

CBCS SCHEME

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18EC36

Third Semester B.E. Degree Examination, Dt0109/.1aif.2020

Power Electronics and Instrumentation

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- I a. Name the power semiconductor devices along their circuit symbols and maximum Ratings. (04 Marks)
- b. Explain the operation of SCR, in terms of two transistor model and derive anode current and gate currents relation. Discuss how a small gate current can trigger the device into condition. (08 Marks)
- c. The latching current of a thyristor circuit is 60m Amp. The duration of the firing pulse is 50gsec. Given $V_f = 100V$, $R = 20\Omega$ and $L = 0.5H$ are connected in series.
- i) Derive the expression for circuit current $i(t)$
 - ii) Draw variation of current $i(t)$ with reference to time
 - iii) Will the thyristor device get turned ON? (08 Marks)

OR

- 2 a. Enumerate the applications of power electronics. (04 Marks)
- b. Explain the operation of self commutation by resonating load [class A] with relevant circuit and waveforms. (08 Marks)
- c. What are the gate triggering schemes? Explain with circuit diagram and waveforms, how RC triggering circuit turns ON (triggers) SCRs. (08 Marks)

Module-2

- 3 a. Explain the control strategies used to operate choppers. (06 Marks)
- b. Explain with the help of neat circuit diagram and waveforms, the operation of a single phase half wave controlled rectifiers with resistive load. Derive an expression for the :
- i) Average load voltage ii) RMS load voltage. (08 Marks)
- c. For the ideal type A [step down] chopper circuit, following conditions are given : $V_s = 220V$, Duty cycle = 0.3, Chopping frequency $f = 500Hz$, $R = 1\Omega$, $L = 3mH$ and $E_b = 23$ volts. Determine the following :
- i) Minimum value of output current (load)
 - ii) Maximum value of output current (load)
 - iii) Average output (load) current. (06 Marks)

OR

- 4 a. Explain the effect of free wheeling diode used in controlled rectifiers. (04 Marks)
- b. With the circuit diagram and circuit waveforms, explain the principle of operation of step-up chopper. (08 Marks)
- c. A single phase fully controlled bridge rectifier is feeding to a RL load, to obtain a regulated DC output voltage. The RMS value of the AC voltage is 230V, at 50Hz and the firing angle is maintained at 1113, so that the load current is 4Amp.
- i) Calculate the DC average output voltage
 - ii) Active power and reactive power input
- iii) Assuming the load resistance remains the same, determine DC average output voltage. If a freewheeling diode is used at output with all the conditions remains same. (08 Marks)