ROLL NO. _____

Code: DE71/DE110 **Subject: POWER ELECTRONICS**

DipIETE – ET (Current & 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. Which triggering is the most reliable?
(A) Thermal triggering **(B)** dV / dt triggering
(C) Forward voltage triggering **(D)** Gate triggering

b. An AC Voltage Controller is used for _____
(A) induction heating
(B) high voltage DC transmission
(C) speed control of induction motors
(D) speed control of DC motors

c. Switching frequency of a Chopper is given by _____
(A) 1/ TON + TOFF **(B)** TOFF / TON
(C) TON /TOFF **(D)** TON + TOFF

d. If the frequency of output voltage of a CSI is f Hz, then frequency of input voltage to CSI is _____
(A) f **(B)** f/2
(C) 3f **(D)** 2f

e. A single phase semi converter is feeding highly inductive load and has a freewheeling diode across the load. The wave shapes of output voltage and output current _____
(A) may be similar or dissimilar
(B) are not similar
(C) are similar only if firing angle is zero
(D) are similar

f. A single phase full bridge inverter can operate in load commutation mode, in case load consists of:
(A) R-L-C under damped **(B)** R-C ckt
(C) R-L-C critically damped **(D)** R-L-C over damped

g. A UJT contains_____.
(A) three pn junction **(B)** two pn junction
(C) one pn junction **(D)** four pn junction

h. A Cycloconverter can be_____.
(A) step down **(B)** step up
(C) Neither **(A)** nor **(B)** **(D)** Both **(A)** and **(B)**

i. 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.

j. The _____ is a commonly used device in power electronics.
(A) PIN Diode **(B)** UJT
(C) PV Cell **(D)** SCR

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. What is the basic difference between a PN junction power diode and an ordinary PN junction diode? Discuss various principal ratings for power diodes. **(8)**

Q.3 a. Give classification of power transistors. Explain the three operating regions of BJT and draw its output characteristics. **(8)**

b. Explain with the help of suitable diagram, the construction and working principle of UJT. Also site few examples where UJT is used. **(8)**

Q.4 a. What is commutation? What are the different types of communication? Classify the types of communication techniques by which the SCR can be turned off. **(8)**

b. List out the types of thyristors and explain briefly the operation of Fast-Switching thyristor. **(8)**

Q.5 a. Explain the circuit diagram and output waveforms of Single Phase, Full Wave, fully Controlled Bridge Rectifier with Resistive load. **(8)**

b. Explain the working principle of single-phase dual converter with neat circuit diagram. **(8)**

Q.6 a. A three-phase half-wave controlled rectifier, connected to a three-phase, 280 V, 60 Hz AC source, supplies power to a 10 Ω resistive load. If the delay angle is 20^o. Find
(i) maximum output current
(ii) average output voltage
(iii) average output current
(iv) SCR average current **(2×4)**

b. Explain the working of three phase half-wave controlled rectifier with an inductive load and a Freewheeling diode. Draw relevant circuit diagram and waveforms. **(8)**

Q.7 a. What is a DC Chopper? Explain the operating principle of dc chopper with the help of suitable diagram and waveforms. What are its various industrial applications? **(8)**

b. What is Step-Down chopper? Draw its circuit diagram and relevant waveforms to explain its operation for the ON state and OFF state. **(8)**

Q.8 a. The single phase half-bridge inverter has resistive load of R=2.4Ω, and the dc source voltage Vs=48V. Determine :
(i) The RMS voltage at the fundamental frequency V_1.
(ii) The output power P_0.
(iii) Peak thyristor current
(iv) Peak reverse blocking voltage V_{BR} of each thyristor. **(2×4)**

b. Draw the circuit diagram of single-phase full-bridge Voltage Source Inverter (VSI) with R-L load and briefly explain its working showing relevant waveforms. **(8)**

Q.9 a. What are solid state relays? How these are different from electromagnetic relays? Explain solid state relays by giving suitable circuit diagrams. **(8)**

b. What is a Cycloconverter? What are the advantages and disadvantages of Cycloconverters? What are its industrial applications? **(8)**