

CBCS SCHEME

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15EC73

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022

Power Electronics

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. What is a Converter? How are Power Converter classified? Explain briefly. (08 Marks)
- b. Explain the peripheral effects caused by Power Electronic Converters. What are the remedies for them? (08 Marks)

OR

- 2 a. Mention the applications of Power Electronics. (06 Marks)
- b. A simple transistor switch is used to connect a 24V DC supply across a relay coil, which has a DC resistance of 200Ω . An input pulse of 0 to 5V amplitude is applied through a series base resistance R_B at the base so as to turn on the transistor switch. Calculate
 - i) ICS.
 - ii) Value of Resistor R_B required to obtain over drive factor of 2.
 - iii) Total power dissipation in the transistor that occurs during the saturation state. (10 Marks)

Module-2

- 3 a. Using two transistor models, explain how a small gate current can turn ON a SCR when blocking toward voltage. (06 Marks)
- b. Draw and explain the $V-I$ characteristics of SCR. And also explain the mode of operations. (10 Marks)

OR

- 4 a. What is the need for protection of thyristor? Explain how thyristors are protected against high di/dt and $\frac{dv}{dt}$. (06 Marks)
- b. Explain the different turn ON methods of SCR. (05 Marks)
- c. The thyristor is gated with a pulse width of $40\mu\text{sec}$. The latching current of thyristor is 36mA. For a load of 60Ω and 2H, will be thyristor get turned ON? If not, how it can be overcome for the given load? Find its value ($V_s = 220V$). (05 Marks)

Module-3

- 5 a. Show the circuit diagram of a $1-\phi$ semi converter and explain the operation; assuming constant load current. Sketch waveforms of output voltage and current in one SCR for a firing angle 45° . (10 Marks)
- b. What is Freewheeling diode? What are the advantages of freewheeling diode in rectifier circuits feeding inductive load? (06 Marks)

OR

- 6 a. With a circuit diagram and waveform, explain the operation of a $1-\phi$ ON – OFF type ACVC. Derive an expression for rms output voltage. (10 Marks)

- b. A single phase half wave AC voltage controller. Shown in Fig. Q6(b) feeds power to a resistive load of 6Ω from $230V$, $50Hz$ source. The firing angle of SCR is $\alpha = \frac{\pi}{2}$. Calculate
- i) RMS value of output voltage ii) Input power factor iii) Average input current. (06 Marks)

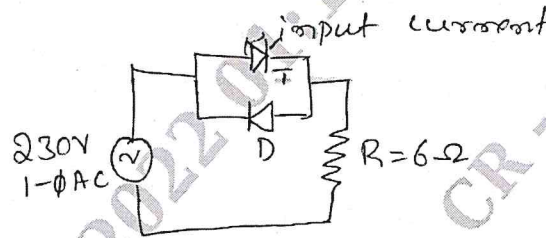


Fig. Q6(b)

Module-4

- 7 a. With a neat circuit and waveform, explain the basic principles of operation of a step – down chopper with resistive load. Obtain the expression for i) DC output voltage ii) Output power iii) Chopper efficiency. (10 Marks)
- b. Explain the class E Chopper. (06 Marks)

OR

- 8 a. In a DC chopper the average load current is $30A$. The chopping frequency is $250Hz$ and supply voltage is $110V$. Calculate ON and OFF periods, if the load resistance is 2Ω . (06 Marks)
- b. With a neat circuit and waveform, explain the step up chopper and derive output voltage $V_{O(avg)}$. (10 Marks)

Module-5

- 9 a. Draw the circuit diagram of $1-\phi$, current source inverter employing power switching transistors. Sketch the gating single waveforms and the load current waveform. Explain the operation of the circuit. (10 Marks)
- b. Define the Performance Parameters for inverters. (06 Marks)

OR

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- 10 a. Considering a $1-\phi$ bridge inverter, explain the Phase Displacement method of output voltage control, if the DC input voltage is $200V$ and the required rms fundamental output voltage is $90V$. Determine the delay angle β . (04 Marks)
- b. Comparison between Voltage Source inverter and Current Source inverter. (06 Marks)
- c. Write a note on Voltage Control of Single phase inverters by Sinusoidal pulse width modulation technique. (06 Marks)

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