EX/IEE/PC/H/T/322/2024

B.E. INSTRUMENTATION AND ELECTRONICS ENGINEERING EXAMINATION, 2024

(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) "A step up/down transformer cannot be treated as a power electronic converter." Justfy. 4
   (b) What are meant by the reverse recovery time and the softness factor of a power electronic diode? On what factors does their values depend ? 8
   (c) For a power electronic diode, deduce the expressions for,
   i) the storage charge Q_{RR}, 8
   ii) the peak reverse current I_{RR}

2. (a) For an npn power transistor operating in the switching mode and in CE configuration, draw the output voltage and current waveforms and explain each segment of the waveforms. 14
   (b) Write a brief note on COOLMOS. 6

3. (a) Explain the static characteristics of a four layer device using a two-transistor model. 14
   (b) What is meant by a TRIAC ? Explain some applications of such a device. 6

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 techniques 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