CBCS SCHEME

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18EC36

Third Semester B.E. Degree Examination, Dec.2019/Jan.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

1 a. Name the power semiconductor devices along their circuit symbols and maximum Ratings. **(04 Marks)**

b. Explain the operation of SCR, interms 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 50μsec. Given $V_s = 100V$, $R = 20\Omega$ 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 gets 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 wave forms, now 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 = 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 $\pi/3$, 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)**

Module-3

5 a. Define the terms : i) instrument ii) Accuracy iii) Absolute error iv) Relative errors? **(04 Marks)**

b. Explain the operation of single – phase half bridge inverter connected to RL load, with the help of circuit and waveforms. **(08 Marks)**

c. A basic D' arsonval movement with a null scale deflection of 2mAmp and having an internal resistance of 50Ω is available. It is to be converted into a 0–10V, 0–1000V, 0–100V and 0–250V multi range voltmeter. Determine the value of resistance to extend? **(08 Marks)**

OR

6 a. What are inverters? Classify the inverters according to commutation and connections? **(04 Marks)**

b. What are the static errors? Explain them in detail with examples. **(08 Marks)**

c. A single phase half bridge inverter, has resistive load of R = 3Ω and DC input voltage V_{dc} = 50 volts. Calculate :

i) RMS output voltage at fundamental frequency
ii) The output power (P_0)
iii) The average and peak current of each thyristor
iv) The peak – reverse blocking voltage of each thyristor. **(08 Marks)**

Module-4

7 a. Explain how a simple AC bridge circuit operates and derive an expression for the unknown parameters. **(04 Marks)**

b. With the aid of diagram, explain the working of unbalanced wheat stone bridge and derive for a galvanometer current expression. **(08 Marks)**

c. Explain the principle of operation of digital time measurement with basic block diagram. **(08 Marks)**

OR

8 a. What are the advantages of digital instruments over analog instruments? **(04 Marks)**

b. Determine the equivalent parallel resistance and capacitance that causes a Wein's bridge to null condition with the following values : R_1 = 3.1KΩ, C_1 = 5.2μF, R_2= 55KΩ, R_4 = 100KΩ, ff = 2.5KHz. Derive the balanced expressions. **(08 Marks)**

c. With neat block diagram, explain the operating principle of a Ramp type DVM. **(08 Marks)**

Module-5

9 a. Define transducers. What are advantages of electrical transducers? **(04 Marks)**

b. Explain instrumentation Amplifier using transducer bridge with the help of circuit diagram. **(08 Marks)**

c. Explain with neat diagram the PLC structure. **(08 Marks)**

OR

10 a. What are features of instrumentation Amplifiers? How it differs from the ordinary opAmp. **(04 Marks)**

b. Describe the operation of resistive position transducer with constructional diagram and typical circuit used. **(08 Marks)**

c. With the aid of Bridge circuit, explain the working of resistance thermometer. Mention limitations of it. **(08 Marks)**

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