USN | | | | | | | | | | | **18EC36**

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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. Explain the static anode cathode characteristic of SCR. **(04 Marks)**
   b. With the help of waveforms, explain dynamic turn on switching characteristics and turn-off mechanism of SCR. **(08 Marks)**
   c. Write the applications of power electronics in various sectors. **(08 Marks)**

OR

2 a. Draw the circuit diagram of R.C. firing and explain its operation. **(06 Marks)**
   b. With the help of circuit diagram and waveforms, explain Class-A commutation circuit. **(06 Marks)**
   c. Design a UJT relaxation oscillator using UJT 2N2646, for triggering an SCR. The UJT has the following characteristics $\eta = 0.7$, $I_P = 50$ μA, $V_V = 2V$, $I_V = 6$ mA, $V_{BB} = 20$ V, $R_{BB} = 7$ kΩ, $I_{EO} = 2$ mA. **(08 Marks)**

Module-2

3 a. With the help of circuit diagram and waveforms, explain the working of single phase full wave controlled rectifier. Consider M2 (midpoint) configuration and R-Load. **(08 Marks)**
   b. Explain the effect of free wheeling diode in controlled rectifiers. **(04 Marks)**
   c. A step down DC chopper has a resistive load of R = 15 Ω and input voltage $E_{dc} = 200$ V. When the chopper remains ON. Its voltage drop is 2.5 V. The chopper frequency is 1 kHz. If the duty cycle is 50%, determine: (i) Average output voltage   (ii) RMS output voltage (iii) Chopper efficiency **(08 Marks)**

OR

4 a. Give the classifications of choppers according to the directions of output voltage and current. **(05 Marks)**
   b. Explain the principle of operation of step up/down choppers with the help of circuit diagram. **(09 Marks)**
   c. A single phase half wave controlled converter is operated from a 120 V, 50 Hz supply. Load resistance R = 10 Ω. If the average output voltage is 25% of the maximum possible average output voltage, determine: (i) Firing angle   (ii) rms and average output currents (iii) Average and rms SCR currents **(06 Marks)**

Module-3

5 a. Define the following terms:
   (i) Measurement   (ii) Resolution   (iii) Error   (iv) Sensitivity **(04 Marks)**
   b. Design a multi-range ammeter with range of 0-1A, 5A and 10A employing individual shunt in each D'Arsonval movement with an internal resistance of 500 Ω and a full scale deflection of 10 mA is available. **(08 Marks)**
   c. With the help of necessary circuit diagram and waveforms, explain the operation of single phase half bridge inverter with R-Load. **(08 Marks)**

OR

6 a. Define the following:
   (i) Instrumental error
   (ii) Environmental errors
   (iii) Observational errors **(06 Marks)**

   b. A voltmeter having a sensitivity of 1 KΩ/V is connected across an unknown resistance in series with a miliammeter reading 80 V on 150 scale. When the miliammeter reads 10 mA, calculate the
   (i) Apparent resistance of the unknown resistance
   (ii) Actual resistance of the unknown resistance
   (iii) Error due to the loading effect of the voltmeter. **(06 Marks)**

   c. With the help of necessary circuit and waveforms, explain the operation of Buck converter. **(08 Marks)**

Module-4

7 a. With the help of neat block diagram, explain the working of dual slope integrating type digital voltmeter. **(08 Marks)**

   b. An unbalanced Wheatstone bridge is given in Fig.Q7(b). Calculate the current through the galvanometer.
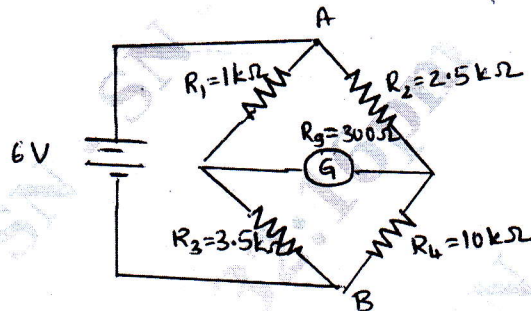

Fig.Q7(b) **(08 Marks)**

   c. What is the principle of digital frequency measurement? Explain. **(04 Marks)**

OR

8 a. Explain successive approximation type digital voltmeter with the help of block diagram. **(08 Marks)**

   b. Derive an expression for measuring unknown capacitance using capacitance comparison bridge. **(06 Marks)**

   c. Obtain an expression for audio frequency using Wein's bridge **(06 Marks)**

Module-5

9 a. What are the parameters to be considered while selecting a transducer? **(04 Marks)**

   b. Obtain an expression for the gauge factor of a strain gauge. **(08 Marks)**

   c. Write the circuit of instrumentation amplifier and derive an expression for output voltage. **(08 Marks)**

OR

10 a. Explain the structure of PLC. **(07 Marks)**

   b. Explain different type of thermistors. Also mention its advantages. **(06 Marks)**

   c. With the help of diagram, explain the operation of linear variable differential transformer. **(07 Marks)**

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