BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – Dip.ME-2022
Course Name – Measurements & Metrology
Course Code - DMEPC502
(Semester V)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) When a set of readings of a measurement has a wide range, from the followings it define
   a) high precision b) low precision
   c) high accuracy d) low accuracy

(ii) When determining the uncertainty for a particular measurement device, identify the common uncertainty factors that should be included are
   a) errors in the measurement technique and method b) random variability of the measurement process
   c) technician's error d) all of these

(iii) Define parallax error from the options
   a) Same as observational error b) Apparent shift of an object when the position of the observer is altered
   c) Error caused by the distance between the scale and the measured feature d) Mean of the values of measurements when the object is observed from the right and from the left

(iv) Interpretation of repeated measurement results on the same feature is tell the instrument's
   a) accuracy b) range
   c) precision d) sensitivity

(v) Recall systematic errors from the following options
   a) controllable errors b) random errors
   c) uncontrollable errors d) none of these

(vi) Show the purpose of using secondary standards in measurement?

a) To replace primary standards
b) To calibrate measuring instruments
c) To measure large quantities
d) To create new measurement units

(vii) Identify direct method of measurement from the following.

a) Using a micrometer screw gauge
b) Using a statistical analysis
c) Using calibration standards
d) Using error analysis

(viii) The standard meter can be expressed as

a) The distance traveled by light in a vacuum in 1/299,792,458 seconds
b) The length of a platinum-iridium bar
c) The circumference of the Earth
d) The length of a carbon-12 atom

(ix) Illustrate the importance of calibration for measuring instruments

a) It reduces the cost of the instrument
b) It ensures the instrument is used for longer periods
c) It verifies the instrument's accuracy and corrects deviations
d) It increases the instrument's speed

(x) Hysteresis in a measuring instrument refers to

a) The difference in readings when approaching a value versus leaving it
b) The ability to measure rapidly changing values
c) The ease of calibration
d) The range of the instrument

(xi) Select from the following methods that can be used to detect systematic errors

a) Using a different instrument to measure the same quantity
b) Increasing the number of measurements
c) Using statistical tools to analyze data variability
d) Repeating the measurement process multiple times

(xii) Select the correct purpose of providing relief holes in sine bars from the following options

a) improve accuracy
b) reduce weight
c) improve precision
d) reduce wear

(xiii) Identify the correct process to determine the precision of a dial comparator,

a) By comparison of the readings with slip gauges
b) By dispersal of a series of readings
c) From the manufacturer's specifications
d) From the distance between dial graduations

(xiv) Select the passive transducer from the following

a) Photovoltaic cell
b) Piezoelectric
c) Thermocouple
d) Thermistor

(xv) Express the gauge factor (GF) in a strain gauge

a) The ratio of fractional change in resistance to the strain applied
b) The ratio of voltage to current
c) The ability to resist strain
d) The total amount of resistance

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Describe the terms pitch, root and thread angle. (3)
3. Explain the working principle of thermocouple. (3)
4. Define the terms: (a) Limits (b) Tolerance (3)
5. Tolerances for a hole and shaft assembly having a nominal size of 50 mm are as follows: Hole = 50 (+0.00/+0.02) mm and shaft = 50 (-0.08/-0.05) mm. Estimate the following values: (a) Maximum and minimum clearances (b) Type of fit (3)
6. With a suitable diagram categorize the different parts of a bevel protector. (3)

OR

Explain the concept of gauge factor in strain gauges (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Discuss the significance of measurement in practical applications. (5)
8. List all of the different types of methods of measurement. Describe about any 3 of them. (5)
9. Illustrate the characteristics of a comparator. (5)
10. Explain the working principle of a LVDT with the help of a neat sketch. (5)

11. A clearance fit has to be provided for a shaft and bearing assembly having a diameter of 40 mm. Tolerances on hole and shaft are 0.006 and 0.004 mm, respectively. The tolerances are disposed unilaterally. If an allowance of 0.002 mm is provided, evaluate the limits of size for hole and shaft when (a) hole basis system and (b) shaft basis system are used. (5)
12. Categorize the factors that affect the surface finish. (5)

OR

Evaluate the thread geometry with diagram. (5)

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