Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (DEFENCE TECHNOLOGY)

END SEMESTER MAKE UP EXAMINATIONS, JUNE 2024

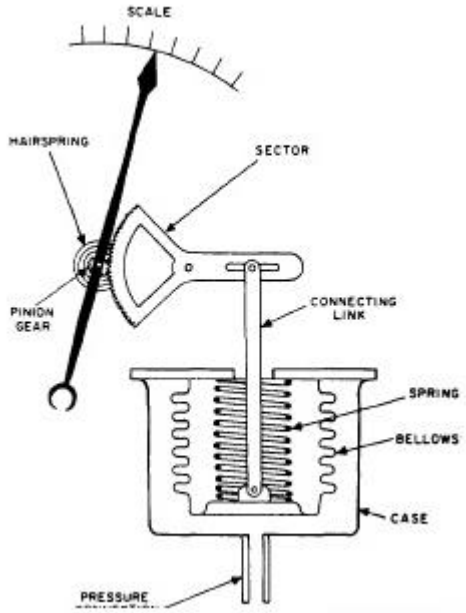
DATA ACQUISTION, TRACKING AND POST FLIGHT ANALYSIS [AAE 5060]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 26th June 2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

Q.NO	Questions	*Marks*	*CO*	*BTL*
1A.	Write a note on classification of instruments and direct and indirect measurements with appropriate examples.	**[5M]**	**1**	***2***
1B.	For the measuring instrument given below, draw the generalized block diagram of all function components and explain its working.  	**[5M]**	**2**	**4**
2A.	Consider a Pressure control system with a tank capacity of 0 to 2 Kg/cm2. A pressure transmitter is used and calibrated to give an output of 4 to 20 mA. A data acquisition system with a resolution of 10 bit is used with an input range of 0 to 20mA. If the pressure value is 0.6 Kg/cm2, calculate (a) the binary value that will be stored in memory of the system. (b) find out the input pressure change and transmitter change, if there is a 1bit change in the memory (minimum detectable pressure).	**[5M]**	**2**	**4**

<table>
<tr><td>2B.</td><td>Draw the block diagram of a typical data acquisition system and explain its functional blocks.</td><td>[3M]</td><td>2</td><td>1</td></tr>
<tr><td>2C.</td><td>What is aliasing? Explain.</td><td>[2M]</td><td>2</td><td>1</td></tr>
<tr><td>3A.</td><td>The table given below lists a sample of experimental data.
<table>
<tr><td>Value</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
<tr><td>Frequency of Occurrence</td><td>2</td><td>3</td><td>3</td><td>6</td><td>7</td><td>6</td><td>4</td><td>3</td><td>2</td></tr>
</table>
Calculate (a) Arithmetic Mean, (b). Mean Deviation (c). Std. Deviation, (d). Probable error of one reading, (e). Probable error of mean, and (f). Std. Deviation of Std. Deviation.</td><td>[5M]</td><td>3</td><td>4</td></tr>
<tr><td>3B.</td><td>Draw the circuit of a non-inverting summing amplifier and derive an expression for its output.</td><td>[5M]</td><td>3</td><td>3</td></tr>
<tr><td>4A.</td><td>Differentiate primary and secondary sensing elements with an example.</td><td>[2M]</td><td>2</td><td>1</td></tr>
<tr><td>4B.</td><td>A thermocouple provides 0.56mV at 10^0C and 0.68mV at 500 ^{0}C. Design an amplification circuit to get an output of 0 to 5V.</td><td>[3M]</td><td>4</td><td>4</td></tr>
<tr><td>4C.</td><td>Design a second-order Sallen-Key low-pass filter circuit using operational amplifiers to meet the following specifications:
a) Cutoff frequency (fc): 1 kHz
b) Passband gain (A_pass): -3 dB (unity gain)
c) Quality factor (Q): 0.707 (Butterworth response)</td><td>[5M]</td><td>4</td><td>4</td></tr>
<tr><td>5A.</td><td>Write a note on second order systems and its time domain response.</td><td>[3M]</td><td>4</td><td>2</td></tr>
<tr><td>5B.</td><td>Explain any four static characteristics of a measuring instrument</td><td>[2M]</td><td>4</td><td>2</td></tr>
<tr><td>5C.</td><td>Design a RTD circuit with wheat stone bridge for an input temperature of 200 ^{0}C to 600 ^{0}C, with a required output of 0 to 5V. Consider a 10bit ADC which is used to convert the analog signal to digital and interfaced with a computer. Calculate the corresponding binary value stored in the memory if the current temperature is 350 ^{0}C.</td><td>[5M]</td><td>5</td><td>5</td></tr>
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