



قائمة الاسئلة

(50) الاختبار هذا درجة - (القياس وعلم الميكانيكية القياسات) ME223 Mechanical Measurements and Metrology

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- 1) \_\_\_\_\_ is the smallest difference between two indications that can be detected on the instrument scale.
  - 1) - Readability
  - 2) ☒ + Least Count
  - 3) - Range
  - 4) - Sensitivity
- 2) \_\_\_\_\_ type of thermistor is defined as a resistor that is thermally sensitive, its resistance \_\_\_\_\_ decreases in an exact and predictable manner as the core temperature \_\_\_\_\_ over a temperature range.
  - 1) - PTC Thermistors, increases, decreases
  - 2) - PTC Thermistors, increases, increases
  - 3) - PTC Thermistors, decreases, increases
  - 4) ☒ + All answers are incorrect
- 3) A type J thermocouple is made of the following metals \_\_\_\_\_.
  - 1) - Aluminum and Tungsten
  - 2) ☒ + Iron and Constantan
  - 3) - Platinum and Platinum/Rhodium alloy
  - 4) - Copper and Constantan
- 4) The working principle of the optical pyrometer for temperature measurement is based on the \_\_\_\_\_.
  - 1) - Heated junction of the thermocouple, lenses concentrate radiant energy
  - 2) - Photocell Principle
  - 3) ☒ + Color of the hot body in contrast to the heating filament.
  - 4) - All answers are correct
- 5) Constantan is an alloy containing \_\_\_\_\_.
  - 1) - Nickel & Aluminium
  - 2) ☒ + Copper & Nickel
  - 3) - Silicon, Manganese & Aluminium
  - 4) - Aluminium & Manganese
- 6) Thermostats have \_\_\_\_\_.
  - 1) - Positive temperature coefficient
  - 2) - Negative temperature coefficient
  - 3) - Zero temperature coefficient
  - 4) ☒ + Infinite temperature coefficient
- 7) A 3v dc power source required for a circuit is obtained by connecting together two 1.5v batteries in series. If the error in the voltage output of each battery is specified as  $\pm 1\%$ , calculate the possible error in the 3v power source which they make up. \_\_\_\_\_.
  - 1) ☒ + % error = 0.71%
  - 2) - % error = 0.63%
  - 3) - % error = 0.57%
  - 4) - All answers are incorrect
- 8)





- 1) - 90.064  
2) - 125.196  
3) ☒ 231.545  
4) - All answers are incorrect
- 12) The variance is equal to the standard deviation of signal.  
1) - True .  
2) ☒ False .
- 13) Replacing mercury by mercury-thallium mixture as the thermometric fluid in a liquid-glass thermometer helps in \_\_\_\_\_.  
1) ☒ Reducing the lowest temperature possible to be measured  
2) - Increasing the highest temperature possible to be measured  
3) - Reducing the toxicity level  
4) - Enhancing the visibility of liquid column inside capillary tube
- 14) **A thermoelectric device used for temperature measurement produces output voltage proportional to the temperature difference enforced across its input terminals. If a temperature difference of 10°C leads to the flow of 0.8 mA of current through a 50 Ω resistor connected across the output terminals, the sensitivity of the instrument is \_\_\_\_\_ mV/K of temperature difference.**  
1) - 1  
2) - 2  
3) - 3  
4) ☒ 4
- 15) A null-type instrument will normally be more accurate than a deflection-type instrument  
1) ☒ True .  
2) - False .
- 16) Liquid water is flowing through a horizontal channel. Pressure difference between two different locations of this channel needs to be measured using a manometer. Which among the following configurations will be suitable, if air is selected as the manometric fluid? \_\_\_\_\_  
1) - Standard U-tube manometer  
2) ☒ Inverted U-tube manometer  
3) - Micromanometer  
4) - Inclined-tube manometer
- 17) The dimensional representation of frequency units is \_\_\_\_\_.  
1) -  $M^2T^{-1}$   
2) ☒  $T^{-1}$   
3) -  $MLT^{-2}$   
4) -



LT<sup>-2</sup>

- 18) Smallest possible change in input required to cause a change in the output of a sensor is known as \_\_\_\_\_.
- 1) - Threshold
  - 2) ☒ Resolution
  - 3) - Sensitivity
  - 4) - Span
- 19) A data set with large systematic error, but small random error will be \_\_\_\_\_.
- 1) - Highly accurate, but less precise
  - 2) ☒ Highly precise, but less accurate
  - 3) - Highly precise and highly accurate
  - 4) - Less precise and less accurate
- 20) Static sensitivity can be defined for which type of transducer(s)? \_\_\_\_\_.
- 1) - Only for zeroth-order transducer
  - 2) - Only for first-order transducer
  - 3) - Only for second-order transducer
  - 4) ☒ For zeroth-, first- and second-order transducers
- 21) A liquid-in-glass thermometer can be considered as a first-order instrument. Among the followings, which one is an efficient option of enhancing the static sensitivity, but may not affect the time constant? \_\_\_\_\_.
- 1) - Use of a thermometric fluid with higher heat capacity
  - 2) ☒ Use of a thermometric fluid with higher volumetric expansivity
  - 3) - Using a bulb with larger diameter
  - 4) - Enhancing the convective heat transfer coefficient
- 22) The temperature of a furnace is increased at a constant rate of 10 °C per minute. A first-order sensor is used to monitor the continuous progress in temperature. If a maximum recording error of 3°C can be allowed for the sensor under steady-state, the maximum value of system time constant is \_\_\_\_\_ s.
- 1) - 12
  - 2) ☒ 18
  - 3) - All answers are incorrect
  - 4) - 15
- 23) In relation with the frequency response of a transducer, time delay is defined as \_\_\_\_\_.
- 1) - The phase lag present in the output signal
  - 2) - The time period of the imposed periodic signal
  - 3) - The ratio of phase lag and time constant of the transducer
  - 4) ☒ The ratio of phase lag and angular frequency
- 24) The fundamental optical principle(s) of precision measuring equipment is (are) \_\_\_\_\_.
- 1) - Reflection phenomena
  - 2) - Refraction phenomena
  - 3) - Interference phenomena
  - 4) ☒ All answers are correct
- 25) **The radius of curvature (R) of a concave surface is determined by noting two dimensions d and h such that,  $R = \frac{d^2}{8h} + \frac{h}{2}$ . If error in measurement of d is  $\pm 1\%$  and in measuring h is  $\pm 0.5\%$ . If d = 50 mm and h = 5 mm, the total error in measurements of R,  $\delta R =$  \_\_\_\_\_.**



- 1) ☒  $\pm 1.57\%$
- 2) ☐  $\pm 0.65\%$
- 3) ☐  $\pm 1.08\%$
- 4) ☐ All answers are incorrect

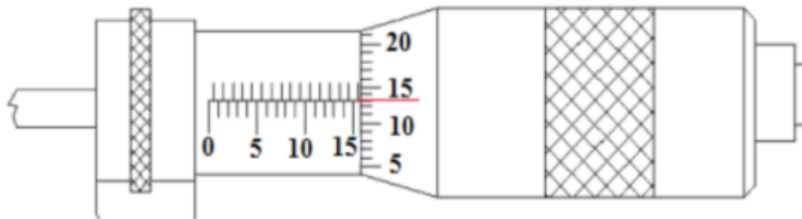
26) A thermistor is placed in a  $100^{\circ}\text{C}$  environment, and its resistance measured as  $20,000\Omega$ . The material constant,  $\beta$ , for this thermistor is  $365^{\circ}\text{C}$ . If the thermistor is then used to measure a particular temperature, and its resistance is measured as  $500\Omega$ , the thermistor temperature is \_\_\_\_\_ K.

- 1) ☐ 375.3
- 2) ☒ 598.7
- 3) ☐ 784.2
- 4) ☐ All answers are incorrect

27) It is desired to measure the effective diameter of a  $32 \times 3.5$  mm pitch metric plug screw gauge. For this purpose, following readings (average values) were noted. Micrometer reading over the standard cylinder of  $30.500$  mm and the wires of  $2.000$  mm diameter as  $13.3768$  mm. Micrometer reading over the gauge and wires as  $12.248$ . The effective diameter,  $E =$  \_\_\_\_\_.

- 1) ☒ 30.397 mm
- 2) ☐ 31.204 mm
- 3) ☐ 33.336 mm
- 4) ☐ 29.366 mm

28)



The reading for the following micrometer device is \_\_\_\_\_.

- 1) ☐ 15.5 mm
- 2) ☐ 15.76 mm
- 3) ☒ 15.63 mm
- 4) ☐ All answers are incorrect

29) Which of the following is caused by careless handling? \_\_\_\_\_

- 1) ☐ Systematic error
- 2) ☒ Gross error
- 3) ☐ Random error
- 4) ☐ All answers are incorrect

30) Which of the following error is caused by poor calibration of the instrument? \_\_\_\_\_

- 1) ☐ Random error
- 2) ☐ Gross error
- 3) ☒ Systematic error
- 4) ☐ Precision error

31) Standards to be used for reference purposes in laboratories and workshops are referred to as \_\_\_\_\_.

- 1) ☐ Primary standards



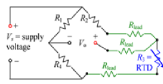
- 2) - Secondary standards  
3) ☒ Tertiary standards  
4) - Working standards
- 32) The best size wire for ISO metric thread for measuring pitch diameters of screw thread in terms of its pitch  $p$  is \_\_\_\_\_.  
1) ☒  $0.5773 p$   
2) -  $0.75 p$   
3) -  $0.4227 p$   
4) -  $0.6 p$
- 33) Which transducer is known as "self-generating transducer"? \_\_\_\_\_.  
1) ☒ Active transducer  
2) - Passive transducer  
3) - Secondary transducer  
4) - Analog transducer
- 34) To compare an unknown with a standard through a calibrated system is called \_\_\_\_\_.  
1) - a. Direct comparison  
2) ☒ b. Indirect comparison  
3) - c. both 'a' and 'b'  
4) - d. All answers are incorrect
- 35) The following is used to check the diameters of holes \_\_\_\_\_.  
1) ☒ Plug gauge  
2) - Ring gauge  
3) - Slip gauge  
4) - Standard screw pitch gauge
- 36) The \_\_\_\_\_ method(s) is (are) used to measure the minor diameter of internal threads  
1) - a. Taper parallels methods  
2) - b. Calibrated rollers methods  
3) ☒ c. both 'a' and 'b'  
4) - d. All answers are incorrect
- 37) What is the purpose of using a ratchet screw in the micrometer screw gauge? \_\_\_\_\_.  
1) ☒ To maintain uniform measuring pressure  
2) - To reduce wear of screw threads  
3) - Both the above  
4) - All answers are incorrect
- 38) The working principle of sine bar is \_\_\_\_\_.  
1) ☒ Trigonometry  
2) - Optometry  
3) - Interferometry  
4) - Algebraic
- 39) What is the use of Spirit Levels? \_\_\_\_\_.  
1) - Angular measurements only  
2) - Static leveling only  
3) ☒ Static leveling of equipment and angular measurement  
4) - Finding roundness of rotating parts
- 40) A very small, very sensitive thermocouple will reach a steady state value sooner for a small step input than a large step input.  
1) - True .  
2) ☒ False .
- 41) Auto collimator is used for \_\_\_\_\_.



- 1) - Straightness measurement
  - 2) - Parallelism measurement
  - 3) - Flatness measurement
  - 4) ☒ Angular measurement
- 42) The dynamic response of a first order sensor will tend to \_\_\_\_\_.
- 1) ☒ Attenuate higher frequencies more than lower ones.
  - 2) - Overshoot the actual signal in response to a step input.
  - 3) - Be linear
  - 4) - All answers are incorrect
- 43) An electrical potentiometer exhibits a dynamic behavior typically of a \_\_\_\_\_.
- 1) ☒ Zeroth order system.
  - 2) - First order system.
  - 3) - Second order system
  - 4) - All answers are incorrect
- 44) The slope of the static calibration curve is known as the \_\_\_\_\_.
- 1) - Response function
  - 2) - Time constant
  - 3) ☒ Static sensitivity
  - 4) - All answers are incorrect
- 45) Repeated measurements of the same known static input can be used to quantify the \_\_\_\_\_.
- 1) - Precision error.
  - 2) - Instrument accuracy.
  - 3) - Bias error.
  - 4) ☒ All answers are correct
- 46) Hysteresis of an instrument means \_\_\_\_\_.
- 1) ☒ The change in the same reading when input is first increased and then decreased
  - 2) - The reliability of the instrument
  - 3) - The repeatability of the instrument
  - 4) - The inaccuracy due to change in temperature
- 47) The fact that how closely the instrument reading follows the measured variables is termed as \_\_\_\_\_.
- 1) ☒ Fidelity
  - 2) - Accuracy
  - 3) - Threshold sensitivity
  - 4) - Precision
- 48) The relative error is the \_\_\_\_\_.
- 1) ☒ Ratio of the absolute error to the true value of the quantity under measurement
  - 2) - Difference of the measured value and the true value
  - 3) - Ratio of absolute error to the measured value of the quantity under measurement
  - 4) - Ratio of the probable error to the true value of the quantity under measurement
- 49) The reliability of the instrument refers to \_\_\_\_\_.
- 1) - The time interval between two responses of the instrument
  - 2) - The life of the instrument
  - 3) - The extent to which the characteristics remain linear
  - 4) ☒ The degree to which repeatability continues to remain within specified limits
- 50)



A standard 100-Ω platinum RTD is used to measure temperature. A Wheatstone bridge is set up in the three-wire configuration, using resistor  $R_0$  as the RTD, as sketched. If  $R_{0,0}$  = 0.51 Ω at 20°C and  $V_s$  = 10.00 V. Note: At 40°C,  $R_{0,0}$  increases slightly to 0.54 Ω. At  $T$  = 40°C,  $V_x$  = \_\_\_\_\_ volts.



Appendix A

PT100 Resistance Table

°C	1	2	3	4	5	6	7	8	9	°C
-200.00	-18.22									-200.00
-180.00	-22.03	-22.45	-21.97	-21.56	-21.11	-20.68	-20.25	-19.82	-19.39	-180.00
-160.00	-27.00	-26.57	-26.14	-25.71	-25.30	-24.87	-24.44	-24.01	-23.58	-160.00
-140.00	-31.94	-31.51	-31.08	-30.65	-30.22	-29.79	-29.36	-28.93	-28.50	-140.00
-120.00	-36.84	-36.41	-35.98	-35.55	-35.12	-34.69	-34.26	-33.83	-33.40	-120.00
-100.00	-41.72	-41.29	-40.86	-40.43	-40.00	-39.57	-39.14	-38.71	-38.28	-100.00
-80.00	-46.58	-46.15	-45.72	-45.29	-44.86	-44.43	-44.00	-43.57	-43.14	-80.00
-60.00	-51.43	-51.00	-50.57	-50.14	-49.71	-49.28	-48.85	-48.42	-47.99	-60.00
-40.00	-56.27	-55.84	-55.41	-54.98	-54.55	-54.12	-53.69	-53.26	-52.83	-40.00
-20.00	-61.10	-60.67	-60.24	-59.81	-59.38	-58.95	-58.52	-58.09	-57.66	-20.00
0.00	-65.92	-65.49	-65.06	-64.63	-64.20	-63.77	-63.34	-62.91	-62.48	0.00
20.00	-70.73	-70.30	-69.87	-69.44	-69.01	-68.58	-68.15	-67.72	-67.29	20.00
40.00	-75.53	-75.10	-74.67	-74.24	-73.81	-73.38	-72.95	-72.52	-72.09	40.00
60.00	-80.32	-79.89	-79.46	-79.03	-78.60	-78.17	-77.74	-77.31	-76.88	60.00
80.00	-85.11	-84.68	-84.25	-83.82	-83.39	-82.96	-82.53	-82.10	-81.67	80.00
100.00	-89.89	-89.46	-89.03	-88.60	-88.17	-87.74	-87.31	-86.88	-86.45	100.00
120.00	-94.67	-94.24	-93.81	-93.38	-92.95	-92.52	-92.09	-91.66	-91.23	120.00
140.00	-99.44	-99.01	-98.58	-98.15	-97.72	-97.29	-96.86	-96.43	-96.00	140.00
160.00	-104.21	-103.78	-103.35	-102.92	-102.49	-102.06	-101.63	-101.20	-100.77	160.00
180.00	-108.98	-108.55	-108.12	-107.69	-107.26	-106.83	-106.40	-105.97	-105.54	180.00
200.00	-113.75	-113.32	-112.89	-112.46	-112.03	-111.60	-111.17	-110.74	-110.31	200.00
220.00	-118.52	-118.09	-117.66	-117.23	-116.80	-116.37	-115.94	-115.51	-115.08	220.00
240.00	-123.29	-122.86	-122.43	-122.00	-121.57	-121.14	-120.71	-120.28	-119.85	240.00
260.00	-128.06	-127.63	-127.20	-126.77	-126.34	-125.91	-125.48	-125.05	-124.62	260.00
280.00	-132.83	-132.40	-131.97	-131.54	-131.11	-130.68	-130.25	-129.82	-129.39	280.00
300.00	-137.60	-137.17	-136.74	-136.31	-135.88	-135.45	-135.02	-134.59	-134.16	300.00
320.00	-142.37	-141.94	-141.51	-141.08	-140.65	-140.22	-139.79	-139.36	-138.93	320.00
340.00	-147.14	-146.71	-146.28	-145.85	-145.42	-144.99	-144.56	-144.13	-143.70	340.00
360.00	-151.91	-151.48	-151.05	-150.62	-150.19	-149.76	-149.33	-148.90	-148.47	360.00
380.00	-156.68	-156.25	-155.82	-155.39	-154.96	-154.53	-154.10	-153.67	-153.24	380.00
400.00	-161.45	-161.02	-160.59	-160.16	-159.73	-159.30	-158.87	-158.44	-158.01	400.00

- 1) ☐ + 0.173
  - 2) ☐ - 2.23
  - 3) ☐ - 1.53
  - 4) ☐ - All answers are incorrect
- 51) \_\_\_\_\_ phenomenon results from the conversion of electrical to thermal energy at a junction.
- 1) ☐ - Seebeck coefficient
  - 2) ☐ - Thermocouple laws
  - 3) ☐ - Reference junction
  - 4) ☐ + Peltier effect
- 52) The more sensitive instrument \_\_\_\_\_.
- 1) ☐ + Oscillates more slowly
  - 2) ☐ - Has no oscillations
  - 3) ☐ - First oscillates more
  - 4) ☐ - Is unstable
- 53) \_\_\_\_\_ is useful for measuring very high temperatures of things that glow.
- 1) ☐ - Infrared pyrometer
  - 2) ☐ + Optical pyrometer
  - 3) ☐ - Platinum RTD
  - 4) ☐ - Thermocouple
- 54) Which of the following is detected using manometer devices? \_\_\_\_\_.
- 1) ☐ + Pressure difference between manometric and measuring liquid
  - 2) ☐ - pH difference between manometric and measuring liquid
  - 3) ☐ - Density difference between manometric and measuring liquid
  - 4) ☐ - All answers are correct
- 55) Most metallic conductor have a \_\_\_\_\_.
- 1) ☐ + PTC of resistance
  - 2) ☐ - Zero temperature coefficient of resistance
  - 3) ☐ - NTC of resistance
  - 4) ☐ - All answers are incorrect
- 56) The value of a set of data at which the greatest number of cases is concentrated is called \_\_\_\_\_.
- 1) ☐ - Median
  - 2) ☐ - Mean
  - 3) ☐ - Standard deviation
  - 4) ☐ + Mode
- 57) A clinical thermometer is marked with 30 s as a time of insertion. The time constant of thermometer is \_\_\_\_\_.





- 1) - 30 s  
2) - 18.96 s  
3) ☒ 6 s  
4) - All answers are incorrect
- 58) Bourdon gauge pressure measurement instrument is an example of the \_\_\_\_\_.
- 1) - Coincidence method  
2) - Complementary method  
3) - Null measurement  
4) ☒ Deflection method
- 59) A zero-order sensor will attenuate and delay the output with respect to the input.
- 1) - True .  
2) ☒ False .
- 60) An inclined manometer with the inclined tube set at 30 degrees is to be used at 20°C to measure an air pressure of nominal magnitude of 100 N/m<sup>2</sup> relative to ambient. Manometer "unity" oil ( $S = 1$ ) is to be used. The specific weight of the oil is  $9770 \pm 0.5\% \text{ N/m}^3$  (95%) at 20°C, the angle of inclination can be set to within 1 degree using a bubble level, and the manometer resolution is 1 mm with a manometer zero error equal to its interpolation error. Estimate the uncertainty in indicated differential pressure at the design stage.

- 1) -  $\pm 7.2 \text{ N/m}^2$
- 2) -  $\pm 5.9 \text{ N/m}^2$
- 3) ☒  $\pm 4.6 \text{ N/m}^2$
- 4) - All answers are incorrect