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(b) A CRT has an anode voltage of 2000 V and parallel deflecting plates 2 cm long and 5 mm apart. The screen is 30 cm from the center of plates. Find the input voltage required to deflect the beam through 3 cm. The input voltage is applied to the deflecting plates through amplifiers having an overall gain of 100. **5**

7. (a) A steel diaphragm is used for pressure measurement. It is 50 mm in diameter and is to be designed to measure a maximum pressure of 1.5 MN/m^2. The modulus of elasticity of steel is 200 GN/m^2 and Poisson's ratio is 0.3. Calculate the thickness of diaphragm in order that the maximum deflection is not more than 1/3 of its thickness. Calculate the natural frequency of diaphragm. The density of steel is 7800 kg/m^3. **10**

(b) Discuss the working principle of a digital temperature sensing system and its advantages over traditional analog temperature measurement methods. **5**

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May 2024

B. Tech. (EEIOT) (Fourth Semester)

Measurement and Instrumentation (EEN-402)

Time : 3 Hours] [*Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other. Assume relevant data, if not provided.

Part A

1. (a) What is the root sum squares formula and its relevance in quantifying error in measurement systems ? **1.5**

(b) What are the key performance characteristics of measuring instruments and how do they impact measurement accuracy ? **1.5**

(c) How can the range of analog ammeters and voltmeters be extended ? **1.5**

(d) What would a true rms reading voltmeter indicate if a pulse waveform of 5V peak and a duty cycle of 25% is applied to it ? **1.5**

(e) How frequency is measured using a Wien's bridge ? **1.5**

(f) Why Wheatstone bridge is still relevant in today's world ? **1.5**

(g) Compare the dual trace and dual beam CRO. **1.5**

(h) What is the use of focusing anode in CRO and which potential is applied to it ? **1.5**

(i) Give the expressions for flow meter in (i) venturimeters and (ii) orifice plates. **1.5**

(j) Why LVDT has linear response ? **1.5**

Part B

2. Provide an overview of key specifications for DC Voltmeters and AC Voltmeters including accuracy, sensitivity and compliance with standards. **15**

3. (a) Describe the circuit diagram and operation of an Electronic Voltmeter using a difference amplifier. Explain the functions of zero setting and calibration resistors. **10**

(b) Draw Block diagram of a Sweep generator and explain its working. **10**

4. Describe the basic circuit of a spectrum analyzer. Explain how the spectra of the following is displayed : **15**

(i) Continuous wave signals

(ii) Amplitude modulated signals

(iii) Pulse modulated signals.

5. (a) Derive the equations of balance for an Anderson's bridge. Draw the phasor diagram for conditions under balance. **10**

(b) The four arms of a Hay's A.C. bridge are arranged as follows: AB is a coil of unknown impedance: BC is a non-reactive resistor of 1000 Ω CD is a non-reactive resistor of 833 Ω in series with a standard capacitor of 0.38 μF; DA is a non-reactive resistor of 16800 Ω. If the supply frequency is 50 Hz, determine the inductance and the resistance at the balance conditions. **5**

6. (a) Explain, how CRO can be used to measure frequency and phase angle. **10**