CBCS SCHEME

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17EC73

Seventh Semester B.E. Degree Examination, June/July 2025
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. Explain different types of power electronic circuits. **(10 Marks)**

b. Explain peripheral effects of power electronic components and equipment and mention how to reduce them with a neat block diagram. **(10 Marks)**

OR

2 a. List different types of power MOSFET and explain p-channel depletion type in detail. **(10 Marks)**

b. Explain the features and structure of IGBT. **(10 Marks)**

Module-2

3 a. Draw the two transistor model of thyristor and derive an expression for the a node current in terms of common base current gain α_1 and α_2 of the transistors. **(10 Marks)**

b. Explain the various methods of turning on a thyristor. **(05 Marks)**

c. Explain how thyristors are protected against high $\frac{di}{dt}$. **(05 Marks)**

OR

4 a. Explain R firing circuit and RC firing circuit with relevant waveforms. **(10 Marks)**

b. An UJT used in a relaxation oscillator circuit is having $\eta = 0.7$, $V_v = 1$ V and the supply voltage to the circuit is 15 V. Design the suitable values of R and C given that the frequency of oscillation is 1 KHz. Peak current is 1mA and valley current is 8 mA. **(05 Marks)**

c. Compare natural and forced communication. **(05 Marks)**

Module-3

5 a. Define ACVC. With neat circuit and waveform explain the operation of full ware ACVC with resistive load. Obtain the expression for RMS vale output voltage. **(08 Marks)**

b. Explain the operation of ON-OFF control type ACVC. Draw waveform for ON for 3 cycles and OFF for 2 cycles. **(06 Marks)**

c. Discuss why short duration gate pulses are not suitable for full wave ACVC with inductive load? With example. **(06 Marks)**

OR

6 a. Explain the principle of operation 1 ϕ half wave rectifier with resistive load. Obtain the expression for average value of output voltage. **(08 Marks)**

b. Explain the operation of semi converter with RL load (inductive). **(06 Marks)**

c. Explain the operation of dual converter. **(06 Marks)**

Module-4

7 a. Explain buckboost regulator with neat circuit diagram and waveforms. **(10 Marks)**

b. The buck regulator has an input v/g of Vs = 12V. The required average o/p v/g is Va = 5 V at R = 500 Ω and the peak to peak o/p ripple v/g is 20 mV. The switching frequency is 25 kHz. If the peak to peak ripple current of inductor is limited to 0.8 A. Determine: i) Duty cycle K ii) The filter inductance iii) The filter capacitor C and iv) Critical values of L and C. **(10 Marks)**

OR

8 a. Explain different dc converter classification. **(10 Marks)**

b. The step down dc converter has a resistive load R = 10 Ω and the input voltage is Vs = 220 V, when the converter switch remains on its v/g drop is $u_{ch} = 2$ V and the chopping frequency f = 1 kHz. If the duty cycle is 50%, determine: i) average output v/g va ii) rms o/p v/g vo iii) Converter efficiency. **(10 Marks)**

Module-5

9 a. Explain the performance parameters of an inverter. **(08 Marks)**

b. Explain the principle of operation of a single phase half bridge inverter. **(06 Marks)**

c. Explain the operation of single phase AC switch. **(06 Marks)**

OR

10 a. Explain single pulse width modulation and multiple pulse width modulation methods of controlling the output voltage of inverter. **(10 Marks)**

b. Write a brief note on current source inverter. **(05 Marks)**

c. A single phase bridge inverter has a resistive load of R = 2.4 Ω and dc input voltage is $V_s = 48$ V. Determine
i) The RMS output voltage at the fundamental frequency
ii) The output power
iii) The average and peak current of each transistor
iv) Peak reverse blocking voltage of each transistor. **(05 Marks)**

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