EX/IEE/PC/H/T/322/2022

B.I.E.E. EXAMINATION, 2022

(3rd Year, 2nd Semester)

POWER ELECTRONICS

Time : Three hours Full Marks : 100

CO1: Describe the working principles and usability of different power electronic devices:-

Answer any two questions:-

1.(a) What is meant by the reverse recovery time of a power electronic diode? On what factors does its value depend? How does this parameter affect the performance of the device?. 10

(b) For a power electronic diode, the reverse recovery time is 5 microsecond and the rate of fall of the diode current is 80 Amp/microsecond. If the softness factor of the diode is 0.40, determine,

i) the storage charge Q_{RR},

ii) the peak reverse current I_{RR}.

Deduce necessary relations. 10

2. (a) What is meant by the overdriving of a power transistor? How does it affect the switching characteristics of the device ? 5

(b) For a power electronic switch using a BJT,

i) Explain the switching characteristics.

ii) Derive the expression for the total power loss during switching. 15

3. (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

CO2: Explain the working principle of single phase and polyphase converter and inverter circuits.

Answer any two questions:-

4. (a) With the help of circuit and waveform diagrams explain the operation of a multiphase star rectifier. 8

(b) For a three phase star rectifier with a purely resistive load , determine,

i) the transformer utilization factor,

ii) the peak inverse voltage of each diode,

iii) the peak current through a single diode . 12

5. (a) For a step down dc-dc converter with a purely resistive load, obtain the variation of the effective input resistance with the duty cycle. 5

(b) With the help of circuit and waveform diagrams explain the function of a step down dc-dc converter with an R-L load. 5

(c) For such a converter ,derive the expression for the maximum ripple current at the load. 10

6. (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

CO3:Describe the speed control techiniques of AC and DC motors.

7. Describe, some methods of controlling the speed of dc shunt motors. 14

CO4: Explain the working principle of SMPS and UPS.

8. Write down, in tabular form, the differences between an SMPS and an UPS. 6