1. Write the answers of any two out of three of the following: 7x2=14
   (a) (i) What is least squares analysis?
       (ii) What is meant by measurement of precision?
       (iii) Write the general comment on report writing.
   (b) (i) Define bandwidth and noise restrictions.
       (ii) Discuss on thermal radiation.
   (c) (i) The following data points are expected to follow a functional variation of \( y = ax^b \). Obtain the values of 'a' and 'b' from a graphical analysis. What is the average deviation?

<table>
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<th>( X )</th>
<th>12</th>
<th>20</th>
<th>30</th>
<th>40</th>
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<th>300</th>
<th>400</th>
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</thead>
<tbody>
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<td>2.5</td>
<td>3</td>
<td>3.3</td>
<td>5.3</td>
<td>10</td>
<td>11</td>
<td>17</td>
<td>30</td>
</tr>
</tbody>
</table>
2 Write the answers of any two out of three of the following: 7x2=14
(a) (i) Write short note on transducer in measurement system.
(ii) Explain frequency to voltage converters.
(b) (i) Discuss on A.C. amplifier and D.C. amplifier.
(ii) Define grounding and shielding of material.
(c) (i) Discuss on different types of instrumentation in measurement system.
(ii) State the differences between analog and digital representation of signals.

3 Write the answers of any two out of three of the following: 7x2=14
(a) (i) Distinguish among gage pressure, absolute pressure and vaccum.
(ii) Write the advantages of a well-type manometer and manometer pressure measurement device.
(b) (i) Write short note on ionization gage.
(ii) Write the principal and application of alphatron.
(c) (i) Write the principle of a Mc-lead gage.
(ii) A diaphragm has a=1.0 in, b=0.125 in and t=0.048 in and is constructed of spring steel. It is subjected to a total loading of 600 lbf. Calculate the deflection.

4 Write the answers of any two out of three of the following: 7x2=14
(a) Discuss on resistance temperature detector. What are the advantages and disadvantages of RTD? Write the applications of RTD.
(b) (i) Write short note on viscosity measurement system.
(ii) Write the function of thermocouple. Discuss on thermocouple compensation.
(c) Define thermoelectric effect. Calculate the temperature sensitivity for thermistor at 100°C. Express the result in ohm-centrimeters per degree celsius: Take $\beta=4120\,^\circ K$ and resistivity $\rho=110\Omega^{-1}$ at 100°C.
Write the answers of any two out of three of the following:

(a) Distinguish between stress and strain. Explain strain gage rosette.

(b) (i) Write the characteristics of bounded resistance wire strain gage.

(ii) Explain semiconductor strain gages.

(c) (i) What is strain sensitivity?

(ii) A rectangular rosette is mounted on a steel plate having $E = 29 \times 10^6$ psi and $\mu = 0.3$. The three strains are measured as $\epsilon_1 = +500 \ \mu \text{in/in}$, $\epsilon_2 = +400 \ \mu \text{in/in}$, $\epsilon_3 = +100 \ \mu \text{in/in}$. Calculate the principal strains, stresses and the maximum shear stress. Locate the axis of the principal stress.