Problem 1 (1 to 5 0.2 %)

Which one of the following best describes instrument or system resolution?

a) The absolute value of an output signal.  
b) The error in repeated measurements.  
c) The minimum signal value of an input.  
d) The smallest change in input that can be detected in the output.

Problem 2

Relative to an instrument control system, what is response time?

a) The change in output over the change in input under specified conditions.  
b) The time for the output to achieve some steady state condition.  
c) The output as a function of time due to a specific input under specified conditions.  
d) The time required for the output to respond to a change in the input.

Problem 3

What is the definition of instrument or system accuracy?

a) The maximum uncertainty of a reading.  
b) Dead band.  
c) Repeatability error.  
d) Sensitivity.

Problem 4

Relative to process control and instrumentation, what is a transmitter?

a) A device that converts a measured signal to a standard signal and sends it to other devices.  
b) A device that amplifies a measured signal.  
c) A device that compares a measured signal to a set point signal.  
d) A device that provides a wireless connection.

Problem 5

Which one of the following best describes instrument or system sensitivity?

a) The error in repeated measurements.  
b) The minimum signal value of an output.  
c) The ratio of the change in output magnitude to the change in input.  
d) The minimum signal value of an input.

Problem 6 (1 to 20 0.2%)

<table>
<thead>
<tr>
<th></th>
<th>Identify the following Definitions?</th>
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<tbody>
<tr>
<td>1</td>
<td>When none of the process variables are changing with time.</td>
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<tr>
<td>2</td>
<td>A device that converts one energy form to another.</td>
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<td>3</td>
<td>The signal from a primary element.</td>
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<td>4</td>
<td>A continuum of signal values defined as a function of time.</td>
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<tr>
<td></td>
<td>Description</td>
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<tr>
<td>5</td>
<td>A sampled signal value defined at discrete time increments.</td>
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<td>6</td>
<td>A device that converts a digital signal to an analog signal</td>
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<td>7</td>
<td>The smallest change in input that can be detected in the output. The least resolution between two discrete indications that can be distinguished from one another</td>
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<tr>
<td>8</td>
<td>The time rate of change of the output of a system as a function of a change to the input.</td>
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<td>9</td>
<td>Relates to the time required to produce a fraction of the steady state change of the output of a first order system as a result of a change to the input.</td>
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<td>10</td>
<td>The upper range value minus the lower range value of an instrument.</td>
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<td>11</td>
<td>The limit or maximum uncertainty, the degree of conformity of of an indicated value to a reference standard or true value.</td>
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<tr>
<td>12</td>
<td>The ratio of the change in output magnitude to the change in input that causes it after steady state has been obtained.</td>
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<td>13</td>
<td>Type of Op-amp that the sign of output voltage relative to ground is the same as the input voltage</td>
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<tr>
<td>14</td>
<td>In many measuring situation, the signal is complicated and often necessary to remove some of these frequencies by a process called…</td>
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<tr>
<td>15</td>
<td>False frequency component that appears in the recorded signal when a signal is sampled at a frequency less than twice the max. frequency in the signal</td>
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<tr>
<td>16</td>
<td>The conditions of the surroundings</td>
</tr>
<tr>
<td>17</td>
<td>Controls all aspect of computer system operation and perform all of the arithmetic operations</td>
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<tr>
<td>18</td>
<td>A subsystem of the computer that can store information temporarily</td>
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<tr>
<td>19</td>
<td>An effect that an amplifier with a narrow bandwidth will change the shape of an input time varying signal</td>
</tr>
<tr>
<td>20</td>
<td>An effect that the phase angles varies non- linear with frequency</td>
</tr>
</tbody>
</table>

**Problem 7 (0.25%)**

An amplifier has again of 60 dB. If the input voltage is 4 mV what is the output voltage

**Problem 8 (0.5%)**

Name the components of the DAS below.

![Diagram](image)
Problem 9 (9 to 10 1.5%)

The mean weight of 400 female workers is 60 kgf and the standard deviation is 6 kgf. Assuming a normal distribution, how many female workers weigh more than 160 lbs?

Problem 10

A distributor claims that the chance that any of the three major components of a computer (CPU, monitor, and keyboard) is defective is 3%. Calculate the chance that none of them will be defective in a single computer.

Problem 11 (3.25%)

a) In filling nominally 12-oz beer cans, the probability that a can has 12 or more ounces is 99%. If five cans are filled, what is the probability that none of them will have 12 or more ounces?

b) A box contains 500 electrical switches, each one of which has probability of 0.005 of being defective. Use poison distribution compute the probability that the box contains no more than three defective switches.

Problem 12 (12 to 14 2.0%)

Three power plants, which X, Y and Z are in service simultaneously, Event A is that power plant X is always idle, event B is that at least two out of three plants generating electricity. The likelihood of event A is 60% and the likelihood of the all outcomes of event A are equal. Complement of A and B is 10%. Determine likelihood of event B?

Problem 13

There is a probability (likelihood) f 0.261 that a milk container is underweight throughout of packaging line. Suppose milk containers are to retail outlets in boxes of 20 containers shipped. What is the likelihood that a box contains no more than 5 underweight containers?

Problem 14

A company manufacturers concrete blocks that are used for construction purposes. Suppose that the weights of the individual concrete blocks are normally distributed with a mean value of \( \mu = 11.0 \) kg and standard deviation of \( \sigma = 0.3 \) kg. Determine the probability that any randomly selected concrete block has a weight within the interval of \([10.23 \text{ kg}, 11.77 \text{ kg}]\)

Problem 15 (15 to 25 0.2%)

What is the limit of resolution for a digital measurement system?

a) 8 bit  b) 2 bit  c) 1 bit  d) 0 bit

Problem 16

Convert the decimal integer -8 to a 4-bit 2’s- complement binary number

Problem 17

Which one of the following is not a transducer?

1. Strain gauge  5. Chemical cell  9. Quartz crystal
2. Transformer  6. Thermocouple  10. bellows

a) 3 and 12  b) 3, 4 and 12  c) 8 and 10  d) none (they are all transducers)

Problem 18

If the range of a particular temperature indicating device is from -25 deg C to 100 deg C, what is its span?
Problem 19
The operation of an electrical type strain gauge makes use of which one of the following principles?

a) A change in resistance or impedance with a change in length.
b) A change in density or specific weight with a change in temperature.
c) A change in capacitance with a change in volume.
d) A change in density and resistance with a change in temperature and length.

Problem 20
Specific weight of pure water in UCS is

a) 62.4 lb/ft³  b) 1000 kg/m³  c) 101 KPa  d) 32.2 ft³/lb  e) 9.81 KN/m³

Problem 21
Rpm is;

a) Angular velocity  b) Object speed divided by speed of sound  c) Voltage  d) Speed of sound

Problem 22
The standard engineering unit for electrical power is

a) Ohms  b) Joules  c) Watts  d) Amperes  e) BTU

Problem 23
Which of the two cars is more fuel-efficient (show your work)

a) Car-A, 8 kilometers per Liter or, b) Car-B, which gives 18 miles per gallon

Problem 24
Specific gravity number is same as density number of matters. The unit of specific gravity is

a) kg/m³  b) slug/ft³  c) unit less  d) N/ m³  e) lb/ft³

Problem 25
Specific gravity of liquid A is 2; liquid B is 10. They used to measure the same pressure. Determine the height ratio of the liquid A and Liquid B if they are used as a manometer?

a) 1.5  b) 2.5  c) 5  d) 10  e) none of them