϕ half-wave controlled rectifier connected to a 3- ϕ , 208 V - 50 Hz AC source supplies power to a 10 Ω resistive load. If the delay angle is 20°, calculate: (8)
- (i) the maximum output current (1 Mark)
 - (ii) the average output voltage (1 Mark)
 - (iii) the average output current (1 Mark)
 - (iv) the maximum SCR current. (1 Mark)
 - (v) Draw waveforms for voltage and current with $\alpha = 30^\circ$. (4 Mark)
- Q.6** a. Draw basic step-down chopper circuit. (4)
For this, the input voltage $V_i = 100$ V, the load resistance $R = 10 \Omega$, and $L = 100$ mH, the switching frequency is $f = 1$ KHz with the on- time of 0.5 msec. If the average source current is 1 A, determine: (4)
- (i) the average load voltage
 - (ii) the output current
 - (iii) the output power
 - (iv) the minimum value of L required?
- b. With required circuit diagram and waveforms, explain concept of a Buck-Boost chopper. (8)
- Q.7** a. Describe operation of three-phase Current Source Inverter with necessary waveforms. (10)
- b. A 1- ϕ full bridge inverter uses PWM for voltage control. Plot the output voltage waveform if the carrier frequency is a sawtooth voltage waveform synchronized to the fundamental and the reference wave is DC voltage level. (6)
- Q.8** a. For the following applications, choose Integral Cycle Control or Phase Control and Justify the same. (2x4)
(i) Motor Speed control and (ii) Heating loads.
- b. What is a static switch? Describe operation of 1- ϕ static AC switch using anti-parallel SCR connection. (8)
- Q.9** Write detailed notes on: (2x8)
(i) Emergency Lighting System and (ii) Static Circuit Breakers.