LNMIIT
The LNM Institute of Information Technology

THE LNM INSTITUTE OF INFORMATION TECHNOLOGY (LNMIIT)

Department of Mechanical-Mechatronics Engineering

Measurement Instrumentation and Control

MID Term Examination

Name: Harshit Khandelwal **Roll No.:** 16UME017

Time: 20 min **Date:** 24 /Feb /2018 **Max. Marks:** 20

Part-A

Instructions: ***No doubt clarifications in the examination hall. If assumptions are to be made, make your own assumptions, state it and use it. If assumptions are relevant and it makes sense it will be considered.***

For each wrong answer, 0.25 marks will be deducted.

1. When a set of readings of a measurement has a wide range, it indicates
   a) high precision
   b) high accuracy
   c) low precision
   d) low accuracy
2. The aim of calibration is to
   a) meet customer requirement
   b) detect deterioration of accuracy
   c) comply with ISO 9000 standard requirements
   d) practice measurement procedures
3. Which of the following defines parallax error?
   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
4. Accuracy is defined as
   a) a measure of how often an experimental value can be repeated
   b) the closeness of a measured value to the real value
   c) the number of significant figures used in a measurement
   d) none of these
5. Random errors can be assessed
   a) Experimentally
   b) by performing sensitivity analysis
   c) statistically
   d) empirically
6. Identify the correct feature control frame from the following:
   (a) ◎ | ϕ0.01
   (b) ◎ | ϕ0.01 | X
   (c) ◎ | ϕ0.01 | X | XT
   (d) ϕ0.01 | ◎
7. Which of the following represents the type of fit for a hole and shaft pair, given that hole = $50^{+0.04}_{+0.00}$ mm and shaft = $50^{+0.060}_{+0.041}$ mm?
   a) Clearance fit
   b) Transition fit
   c) Loose fit
   d) Interference fit
8. In the hole and shaft pair designation of 40 H7/d9, the numbers 7 and 9 indicate

a) nothing of importance
b) tolerance grade
c) accuracy of manufacture
d) ease of assembly

9. MML corresponds to the
a) higher limit of a hole and lower limit of the shaft
b) lower limit of a hole and lower limit of the shaft
c) higher limit of a hole and higher limit of the shaft
d) lower limit of a hole and higher limit of the shaft

10. Limit gauges are used to
a) measure flatness of the component
b) measure exact size of the component
c) check if the component dimension lies within permissible limits
d) measure surface roughness of the component

11. The preferred instrument for measuring holes, grooves, and recesses is
a) plain scale
b) vernier caliper
c) slip gauge
d) depth gauge

12. While measuring the angle of a work piece using a universal bevel protractor in clockwise direction, in which quadrants can the angle be read directly from the scale?
a) Quadrants I and II
b) Quadrants I and III
c) Quadrant I only
d) All the quadrants

13. The purpose of providing relief holes in sine bars is to
a) improve accuracy
b) improve precision
c) reduce weight
d) reduce wear

14. Which of the following statements is true?
a) The longer the sine bar, the better the accuracy.
b) The shorter the sine bar, the better the accuracy.
c) Accuracy of a sine bar does not depend on an ambient temperature.
d) A sine bar cannot measure unknown angles.

15. The performance of the spirit level is governed by the geometrical relationship between the bubble and
a) a single datum
b) its top plate
c) two references
d) three references along mutually perpendicular directions

16. An LVDT works on the principle of
a) mutual inductance
b) mutual capacitance
c) mutual resistance
d) magnetic induction

17. In case of a comparator, measurement is done by
a) displacement method
b) interchange method
c) direct method
d) Parkinson method

18. Surface texture depends to a large extent on
a) material composition
b) type of manufacturing operation
c) skill of the operator
d) accuracy of measurement

19. Peaks and valleys of surface irregularities are called
a) Waves
b) Manifolds
c) asperities
d) perspectives

20. The direction of a lay is
a) the direction that the stylus trace is made
b) the direction of the asperities
c) perpendicular to the asperities
d) any selected straight line taken as reference

$13 - 1.75 = 11.25$

$14 - 1.5 = 12.5$

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MID Term Examination

Part-B

Time: 90 minutes

Date: 24 /Feb /2018

Max. Marks: 40

Instructions: ***No doubt clarifications in the examination hall. If assumptions are to be made, make your own assumptions, state it and use it. If assumptions are relevant and it makes sense it will be considered.***

1. A) Define the following: (5 marks)
   a) What is the main purpose of a 'V-block'? What is the basis for their classification?
   b) Explain the terms local interchangeability and universal interchangeability.

   B) Differentiate between systematic and random errors. (5 marks)

2. Design a general type of GO and NO GO gauge for components having 50 H7/d9 fit. The fundamental tolerance is calculated by the following equation: (10 marks)

$$i = 0.453\sqrt[3]{D} + 0.001\,D$$

The following data is given:

a) Upper deviation of shaft = $-1.6\,D^{0.44}$
b) 50 mm falls in the diameter step of 30–50 mm
c) IT7 = $16i$
d) IT9 = $40i$
e) Wear allowance = 10% of gauge tolerance
f) Assuming gauge tolerance to be 10% of work tolerance

3. A) Symbolically represent the following milling operation (5 marks)

Machining allowance	= 0.58 mm
Surface roughness	= Not to exceed 6 micron Ra
Cut off length or sampling length	= 4.2 mm
Direction of lay	= Angular

B) With the help of a neat sketch, explain the working principle of the Tomlinson surface meter. (5 marks)

4. A) What is an LVDT? Explain its working principle. (5 marks)

B) Give the differences among the following: visual collimator, digital collimator, and laser collimator. (5 marks)

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END Term Examination

Part-B

Time: 2 hrs 30 min **Date:** 05 /May /2018 **Max. Marks:** 75

Instructions: ***No doubt clarifications in the examination hall. If assumptions are to be made, make your own assumptions, state it and use it. If assumptions are relevant and it makes sense it will be considered.***

1. a) Define profile tolerance. How is the profile of a spur gear traced using a profile-measuring instrument? (7)
   b) Define straightness, flatness, and roundness. (3)
2. a) With the help of a neat diagram, explain the construction and working of an RTD. (7.5)
   b) With the help of a neat diagram, explain the working of Laser interferometer. (7.5)
3. a) Discuss the working of a Bourdon gauge with a neat sketch. (7.5)
   b) Explain the working of a profile projector with neat sketch. (7.5)
4. Compare the pros and cons of the five different configurations of a CMM. (10)
5. What is machine vision system? Explain different stages in machine vision system. (10)
6. Find the shaft and hole dimensions with tolerance for a 90 H8/e9 pair given the following data: (5)

   90mm lies in the diameter step of 80 to 100 mm

   Upper deviation for e shaft = - 11 $D^{0.41}$

   Tolerance unit $i = 0.453\sqrt[3]{D} + 0.001\,D$

   Also find the type of fit produced.

   $i_{IT8} = 25i$

   $i_{IT9} = 40i$

7. a) Define PID controller. Also write transfer function for PID controller. (5)
   b) Find the close loop transfer function for the system given below: (5)