

22342

21819

3 Hours / 70 Marks

Seat No.

--	--	--	--	--	--	--	--	--

- Instructions :**
- (1) All Questions are *compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks**

1. **Attempt any FIVE of the following :** **10**
  - (a) Define accuracy & precision.
  - (b) List different measuring standards.
  - (c) State the advantages of interchangeability. (atleast two)
  - (d) Define – Run out w.r.t. gear.
  - (e) State the use of “combination set”.
  - (f) List the causes of surface roughness.
  - (g) Define – RMS value.
  
2. **Attempt any THREE of the following :** **12**
  - (a) Explain parallax error with neat sketch.

- (b) Differentiate between mechanical and pneumatic comparator. (atleast four points)
- (c) Explain Hole basis system. State its significance in production.
- (d) Explain working principle of 'Tool Maker's' microscope.

**3. Attempt any THREE of the following :**

**12**

- (a) Explain
  - (i) Environmental error
  - (ii) Calibration error
- (b) Draw the diagram indicates a reading of 4.32 mm on vernier scale.
- (c) Explain brief construction & working of "sigma comparator".
- (d) Differentiate between Hole basis system and Shaft basis system. (atleast four points)

**4. Attempt any THREE of the following :**

**12**

- (a) Measure a distance of 6.905 mm with the help of slip gauges using 112 set of slip gauges. Show the arrangement with neat sketch.
- (b) A shaft of  $25 \pm 0.004$  mm is to be checked by meance of GO and NOGO gauge. Design the dimensions of a gauge required.
- (c) Write the examples of use of following types of fits :
  - (i) Push fit
  - (ii) Press fit
  - (iii) Running fit
  - (iv) Wringing fit
- (d) An angle of  $49^\circ 29' 18''$  is to be developed by using standard angle gauge set of 13 pieces. Calculate the gauges required and sketch the arrangement.
- (e) Explain procedure to determine whether the given surface is concave or convex by using optical flat.

**5. Attempt any TWO of the following :****12**

- (a) Explain the working principle of “Floating carriage micrometer” with neat sketch.
- (b) Describe the procedure of measurement of tooth thickness using ‘Base Tangent Method’ with neat sketch.
- (c) In the measurement of surface roughness, height of 10 successive peaks and valleys were measured from a datum as  
Peaks – 45, 42, 40, 30, 35 microns.  
Valleys – 30, 25, 25, 24, 18 microns.  
Determine the Ra value of the surface.  
If these values are obtained over length of 20 mm, find CLA & RMS values.

**6. Attempt any TWO of the following :****12**

- (a) Sketch and interpret the meaning of various interference fringes patterns observed using optical flat.
  - (b) The angle of taper plug gauge is to be checked using sine centre and slip gauges. Sketch the set-up and describe the procedure.
  - (c) Draw the following alignment test of Lathe Machine :
    - (i) Parallelism of tail stock
    - (ii) Run out of spindle
-



22342

**21222**

**3 Hours / 70 Marks**

Seat No.

--	--	--	--	--	--	--	--

15 minutes extra for each hour

---

- Instructions :**
- (1) All Questions are *compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.

**Marks**

**1. Attempt any FIVE of the following :**

**10**

- (a) Define the term “Sensitivity” of a measuring device.
- (b) Draw the neat labelled sketch of Dial Indicator.
- (c) Define the terms :
  - (i) Tolerance
  - (ii) Deviation
- (d) Draw a neat sketch of metric screw thread profile, showing all parameters on it.
- (e) List the instruments used for linear measurement according to their level of accuracy in ascending order.
- (f) Distinguish between Primary texture and Secondary texture in two points only.
- (g) Draw the surface finish symbol with its all parameters.

**2. Attempt any THREE of the following : 12**

- (a) Differentiate between systematic error and random error.
- (b) Compare the comparators with measuring instruments.
- (c) Draw the sketches illustrating the transition fit, interference fit and clearance fit.
- (d) Describe any one method with neat sketch to measure the effective diameter of screw thread.

**3. Attempt any THREE of the following : 12**

- (a) Explain the various essential characteristics of precision measuring instruments.
- (b) Explain the various factors affecting on the accuracy of measurement.
- (c) Explain with neat sketch the working principle of differential pneumatic comparator. State its applications.
- (d) The shaft size is given as  $40^{-0.04}$  and the hole size is  $40^{+0.04}$ . Determine the type of fit between them.

**4. Attempt any THREE of the following : 12**

- (a) Prepare a stack of slip gauges for height of 34.468 mm by using set of M45 as given below. Sketch the arrangement.

Range (mm)	Steps in (mm)	No. of Pieces
1.001 to 1.009	0.001	9
1.001 to 1.09	0.01	9
1.1 to 1.9	0.1	9
1 to 9	1	9
10 to 90	10	9

- (b) Draw the sketch of hole based system. Explain, why it is preferred over shaft based system.
- (c) Apply the Taylor's principle to design Ring gauges.
- (d) "Micrometers provides a more accurate reading than Vernier Calliper." Justify the statement.
- (e) Explain the method recommended by IS : 3073-1967 for specifying the surface texture on machined parts.

**5. Attempt any TWO of the following :**

**12**

- (a) Explain the significance of backlash error and runout error observed in gears. How it is checked ?
- (b) Suggest the method to measure the tooth thickness of gear. Explain it with neat sketch.
- (c) "Assessment of surface texture is very important in manufacturing of Job." Justify the statement. State the methods to obtain a numerical value of the texture from a given graphical record.

**6. Attempt any TWO of the following :**

**12**

- (a) Draw the labelled sketch of the set up to measure the angle of  $35^{\circ} 45'$  with sine bar. What are the accuracy requirements of the sine bar ?
- (b) An angle of  $57^{\circ} 6' 9''$  is to be developed using standard angle gauge set of ( $1^{\circ}$ ,  $3^{\circ}$ ,  $9^{\circ}$ ,  $27^{\circ}$ ,  $41^{\circ}$ ), ( $1'$ ,  $3'$ ,  $9'$ ,  $27'$ ) and ( $3''$ ,  $6''$ ,  $18''$ ,  $30''$ ). Show the arrangement by sketch. State the advantages and disadvantages of angle gauges.
- (c) In the measurement of surface roughness heights of 20 successive peaks and troughs were measured from a datum and were 35, 25, 40, 22, 35, 18, 42, 25, 35, 22, 36, 18, 42, 22, 32, 21, 37, 18, 35, 20 microns.

If these measurements were obtained over a length of 20 mm, determine the C.L.A. ( $R_a$ ) and R.M.S. value of the rough surface.

---







# 22342

11819

**3 Hours / 70 Marks**

Seat No.

--	--	--	--	--	--	--	--

- Instructions :**
- (1) *All questions are compulsory.*
  - (2) *Answer **each** next main question on a **new** page.*
  - (3) *Illustrate your answers with neat sketches **wherever** necessary.*
  - (4) *Figures to the **right** indicate **full** marks.*
  - (5) *Assume suitable data, if **necessary**.*
  - (6) *Mobile Phone, Pager and any other Electronic Communication devices are **not permissible** in Examination Hall.*

**Marks**

1. Attempt **any five** of the following :

**10**

- a) Define 'metrology'.
- b) State any four advantages of optical comparator.
- c) State the term selective assembly.
- d) Draw neat sketch of metric screw thread profile.
- e) List down instrument used in angular measurement.
- f) Define sampling length.
- g) Define straightness.

2. Attempt **any three** of the following :

**12**

- a) Differentiate between systematic errors and random errors.
- b) Define wavelength standard. State advantages and disadvantages.
- c) Explain with neat sketch hole basis system.
- d) Explain the principle of measurement of tooth thickness by gear tooth vernier caliper.

3. Attempt **any three** of the following :

**12**

- a) Distinguish between 'Alignment Test' and 'Performance Test' of machine tool.
- b) Sketch a micrometer and explain its working.
- c) Draw labelled sketch of sigma comparator and explain its working.
- d) Differentiate between 'Tolerance' and 'Allowance'.

**P.T.O.**



4. Attempt **any three** of the following :

12

a) Prepare stack of slip gauges for height 58.975 mm using set M112.

Ranges (mm)	Step (mm)	Pieces
1.001 to 1.009	0.001	09
1.01 to 1.49	0.01	49
0.5 to 24.5	0.5	49
25, 50, 75, 100	25	04
1.005	–	01
	<b>Total</b>	<b>112</b>

b) Explain the working principle of floating carriage dial micrometer enlist its application.

c) Explain terminology of screw thread.

d) Explain the principle of stylus probe type direct instrument measurement of surface finish.

e) Draw the following alignment test of Lathe machine.

1) Levelling of Lathe machine

2) Parallelism of main spindle to saddle movement.

5. Attempt **any two** of the following :

12

a) Describe with neat sketch the working of 'Parkinson gear tester' .

b) Define accuracy and list any four factor affecting accuracy of instrument.

c) Explain why size bar is not used for angle greater than 45° if accuracy in angle measurement is required.

6. Attempt **any two** of the following :

12

a) Describe 'Taylor's principle' for design of limit gauges.

b) An angle of 57°6'9" is to be developed using standard angle gauges set of [1°, 3°, 9°, 27°, 41°], [1', 3', 9', 27'], [3", 6", 18", 30"] and show arrangement using sketch.

c) Describe the flatness testing done by using optical flats.

---

22342

**11920**

**3 Hours / 70 Marks**

Seat No.

--	--	--	--	--	--	--	--

- Instructions :**
- (1) All Questions are *compulsory*.
  - (2) Illustrate your answers with neat sketches wherever necessary.
  - (3) Figures to the right indicate full marks.
  - (4) Assume suitable data, if necessary.
  - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks**

**1. Attempt any FIVE of the following :**

**10**

- (a) State various types of metrology.
- (b) List four mechanical comparators. Draw labelled sketch of any one.
- (c) Write Taylor's principle of gauge design.
- (d) Explain errors in gear (i) Runout, (ii) Backlash.
- (e) State the uses of Universal Bevel Protractor.
- (f) Define primary and secondary texture w.r.t. surface finish.
- (g) List the causes of surface roughness.

**2. Attempt any THREE of the following : 12**

- (a) Explain the need of inspection in manufacturing industry.
- (b) Differentiate between line standard and end standard. (any four)
- (c) Explain the meaning of  $27H_5F_6$
- (d) Describe the working principle of floating carriage micrometer with neat sketch.

**3. Attempt any THREE of the following : 12**

- (a) Differentiate between accuracy and precision.
- (b) Ten divisions on the V.C. Scale coincide with smallest nine divisions on the main scale (mm), main scale reading is 2.6 cm and V.S. coincides with seven divisions of main scale (i) Calculate the least count of V.C., (ii) Calculate observed reading.
- (c) Explain the working principle of mechanical comparator with neat sketch.
- (d) Distinguish between Hole basis system and shaft basis system. (any four)

**4. Attempt any THREE of the following : 12**

- (a) Draw slip gauge accessories (any two) and describe the use of it.
- (b) In a limit system, the following limits are specified to give a clearance fit between the shaft and hole.

$$\text{Shaft : } 30 \begin{matrix} -0.005 \\ -0.018 \end{matrix} \text{ mm } \phi$$

$$\text{Hole : } 30 \begin{matrix} +0.020 \\ -0.000 \end{matrix} \text{ mm } \phi$$

Determine (i) Basic size (ii) Shaft and hole tolerance (iii) Minimum and maximum clearance.

22342

[3 of 4]

- (c) Draw hole and shaft assembly and show (i) Limit (ii) Allowance (iii) Tolerance (iv) Deviation.
- (d) An angle of  $117^{\circ} 8' 42''$  is to be developed using standard angle gauge set. Calculate the gauges required and show the arrangement.
- (e) Draw the alignment test of squareness of spindle of radial drilling machine.

5. Attempt any TWO of the following :

12

- (a) Describe the procedure of measurement of tooth thickness using Parkinson's gear tester with neat sketch.
- (b) Explain procedure of minor diameter measurement of screw thread using floating carriage micrometer with neat sketch.
- (c) Draw symbol for designating surface finish on drawing.

6. Attempt any TWO of the following :

12

- (a) Describe stepwise procedure carried out in laboratory for small angle measurement with neat sketch.
  - (b) Differentiate between angle gauges and slip gauges (any four).
  - (c) Draw the following alignment test of lathe machine.
    - (i) True running of lathe main spindle
    - (ii) Run out of spindle.
-





22342

12223

3 Hours / 70 Marks

Seat No.

--	--	--	--	--	--	--	--

- Instructions :**
- (1) All Questions are *compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks****1. Attempt any FIVE of the following :****10**

- (a) State the objectives of Metrology. (Any **four**)
- (b) Define Roughness and Waviness.
- (c) State the advantages of Wavelength Standards.
- (d) State the significance of error 'Backlash' in gear.
- (e) State the types of error found in screw thread.
- (f) Suggest the instruments for measurement of following :
  - (i) Gap of spark plug
  - (ii) Depth of the hole.
- (g) State how the parallelism in two axes is found.



- 2. Attempt any THREE of the following : 12**
- (a) Define Least Count. Explain the procedure for calculating the Least Count of the Vernier calliper.
  - (b) Describe the process of wringing of slip gauges.
  - (c) Describe Selective Fit assembly with suitable example.
  - (d) Explain the Gear Rolling Test bench with neat sketch.
- 3. Attempt any THREE of the following : 12**
- (a) Define :
    - (i) Sensitivity
    - (ii) Readability
    - (iii) Traceability
    - (iv) Calibration
  - (b) Draw the neat labelled sketch of sigma comparator.
  - (c) Differentiate between Hole basis system and Shaft basis system.
  - (d) Describe the various characteristics of precision measuring instruments.
- 4. Attempt any THREE of the following : 12**
- (a) State the various precautions to be taken while using precision measuring instruments.
  - (b) Describe the working mechanism of Dial Indicator with neat sketch.
  - (c) Describe the Taylor's principle of gauge design with suitable figures.
  - (d) Describe the procedure for measurement of Tooth Thickness by Gear Tooth Vernier calliper with neat sketch.
  - (e) Describe the working principle of optical flat. State its limitations.



**5. Attempt any TWO of the following :****12**

- (a) In a hole and shaft assembly of 30 mm nominal size, the tolerance of hole and shaft are as specified below :

$$\text{Hole : } 30^{\begin{smallmatrix} +0.02 \\ -0.000 \end{smallmatrix}} \quad \text{Shaft : } 30^{\begin{smallmatrix} +0.040 \\ -0.070 \end{smallmatrix}}$$

Determine : (i) Maximum and minimum clearance

(ii) Allowance

(iii) Hole and shaft tolerance

(iv) MML shaft and hole

(v) The type of fit.

- (b) Draw the neat sketch of Floating Carriage Micrometer. Describe the procedure for measurement of effective diameter with Floating Carriage Micrometer.

- (c) An angle of  $30^\circ - 9' - 15''$  is to be measured with help of the following angle gauges. [ $1^\circ, 3^\circ, 9^\circ, 27^\circ, 41^\circ$ ] [ $1', 3', 9', 27'$ ] [ $3'', 6'', 18'', 30''$ ].

Show the arrangement of angle gauge with a neat sketch by selecting minimum number of gauges.

**6. Attempt any TWO of the following :****12**

- (a) Describe the construction and working of Auto-Collimator with neat sketch. State its applications.

- (b) Describe the construction and working of Taylor's-Hobson-Talysurf with neat sketch.

- (c) Explain the following alignment test carried out on the lathe machine :

(i) Run-out of main Spindle

(ii) Perpendicularity of cross-slide with Spindle axis.

---

