

**B.I.E.E. EXAMINATION, 2019**  
**(4th Year, 1st Semester)**

**POWER ELECTRONICS**

Time : Three hours

Full Marks : 100

Answer any FIVE questions.

1. (a) Distinguish between a controlled and an uncontrolled power electronic device. Write down, in tabular form, the names of some widely used devices of both the categories in power electronics. 8  
 (b) What is known as a power electronic converter? Write down their names and with the help of circuit/block diagrams explain their functions briefly. 12
  
2. (a) Explain the reverse recovery characteristics of a power electronic rectifier diode. On what factors does the speed of such a diode depend? 8  
 (b) The reverse recovery time of a power electronic diode is 5 microseconds and the rate of fall of the diode current is 80 Amp/microseconds. Determine the storage charge and the peak reverse current. Given that, the softness factor of the diode is 0.50. Deduce necessary relations. 12
  
3. (a) With the help of circuit and waveform diagrams, explain the principle of operation of a three phase bridge rectifier. 6  
 (b) For a 3 phase bridge rectifier having a purely resistive load, given that,  $I_{dc} = 60$  Amp and  $V_{dc} = 280.70$  Volt. Find out,  
 i) the transformer utilization factor,  
 ii) the peak inverse voltage of each diode,  
 iii) the peak current through each diode.  
 Derive necessary relations. 14
  
4. (a) A unipolar rectangular voltage signal is applied to the base of a power transistor acting in the CE configuration. Draw the voltage and current waveforms at the collector of the transistor and explain the nature of each segment of such waveforms. 10

- (b) For a power electronic switch using a BJT, derive the expression for the total power loss during switching. 10
5. (a) What is meant by a four layer device? Explain the static characteristics of such a device using a two-transistor model. 10
- (b) Describe different methods for turning off a thyristor. 5
- (c) Describe the function and main applications of a TRIAC. 5
6. (a) With the help of necessary derivations explain the operation of a step-up dc-dc converter. How can this principle be applied to transfer energy from one voltage source to another? 10
- (b) For a step-up dc-dc converter with a resistive load, find out the output ripple current. 10
7. (a) With the help of circuit and waveform diagrams, describe the function of a single phase half-bridge inverter with an inductive load. Calculate the performance parameters of such a circuit. 14
- (b) How can the above mentioned circuit be converted into a full-bridge inverter? 6
- 8.(a) What are the parameters to be varied for the speed control of ,  
 (i) Separately excited dc motors, 6  
 and (ii) DC series motors?
- (b) With the help of circuit and waveform diagrams explain the operation of different single phase dc motor drives. 14
9. Write short notes on (any two) : - 10 x 2
- (a) Multiphase star rectifiers,  
 (b) Power MOSFETs,  
 (c) Gate turn-off thyristors,  
 (d) Switched mode power supply (SMPS).