

CBCS SCHEME

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18E162

Sixth Semester B.E. Degree Examination, July/August 2022 Power and Industrial 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 the neat waveforms, describe three control characteristics of power semiconductor devices. (09 Marks)
- b. Discuss the working of any four power converter circuits with the input and output waveforms. (08 Marks)
- c. List three applications of power electronics. (03 Marks)

OR

- 2 a. With neat waveforms, discuss the switching characteristics of Bipolar Junction Transistor (BJT). (06 Marks)
- b. With necessary waveforms, describe the switching characteristics of Insulated Gate Bipolar Transistor (IGBT). (06 Marks)
- c. Briefly discuss any two methods used for base drive control in BJT. (08 Marks)

Module-2

- 3 a. Using two transistor analogy, derive the expression for anode current of Silicon Controlled Rectifier (SCR). (06 Marks)
- b. Mention different methods employed to turn on SCR. Sketch the static characteristics of SCR and define (i) Latching current (ii) Holding current (08 Marks)
- c. Design the triggering circuit for UJT (uni-junction transistor) having parameters $V_S = 20V$, $\eta = 0.6$, $I_p = 10 \mu A$, $V_V = 2V$, $I_V = 10 mA$ and $C = 1 \mu f$. The frequency of oscillation is $f = 100 Hz$ and the width of the triggering pulse is $t_g = 50 \mu s$. (06 Marks)

OR

- 4 a. What do you mean by commutation? Distinguish between the self and natural commutation. (02 Marks)
- b. With the necessary circuit derive the expression for:
 - (i) Current when SCCR turns ON
 - (ii) Voltage across capacitor when SCR is OFF (10 Marks)
- c. With a neat circuit and waveform elaborate on the working principle of impulse commutation. (08 Marks)

Module-3

- 5 a. With a relevant circuit and waveforms, explain the principle of phase controlled rectifier operation. Derive an expression for RMS output voltage. (08 Marks)
- b. With a neat circuit and necessary waveforms, describe working of single phase full converters. (08 Marks)
- c. Draw circuit of single phase dual converter in controlled rectifier. (04 Marks)

OR

- 6 a. An AC voltage controller has resistive load of $R = 10 \Omega$ and the input is $V_s = 120 \text{ V}$, 60 Hz. The thyristor switch is ON for $n = 25$ cycle and OFF for $m = 75$ cycles. Determine:
- RMS output voltage
 - Input power factor
- b. With a neat circuit and waveforms, describe the working of phase control in AC voltage controller. (04 Marks) (08 Marks)
- c. With relevant circuit and waveforms, elaborate the operation of single phase full wave AC voltage controller with inductive load. (08 Marks)

Module-4

- 7 a. With necessary waveforms and equations, describe the working of step down converter. (06 Marks)
- b. Describe the working of step up converter with necessary waveform and equations. (06 Marks)
- c. With a neat circuit and waveforms, explain working of class A and class B chopper. (08 Marks)

OR

- 8 a. With the help of circuit diagram, describe the operation of operating modes in DC motor in variable speed applications. (12 Marks)
- b. Elaborate on the basic characteristics of separately excited DC motor. (08 Marks)

Module-5

- 9 a. With a neat circuit and waveforms, describe the working of single phase bridge inverter. (06 Marks)
- b. With a neat circuit and waveforms, briefly describe the working of 180° conduction of three phase inverter. (10 Marks)
- c. Draw circuit for current source inverter. (04 Marks)

OR

- 10 a. With a neat block diagram, explain the AC power supply when :
- Load normally connected to AC main supply
 - Load normally connected to inverter
- b. Briefly describe how power electronics is applied in electric welding for industrial applications. (08 Marks) (06 Marks)
- c. Describe with a neat circuit working of fly back converter in SMPS. (06 Marks)

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