Subject: - Engineering Metrology (22342)

SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Introduction to Metrology	10
2	Standards and Comparators	12
3	Limits, Fits, Tolerances and Gauges	20
4	Screw Thread Measurements and Gear Measurement	18
5	Linear and Angular Measurement	26
6	Other Measurements	16
	Total Marks: -	**102**

BOARD THEORY

PAPER PATTERN

FOR EME (22342)

Q.1		Attempt any FIVE 5*2=10
	a)	Introduction to Metrology
	b)	Standards and Comparators
	c)	Standards and Comparators
	d)	Screw Thread Measurements and Gear Measurement
	e)	Linear and Angular Measurement
	f)	Other Measurements
	g)	Other Measurements
Q.2		Attempt any THREE 3*4=12
	a)	Introduction to Metrology
	b)	Standards and Comparators
	c)	Limits, Fits, Tolerances and Gauges
	d)	Screw Thread Measurements and Gear Measurement

Q.3		Attempt any THREE	3*4=12
	a)	Introduction to Metrology	
	b)	Linear and Angular Measurement	
	c)	Standards and Comparators	
	d)	Limits, Fits, Tolerances and Gauges	
Q.4		Attempt any FOUR	3*4=12
	a)	Limits, Fits, Tolerances and Gauges	
	b)	Limits, Fits, Tolerances and Gauges	
	c)	Limits, Fits, Tolerances and Gauges	
	d)	Linear and Angular Measurement	
	e)	Linear and Angular Measurement	
Q.5		Attempt any TWO	2*6=12
	a)	Screw Thread Measurements and Gear Measurement	
	b)	Screw Thread Measurements and Gear Measurement	
	c)	Other Measurements	
Q.6		Attempt any TWO	2*6=12
	a)	Linear and Angular Measurement	
	b)	Linear and Angular Measurement	
	c)	Other Measurements	

CLASS TEST - I
PAPER PATTERN

COURSE: - Engineering Metrology (22342)

PROGRAMME: - Mechanical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
1	**Introduction to Metrology**	**CO-342.01**
2	**Standards and Comparators**	**CO-342.02**
3	**Limits, Fits, Tolerances and Gauges**	**CO-342.03**

		Course Outcome (CO)
Q.1	**Attempt any FOUR** **4*2=8Marks**	
a)	Introduction to Metrology	CO-342.01
b)	Standards and Comparators	CO-342.02
c)	Limits, Fits, Tolerances and Gauges	CO-342.03
d)	Standards and Comparators	CO-342.02
e)	Introduction to Metrology	CO-342.01
f)	Limits, Fits, Tolerances and Gauges	CO-342.03
Q.2	**Attempt any THREE** **3*4=12 Marks**	
a)	Introduction to Metrology	CO-342.01
b)	Standards and Comparators	CO-342.02
c)	Limits, Fits, Tolerances and Gauges	CO-342.03
d)	Limits, Fits, Tolerances and Gauges	CO-342.03
e)	Introduction to Metrology	CO-342.01

CLASS TEST - II
PAPER PATTERN

COURSE: - Engineering Metrology (22342)

PROGRAMME: - Mechanical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
4	**Screw Thread Measurements and Gear Measurement**	**CO-342.04**
5	**Linear and Angular Measurement**	**CO-342.05**
6	**Other Measurements**	**CO-342.06**

		Course Outcome (CO)
Q.1	**Attempt any FOUR 4*2=8Marks**	
a)	Other Measurements	CO-342.06
b)	Linear and Angular Measurement	CO-342.05
c)	Screw Thread Measurements and Gear Measurement	CO-342.04
d)	Other Measurements	CO-342.06
e)	Other Measurements	CO-342.06
f)	Linear and Angular Measurement	CO-342.05
Q.2	**Attempt any THREE 3*4=12 Marks**	
a)	Screw Thread Measurements and Gear Measurement	CO-342.04
b)	Linear and Angular Measurement	CO-342.05
c)	Other Measurements	CO-342.06
d)	Other Measurements	CO-342.06
e)	Screw Thread Measurements and Gear Measurement	CO-342.04

COURSE OUTCOME

(CO)

COURSE: - Engineering Metrology (22342)

PROGRAMME: - Mechanical Engineering

CO. NO.	Course Outcome
CO- 342.01	Select the relevant instrument for measurement.
CO- 342.02	Use different types of comparators.
CO- 342.03	Select gauges, fits and tolerances for machine components.
CO- 342.04	Use relevant instruments to measure different parameters of screw thread and gear.
CO- 342.05	Use linear and angular measuring instruments.
CO- 342.06	Select relevant surface testing methods.

1. Introduction to Metrology

Position in Question Paper   **Total Marks-10**

Q.1. a) 2-Marks.
Q.2. a) 4-Marks.
Q.3. a) 4-Marks.

Descriptive Question

1. Define accuracy & precision.

2. Explain parallax error with neat sketch.

3. Define 'Metrology'.

4. Explain

5. Environmental error

6. Calibration error

7. Differentiate between systematic errors and random errors.

8. Define accuracy and list any four factor affecting accuracy of instrument.

9. Differentiate between precision and accuracy.

10. Explain parallax error with neat sketch.

11. A cylinder of 80 mm diameter was placed between the micrometer anvils due to inaccurate placement, the angle between the micrometer and cylinder axis was found to be 1 Minute. Calculate the amount of error in the measured diameter, take anvil diameter 6 mm.

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold.**

1. The degree of closeness of the measured value with its true value is known as
   a) Accuracy   c) Standard
   b) Precision   d) Sensitivity

2. Error of measurement =
   a) True value – Measured value   c) Measured value – Precision
   b) Precision – True value   d) None of the above

3. Looking at the below rifle target, how would you describe the shooting of this contestant?
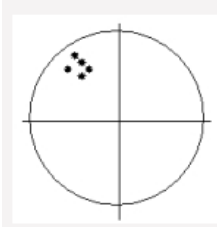
   a) Accurate and imprecise   c) Inaccurate and imprecise
   b) Inaccurate and precise   d) Accurate and precise

4. Careless handling is the type of_____ error
   a) Systematic error   c) Random error
   b) Human error   d) None of the mentioned

5. The ratio of change in output signal to change in Input signals are called as_____
   a) Readability   c) Reproducibility
   b) Repeatability   **d) Sensitivity**

6. Sometimes object does not hold properly the error occurs are called as
   a) Instrumental Error   c) Observational Error
   b) Environmental Error   **d) Operational Error**

7. 'A system will be error free if we remove all systematic error'.
   a) True   b) False

8. Which of the following error is caused by poor calibration of the instrument?
   a) Random error   **c) Systematic error**
   b) Gross error   d) Precision error

9. How systematic errors are eliminated?
   a) Frequent measurement   c) Finding mean of reading
   b) Replacement of instrument   d) Finding variance of reading

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10. 'Zero error is an indication of instrumental error'.
    a) True   b) False

11. Science of precise and accurate measurement of various physical quantities is termed as _____
    a) Metrology   c) Pedology
    b) Meteorology   d) Mineralogy

12. What is the least count of a micrometer?
    a) 0.01 mm   c) 0.1 mm
    b) 0.02 mm   d) 0.2 mm

13. What is the use of ratchet stop in micrometer?
    a) Prevent motion of spindle   c) Provide measuring surface
    b) Maintain uniform measuring   d) Forms measuring tip
    pressure

14. Which of the following is incorrect about micrometer?
    a) Thimble and barrel should have a dull finish
    b) Total travel of the measuring spindle is called measuring range
    c) Graduated surface diameter of barrel should be 5 mm
    d) Screw has 10 or 20 threads per cm

15. What is the total error in micrometer?
    a) Positive and negative deviation from the zero point
    b) Error in parallelism
    c) Deviation from measurement of a nominal dimension
    d) Maximum difference between ordinates of cumulative error

16. How many divisions are graduated on thimble?
    a) 20   c) 45
    b) 25   **d) 50**

17. Which of the following option is correct about given statements about micrometer?
    Statement 1: The anvil should not protrude from the frame.
    Statement 2: An adjusting nut is present in micrometer to compensate wear
    a) Only statement 1 is true   c) Both the statements are true
    b) Only statement 2 is true   d) Both the statements are false

18. Which of the following option is true for the given statements about micrometer?
    Statement 1: There is a fixed spindle and a rotated anvil.
    Statement 2: For taking the reading, micrometer dimension is set slightly larger than part size.
    a) T, F   **c) F, T**
    b) F, F   d) T, T

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19. Which of the following is incorrect about precautions in using a micrometer?

    a) Final movement is given by ratchet

    b) Thimble is turned till the Measuring tip just touches the part to be measured

    c) Part to be measured is held in right hand and micrometer in left hand for good results

    d) Error is reading is may be due to lack of flatness of anvil

20. Which of the following is incorrect?

    a) V-Anvil micrometer caliper is used to check out of roundness

    b) Blade type micrometer has a non-rotating spindle

    c) Tube wall thickness can be measured by an ordinary micrometer

    d) Self-centering inside micrometer has an interchangeable measuring head

21. Which of the following is incorrect about bench micrometer?

    a) Anvil retractor device   **c) Non-adjustable work table**

    b) High precision micrometer head   d) Interchangeable dial indicator

22. Dead time of the instrument is

    a) The time required by an instrument to begin to respond to a change in the measurand

    b) The time required by an instrument for initial warming up

    c) The largest change of input quantity for which there is no output of the instrument

    d) None of the above

23. Scale of an instrument will be uniform if

    a) Deflecting torque varies directly as the deflection angle

    b) Control torque varies directly as the deflection angle

    c) Both (a) and (b)

    d) Damping torque varies directly as the deflection angle

24. In an instrument hysteresis means

    a) The inaccuracy due to change in temperature

    b) The reliability of the instrument

    c) The repeatability of the instrument

    d) The change in same reading when input is first increased and then decreased

25. An instrument's reliability means

    a) The extent to which the characteristics remain linear

    b) The life of the instrument

    c) The degree to which the repeatability continues to remain within specific limits

    d) All of the above

26. The pointer of an indicating instrument should be

    a) Very light   c) Either (a) or (b)

    b) Very heavy   d) Neither (a) or (b)

27. Accuracy and Precision are dependent on each other.

    a) True   **b) False**

28. Considering cost of instruments, which is a better choice, active or passive?

    a) Active instruments

    b) Passive instruments

    c) Cost of both active and passive instruments are approximately same

    d) None of these

29. The accuracy of the deflection type instruments and of the null type instruments depends on

    a) Linearity, calibration of spring

    b) Calibration of spring, linearity and calibration of weights

    c) Linearity and calibration of spring, calibration of weights

    d) Both depends on calibration of weight

30. In terms of usage, deflection type instruments are

    a) More convenient than null type instrument

    b) Less convenient than null type instruments

    c) Both are equally convenient

    d) None of these

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2. Standards and Comparators

Position in Question Paper   **Total Marks-10**

  Q.1. b) 2-Marks.
  Q.2. b) 4-Marks.
  Q.3. c) 4-Marks.

Descriptive Question

1. State any four advantages of optical comparator.

2. Define wavelength standard. State advantages and disadvantages.

3. Draw labelled sketch of sigma comparator and explain its working.

4. List different measuring standards.

5. State the advantages of interchangeability. (atleast two)

6. Differentiate between mechanical and pneumatic comparator. (atleast four points)

7. Explain brief construction & working of "sigma comparator".

8. List different Measuring standard

9. Distinguish between Line Standard and end Standard.

10. Draw labeled diagram of sigma comparator and explain its working.

MCQ Question

(Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. 'Sigma comparator' belongs from _____ category
   a) Optical comparator
   b) **Mechanical-optical comparator**
   c) Mechanical comparator
   d) Pneumatic comparator

2. The advantage of mechanical comparator over others is
   a) Less moving parts
   b) **No need of external supply**
   c) No error due to parallax
   d) large range of instrument

3. The approximate size of slip gauges are_____
   a) **30mm long and 10mm wide**
   b) 45mm long and 15mm wide
   c) 20mm long and 5mm wide
   d) 25mm long and 10mm wide

4. Internal diameter of any workpiece can be measured using
   a) **Solex pneumatic comparator**
   b) Sigma comparator
   c) Johansson mickrocator
   d) All of the above

5. _____ is not end standard.
   a) **Precision scale**
   b) Length bars
   c) Slip gauges
   d) Gap gauge

6. For slip gauges _____ grades or classes of are present.
   a) 3
   b) **5**
   c) 6
   d) 4

7. To compare an unknown with a standard through a calibrated system is called
   a) Direct comparison
   b) **Indirect comparison**
   c) both 'a' and 'b'
   d) None of the above

8. The following is an internationally recognized and accepted unit system
   a) MKS
   b) FPS
   c) **SI**
   d) All of the above

9. The angle gauge by Dr. Tamlison consists of a set of
   a) **10 gauges**
   b) 12 gauges
   c) 14 gauges
   d) 6 gauges

10. The principle of 'Interchangeability' is normally employed for
    a) Mass production
    b) Production of identical parts
    c) Parts within the prescribed limits of sizes
    d) All of the above

11. Which of the following is not a name of slip gauges?
    a) Gauge Blocks
    b) Johannsen Gauges
    c) Gage Blocks
    d) Linear Gauges

12. Which of the following is not a common basic form of slip gauge
    a) Rectangular
    b) Square with centre hole
    c) Square without centre hole
    d) Parallelogram

13. Which of the following is not the most important feature of slip gauge?
    a) Length between measuring surface
    b) Flatness
    c) Surface conditions of measuring surface
    d) Adhereness efficiency

14. To compare an unknown with a standard through a calibrated system is called
    a) Direct Comparison
    b) Indirect Comparison
    c) Both a and b
    d) None of the above

15. Which of the following is true for uses of comparators?
    a) Can't be used in mass production
    b) Not suitable for inspection purposes
    c) Can be used as working gauge
    d) Slow rate of working

16. Which of the following is necessary for the working mechanism of dial indicators?
    a) High magnification ratio
    b) Low magnification ratio
    c) Moderate magnification ratio
    d) Good magnification ratio is achieved by using gear and pinions in a large area

17. What is the purpose of lever attachment used in dial indicators?
    a) Checking of parts
    b) Transfer motion at the right angle to the spindle
    c) Transfer motion at the 180 degree to the spindle
    d) Transfer motion at the 60 degree to the spindle

18. Which of the following is not correct for pneumatic comparator?
    a) Independent of operator skill
    b) Loss of accuracy due to gauge wear
    c) Speedy operation
    d) Total life cost is less

19. Which of the following is not a slip gauge accessor

   a) Measuring jaws   **c) Rod clamp**

   b) Holder   d) Base

20. Which of the following is true for the use of dial indicators?

   a) Skilled labour is necessary

   b) Useful for quantity control in inspection room

   c) Useful for quality control in inspection room

   d) Considerable practice is required before use

21. Which of the following is provided in dial gauge to raise the plunger?

   a) A finger lever   c) Spring

   b) Probe   d) A pointer

22. Which of the following is not an advantage of dial indicator?

   a) Use in mass production

   b) Suited for precision dimensional control

   c) Specialised skilled labour helps in attain greater accuracy

   d) Versatile

23. Which of the following is a problem in using dial gauges?

   a) Gauge wear   c) Economy

   b) Effect of temperature variation   **d) Oscillation in the pointer**

24. Which of the following is true for the advantages of dial indicators?

   a) Slow speed but good adaptability

   b) Adaptability and positive visibility

   c) Positive visibility and expensive set ups

   d) Use of different inspectors but inexpensive set-ups

25. Which of the following is necessary for the working mechanism of dial indicators?

   a) High magnification ratio

   b) Low magnification ratio

   c) Moderate magnification ratio

   d) Good magnification ratio is achieved by using gear and pinions in a large area

26. What is the purpose of lever attachment used in dial indicators?

   a) Checking of parts

   b) Transfer motion at the right angle to the spindle

   c) Transfer motion at the 180 degree to the spindle

   d) Transfer motion at the 60 degree to the spindle

27. Why a revolution counter is used in dial gauge?

a) To withstand sudden shock

b) To indicate correctly the number of revolution

c) To count and display the number of revolutions

d) To transfer motion at right angle

28. For which surfaces, spirit level is used for testing straightness?

a) Both horizontal and vertical surfaces   c) In any plane

b) Vertical surfaces   **d) Horizontal surfaces**

29. Which of the following statements are true?

1. Mechanical comparators are compact and easy to handle

2. Parallax error is never observed in mechanical comparator

3. Sigma comparator is a type of mechanical comparator

4. Mechanical comparators have low inertia which makes them sensitive to vibrations

a) 1 and 2   **c) 1 and 3**

b) 3 and 4   d) All of the above

30. How many types of measuring jaws are present?

a) 1   c) 3

b) 2   d) 4

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3. Limits, Fits, Tolerances and Gauges

Position in Question Paper   **Total Marks-12**

Q.2. c) 4-Marks.

Q.3. d) 4-Marks.

Q.4. a) 4-Marks.

Descriptive Question

1. Explain Hole basis system. State its significance in production

2. Differentiate between Hole basis system and Shaft basis system. (at least four points)

3. 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.

4. A shaft of 25 +- 0.004 mm is to be checked by meance of GO and NOGO gauge. Design the dimensions of a gauge required.

5. State the term selective assembly.

6. Differentiate between 'Tolerance' and 'Allowance'.

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

Range (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
Total		112

8. Describe 'Taylor's principle' for design of limit gauges.

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9. Write the examples of use of following types of fits :

   Push fit

   Press fit

   Running fit

   Wringing fit

10. State the term Interchangeability

11. Explain the Wringing of Slip gauges with neat sketch.

12. Explain Hole basis system. Why it is Preferred?

13. Explain with representation of features of Geometrical tolerance in simple engineering part.

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MCQ Question

(Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. Tolerances are given to the parts
   a) Because it's impossible to make perfect settings
   b) To reduce weight of the component
   c) To reduce cost of the assembly
   d) To reduce amount of material used

2. Bilateral tolerance means_____
   a) Total tolerance is in 1 direction only
   b) Total tolerance is in both the directions
   c) May or may not be in one direction
   d) Tolerance provided all over the component bodyDf

3. Clearance fit is_____
   a) Maximum limit of hole is less than maximum limit of shaft
   b) Minimum limit of hole is equal to maximum limit of shaft
   c) Minimum limit of shaft is greater than maximum limit of hole
   d) Maximum limit of shaft less than minimum limit of hole

4. _____is called actual deviation
   a) Algebraic sum between actual size and corresponding basic size
   b) Algebraic difference between actual and corresponding basic size
   c) Average of actual and basic size
   d) Algebraic difference between upper and lower deviation.

5. Thread ring gauge is used for checking
   a) External threads   c) Internal threads
   b) External diameter of cylindrical job   d) Internal diameter of job

6. A plain ring gauge is used for checking
   a) Taper holes
   b) External diameter of cylindrical parts
   c) Internal diameter of cylindrical par
   d) Major diameter of external threads

7. A Plug gauge is used for checking
   a) Cylinders   **c) Spherical Holes**
   b) Cylindrical bores   d) Major diameter of external threads

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8. In a shaft basis system, the upper deviation of the size of the shaft is _____.

   a) 1   c) less than 0

   b) not related to size   **d) 0**

9. Limit gauges are used to _____.

   a) measure the flatness of the component

   b) measure the exact size of the component

   c) check if the component dimension lies within permissible limits

   d) measure surface roughness of the component

10. According to Taylor's principle, GO gauges are designed to check _____.

   a) maximum metal condition   c) both of these

   b) minimum metal condition   d) none of these

11. The relationship that results between the two mating parts before assembly is called _____

   a) Tolerance   c) Limit

   b) Allowance   **d) fit**

12. What is equal to the differences between the two limits of size of the part?

   a) Tolerance   c) High limit

   b) Low limit   d) Design size

13. The surface texture depends to a large extent on _____.

   a) material composition   c) the skill of the operator

   b) Type of manufacturing operation   d) accuracy of measurement

14. What is the advantage of the use of slip gauge standards for dial comparators?

   a) Size of the standard is equal to one of the limits of the plug gauge size

   b) Size of the standard is greater than one of the limits of the plug gauge size

   c) Size of the standard is less than one of the limits of the plug gauge size

   d) Slip gauges are more accurate

15. Which of the following is most convenient to measure the cylindrical ring gauges?

   a) Slip gauges   c) Measurement by using rollers

   b) Micrometer   **d) Pneumatic comparators**

16. Why tolerances are given to the parts?

   a) Because it's impossible to make perfect settings

   b) To reduce weight of the component

   c) To reduce cost of the assembly

   d) To reduce amount of material used

17. What is bilateral tolerance

   a) Total tolerance is in 1 direction only

   b) Total tolerance is in both the directions

   c) May or may not be in one direction

d) Tolerance provided all over the component body

18. What is mean clearance?

a) Maximum size of hole minus maximum size of shaft

b) Minimum size of hole minus minimum size of shaft

c) Mean size of hole minus mean size of shaft

d) Average of both size of shaft and hole

19. Which of the following is incorrect about tolerances?

a) Too loose tolerance results in less cost

b) Tolerance is a compromise between accuracy and ability

c) Too tight tolerance may result in excessive cost

d) Fit between mating components is decided by functional requirements

20. Which of the following option is true for given statements?

Statement 1: Bilateral tolerances are used in mass production techniques.

Statement 2: The basic size should be equal to upper and lower limits.

a) T, T   **c) T, F**

b) F, F   d) F, T

21. Which one of the following instruments is used for checking large internal diameter

a) Small hole gauge   c) Pluge gauge

b) Telescopic gauge   d) Snap gauge

22. Thread ring gauge is used for checking

a) External threads   b) Internal threads

c) External diameter of cylindrical job   d) Internal diameter of jobs

23. Gauges are made of

a) Mild steel   **c) Cast steel**

b) Alloy steel   d) Cast iron

24. A plug gauge which has its "Go" and "No Go" sizes on the same end is known as

a) Single ended plug gauge   **c) Progressive plug gauge**

b) Double ended plug gauge   d) Continues plug gauge

25. Which one of the following gauges is used to align the lathe tool with the work

a) Try square   c) Thread gauge

b) Centre gauge   d) Straight edge

26. Which principle is related to Gauge design?

a) Rankin principle   **c) Taylor's principle**

b) Position principle   d) Carnot Principle

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27. 'Go limit' applied to which limit condition?

a) Maximum material limit　　　　　　　c) Minimum material limit

b) Lower limit of shaft and upper limit of hole　　d) Moderate material limit

28. Which of the following is true for plug gauges?

a) Size difference between 'Go' and 'No Go' plug gauges is greater than the tolerance of tested shaft or hole

b) Size difference between 'Go' and 'No Go' plug gauges is Equal to the tolerance of tested shaft or hole

c) Size difference between 'Go' and 'No Go' plug gauges is less than the tolerance of tested shaft or hole

d) Size difference between 'Go' and 'No Go' plug gauges more or less than the tolerance of tested shaft or hole

29. Which of the following is incorrect for the gauging faces of snap gauges?

a) Parallel to each other

b) Square to each other

c) Gauging point and work are in same plane

d) Work and gauging faces are at 60 degree

30. Which of the following can't be done by 'Go' plug gauges?

a) Ensure bore alignability　　　　　　　c) Check straightness of hole

b) Controls diameter　　　　　　　　　　d) Check degree of ovality

31. What is the effect of wear on the size of 'Go' snap gauges?

a) Decrease　　　　　　　　　　　　　c) May increase or decrease

b) Increase　　　　　　　　　　　　　d) No effect

32. What is the use of 'No Go' gauges?

a) Check a single element of a feature

b) Check several dimensions simultaneously

c) Check roundness and size at the same time

d) Check location and size at the same time

33. Which among the following is a type of clearance fit?

a) Force fit　　　　　　　　　　　　**c)Slide fit**

b)Push fit　　　　　　　　　　　　　d)Tight fit

34. Which of the following statements is/are false?

a) Interference is observed in tight fit

b) Allowance represents minimum interference for interference fits

c) Clearance is observed in push fit

d) All of the above

35. What is a loose running fit?

   a) Loose running fit has minimum clearance   c) Used in high precision task

   b)They can be used in textile machinery   d) All the above

36. Which of the following is true for interference fit?

   a) Shaft is always smaller than the hole

   b) Shaft is always bigger than the hole

   c) Interference fits have shaft and hole of same dimension

   d) None of the above

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4. Screw Thread Measurements and Gear Measurement

Position in Question Paper   **Total Marks-12**

   Q.1. d) 2-Marks.
   Q.2. d) 4-Marks.
   Q.5. a) 6-Marks.

Descriptive Question

1. Draw neat sketch of metric screw thread profile.

2. Explain the principle of measurement of tooth thickness by gear tooth vernier caliper.

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

4. Explain terminology of screw thread.

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

6. Define – Run out w.r.t. gear.

7. Describe the procedure of measurement of tooth thickness using 'Base Tangent Method' with neat sketch.

8. Explain working principle of 'Tool Maker's' microscope.

9. List different methods of measuring Tooth Thickness.

10. Describe the procedure of measurement of tooth thickness using constant chord method with neat sketch.

11. Draw Spur gear showing its terminology.

MCQ Question

(Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. Dedendum for external threads is_____
   a) Radial distance between pitch and minor cylinder
   b) Radial distance between major and pitch cylinder
   c) Radial distance between major and minor cylinder
   d) Axial distance between major and pitch cylinder

2. _____of the following is not true about effective diameter
   a) Also known as pitch diameter
   b) It decides quality of fit between nut and screw
   c) This is the diameter of minor cylinder
   d) It is a very important dimension for screw threads

3. Flanks of the threads connect the crest with the roots.
   a) True   b) False

4. To measure the major diameter of an external thread_____ is used
   a) Bench micrometer   c) One wire method
   b) Thread micrometer   d) All of the above

5. _____of the following machine is used for rolling tests
   a) Parkinson's gear tester   c) Tooth caliper
   b) Base pitch measuring instrument   d) Involute profile testing machine

6. Tooth thickness of gear = _____
   a) Circular pitch / 2   c) 2 x Circular pitch
   b) Circular pitch / 4   d) 4 x Circular pitch

7. The name of angle which is present between line of action and common tangent to the pitch circles is called as _____
   a) Helix angle   c) Pitch angle
   b) Lead angle   **d) Pressure angle**

8. What is the name of screw thread which is formed on a cone?
   a) Parallel screw thread   **c) Tapered screw thread**
   b) Straight screw thread   d) cylindrical screw thread

9. Which of the following is not a name of the major diameter of an external thread?
   a) Outside diameter   c) Full diameter
   b) Crest diameter   **d) Cone diameter**

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10. Which of the following is not true about the axial thickness of screw thread?
   a) Measured in direction perpendicular to the axis of thread
   b) Measured on pitch cylinder
   c) Distance between opposite faces of same thread
   d) Measured at the same thread

11. What is the alternative name of functional diameter?
   a) Cone diameter
   b) Virtual diameter
   c) Root diameter
   d) Inside diameter

12. What is a thread per inch in screw thread?
   a) Pitch in inches
   b) Axial distance moved by threaded part
   c) Reciprocal of pitch in inches
   d) Radial distance moved by threaded part

13. Which of the following is not true about effective diameter?
   a) Also known as pitch diameter
   b) It decides quality of fit between nut and screw
   c) This is the diameter of minor cylinder
   d) It is a very important dimension for screw threads

14. Which of the following is true for the multiple start screw threads?
   a) It is produced by a single helical groove
   b) Grooves should be different in spacing
   c) It gives a quick transverse
   d) It is formed in a transverse section on a cylinder

15. Which of the following statement is true for screw threads?
   Statement 1: Flank angle of symmetrical thread is known as thread's half-angle.
   Statement 2: It is measured parallel to the axis of a thread.
   a) T, F
   b) F, F
   c) T, T
   d) F, T

16. Flanks of the threads connect the crest with the roots.
   a) True
   b) False

17. Why are pitch errors observed in threads?
   a) Lack of inspection
   b) Incorrect ratio of tool work velocity
   c) Interference between mating parts
   d) All of the above

18. Which thread has a combined strength of square thread and V thread?
   a) Acme thread
   b) Knuckle thread
   c) Buttress thread
   d) British standard Whitworth thread

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19. Which type of errors show linear relation between cumulative pitch error and length of thread?
a) Periodic errors
b) Progressive errors
c) Both a. and b.
d) None of the above

20. What is used to measure the major diameter of an external thread?
a) Bench micrometer
b) Thread micrometer
c) One wire method
d) All of the above

21. Which type of threads are used to transmit power in one direction?
a) Square threads
b) Buttress threads
c) Both a. and b.
d) None of the above

22. Which method gives accurate results when effective diameter is measured without considering the thread angle?
a) Two wire method
b) Three wire method
c) Best wire size
d) All the above

23. The indicator that enables the application of a pressure already decided upon on the screw thread in a bench micrometer is called _____ .
a) a fiducial indicator
b) a pressure indicator
c) a span indicator
d) none of the above

24. In wire methods, the diameter of the wire selected should be such that it makes contact with the screw along the _____ .
a) outer diameter
b) pitch cylinder
c) root diameter
d) axis of the screw

25. In a two-wire method, the diameter of the best-size wire is given by _____.
a) d = (p/2) sec (x/2)
b) d = (p/4) sec (x/2)
c) d = (p/2) cosec (x/2)
d) d = (p/2) cot (x/2)

26. From the following, which one is not a method to find effective thread diameter?
a) Thread micrometer
b) Two wire method
c) Three wire method
d) The v-piece method

27. What is the effect of improper alignment of each tooth?
a) Tooth thickness increases
b) Load will not distributed evenly
c) Face width decreases
d) Pitch of teeth reduced

28. Which of the following is not true about concentricity of teeth?
a) Fluctuating velocity will be noticed when not concentric
b) Can be checked by using projector
c) Inaccuracy of parts when not concentric
d) Should be tested to ensure the proper heat treatment

29. Which of the following element is not determined by analytical inspection?
   a) Profile
   c) Spacing
   b) Composite vibrations
   d) Pitch

30. Which of the following option is correct for given statements about gear measurement?
   Statement 1: Improper alignment of each teeth will cause high bearing stresses.
   Statement 2: Gear blank should be tested for dimensional accuracy.
   a) T, F
   c) F, T
   b) F, F
   d) T, T

31. Which of the following is not determined by the functional type of inspection?
   a) Lead
   c) Variation in action
   b) Noise level
   d) Vibration

32. Which of the following statement is true about inspection of gear?
   a) Profile is determined by functional inspection
   b) Backlash is determined by analytic inspection
   c) Analytic test require running test of gear
   d) Thickness of tooth is measured by functional inspection

33. If reference circle of gear is eccentric then which error is reflected by this eccentricity?
   a) Cyclic error
   c) Pitch error
   b) Periodic error
   d) Undulation

34. Which of the following option is true for given statements about gear measurement?
   Statement 1: There is no effect of cutter accuracy on the accuracy of gear.
   Statement 2: Accuracy of individual elements is necessary for precision gears.
   a) T, F
   c) T, T
   b) F, F
   d) F, T

35. What is the alternative name of involute gears?
   a) Straight tooth gear
   c) Cycloid gear
   b) Helical gear
   d) Spiral gear

36. What type of teeth is present in involute rack?
   a) Spiral
   c) Straight
   b) Helical
   d) Double helical

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5. Linear and Angular Measurements

Position in Question Paper   **Total Marks-12**

Q.1. e) 2-Marks.

Q.1. f) 2-Marks

Q.3. b) 4-Marks.

Q.4. b) 4-Marks.

Descriptive Question

1. State the use of "combination set".
2. Draw the diagram indicates a reading of 4.32 mm on vernier scale.
3. An angle of 49° 29′ 18″ is to be developed by using standard angle gauge set of 13 pieces. Calculate the gauges required and sketch the arrangement.
4. Explain procedure to determine whether the given surface is concave or convex by using optical flat.
5. Sketch and interpret the meaning of various interference fringes patterns observed using optical flat.
6. The angle of taper plug gauge is to be checked using sine centre and slip gauges. Sketch the set-up and describe the procedure.
7. List down instrument used in angular measurement.
8. Sketch a micrometer and explain its working.
9. Explain why sine bar is not used for angle greater than 45° if accuracy in angle measurement is required.
10. 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.
11. Explain with neat sketch Construction of Bevel Protractor.
12. The angle of Taper plug gauge is to be checked using sine centre and slip gauges, sketch the set up and describe the procedure.
13. An angle of 49°29′18″ is to be developed by using standard angle gauges set of 13 pieces. Calculate the gauges required and show arrangement using sketch.

MCQ Question

(Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. _____ of the following is not among the methods of linear measurements
   a) Direct measurements
   b) Measurements by optical means
   c) Indirect measurements
   d) Electromagnetic methods or EDM

2. The use of Spirit Levels is_____
   a) Angular measurements only
   b) Static leveling only
   c) Static leveling of equipment and angular measurement
   d) Finding roundness of rotating parts

3. As spirit level is placed horizontally the bubble rests at_____ on the scale
   a) Left most   c) Right most
   b) Centre   d) Bottom

4. Testing flatness or straightness of a surface is possible using
   a) vernier caliper   **c) Autocollimator**
   b) Micrometer   d) All of the abov

5. _____ among the following is an optical instrument
   a) Angle dekkor   **c) Both a. and b**
   b) Autocollimator   d) None of the above

6. The range of bevel protractor is_____
   a) 0-90°   **c) 0-360°**
   b) 0-180°   d) 90-270°

7. Sine bars can measure the angle up to _____
   a) 45 degree   c) 90 degree
   b) 60 degree   d) 120 degree

8. Which of the following is not among the methods of linear measurements?
   a) Direct measurements
   b) Measurements by optical means
   c) Indirect measurements
   d) Electromagnetic methods or EDM

9. Which of the following is not a method of measuring the distances directly?

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a) Pacing

c) Measurement with pedometer

b) Measurement with passometer

d) Measurement with theodolite

10. Vernier caliper helps in measuring

a) External diameter

c) Internal diameter

b) Thickness and depth of narrow tubes

d) all of them

11. The error which is most common in measurements is due to wrong placement of eye while taking readings is called

a) parallax error

c) common error

b) eye error

d) free error

12. The least count of a micrometer is

a) 0.10mm

c) 0.001mm

b) 0.01mm

d) 0.0001mm

13. On which part of the vernier height gauge, are the main scale division graduated

a) Vernier plate

c) Fine adjusting unit

b) Beam

d) Base

14. While measuring with vernier bevel protractor, which part is used normally as reference surface

a) Stock

c) Dial

b) Blade

d) Disc

15. The least count of the vernier caliper is equal to

a) Value of 1 M.S.D.- value of 1 V.S.D.

b) Value of 1 V.S.D. – value of 1 M.S.D.

c) Value of 2 M.S.D.- value of 1 V.S.D

d) Value of 1 M.S.D. + value of 1 V.S.D.

16. Ratchet stop in the micrometer helps to

a) Hold the workpiece

c) Lock the spindle

b) Adjust zero error

d) Control the pressure

17. Which one of the following instruments is used to measure accurately the angle of taper

a) Bevel gauge

c) Bevel protractor

b) Vernier bevel protractor

d) Taper gauge

18. Micrometer work on the principal of

a) Screw

c) Stud

b) Bolt

d) Nut & bolt

19. Up to which angle sine bars can measure the angles?

a) 45 degree

c) 90 degree

b) 60 degree

d) 120 degree

20. Which of the following is not used in making of sine bars?

a) High carbon   c) Corrosion resistant steel

b) High chromium   **d) Aluminium**

21. Which of the following is incorrect regarding sine bars?

   a) Sine bar is itself a complete measuring instrument

   b) Some holes are drilled in the body

   c) It can be used to locate any work to a given angle

   d) It is capable of self generation

22. Which of the following is true for the given statements about sine bars?

   Statement 1: Grade A sine bars are less accurate than grade B.

   Statement 2: Grade B sine bars are accurate up to 0.01 mm/m of length.

   a) T, F   c) F, T

   b) T, T   **d) F, F**

23. What is sine centre?

   a) Centre of sine bar

   b) Sine bar with block holding centres

   c) Sine bar with hole in centre

   d) Sine bar with hollow rod in centre

24. What is the range of bevel protractor?

   a) 0-90°   **c) 0-360°**

   b) 0-180°   d) 90-27

25. Which of the following is correct about the adjustable blade?

   a) Adjustable blade is attached to main body

   b) Adjustable blade is capable of rotating freely about the centre

   c) Adjustable blade is capable of rotating freely about the free edge

   d) Adjustable blade is attached to base plate

26. Which of the following is a general dimension of blade(length*width)?

   a) 250mm*3mm   **c) 150mm*3mm**

   b) 100mm*2mm   d) 150mm*2mm

27. What is the use of Spirit Levels?

   a) Angular measurements only

   b) Static leveling only

   c) Static leveling of equipment and angular measurement

   d) Finding roundness of rotating parts

   Where the bubble rests on the scale when spirit level is placed horizontally?

   a) Left most   c) Right most

   b) Centre   d) Bottom

28. What is the range of base length of type-1 spirit level?

a) 20-90 mm

c) 200-300 mm

b) 100-200 mm

d) 200-500 mm

29. Which of the following given statement is true/false about the sensitivity of spirit level?

Statement 1: Sensitivity of the spirit level increases as the radius of tube increases.

Statement 2: Spirit levels are insensitive to the temperature variation.

a) F, F

c) T, F

b) F, T

d) T, T

30. Which of the following is true for spirit level?

a) The tube is completely filled with the liquid

b) The Liquid almost fills the tube

c) One-fourth part of the tube is filled with liquid

d) One-tenth part of the tube is filled with liquid

31. At which part spirit level is present in the clinometers?

a) On a rotary member

c) On the base

b) On the fixed member

d) On the circular scale

32. At which interval, circular glass is divided in Hilger and Watts type clinometers?

a) 3'

c) 10'

b) 5'

d) 2'

33. Which of the following option is incorrect with respect to angle gauges?

a) Sine bar is better than angle gauges

b) Angle gauges are made of high carbon high chromium steel

c) Angle gauges can measure the angle from 0 to 360 degrees

d) They are available in two sets of 13 and 16 gauges

34. How 34' can be built by using angle gauges?

a) 27'+9'-3'+1'

c) 27'+10'-3'

b) 26'+10'-2'

d) 27'+8'

35. What is the approximate size of angle gauges?

a) 76mm long and 16 wide

c) 16mm long and 75 wide

b) 85mm long and 26 wide

d) 70mm long and 18 wide

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6. Other Measurements

Position in Question Paper   **Total Marks-14**

   Q.1. g) 2-Marks

   Q.5. c) 6-Marks.

   Q.6. c) 6-Marks.

Descriptive Question

1. List the causes of surface roughness.
2. Define – RMS value.
3. In the measurement of surface roughness, height of 10 successive peaks and valleys were measured from a datum as
4. Peaks – 45, 42, 40, 30, 35 microns.
5. Valleys – 30, 25, 25, 24, 18 microns.
6. Determine the Ra value of the surface. If these values are obtained over length of 20 mm, find CLA & RMS values.
7. Draw the following alignment test of Lathe Machine :
8. Parallelism of tail stock
9. Run out of spindle
10. Define sampling length.
11. Define straightness.
12. Distinguish between 'Alignment Test' and 'Performance Test' of machine tool.
13. Explain the principle of stylus probe type direct instrument measurement of surface finish.
14. Draw the following alignment test of Lathe machine.
    Levelling of Lathe machine ,Parallelism of main spindle to saddle movement
15. Describe the flatness testing done by using optical flats.
16. Define Lay.
17. List the causes of Surface Roughness.
18. Draw the alignment test of Squareness of spindle axis of radial drilling machine.
19. Draw the following alignment test of Lathe machine.
    Parallelism of tail stock, Parallelism of main spindle to saddle movement.

MCQ Question

(Total number of Question=Marks*3=14*3=42)

Note: Correct answer is marked with **bold**

1. Roughness is nothing but_____
   a) Minute succession of hills of different height
   b) Minute succession of valleys and hills of different height and varied spacing
   c) Minute succession of valleys and hills of same height and same gap
   d) Minute succession of valleys of different depth

2. RMS stands for _____
   a) Root Mean Square   c) Root Maximum sum
   b) Root Mean Sum   d) Root Minimum Sum

3. Under which group, does waviness in surface falls
   a) Primary texture   c) Tertiary texture
   b) Secondary texture   d) Quaternary texture

4. _____is another name of the axial play
   a) Full play   c) Back play
   b) Front play   **d) End play**

5. Indicator method is used to test
   a) Straightness   c) Flatness
   b) Squareness   d) All of the above

6. _____is type of test is done on the main spindle of a machine
   a) True running   c) Levelling
   b) Alignment   d) Flatness

7. _____ of the following is used to test leveling of machine bed
   a) Feeler gauge   **c) Sensitive spirit level**
   b) Slip gauge   d) Mandrels

8. Which of the following option is true for given statements about surface texture?
   Statement 1: Concept of surface roughness is sensory.
   Statement 2: Failure due to fatigue starts always at sharp corners.
   a) T, F   c) F, F
   b) F, T   **d) T, T**

9. Which of the following is not true about first order irregularities?
   a) Arising due to irregularities in machine tool itself
   b) Arising due to weight of material itself

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c) Arise due to vibrations

d) May arises due to deformation of work under action

10. Under which group, does waviness in surface falls?

a) Primary texture

b) Secondary texture

c) Tertiary texture

d) Quaternary texture

11. In how many categories, geometrical irregularities can be classified?

a) 3

b) 2

c) 4

d) 5

12. Under which group, does third order irregularities fall?

a) Primary group

b) Secondary group

c) First group

d) Second group

13. Which type of irregularities comes under the first group?

a) First and second order

b) Second and third order

c) Third and fourth order

d) First and fourth order

14. Under which category, does the error arises due to non-linear feed motion falls?

a) Second group

b) Primary texture

c) Waviness

d) Roughness

15. Which of the following option is true if hills and valleys on any surface are very close?

a) Wavelength is more

b) Wavelength is small

c) Surface appears more wavy

d) Surface appears rough but wavelength is more

16. Which term is used for errors of first and second order?

a) Micro geometrical error

b) Macro geometrical error

c) Mini geometrical error

d) Mili geometrical error

17. Match the following Group 1 items with Group 2 items

1. Flaw --- A. Secondary texture
2. Actual surface -------------------------------- B. Surface which does not exist
3. Nominal surface ----------------------------- C. Primary texture
4. Waviness ------------------------------------- D. Designer prescribes the surface
5. Roughness ------------------------------------ E. Irregularities occurring at one place

a) 1 - A, 2 - B, 3 - D, 4 - C, 5 – E

b) 1 - D, 2 - E, 3 - D, 4 - C, 5 – C

c) 1 - E, 2 - D, 3 - B, 4 - A, 5 - C

d) 1 - C, 2 - A, 3 - D, 4 - B, 5 - E

18. What does effective profile mean, while defining a surface texture?

a) Workpiece having repetitive irregularities

b) Roughness can be measured in this imaginary profile

c) **Real contour of a surface**

d) All of the above

19. Which among the following causes first order surface irregularity?

    a) Lack of straightness   c) Feed and speed

    b) Lack of rigidity   d) Vibrations

20. Which among the following is a type of direct measuring instrument of roughness?

    a) Micro interferometer   **c) Profilometer**

    b) Wallace surface dynamometer   d) None of the above

21. Which principle does Taylor-Hobson-Talysurf tester work on?

    a) Capacitive demodulating principle   c) Inductive modulating principle

    b) Intensity modulating principle   **d) Carrier modulating principle**

22. Which of the following methods is unreliable to evaluate the surface finish?

    a) Electrical stylus profilometer   c) Profilograph

    b) Wallace surface dynamometer   d) Tomlinson surface tester

23. What is ten point height method?

    a) It is the average sum of ten highest points measured within sampling length

    b) It is the average difference of five highest points and five deepest valleys measured within sampling length

    c) It is the sum of ten highest points divided by sum of ten deepest valleys measured within sampling length

    d) It is the average sum of five highest points and five deepest valleys measured within sampling length

24. Which method is calculated considering geometric average of ordinates?

    a) Centre line average method   **c) Root mean square method**

    b) Peak to valley height method   d) All of the above

25. What is meant by roughness?

    a) Minute succession of hills of different height

    b) Minute succession of valleys and hills of different height and varied spacing

    c) Minute succession of valleys and hills of same height and same gap

    d) Minute succession of valleys of different depth

26. Which of the following is necessary for the complete study of surface roughness?

    a) Measurement of all the components of elements

    b) Analysis of all the component element

    c) Assessment of the effects of combined texture

    d) Measurement and analysis of all the components and assessment of combined texture

27. Which of the following is true for measurement of surface roughness?

a) 3 dimensional geometry can be easily measured

b) Direction of measurement is perpendicular to the lay

c) Direction of measurement is parallel to the lay

d) Direction of measurement is parallel to the direction of the predominant surface marking

28. Which of the following is used for the direct measurement of surface quality and commonly used in U.S.A.?

a) Profilometer   c) Talysurf

b) Tomlinson surface meter   d) Replica method

29. Which of the following parameter is important for specifying surface roughness?

a) Size of irregularity   c) Spacing of irregularity

b) Height, spacing and form of irregularities   d) Height of irregularities

30. What is the purpose of locating cylinder in the test of the true running of the main spindle?

a) To locate the chuck   c) To locate the feeler

b) To locate the main spindle   d) To level the machine

31. In what direction the parallelism of the main spindle to saddle movement is checked?

a) Vertical direction

b) Horizontal direction

c) Both vertical and horizontal direction

d) At an angle

32. What is axial play?

a) Freedom of spindle movement in axial direction

b) Freedom of spindle movement perpendicular to axial direction

c) Freedom of spindle movement in direction of cutting forces

d)Freedom of spindle movement in horizontal direction

33. What will happen if an axial play is not provided to the spindle?

a) It will try to expand   c) It will shrink in some time

b) It will try to bend   d) It will show fracture

34. In leveling of machine, which direction is more important in horizontal plane?

a) Longitudinal

b) Transverse

c) Both longitudinal and transverse

d) Both longitudinal and transverse direction is not important

35. What is the effect of axial slip in screw cutting?

a) Pitch will not be uniform   c) Pitch will be short

b) Pitch will be uniform   d) Pitch will be high

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36. Which of the following is done for testing the true running of headstock centre?

a) Feeler of dial indicator is pressed perpendicular to the taper surface

b) Feeler of dial indicator is pressed parallel to the taper surface of cent

c) Feeler of dial indicator is pressed at acute angle to the taper surface of cent

d) Feeler of dial indicator is pressed at obtuse angle to the taper surface of cent

37. Which of the following is not used in testing the pitch accuracy of lead screw?

a) A negative stop   c) Length bars

b) Slip gauge   d) Dial gauge

38. In which plane the test for the level of installation of the machine takes place?

a) In vertical plane   c) In oblique plane

b) In both vertical and horizontal plane   d) In horizontal plane

39. Which type of test is done on the main spindle of a machine?

a) True running   c) Levelling

b) Alignment   d) Flatness

40. Which of the following is used to test leveling of machine bed?

a) Feeler gauge   **c) Sensitive spirit level**

b) Slip gauge   d) Mandrel

41. Which of the following is used to test straightness of bed in the transverse direction of long beds.

a) Autocollimator   c) Taut wire method

b) Straight edge   **d) Spirit level**

42. Which of the following is not true about mandrels?

a) Used in alignment test

b) Mandrel between centres have has 2 reference marks

c) Mandrel of large diameter made tubular

d) Test mandrel with taper shanks has conical shanks