

DiplETE – ET (NEW SCHEME) - Code: DE71**Subject: POWER ELECTRONICS**

Time: 3 Hours

DECEMBER 2011

Max. Marks: 100

NOTE: There are 9 Questions in all.

- Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.
- 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 IGBT has three terminals called _____
- (A) collector, emitter and base. (B) drain, source and base.
(C) drain, source and gate. (D) collector, emitter and gate.
- b. Power-electronic equipment has very high efficiency, because _____
- (A) The devices always operate in action region.
(B) The devices never operate in action region.
(C) The devices transverse active region at high speed and stay at the two states, on and off.
(D) Cooling is very efficient.
- c. When a thyristor is forward biased, the number of blocked p-n junction is _____
- (A) 1 (B) 2
(C) 3 (D) 4
- d. The function of snubber circuit connected across an SCR is to _____
- (A) suppress dv/dt .
(B) increase dv/dt .
(C) decrease dv/dt .
(D) keep transient overvoltage at a constant value.
- e. A single-phase half-wave controller rectifier has $400\sin 314t$ as the input voltage and R as the load. For a firing angle of 60° , the average output voltage is _____
- (A) $400/\pi$. (B) $300/\pi$.
(C) $240/\pi$. (D) $200/\pi$.

- f. In a single-phase full converter, for conduction, each pair of SCRs conduct for _____
- (A) $\pi - \alpha$. (B) π .
(C) α . (D) $\pi + \alpha$.
- g. A freewheeling diode across inductive load will provide _____
- (A) quick turn-on. (B) slow turn-off.
(C) reduced utilization factor. (D) improved power factor.
- h. Each diode of a 3-phase half-wave diode rectifier conducts for _____
- (A) 60° (B) 120°
(C) 180° (D) 90°
- i. Each diode of a 3-phase, 6-pulse bridge diode rectifier conducts for _____
- (A) 60° (B) 120°
(C) 180° (D) 90°
- j. The output of a single-phase full wave rectifier contains _____
- (A) DC plus even harmonics.
(B) DC plus odd harmonics.
(C) DC plus both odd and even harmonics.
(D) DC and no harmonics.

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

- Q.2** a. Discuss various types of power electronic converters. (8)
b. Draw and briefly explain the VI characteristics of power diode. (8)
- Q.3** a. Draw and explain the transfer and output characteristics of Power Metal-Oxide Semiconductor Field-effect transistor. (8)
b. Give a comparison between IGBT with MOSFET. (8)
- Q.4** a. Sketch the I-V characteristics of a thyristor .Label various voltages, currents and the operating modes on this sketch. (8)
b. List different thyristor turn on methods and explain gate triggering method. (8)

- Q.5** a. Explain the principle of chopper operation, with the help of a neat sketch. (8)
- b. What are the different types of chopper configurations? Briefly discuss second quadrant or type B chopper. (8)
- Q.6** a. Draw the circuit diagram of single phase half bridge inverter and briefly explain its working. (8)
- b. Explain the various methods of voltage control with pulse width modulations. (8)
- Q.7** a. With the help of waveforms and circuit diagram, briefly explain Half-wave controlled rectifier with an inductive load and an FWD. (8)
- b. A three-phase half-wave controlled rectifier is connected to a 220 V source. If the delay angle is 45° and the load resistance $R = 10\Omega$ find
- (i) The average SCR current
 - (ii) The SCR RMS current
 - (iii) The average power dissipation in the SCR, if the SCR has a forward voltage drop of 1.0V.
 - (iv) The maximum reverse voltage rating. (2×4 = 8)
- Q.8** a. A single phase rectifier for 10 KW rating is required and thyristors of current rating 50 A are to be used. Find the rated voltage of thyristor using a safety factor of 2 if the rectifier is:
- (i) Full wave using centre tapped transformer, (8)
 - (ii) Full wave bridge rectifier. Assume R-L load
- b. With the help of the circuit diagram, briefly explain dual converters. (8)
- Q.9** a. What are solid state relays? Explain how is the electrical isolation is obtained in these relays? (8)
- b. Describe the operating principle of single phase to single phase step up cyclo converter with the help of mid-point configuration generation. (8)