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17EC73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
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. Draw the symbols and the V-I characteristics of the following power semiconductor devices: (i) Diode (ii) Thyristor (SCR) (iii) SITH (iv) GTO (v) TRIAC **(10 Marks)**

b. Explain peripheral effects of power electronic components and equipment, mention how to eliminate them. **(06 Marks)**

c. List out different applications of power electronic system. **(04 Marks)**

OR

2 a. Explain the important characteristic features of power transistors and discuss different operating ranges of power BJT with the aid of output and transfer characteristic. **(10 Marks)**

b. Illustrate the switching characteristics of power MOSFET with necessary waveforms. **(10 Marks)**

Module-2

3 a. Describe modes of operation of SCR with a neat V-I characteristic. **(10 Marks)**

b. Develop two transistor model and derive an expression for anode current in terms of transistor parameters for a thyristor. **(10 Marks)**

OR

4 a. Illustrate with neat diagrams and waveforms, the operation of UJT triggering circuit for SCR. **(10 Marks)**

b. Estimate the required parameter for Snubber circuit to provide $\frac{dv}{dt}$ protection to SCR used in single phase bridge converter; the SCR has a maximum $\frac{dv}{dt}$ of 60 V/Msec. the input line to line voltage has peak value of 425 V and series inductance of 0.2 mH. **(05 Marks)**

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

Module-3

5 a. Describe with neat diagram and waveforms, half wave controlled rectifier with freewheeling diode and obtain average value of output voltage. **(12 Marks)**

b. A single phase full converter is operated from 120 V, 60 Hz supply. The load current with an average value of I_a is continuous with negligible ripple current. If turn ON ratio of transformer is unity with delay angle $\alpha = \frac{\pi}{3}$. Calculate:

(i) Harmonic Factor (HF) of input current
(ii) Displacement Factor (DF)
(iii) Supply Power Factor (PF) **(08 Marks)**

OR

6 a. Illustrate with neat circuit diagram and waveforms, the working principle of single phase AC voltage controller using phase control. Obtain average value of output voltage for single phase half wave controller. **(12 Marks)**

b. A single phase half wave AC voltage controller has resistance load of R = 5Ω and input voltage V_S = 120 V, 60 Hz. The delay angle of thyristor is $\alpha = \frac{\pi}{3}$, determine:

(i) rms output voltage (ii) input power factor (iii) average input current **(08 Marks)**

Module-4

7 a. Demonstrate the working principle of step-down Chopper with RL load. Derive an expression for average and rms value of load voltage. **(12 Marks)**

b. A step up dc chopper has an input of 200 v and an output of 250 V. The blocking period (T_{off}) in each cycle of operation is 0.6×10^{-3} seconds. Find the period of conduction (T_{ON}) in each cycle. **(08 Marks)**

OR

8 a. Outline the different performance parameters of dc choppers. **(06 Marks)**

b. Describe class D chopper with neat diagram. **(08 Marks)**

c. Design the filter components for buck convert which has an input voltage of 12V and output voltage of 5V. The peak to peak ripple voltage is 20 mV and peak to peak ripple current of inductor is limited to 0.8A. The switching frequency is 25 kHz. **(06 Marks)**

Module-5

9 a. With the help of circuit diagram and waveforms, explain the working of single phase bridge inverters. **(12 Marks)**

b. The single phase full bridge inverter with resistive load of R = 2.4 Ω and dc input voltage V_S = 48V. Determine:

i) RMS output voltage at the fundamental frequency
ii) Output power
iii) Peak current and average current of each transistor **(08 Marks)**

OR

10 a. Outline various performance parameters used for inverters. Compare Current Source Inverter (CSI) and Variable DC link inverter. **(10 Marks)**

b. Explain AC Switches (single phase) and Microelectronic Relays (MER) with neat diagram. **(10 Marks)**

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