

# CBCS SCHEME

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21EE54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

## Power Electronics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. With neat diagram, explain the different types of power electronic circuits. (10 Marks)
- b. List the applications of power electronics. (06 Marks)
- c. Write short notes on peripheral effects of power electronic circuits. (04 Marks)

OR

- 2 a. Explain the reverse recovery characteristics of diode. (07 Marks)
- b. The reverse recovery time of a diode is  $t_{rr} = 3 \mu s$  and the rate of fall of the diode current is  $\frac{di}{dt} = 30 \frac{A}{\mu s}$ . Determine the (i) Storage charge QRR (ii) Peak reverse current  $I_{RR}$ . (03 Marks)
- c. With neat circuit diagram and waveform, explain the single phase full wave bridge type diode rectifier with R load, derive average and RMS output voltage. (10 Marks)

### Module-2

- 3 a. Explain the switching characteristics of MOSFET. (10 Marks)
- b. Write short notes on switching limits of BJT. (06 Marks)
- c. List the applications of BJT, MOSFET, IGBT. (04 Marks)

OR

- 4 a. Explain the isolation of Gate and Base drives with the help of,  
(i) Pulse transformer. (12 Marks)  
(ii) Opto coupler. (08 Marks)
- b. Explain with neat diagram, Anti saturation control of BJT using collector clamping circuit. (08 Marks)

### Module-3

- 5 a. Explain the two transistor model of Thyristor with neat diagram and derive the expression for anode current. (10 Marks)
- b. Explain different turn ON methods of thyristor. (05 Marks)
- c. Draw the VI characteristics of thyristor, define latching current and holding current. (05 Marks)

OR

- 6 a. Explain the  $\frac{di}{dt}$  protection of thyristors. (06 Marks)
- b. Explain UJT firing circuit for the SCR. (08 Marks)
- c. A thyristor operating at 200 V, latching current of the thyristor is 100 mA, for a load of 20  $\Omega$  and 0.2 H. Find the minimum width of gate pulse required to turn on the thyristor. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50; will be treated as malpractice.

**Module-4**

- 7 a. With neat circuit and waveforms, explain the single phase half wave controlled rectifier with RL load, derive the average and RMS output voltage. (10 Marks)
- b. Explain with neat circuit and waveform, the single phase dual converter. (10 Marks)

**OR**

- 8 a. Explain the single phase full wave AC voltage controller with R load with neat diagram and waveforms, and derive the RMS output voltage. (12 Marks)
- b. An AC voltage controller with ON-OFF control has an input of 230 V, 50 Hz is connected to a resistive load of  $20\Omega$ . The circuit is operating with the switch ON for 30 cycles and OFF for 30 cycles. Determine (i) RMS output voltage, current (ii) Input power factor. (05 Marks)
- c. List the applications of AC voltage controller. (03 Marks)

**Module-5**

- 9 a. With neat diagram and waveform, explain the step-up chopper and derive the expression for the output voltage. (10 Marks)
- b. Classify the different types of chopper. With the help of circuit and quadrant diagram, explain four quadrant (Class E) chopper. (10 Marks)

**OR**

- 10 a. With neat circuit and waveform, explain the operation of single phase full bridge inverter and derive the RMS output voltage. (10 Marks)
- b. List the different types of voltage control techniques for single phase inverters, briefly explain about,  
(i) Single pulse width modulation.  
(ii) Sinusoidal pulse width modulation. (10 Marks)

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