MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (DEFENCE TECHNOLOGY)
END SEMESTER EXAMINATIONS, MAY 2023

DATA ACQUISTION, TRACKING AND POST FLIGHT ANALYSIS [AAE 5060]
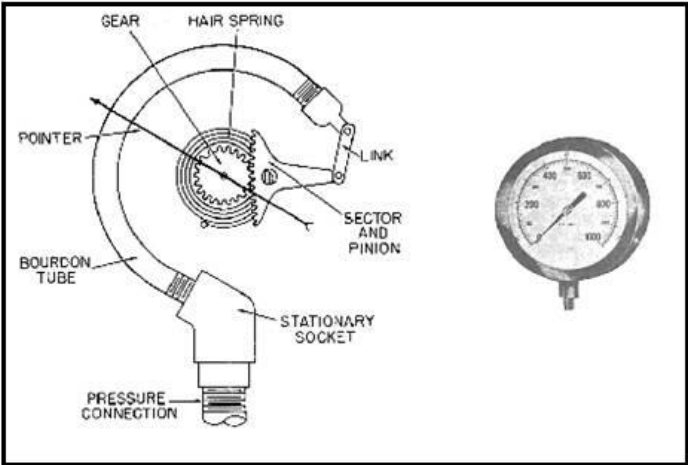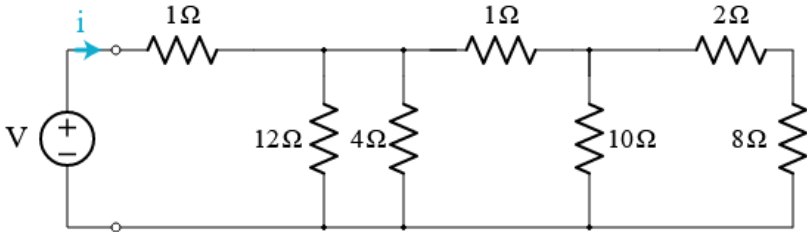### REVISED CREDIT SYSTEM

Time: 3 Hours   **Date: 09 May 2024**   **Max. Marks: 50**

Instructions to Candidates:
- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.

Q.NO	Questions	Marks	CO	BTL
1A.	For the measuring instrument given below, draw the generalized block diagram of all function components and explain its working.	**[5M]**	1	3
1B.	A RTD temperature sensor is characterized by $R = R_0(1 + \alpha\,\Delta T)$ where α = 0.00385, R_0= 100^{0}C. The experimental data of the same is listed below. Calculate the following: i. Sensitivity ii. Deflection Factor iii. Zero drift iv. Sensitivity drift <table><tr><td>Temperature (ºC)</td><td>Resistance (Ω)</td></tr><tr><td>0</td><td>100.5</td></tr><tr><td>50</td><td>119.4</td></tr><tr><td>100</td><td>138.5</td></tr><tr><td>150</td><td>157.3</td></tr><tr><td>200</td><td>175.9</td></tr></table>	**[5M]**	*2*	4
2A.	Write a note on classification of instruments with appropriate examples.	**[3M]**	1	1

2B.	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 the 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
2C.	What is aliasing? Explain.	[2M]	2	1
3A.	A set of independent ten measurements were made to determine the weight of a lead shot. The weights in gramme were: 1.510, 1.597, 1.591, 1.562, 1.577, 1.580, 1.564, 1.586, 1.550, 1.575. Calculate (a) Arithmetic Mean, (b). Mean Deviation (c). Std. Deviation, (d). Variance, and (e). Probable error of one reading	[4M]	3	4
3B.	Draw the circuit of a differential amplifier and derive an expression for its output.	[3M]	3	3
3C.	For the circuit given below, calculate the overall resistance value and calculate the value of the current i, if the supply is 5V. 	[3M]	3	1
4A.	Differentiate primary and secondary sensing elements with an example.	[2M]	2	1
4B.	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.	[3M]	4	4
4C.	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)	[5M]	4	4
5A.	Write a note on second order systems and its time domain response.	[3M]	4	2

5B.	Explain any four static characteristics of a measuring instrument	[2M]	4	2
5C.	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.	[5M]	5	5