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15EC73

Seventh Semester B.E. Degree Examination, June/July 2019 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. Explain the control characteristics of various power devices. (08 Marks)
- b. Explain the various types of power electronic circuits along with suitable waveforms. (08 Marks)

OR

- 2 a. Explain the construction, working and steady state characteristics of n-channel enhancement MOSFET. (08 Marks)
- b. With the help of neat circuit diagram and relevant waveforms, explain the transient characteristics of BJT. (08 Marks)

Module-2

- 3 a. Explain two transistor analogy of SCR. Using two transistor analogy derive the expression for anode current in terms of gate current. (08 Marks)
- b. With the help of suitable circuit and relevant waveforms, explain the following turn-OFF methods of SCR.
 - i) Natural commutation
 - ii) Class-A commutation with series load
 - iii) Class-A commutation with the load in parallel
 - iv) Class-B commutation (08 Marks)

OR

- 4 a. An SCR has $\frac{di}{dt}$ rating of 100 A/ μ s and $\frac{dv}{dt}$ rating of 50 V/ μ s. Design a protection circuit for SCR using a supply of 200 V. The load current is 20 A. (04 Marks)
- b. Using UJT triggering circuit, it is required to design a triggering circuit for the SCR so that the triggering angle can be varied for 20° to 120°. The supply voltage is 100 sin ωt . The intrinsic stand-off ratio of UJT is 0.6. (06 Marks)
- c. Draw the circuit of R-C triggering of SCR, explain the circuit operation and sketch the relevant waveforms. (06 Marks)

Module-3

- 5 a. A single phase full converter is connected to a supply of $(\sqrt{2} * 120) \sin 2\pi * 50t$. The triggering angle of the SCR is 60°. The load inductance is very large. Calculate (i) DC of output voltage (ii) rms output voltage (iii) Harmonic factor (HF) (iv) Input power factor (v) rms value of fundamental component of supply current. Take the load current as 10A. (08 Marks)
- b. A DC motor is used in an electric train. The DC motor is controlled by a power electronic circuit. It is required that the power electronic circuit should be capable of operating the DC motor in all four quadrant of operation. Draw the necessary circuit, explain its operation along with waveforms and derive the expression for DC o/p voltage. (08 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.

OR

- 6 a. A single phase full-wave AC voltage controller delivers an output power of 719.95 W to a load of 10Ω . The input voltage is $V_s = (169.7) \sin \omega t$. Find:
- rms o/p voltage
 - triggering angle α
- b. iii) rms value of SCR current
iv) average value of SCR current
v) input power factor. (08 M)
- Draw the circuit of single phase bidirectional AC voltage controller with inductive load. Explain its operation along with relevant waveforms. Derive the expression for rms output voltage. (08 M)

Module-4

- 7 a. A step down chopper is used for supplying power to load consisting of resistance of 5Ω and inductance of 7.5 mH. The chopper is operated at a constant frequency 1 kHz and the duty cycle is adjusted to get maximum ripple current in the load. Calculate:
- peak currents I_1 and I_2
 - the ripple current ΔI
 - average load current
 - rms load current
 - average source current. (08 M)
- b. Draw the circuit of step up chopper and explain its operation with relevant waveforms. Derive the expression for output voltage and show that the o/p voltage is greater than the input voltage. (08 M)

OR

- 8 a. A step down chopper is used for supplying power to 10Ω load. The input voltage is 220V. The voltage drop across the chopper is 2V. The operating frequency of the chopper is 1 kHz with a duty cycle of 0.5. Calculate: (i) rms and average output voltage (ii) efficiency of the converter (iii) input resistance (iv) rms value of fundamental component of output voltage. (08 M)
- b. Explain the classification of chopper. (08 M)

Module-5

- 9 a. Explain the operation of single phase full bridge inverter with relevant waveforms. (08 M)
- b. With the help of circuit diagram and relevant waveform, explain current source inverter. What are the advantages and disadvantages of current source inverter? (08 M)

OR

- 10 a. Explain the working of boost inverter with the help of neat circuit diagram and waveforms. Derive the expression for o/p voltage. (08 M)
- b. Write short notes on:
- Single phase AC switches
 - Solid state switches (08 M)

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