B.E. INSTRUMENTATION AND ELECTRONICS ENGINEERING EXAMINATION, 2023

(3rd Year, 2nd Semester)

POWER ELECTRONICS (HONS)

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 70 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 ?   6

(b) For a power electronic switch using a BJT, deduce the expression for the total power loss during switching.   14

3. (a) Explain the static characteristics of a four layer device using a two-transistor model.   12

(b) What is meant by a TRIAC ? Explain some applications of such a device.   8

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 three phase bridge rectifier.   8

   (b) For a three phase bridge 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) 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

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 techniques of AC and DC motors.

7. Describe, some methods of controlling the speed of dc series motors.   10

CO4: Explain the working principle of SMPS and UPS.

8. With the help a block diagram describe the function of a static switch. Write down, in tabular form, the differences between an SMPS and an UPS.   10