CBCS SCHEME

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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 50μs. Will the thyristor get fired? **(05 Marks)**

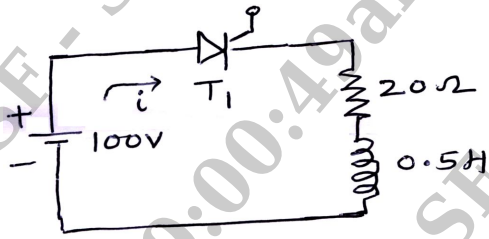

Fig.Q.2(b)

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 5Ω. 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 80μs. 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 100Ω 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 = 100μF, R_1 = 10KΩ, R_2 = 50KΩ, R_3 = 100KΩ. 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 = 3.1KΩ, C_1 = 5.2μF, R_2 = 25KΩ, f = 2.5kHz, R_4 = 100KΩ. **(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 = 2.2K, R_F = 10K, R_A= R_B = R_C = 120K, E = +5V and op-amp supply voltage = ±15V, the transducer is a transistor with the following specifications. R_T = 120K at a reference temperature of 25°C. Temperature coefficient of resistance = -1K/°C. Determine the output voltage at 0°C and 100°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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