

DipIETE – ET (NEW SCHEME)

Time: 3 Hours

JUNE 2012

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. Power Electronics equipment has very high efficiency, because _____

- (A) the device always operate in active region.
- (B) the device never operate in active region.
- (C) the device transverse active region at high speed and stay at the two states, ON and OFF.
- (D) cooling is very efficient.

b. In the conduction mechanism of schottky diode _____

- (A) only electrons can participate.
- (B) only holes can participate.
- (C) both holes and electrons participate.
- (D) none of the above.

c. UJT is a _____

- (A) two-terminal two-junction semiconductor device.
- (B) three-terminal two- junction semiconductor device.
- (C) three-terminal one-junction semiconductor device.
- (D) two-terminal one-junction semiconductor device.

d. A SCR can be operated _____

- (A) only on reverse biased condition.
- (B) only on forward biased condition.
- (C) both reversed and forward biased condition.
- (D) without any biasing.

- e. A single phase full wave fully controlled bridge rectifier uses_____
- (A) 2 SCR (B) 3 SCR
(C) 4 SCR (D) 6 SCR
- f. In a 3-phase full wave diode rectifier, if V is the per phase input voltage, then average output is given by_____
- (A) 0.955 V. (B) 1.35 V.
(C) 2.34 V. (D) 3 V.
- g. In a Current Source Inverter (CSI), if frequency of output voltage is f Hz, then the frequency of voltage input to CSI is_____
- (A) f (B) $3f$
(C) $f/2$ (D) $2f$
- h. Cycloconverter are used for situation demanding_____
- (A) very high frequency. (B) low frequency.
(C) high frequency. (D) very low frequency.
- i. Duty cycle of a chopper circuit is expressed by_____
- (A) T_{on} / T_{off} (B) $T_{on} / (T_{on} + T_{off})$
(C) $(T_{on} + T_{off}) / T_{off}$ (D) T_{off} / T_{on}
- j. A snubber circuit is used in the thyristorised control circuit to overcome the effect of_____
- (A) heating due to high voltage AC. (B) electromagnetism.
(C) transient in the ac supply. (D) corona. .

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

- Q.2** a. Discuss and compare the V-I characteristics of power diode and ideal diode. (8)
- b. Classify the power diodes according to their reverse recovery characteristics and explain any one in brief. (8)
- Q.3** a. Draw and explain the switching characteristics of an Insulated-Gate Bipolar Transistors. (8)
- b. Explain with the help of a diagram, the construction and working principle of UJT. (8)

Code: DE71

Subject: POWER ELECTRONICS

- Q.4** a. Describe the V-I Characteristics of an SCR and mark the various states, voltages and currents on the first and third quadrants. (8)
- b. A SCR circuit has dc supply voltage of 400 V, Turn-off time of 220 μ s and load resistance of 40 Ω . Find the minimum value of capacitance that will ensure commutation. (8)
- Q.5** a. Draw the circuit diagram of 3- phase full wave half controlled bridge rectifier and describe its operation. (8)
- b. A 3-phase fully controlled bridge rectifier is fed by 400 V 3phase 50 Hz supply. The average load current is 150 A and load is inductive. The first angle is 60° , then find (8)
- (i) Output Power (P_{dc}).
(ii) Average, RMS and Peak current through thyristors.
(iii) Peak Inverse Voltage.
- Q.6** a. Describe the principle of operation of basic dc chopper and derive an expression for its average output voltage. (8)
- b. The input voltage applied to basic step down chopper circuit is 200 V and the load consist of resistor of 20 Ω and inductance of 100 mH, the switching frequency is $f=1\text{kHz}$ and ON time is 0.5 ms, if the average current is 1A, find the following (8)
- (i) duty cycle (ii) output current
(iii) output power (iv) output load voltage
(v) minimum value of L required
- Q.7** a. Draw the circuit diagram of a full bridge Voltage Source Inverters and sketch the firing pulses and output voltage waveforms. (8)
- b. In a three phase CSI, the input current flowing through is 30A and load phase angle is 60° , then find the RMS value of output line current and dc input voltage. (8)
- Q.8** a. A single phase 110 V ac source ,control power to a 10 Ω resistive load using integral cycle control and total period $T= 24$ cycles. Find (8)
- (i) RMS output current (ii) Max power
(iii) Average power (iv) Duty cycle
(v) T_{ON}
- b. List five advantages of semiconductor switches over mechanical switches. (4)
- c. Write short note on Hybrid Switch. (4)
- Q.9** a. Draw the circuit diagram of single phase full wave half controlled bridge rectifier and sketch the voltage and current wave shapes for inductive load. (8)
- b. A SCR full wave rectifier supplies to load of 100, if the peak ac voltage between centre tap and one end of secondary is 200 V, find DC output voltage V_{dc} and load current for a firing angle of 60° . (8)