NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: IV - THEORY EXAMINATION (2024-2025)

Subject : Measurement and Metrology

Time: 3 Hours   Max. Marks:100

General Instructions:

IMP: Verify that you have received question paper with correct course, code, branch etc.

1. *This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*
2. *Maximum marks for each question are indicated on right hand side of each question.*
3. *Illustrate your answers with neat sketches wherever necessary.*
4. *Assume suitable data if necessary.*
5. *Preferably, write the answers in sequential order.*
6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION – A   20

1. Attempt all parts:-

1-a.   Which principle is used in limit gauging to ensure GO and NO-GO gauges are effective?   1

(CO1, K2)

(a) Taylor's Principle

(b) Archimedes' Principle

(c) Bernoulli's Principle

(d) Newton's Principle

1-b.   Interferometers are primarily used for: (CO1, K1)   1

(a) Coarse measurements

(b) Surface roughness measurement

(c) High-precision length measurement

(d) Thread inspection

1-c.   Surface quality inspection typically includes: (CO2, K2)   1

(a) Hardness testing

(b) Roughness measurement

(c) Torsional analysis

(d) Magnetic particle testing

1-d. Squareness inspection ensures that two surfaces: (CO2, K2)　　　　1

        (a) Are round and concentric

        (b) Are perfectly flat

        (c) Meet at a 90° angle

        (d) Have a uniform thickness

1-e. A typical function of a CMM (Coordinate Measuring Machine) is to: (CO3, K2)　　　　1

        (a) Measure flow rate

        (b) Inspect 2D shapes only

        (c) Measure 3D geometries precisely

        (d) Perform destructive testing

1-f. Alignment in measuring systems is necessary to: (CO3, K2)　　　　1

        (a) Reduce electrical interference

        (b) Eliminate positional errors

        (c) Avoid software errors

        (d) Minimize visual distortion

1-g. Nanotechnology instrumentation is primarily used for: (CO4), K1)　　　　1

        (a) Detecting large-scale deformations

        (b) Micro-level hardness testing

        (c) Sub-micron level measurements

        (d) Macro-scale imaging

1-h. Contact bonding in optomechanical assemblies refers to: (CO4, K1)　　　　1

        (a) Adhesive bonding of optical lenses

        (b) Mechanical fastening

        (c) Use of magnetic fields

        (d) Atomic-level bonding without adhesives

1-i. Laser interferometers are used for: (CO5, K2)　　　　1

        (a) Extremely precise dimensional measurements

        (b) Measuring large distances

        (c) Visual inspection only

        (d) Estimating material hardness

1-j. Speckle measurement in metrology refers to: (CO5, K2)　　　　1

        (a) Measurement of color variation

        (b) Noise analysis in electronic circuits

        (c) Laser-based surface displacement measurement

        (d) Dot matrix printing analysis

2. Attempt all parts:-

2.a. What is interchangeability in dimensional metrology? (CO1, K1)　　　　2

2.b. Define parallelism in metrology. (CO2, K2)　　　　2

2.c.	What is touch trigger probing? (CO3, K1)	2
2.d.	Define 3D metrology. (CO4, K1)	2
2.e.	What is software metrology? (CO5, K2)	2

SECTION – B   30

3.   Answer any <u>five</u> of the following-

3-a.	Explain the process of standardization with an example. (CO1, K2)	6
3-b.	A part's surface roughness is measured as Ra = 3.2 μm. Interpret the result. (CO1, K3)	6
3-c.	Discuss the need and application of dimensional inspection. (CO2 ,K2)	6
3-d.	A flow sensor outputs 4–20 mA corresponding to 0–100 L/min. Find the flow rate at 12 mA. (CO2, K3)	6
3-e.	Explain with sketch the working of a touch trigger probe. (CO3, K3)	6
3-f.	Differentiate between contact bonding and adhesive bonding with examples. (CO4, K2)	6
3-g.	Describe interfacing methods in computer-aided metrology. (CO5, K2)	6

SECTION – C   50

4.   Answer any <u>one</u> of the following-

4-a.	Derive and explain how an interferometer works with a labeled diagram. (CO1, K3)	10
4-b.	Explain in detail Taylor's Principle with sketches. Design GO and NO-GO gauges for a 25 mm hole with H7 tolerance. (CO1, K3)	10

5.   Answer any <u>one</u> of the following-

5-a.	Explain the inspection procedure for straightness using an autocollimator. (CO2, K3)	10
5-b.	Explain the process of feature inspection using a dial gauge and comparator setup. (CO2, K4)	10

6.   Answer any <u>one</u> of the following-

6-a.	Describe different types of CMMs with diagrams and applications. (CO3, K3)	10
6-b.	Discuss temperature and flow measurement principles and instruments used. (CO3, K3)	10

7.   Answer any <u>one</u> of the following-

7-a.	Explain complex optomechanical assemblies and their metrological challenges. (CO4, K2)	10
7-b.	Describe radioactive metrology technologies and their safety implications. (CO4, K2)	10

8.   Answer any <u>one</u> of the following-

8-a.	Explain the working and advantages of laser interferometers with applications. (CO5, K3)	10
8-b.	Write a detailed note on non-contact sensors used in CMMs and surface finish measurement. (CO5 , K3)	10