

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)

FOURTH YEAR FIRST SEMESTER EXAMINATION– 2024

POWER ELECTRONICS

Time : 3 hours

Full Marks : 100
(50 marks for each part)

Use separate answer-scripts for each parts.

PART I

Answer any three questions. Two marks are reserved for neat and well organized answer.

1. Classify power diodes according to their reverse recovery time. Explain the reverse recovery effect in a power diode. What is SRD and HRD ? 16

2. State the characteristics of power transistor ? Explain why negative base drive is used in power transistor. Also explain why power transistor is operated in the Quasi-saturation region . 16

3. With the help of suitable circuit diagram and relevant waveform explain the working principle of a boost chopper.

The input of a boost chopper is 150 volts and is feeding a resistive load of 10 ohms. If the load current is 20 amperes, find the duty cycle needed. If the OFF time of the chopper is 40 microseconds, calculate the switching frequency of the chopper. 16

4 3. With the help of suitable circuit diagram and relevant waveform explain the working principle of a buck chopper.

The input of a buck chopper is 100 volts and is feeding a resistive load of 10 ohms. If the duty cycle is 0.8, calculate the value of load current. If the switching frequency of the chopper is 20 KHz, calculate the ON time of the chopper. 16

5. Write short notes on any two of the following: 16

(a) SCR

(b) Power losses in semiconductor devices.

(c) Buck-Boost chopper

(d) Power MOSFET

[Turn over

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Part-II

Answer ANY THREE questions. Two marks reserved for neatness.

Answer all parts of a question in the sequential order.

1. a) Explain the advantages and disadvantages of power electronic rectifiers.
b) Give few examples of the application of power electronic rectifiers explaining their role and benefits obtained from those applications.
c) Explain, with necessary circuit diagram and waveforms, the principle of operation of various types single phase uncontrolled rectifiers with resistive load.
[4+4+8=16]
2. a) Explain the advantages and disadvantages of controlled rectifiers.
b) Explain, with necessary circuit diagram and waveforms, the principle of operation of bridge type single phase rectifier with R-L load.
[6+10=16]
3. a) Why filters are required in conjunction with rectifiers? Make a brief comparison of Capacitive Type, Inductive Type and Capacitive-Inductive Type filters when applied in rectifiers.
b) Explain the principle of operation, with necessary circuit diagram and waveforms, of a single phase full converter with RL load.
[2+4+10=16]
4. Explain the principle of operation, with necessary circuit diagram and waveforms, of a three phase half-wave controlled rectifier with R and RL loads.
[16]
5. Write short notes on **ANY TWO** from the following:
 - a) Effect on input power factor after rectification of AC Voltage.
 - b) Applications of Dual Converters.
 - c) Performance specifications of power rectifiers.[8x2=16]