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18EC36

Third Semester B.E. Degree Examination, Feb./Mar. 2022  
**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. Mention the different types of power electronic converters. Explain the significance, functions and applications of them. (07 Marks)
- b. Explain the static Anode-Cathode characteristics of SCR with circuit diagram and V-I characteristics. (08 Marks)
- c. Explain the basic operation of the unijunction transistor with basic UJT structure, UJT symbol and equivalent circuit. (05 Marks)

OR

- 2 a. Mention the applications of power electronics in various sectors. (07 Marks)
- b. The latching current of a thyristor circuit is 50mA. The duration of the firing pulse is 50 $\mu$ s. Will the thyristor get fired? (05 Marks)

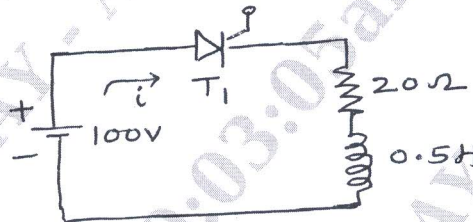


Fig.Q.2(b)

- c. Explain the operation of the resistance firing circuit with associated voltage waveforms. Derive the relevant expressions. (08 Marks)

**Module-2**

- 3 a. Explain the operation of the single phase half wave controlled rectifier with resistive load using circuit and waveforms. (10 Marks)
- b. Give basic chopper classification with different chopper configurations. (05 Marks)
- c. A dc chopper circuit connected to a 100V dc source supplies an inductive load having 40mH in series with a resistance of 5 $\Omega$ . A freewheeling diode is placed across the load. The load current varies between the limits of 10A and 12A. Determine the time ratio of the chopper. (05 Marks)

OR

- 4 a. Explain the effect of freewheeling diode with half wave controlled rectifier circuit and waveforms using inductive load. (10 Marks)
- b. Explain the operation of step-up/down choppers with suitable circuit. Derive the relevant expression. (07 Marks)
- c. A step-up chopper is used to deliver load voltage of 500V from a 220V dc source. If the blocking period of the thyristor is 80 $\mu$ s. Compute the required pulse-width. (03 Marks)

Module-3

- 5 a. Explain the operation of the single phase half bridge inverter with RL load. Draw the relevant circuit and waveforms. (10 Marks)
- b. Explain the operation of the isolated forward converter with suitable circuit diagram and relevant waveforms. Mention the advantages and disadvantages. (10 Marks)

OR

- 6 a. Explain the types of errors in measurements. (07 Marks)
- b. Explain the operation of the multirange voltmeter with normal circuit and with multipliers connected in series string circuit. (07 Marks)
- c. A 1mA meter movement having an internal resistance of  $100\Omega$  is used to convert into a multirange ammeter having the range 0-10mA, 0-20mA, and 0-30mA. Determine the value of the shunt resistance required. (06 Marks)

Module-4

- 7 a. Explain the operation of dual slope integrating type DVM with basic principles and suitable block-diagram. (08 Marks)
- b. With suitable block diagram, explain the operation of measurement of time briefly. (07 Marks)
- c. A capacitance comparison bridge is used to measure a capacitive impedance at a frequency of 2kHz. This bridge constants at balance are  $C_3 = 100\mu\text{F}$ ,  $R_1 = 10\text{K}\Omega$ ,  $R_2 = 50\text{K}\Omega$ ,  $R_3 = 100\text{K}\Omega$ . Find the equivalent series circuit of the unknown capacitance. (05 Marks)

OR

- 8 a. With suitable block diagram and table explain the operation of successive approximation DVM. (08 Marks)
- b. With suitable block diagram approach explain the operation of the digital frequency meter. (07 Marks)
- c. Find the equivalent parallel resistance and capacitance that causes a Wien bridge to null with the following component values  $R_1 = 3.1\text{K}\Omega$ ,  $C_1 = 5.2\mu\text{F}$ ,  $R_2 = 25\text{K}\Omega$ ,  $f = 2.5\text{kHz}$ ,  $R_4 = 100\text{K}\Omega$ . (05 Marks)

Module-5

- 9 a. Explain the operation of the resistive position transducer with construction and electrical equivalent circuit. (07 Marks)
- b. In the differential instrumentation amplifier using transducer bridge,  $R_1 = 2.2\text{K}$ ,  $R_F = 10\text{K}$ ,  $R_A = R_B = R_C = 120\text{K}$ ,  $E = +5\text{V}$  and op-amp supply voltage =  $\pm 15\text{V}$ , the transducer is a transistor with the following specifications.  $R_T = 120\text{K}$  at a reference temperature of  $25^\circ\text{C}$ . Temperature coefficient of resistance =  $-1\text{K}/^\circ\text{C}$ . Determine the output voltage at  $0^\circ\text{C}$  and  $100^\circ\text{C}$ . (06 Marks)
- c. Explain the PLC structure with block diagram. And also explain the PLC operation with PLC operation diagram. (07 Marks)

OR

- 10 a. Explain the operation of the LVDT with construction, various core positions of it, and variation of output voltage vss displacement. (10 Marks)
- b. What is the significance of analog weight scale? Using strain gauge bridge circuit for analog weight scale explain its operation briefly. (05 Marks)
- c. With Bell circuit diagram, explain the operation of the Programmable Logic Controller (PLC) relays. (05 Marks)

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