

DipIETE – ET (Current & New Scheme)

Time: 3 Hours

DECEMBER 2015

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. An AC Voltage Controller is used for _____
(A) high voltage DC transmission
(B) speed control of induction motors
(C) induction heating
(D) speed control of DC motors
- b. When a power diode is conducting, the voltage drop across it is about _____
(A) 1V
(B) 5V
(C) 20V
(D) 50V
- c. An UJT exhibits negative resistance characteristics when its _____
(A) current is less than valley current
(B) current is less than peak current
(C) current is more than peak current but less than valley current
(D) none of these
- d. The minimum anode current that must flow through the SCR in order for it to stay on after the gate signal is removed is called _____
(A) Holding current
(B) Surge current
(C) Latching current
(D) Repetitive current
- e. During forward blocking state of SCR, the voltage and current respectively are _____
(A) high and high
(B) low and low
(C) high and low
(D) low and high
- f. A single phase dual converter consists of _____
(A) two fully controlled converters connected in parallel
(B) two fully controlled converters connected in antiparallel
(C) two fully controlled semiconverters connected in antiparallel
(D) two fully controlled semiconverters connected in parallel
- g. In a 3 phase fully controlled converter, the firing frequency is _____
(A) 3 times the line frequency
(B) 6 times the line frequency
(C) 9 times the line frequency
(D) 12 times the line frequency

- h. A DC Chopper converts _____
 (A) constant voltage dc into ac and then into variable voltage dc
 (B) constant voltage dc into variable voltage dc directly
 (C) ac of one frequency into ac of another frequency
 (D) ac to dc
- i. Inverters finds application in _____
 (A) HVDC transmission (B) UPS
 (C) variable speed ac drives (D) all of these
- j. A cycloconverter is a _____
 (A) ac to dc converter (B) dc to ac converter
 (C) dc to dc converter (D) ac to ac converter

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

- Q.2** a. What is power loss in an ideal switch? Explain the conduction losses in a bipolar junction transistor with the help of circuit diagram. (8)
- b. Explain, how the power diode must be protected against the following:- (8)
 (i) Overvoltage
 (ii) Overcurrent
 (iii) Transients
- Q.3** a. How does a Power Bipolar Junction Transistor used as a switch? Draw its V-I characteristics and explain the significance of saturation, active and cut-off regions. (8)
- b. A Power MOSFET has $I_{DSS} = 2 \text{ mA}$, $R_{DS(ON)} = 0.3 \Omega$, duty cycle $d = 50\%$, $I_D = 6 \text{ A}$, $V_{DS} = 100 \text{ V}$, $t_r = 100 \text{ ns}$ and $t_f = 200 \text{ ns}$. If the frequency of switching is 40 KHz, then find (8)
 (i) on-state loss
 (ii) off-state loss
 (iii) turn-on switching loss
 (iv) turn-off switching loss
- Q.4** a. What is the necessity of connecting two SCRs in parallel? Draw the circuit of connecting two SCRs in parallel and explain its operation with the help of on-state characteristics. (9)
- b. What are the most common methods of achieving commutation? Explain the commutation method by external source and explain its operation with the help of waveforms. (7)
- Q.5** a. Draw a neat diagram for Single Phase Full Wave Controlled Bridge Rectifier with a resistive load and explain its operation with the help of waveforms. (10)
- b. A single phase half wave controlled rectifier connected to a 150 V, 60 Hz source to supplying a resistive load of 10Ω . If the delay angle α is 30° , then find: (6)
 (i) the maximum load current
 (ii) the average load current

- Q.6** a. Draw a neat diagram for Three Phase Half Wave Controlled Rectifier circuit with a resistive load and explain its operation with waveforms. **(10)**
- b. A six pulse half controlled bridge rectifier is connected to a three phase 220 V AC source. Calculate the firing angle if the terminal voltage of the rectifier is 240 V. What is the maximum value of the DC output voltage? **(6)**
- Q.7** a. What is a DC Chopper? Explain its principle with the help of suitable diagram and waveforms. What are its various industrial applications? **(8)**
- b. What is a Buck-Boost Chopper? Draw its circuit configuration and explain its working with the help of voltage and current waveforms. **(8)**
- Q.8** a. Explain the working of a full bridge VSI with a neat circuit diagram and waveforms. **(8)**
- b. What are the most commonly used methods of pulse width modulation? Explain multiple pulse width modulation with the help of waveforms when the number of pulses (m) = 2 and 3. **(8)**
- Q.9** a. What do you mean by AC power control? Discuss the differences between integral cycle control and AC phase control. **(8)**
- b. Compare the advantages and disadvantages of semiconductor switches over mechanical switches. **(8)**