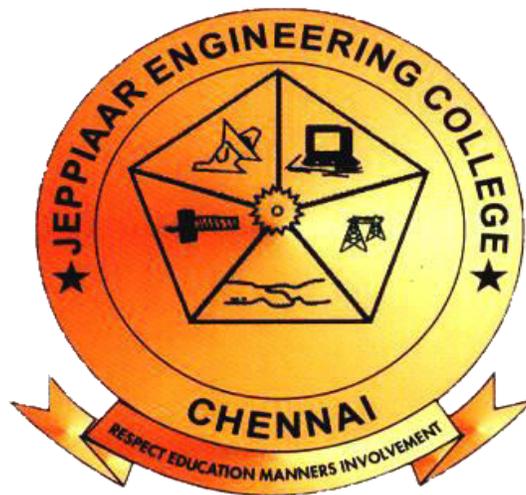


JEPPIAAR ENGINEERING COLLEGE

Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK



V SEMESTER

ME2304 – ENGINEERING METROLOGY AND MEASUREMENTS

Regulation – 2008



JEPPIAAR ENGINEERING COLLEGE

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DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

Subject : ME2304– METROLOGY AND MEASUREMENTS
 Year / Sem : III / V

UNIT I CONCEPT OF MEASUREMENT

General concept - Generalised measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Tolerancing - interchangeability,

PART-A

CO Mapping : C305.1

Q.No.	Questions	BT Level	Competence	PO
1	What is Range of measurement	BTL-1	Remembering	PO1, PO6
2	What is Resolution	BTL-1	Remembering	PO1
3	Distinguish between sensitivity and range with suitable example.	BTL-3	Analyzing	PO1, PO6
4	Define system error and correction	BTL-1	Remembering	PO1
5	Define: Measurand.	BTL-1	Remembering	PO1, PO6
6	Define: Deterministic Metrology	BTL-1	Remembering	PO1, PO2
7	Define over damped and under damped system.	BTL-1	Remembering	PO1, PO2

8	List any four methods of measurement	BTL-4	Analyzing	PO1
9	list classification of measuring instruments.	BTL-1	Remembering	PO1
10	Define True size.	BTL-1	Remembering	PO1, PO2
11	Define Actual size.	BTL-1	Remembering	PO1, PO2
12	What is Hysteresis?	BTL-1	Remembering	PO1, PO2
13	Distinguish accuracy and Uncertainty with example.	BTL-1	Remembering	PO1
14	Define Span. ?(NoV/DEC 2015)	BTL-1	Remembering	PO1
15	Distinguish between precision and accuracy	BTL-3	Analyzing	PO1
16	What is Scale interval?	BTL-1	Remembering	PO1
17	What is Response Time?	BTL-1	Remembering	PO1, PO2
18	Define Repeatability.	BTL-1	Remembering	PO1, PO2
19	Explain the term magnification.	BTL-2	Understanding	PO1
20	Classify the Absolute error.	BTL-2	Understanding	PO1
21	What is Relative error?	BTL-1	Remembering	PO1
22	Classify the errors.	BTL-1	Remembering	PO1
23	What is the basic Principle of measurement?	BTL-1	Remembering	PO1
24	What are the applications of Legal metrology?	BTL-1	Remembering	PO1
25	What is the need of inspection?	BTL-1	Remembering	PO1
26	What are the important elements of measurements?	BTL-1	Analysing	PO1, PO2
27	What is LEGAL METROLOGY?	BTL-1	Remembering	PO1
PART-B				
1	list the Structure of Generalized Measurement system and Explain in details? (NOV/DEC 2013)	BTL-5	Evaluating	PO1, PO2
2	Explain the desirable characteristics of precision measuring instrument? (NOV/DEC) 2013)	BTL-2	Understanding	PO1, PO2, PO6
3	Explain the different types of error in measurement and their causes ? (NOV/DEC 2013)	BTL-2	Understanding	PO1, PO2
4	Define Calibration and interchangeability? Explain the purpose of calibrating and discuss various calibrating systems (MAY/JUNE 2014)	BTL-1	Remembering	PO1
5	Explain the various types of input signal? (NOV/DEC 2012)	BTL-2	Understanding	PO1, PO2

6	What are the various Elements of Metrology? with example ,explain how these elements influence the accuracy of measurement?(NOV/DEC 2015)	BTL-1	Remembering	PO1
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UNIT II LINEAR AND ANGULAR MEASUREMENT

12
 Definition of metrology-Linear measuring instruments: Vernier, micrometer, Slip gauges and classification, Tool Makers Microscope - interferometry, optical flats, Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: -Sine bar, Sine center, bevel protractor and angle Decker.

PART-A

CO Mapping : C305.2

Q.No.	Questions	BT Level	Competence	PO
1	What are the considerations while manufacturing the slip gauges?	BTL-1	Remembering	PO1
2	How do you calibrate the slip gauges ?(NOV/DEC 2015)	BTL-1	Remembering	PO1
3	List the various linear measurements?	BTL-1	Remembering	PO1
4	What are the various types of linear measuring instruments?	BTL-1	Remembering	PO1, PO2
5	List out any four angular measuring instrument used in metrology. ?(NOV/DEC 2015)	BTL-3	Analyzing	PO1, PO2
6	Classify the comparator according to the principles used for obtaining magnification. (NOV/DEC 2013)	BTL-2	Understanding	PO1, PO2
7	What are comparators?	BTL-1	Remembering	PO1
8	Expalin the mechanical comparator works?	BTL-2	Understanding	PO1
9	State the best example of a mechanical comparator.	BTL-1	Remembering	PO1
10	Define least count and mention the least count of a mechanical comparator.	BTL-1	Remembering	PO1
11	How the mechanical comparator is used? State with any one example.	BTL-1	Remembering	PO1
12	12. State any four advantages of reed type mechanical comparator. ?(NOV/DEC 2015)	BTL-1	Remembering	PO1
13	Mention any two disadvantages of reed type mechanical comparator. (NOV/DEC 2013)	BTL-1	Remembering	PO1
14	What are the major types of on electrical comparator?	BTL-1	Remembering	PO1, PO2
15	On what basis the transducer works? ?(NOV/DEC 2015)	BTL-1	Remembering	PO1
16	Explain the accuracy of an electrical comparator checked?	BTL-1	Remembering	PO1
17	List the working principle of an electronic comparator.	BTL-1	Remembering	PO1

18	List the important parts of an electronic comparator. (NOV/DEC2012)	BTL-1	Remembering	PO1
19	Classify pneumatic comparators.	BTL-1	Remembering	PO1
20	What are the advantages of electrical and electronic comparator?	BTL-1	Remembering	PO1, PO2
21	What are the disadvantages of electrical and electronic comparator?	BTL-1	Remembering	PO1, PO2
22	List the various parts of an optical comparator. (NOV/DEC2012)	BTL-1	Remembering	PO1
23	What are the advantages of pneumatic comparators?	BTL-1	Remembering	PO1

PART-B

1	Explain neat diagram explain the working of SINE BAR and Angle Dekkar? (NOV/DEC2013)	BTL-2	Understanding	PO1, PO2
2	Explain the Working Principle of AC Laser Interferometer and explain how the Straightness is measure? (NOV/DEC 2015)	BTL-1 BTL-5	Remembering Evaluating	PO1
3	Explain with a Schematic sketch the working Principle of solex pneumatic comparator? (MAY/JUNE2014)	BTL-2	Understanding	PO1
4	Describe the working principle, advantages and disadvantages of optical comparator? (MAY/JUNE2014)	BTL-5	Evaluating	PO1
5	Explain the working principle of Angle Dekkar with a neat sketch .Also Write the application of angle dekkar? (NOV/DEC2015)	BTL-2	Understanding	PO1
6	Explain the following with neat sketches: (NOV/DEC2012) (i) Differential screw micrometer (ii) Thread Micrometer (iii) Blade Type Micrometer (iv) Micrometer Thread Gauge	BTL-2	Understanding	PO1

UNIT III FORM MEASUREMENT

Measurement of screw threads: Thread gauges, floating carriage micrometer measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

PART-A

CO Mapping : C305.3

Q.No.	Questions	BT Level	Competence	PO
1	Name the various types of pitch errors found in screw? (NOV/DEC2012)	BTL-1	Remembering	PO1
2	Name the various methods of measuring the minor	BTL-1	Remembering	PO1, PO2

	diameter of the thread. (NOV/DEC2012)			
3	Name the various methods used for measuring the major diameter?	BTL-1	Remembering	PO1
4	Name the various methods for measuring effective diameter.	BTL-1	Remembering	PO1, PO2
5	Name the various methods for measuring pitch diameter.	BTL-2	Understanding	PO1, PO6
6	Name the two corrections are to be applied in the measurement of effective diameter. (NOV/DEC 2015)	BTL-1	Remembering	PO1, PO6, PO7
7	What is best size of wire?	BTL-1	Remembering	PO1, PO6
8	Define. Drunken thread	BTL-1	Remembering	PO1
9	What is the effect of flank angle error? (NOV/DEC2012)	BTL-1	Remembering	PO1, PO6, PO7
10	What are the applications of toolmaker's microscope?	BTL-1	Remembering	PO1, PO6, PO7
11	Define: Periodic error.	BTL-1	Remembering	PO1, PO6, PO7
12	What are the commonly used forms of gear teeth?	BTL-1	Remembering	PO1, PO6, PO7
13	What are the types of gears? (NOV/DEC2012)	BTL-1	Remembering	PO1, PO6, PO7
14	Define: Module.	BTL-1	Remembering	PO1
15	Define: Lead angle.	BTL-4	Analyzing	PO1
16	What are the various methods used for measuring the gear tooth thickness?	BTL-1	Remembering	PO1
17	List four gear errors. (NOV/DEC 2013)	BTL-1	Remembering	PO1
18	List the method used for checking the pitch of the gear. ?(MAY/JUNE2014)	BTL-1	Remembering	PO1
19	What are the direct angular measurements methods?	BTL-1	Remembering	PO1
20	Define: constant chord.	BTL-1	Remembering	PO1
21	Give the formula for measuring radius of circle.	BTL-1	Remembering	PO1
22	What are the two methods used in measuring radius of concave surface? (NOV/DEC2012)	BTL-1	Remembering	PO1
23	What are the factors affecting surface roughness?	BTL-1	Remembering	PO1, PO6
24	What are the methods used for evaluating the surface finish?	BTL-1	Remembering	PO1
25	Define fullness and emptiness in form factor. ?(MAY/JUNE2014)	BTL-1	Remembering	PO1, PO6, PO7
26	What are the methods used for measuring surface roughness?	BTL-1	Remembering	PO1, PO6, PO7
27	What are the stylus probe instruments?	BTL-1	Remembering	PO1, PO6, PO7
28	Define: Straightness of a line in two planes.	BTL-1	Remembering	PO1
29	Define: Roundness. Name the four measurement of roundness.	BTL-1	Remembering	PO1
30	Name the devices used for measurement of roundness.	BTL-1	Remembering	PO1
31	What is run out? ?(MAY/JUNE2014)			PO1

PART-B				
1	Explain the following Direct Instrument Measurements: (i) Stylus Probe type Instrument ii) Tomlinson Surface meter. (NOV/DEC 2013)	BTL-6	Creating	PO1, PO6, PO7
2	Explain how V-Block and three point probe are used for measurement of roundness. What are the Limitation of V-Block? (NOV/DEC 2013)	BTL-5	Evaluating	PO1, PO6, PO7
3	Explain with a neat sketch the working of Talysurf instrument for surface finish measurement? (MAY/JUNE 2014)	BTL-5	Evaluating	PO1, PO6, PO7
4	Explain the two wire method of finding the effective diameter of screw threads? (MAY/JUNE 2014)	BTL-5	Evaluating	PO1, PO6, PO7
5	Explain the following tooth thickness measurement (i) Constant chord method (ii) Chordal thickness method? (NOV/DEC 2012)	BTL-5	Evaluating	PO1, PO2, PO6
6	Explain about the Various stages involved in Machine Vision? (NOV/DEC 2015)	BTL-5	Evaluating	PO1, PO2, PO6, PO7

UNIT IV LASER AND ADVANCES IN METROLOGY

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications. - computer aided inspection.

PART-A

CO Mapping : C305.4

Q.No.	Questions	BT Level	Competence	PO
1	Explain briefly the three important fields of machine vision system? (NOV/DEC 2015)	BTL-1	Remembering	PO1
2	2 What is interferometer?	BTL-1	Remembering	PO1, PO2
3	Name the different types of interferometer? (NOV/DEC 2015)	BTL-1	Remembering	PO1
4	Name the common source of light used for interferometer?	BTL-1	Remembering	PO1
5	What is crest and trough?	BTL-1	Remembering	PO1
6	What is meant by alignment test on machine tools?	BTL-1	Remembering	PO1
7	List the various geometrical checks made on machine tools.	BTL-1	Remembering	PO1
8	What is wavelength?	BTL-1	Remembering	PO1
9	Distinguish between geometrical test and practical test on a machine tool.	BTL-1	Remembering	PO1
10	What are the main spindle errors? (NOV/DEC 2013)	BTL-1	Remembering	PO1
11	the various tests conducted on any machine	BTL-1	Remembering	PO1

	tools?(NOV/DEC 2015)			
12	Why the laser is used in alignment testing?	BTL-1	Remembering	PO1
13	Classify the machine tool test.	BTL-1	Remembering	PO1
14	What are the different types of geometrical tests conducted on machine tools	BTL-1	Remembering	PO1, PO2
15	What is CMM? ?(MAY/JUNE2014)	BTL-1	Remembering	PO1
16	What is the principle of laser?	BTL-1	Remembering	PO1
17	Define axial length measuring accuracy.	BTL-1	Remembering	PO1
18	Explain the types of coordinate measuring machines?	BTL-1	Remembering	PO1
19	Explain CNC, CMM briefly.	BTL-1	Remembering	PO1
20	Explain some features of CMM software.	BTL-1	Remembering	PO1
21	What are the four basic types of machine, vision system? (NOV/DEC 2013)	BTL-1	Remembering	PO1
22	What are the advantages of machine vision system.	BTL-1	Remembering	PO1
23	Define machine vision. (NOV/DEC 2013)	BTL-1	Remembering	PO1
24	Define grayscale analysis	BTL-1	Remembering	PO1
25	25 Mention the advantages of CMM.	BTL-1	Remembering	PO1, PO2
26.	What are the disadvantages of CMM.	BTL-1	Remembering	PO1
27.	What are the application of CMM. ?(MAY/JUNE2014	BTL-1	Remembering	PO1
28.	Explain the features of a flexible inspection system. ?(MAY/JUNE2014)	BTL-1	Remembering	PO1
29.	Explain brief note about	BTL-1	Remembering	PO1, PO2
PART-B				
1	Explain the construction details of column type of CMM? Mention the Advantages and Disadvantages ?(MAY/JUNE 2014)	BTL-5	Evaluating	PO1
2	Explain in Details the various method of testing accuracy of horizontal milling m/c and lathe using laser Interferometer?(MAY/JUNE 2014)	BTL-2	Understanding	PO1
3	Explain the Various types of co-ordinate measuring machine with a neat sketch?(NOV/DEC2013)	BTL-5	Evaluating	PO1
4	Explain with a neat sketch explain the dimensional measurement using scanning laser gauge?(NOV/DEC2013)	BTL-2	Understanding	PO1
5	Explain the construction and working of a laser Telemetric with a neat sketch?(NOV/DEC2012)	BTL-5	Evaluating	PO1
6	Explain the construction and working principle of various bridge type co-ordinate measuring machine?(NOV/DEC2012)	BTL-5	Evaluating	PO1

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Pressure measurement - Flow: Venturi, orifice, rotameter, pitot tube -Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor

PART-A

CO Mapping : C305.5

Q.No.	Questions	BT Level	Competence	PO
1	What are load cells?	BTL-1	Remembering	PO1, PO5
2	List the principle of hot wire anemometer.	BTL-1	Remembering	PO1
3	State any four inferential type of flow meters ?(NOV/DEC 2015)	BTL-1	Remembering	PO1, PO5
4	What is the principle involved in fluid expansion thermometer?	BTL-1	Remembering	PO1
5	List some instruments used to measure negative pressures.	BTL-1	Remembering	PO1
6	Name the two types of hot wire anemometer. ?(NOV/DEC 2015)	BTL-1	Remembering	PO1
7	What is an Anemometer?	BTL-1	Remembering	PO1, PO5
8	What is thermocouple?	BTL-1	Remembering	PO1
9	What is a Kentometer? ?(MAY/JUNE2014)	BTL-1	Remembering	PO1, PO5
10	What is thermopile?	BTL-1	Remembering	PO1
11	Write the working principles of hot wire anemometer.	BTL-1	Remembering	PO1
12	What is the use of thermometer and pyrometer? ?(MAY/JUNE2014)	BTL-1	Remembering	PO1
13	Name the instruments used for measurement of torque. ?(MAY/JUNE2014)	BTL-1	Remembering	PO1
14	classify the types of strain gauges.	BTL-1	Remembering	PO1, PO2
15	Mention a few materials used in binding of strain gauges. (NOV/DEC 2013)	BTL-1	Remembering	PO1, PO5
16	List the types of dynamometers.	BTL-1	Remembering	PO1, PO5
17	List the types of electrical strain gauges. (NOV/DEC 2013)	BTL-1	Remembering	PO1
18	List the uses of rotometer, hotwire anemometer. ?(MAY/JUNE2014)	BTL-1	Remembering	PO1, PO5
19	Explain any two applications of an ultrasonic flow meter.	BTL-1	Remembering	PO1, PO2
20	Name any four inferential types of flow meters. (NOV/DEC 2013)	BTL-1	Remembering	PO1
21	what is the principle involved in fluid expansion	BTL-1	Remembering	PO1

	thermometer? (NOV/DEC 2013)			
PART-B				
1	Explain the construction and working of a Venturimeter and Rotometer? (NOV/DEC 2013)	BTL-2	Understanding	PO1
2	Explain the neat Sketch explain how bimetallic strips are used for temperature measurement?(MAY/JUNE2012)	BTL-2	Understanding	PO1
3	Explain the working and purpose of electrical resistance thermistors.(MAY/JUNE2013)	BTL-5	Evaluating	PO1, PO2, PO6
4	Explain the neat sketch explain the working of thermocouple and Pitot tube?(NOV/DEC2012)	BTL-5	Evaluating	PO1, PO2, PO6
5	Explain the neat sketch explain the Torque measurement using Strain Gauges and Hydraulic Dynamometer?(MAY/JUNE2014)	BTL-5	Evaluating	PO1
6	Explain the neat sketch explain the velocity measurement using hot wire anemometer?(NOV/DEC 2013)	BTL-5	Evaluating	PO1

UNIT I

CONCEPT OF MEASUREMENTS

1. What is Range of measurement? (NOV/DEC 2013)

The physical variables that are measured between two values. One is the higher calibration value H, and the other is Lower value L, The difference between H, and L, is called range.

2. What is Resolution?(NOV/DEC 2014)

The minimum value of the input signal is required to cause an appreciable change in the output known as resolution.

3. Distinguish between sensitivity and range with suitable example.

Example: An Instrument has a scale reading of 0.01mm to 100mm. Here, the sensitivity of the instrument is 0.01mm i.e. the minimum value in the scale by which the instrument can read. The range is 0.01 to 100mm i.e. the minimum to maximum value by which the instrument can read.

4. Define system error and correction.(MAY/JUNE2012)

Error: The deviation between the results of measured value to the actual value.

Correction: The numerical value which should be added to the measured value to get the correct result.

5. Define: Measurand.

Measurand is the physical quantity or property like length, diameter, and angle to be measured.

6. Define: Deterministic Metrology. (NOV/DEC 2013)

The metrology in which part measurement is replaced by process measurement. The new techniques such as 3D error compensation by CNC systems are applied.

7. Define over damped and under damped system.(NOV/DEC2011)

Over damped - The final indication of measurement is approached exponentially from one side.

Under damped - The pointer approaches the position corresponding to final reading and makes a number of oscillations around it.

8. Explain any four methods of measurement

1. Direct method.
2. Indirect method.
3. Comparison method.
4. Coincidence method.

9. classification of measuring instruments. (NOV/DEC 2013)

1. Angle measuring Instruments.
2. Length measuring Instruments.
3. Instruments for surface finish.
4. Instruments for deviations.

10. Define True size.

True size is Theoretical size of a dimension.

11. Define Actual size.

Actual size = Size obtained through measurement with permissible error.

12. What is Hysteresis?

All the energy put into the stressed component when loaded is not recovered upon unloading. So, the output of measurement partially depends on input called hysteresis.

13. Differentiate accuracy and Uncertainty with example.

Accuracy - Closeness to the true value.
Example: Measuring accuracy is $\pm 0.02\text{mm}$ for diameter 25mm.
Here the measurement true values lie between 24.98 to 25.02 mm
Uncertainty about the true value = $\pm 0.02\text{mm}$

14. Define Span. **?(NOV/DEC 2015)**

The algebraic difference between higher calibration values to lower calibration value.
Example: In a measurement of temperature higher value is 200°C and lower value is 150°C means span = $200 - 150 = 50^\circ\text{C}$.

15. Differentiate between precision and accuracy.

Accuracy - The maximum amount by which the result differ from true value.
Precision - Degree of repetitiveness. If an instrument is not precise it will give different results for the same dimension for the repeated readings.

16. What is Scale interval?

It is the difference between two successive scale marks in units.

17. What is Response Time? **?(NOV/DEC 2015)**

The time at which the instrument begins its response for a change measured quantity.

18. Define Repeatability.

The ability of the measuring instrument to repeat the same results of the actual measurements for the same quantity is known as repeatability.

19. Explain the term magnification.

It means the magnitude of output signal of measuring instrument time's increases to make it more readable.

20. Classify the Absolute error.

The absolute error is classified into

1. True absolute error.
2. Apparent absolute error.

21. What is Relative error?

Relative error is defined as the results of the absolute error and the, value of comparison used for calculation of that absolute error. The comparison may be true value or conventional true value or arithmetic mean for series of measurement.

22. Classify the errors.

The errors can be classified into

1. Static errors - Reading errors
 - Characteristic errors,
 - Environmental errors
2. Loading errors
3. Dynamic error.

23. What is the basic Principle of measurement?

It is the physical phenomenon utilized in the measurement. If energy kind of quantity measured, there must be a unit to measure it. So this will give the quantity to be measured in number of that unit.

24. What are the applications of Legal metrology?

1. Industrial Measurements.
2. Commercial transactions.
3. Public health and human safety ensuring.

<p>25. What is the need of inspection? ?(NOV/DEC 2015) To determine the fitness of new made materials, products or component part and to compare the materials, products to the established standard.</p>
<p>26. What are the important elements of measurements? The important elements of a measurement is</p> <ol style="list-style-type: none"> 1. Measurand. 2. Reference. 3. Comparator
<p>27. What is LEGAL METROLOGY? ?(NOV/DEC 2015) Legal metrology is part of Metrology and it is directed by a National Organization which is called "Notional service of Legal Metrology". The main objective is to, maintain uniformity of measurement in a particular country.</p>
<p>PART-B (16 MARKS) DESCRIPTIVE TYPE QUESTIONS</p>
<p>1. Give the Structure of Generalized Measurement system and Explain in details? (NOV/DEC 2013)</p>
<p>2. Enumerate the desirable characteristics of precision measuring instrument? (NOV/DEC 2013)</p>
<p>3. Describe the different types of error in measurement and their causes ? (NOV/DEC 2013)</p>
<p>4. Define Calibration and interchangeability? Explain the purpose of calibrating and discuss various calibrating systems(MAY/JUNE 2014)</p>
<p>5. Briefly explain the various types of input signal?(NOV/DEC 2012)</p>
<p>6. What are the various Elements of Metrology? with example ,explain how these elements influence the accuracy of measurement?(NOV/DEC 2015)</p>
<p>UNIT II LINEAR AND ANGULAR MEASUREMENTS</p>
<p>1. What are the considerations while manufacturing the slip gauges? The following additional operations are carried out to obtain the necessary qualities in slip gauges during manufacture.</p> <ol style="list-style-type: none"> 1. First the approximate size of slip gauges is done by preliminary operations. 2. The blocks are hardened and wear resistant by a special heat treatment process. 3. To stabilize the whole life of blocks, seasoning process is done. 4. The approximate required dimension is done by a final grinding process.
<p>2. How do you calibrate the slip gauges ?(NOV/DEC 2015) Comparators are used to calibrate the slip gauges.</p>
<p>3. List the various linear measurements?</p> <ol style="list-style-type: none"> (i) Length. (ii) Heights and (iii) Thickness.
<p>4. What are the various types of linear measuring instruments? The various devices used for measuring the linear measurements are</p> <ol style="list-style-type: none"> i. Vernier calipers. ii. Micrometers.

<p>iii. Slip gauge or gauge blocks. Comparator</p>
<p>5. List out any four angular measuring instrument used in metrology. ?(NOV/DEC 2015)</p> <p>(i) Angle gauges. (ii) Divided scales. (iii) Sine bar with slip gauges. (iv) Autocollimator. (v) Angle dekkor.</p>
<p>6. Classify the comparator according to the principles used for obtaining magnification. (NOV/DEC 2013)</p> <p>The common types are:</p> <p>(i) Mechanical comparators. (ii) Electrical comparators. (iii) Optical comparators. (iv) Pneumatic comparators.</p>
<p>7. What are comparators? Comparators are one form of linear measurement device which is quick and more convenient for checking large number of identical dimensions.</p>
<p>8. How the mechanical comparator works? The method of magnifying small movement of the indicator in all mechanical comparators are effected by means of levers, gear trains or a combination of these elements.</p>
<p>9. State the best example of a mechanical comparator. A dial indicator or dial gauge is used as a mechanical comparator.</p>
<p>10. Define least count and mention the least count of a mechanical comparator. Least count. - The least value that can be measured by using any measuring instrument known as least count. Least count of a mechanical comparator is 0.01 mm.</p>
<p>11. How the mechanical comparator is used? State with any one example. Let us assume that the required height of the component is 32.5mm. Initially, this height is built up with slip gauges. The slip gauge blocks are placed under the stem of the dial gauge. The pointer in the dial gauge is adjusted to zero. The slip gauges are removed- Now, the component to be checked is introduced under the stem of the dial gauge. If there is any deviation in the height of the component, it will be indicated by the pointer.</p>
<p>12. State any four advantages of reed type mechanical comparator. ?(NOV/DEC 2015)</p> <p>(i) It is usually robust, compact and easy to handle. (ii) There is no external supply such as electricity, air required. (iii) It has very simple mechanism and is cheaper when compared to other types. (iv) It is suitable for ordinary workshop and also easily portable.</p>
<p>13. Mention any two disadvantages of reed type mechanical comparator. (NOV/DEC 2013)</p> <p>(i) Accuracy of the comparator mainly depends on the accuracy of the rack and pinion arrangement. Any slackness will reduce accuracy. (ii) It has more moving parts and hence friction is more and accuracy is less.</p>
<p>14. What are the major types of an electrical comparator? An electrical comparator consists of the following three major parts such as</p>

- (i) Transducer.
- (ii) Display device as meter.
- (iii) Amplifier.

15. On what basis the transducer works? **?(NOV/DEC 2015)**

An iron armature is provided in between two coils held by a leaf spring at one end. The other end is supported against a plunger. The two coils act as two arms of an A.C. wheat stone bridge circuit.

16. How is the accuracy of an electrical comparator checked?

To check the accuracy of a given specimen or work, first a standard specimen is placed under the plunger. After this, the resistance of wheat stone bridge is adjusted that the scale reading shows zero. Then the specimen is removed. Now, the work is introduced under the plunger.

17. State the working principle of an electronic comparator.

In electronic comparator, transducer induction or the principle of application of frequency modulation or radio oscillation is followed.

18. Mention the important parts of an electronic comparator. **(NOV/DEC2012)**

- (i) Transducer.
- (ii) Oscillator.
- (iii) Amplifier.
- (iv) Demodulator.
- (v) Meter.

19. Classify pneumatic comparators.

- (i) Flow or Velocity type.
- (ii) Back pressure type.

20. What are the advantages of electrical and electronic comparator?

- (i) It has less number of moving parts.
- (ii) Magnification obtained is very high.
- (iii) Two or more magnifications are provided in the same instrument to use various ranges.
- (iv) The pointer is made very light so that it 'IS more sensitive to vibration.

21. What are the disadvantages of electrical and electronic comparator?

- (i) External agency is required to meter for actuation.
- (ii) Variation of voltage or frequency may affect the accuracy of output.
- (iv) Due to heating coils, the accuracy decreases.

It is more expensive than mechanical comparator

22. List the various parts of an optical comparator. **(NOV/DEC2012)**

The optical comparator consists of the following parts such as

- (i) Pivoted lever.
- (ii) Objective lens
- (iii) Scale.
- (iv) Plunger.
- (iv) Table

23. What are the advantages of pneumatic comparators?

- (i) The wear of measuring heads is avoided due to absence of direct contact.
- (ii) Friction is less due to less number of moving parts.
- (iii) Work piece is cleaned by supplying of all during the measurement.
- (iv) High magnification is possible.

- (v) There is no interference of measuring head and indicating device because the measuring head is kept away from the indicating device.
- (vi) It is a suitable method to check taperness of circular bore.

PART-B (16 MARKS)
DESCRIPTIVE TYPE QUESTIONS

1. With a neat diagram explain the working of SINE BAR and Angle Dekkar?(NOV/DEC2013)
2. Explain the Working Principle of AC Laser Interferometer and explain how the Straightness is measure?(NOV/DEC 2015)
3. Explain with a Schematic sketch the working Principle of solex pneumatic comparator?(MAY/JUNE2014)
4. Describe the working principle, advantages and disadvantages of optical comparator?(MAY/JUNE2014)
5. Explain the working principle of Angle Dekkar with a neat sketch .Also Write the application of angle dekkar?(NOV/DEC2015)
6. Explain the following with neat sketches:(NOV/DEC2012)
 - (i) Differential screw micrometer
 - (ii) Thread Micrometer
 - (iii) Blade Type Micrometer
 - (iv) Micrometer Thread Gauge

UNIT 3
FORM MEASUREMENT

1. Name the various types of pitch errors found in screw? (NOV/DEC2012)
 - (i) Progressive error.
 - (ii) Drunken error.
 - (iii) Periodic error.
 - (iv) Irregular errors.
2. Name the various methods of measuring the minor diameter of the thread. (NOV/DEC2012)
 - (i) Using taper parallels.
 - (ii) Using rollers and slip gauges.
3. Name the various methods used for measuring the major diameter?
 - (i) Ordinary micrometer.
 - (ii) Bench micro meter.
4. Name the various methods for measuring effective diameter.
 - (i) One wire method.
 - (ii) Two wire method.
 - (iii) Three wire method.
5. Name the various methods for measuring pitch diameter.
 - (i) Pitch measuring machine.

(ii) Tool maker. (iii) Screw pitch gauge.
6. Name the two corrections are to be applied in the measurement of effective diameter. (NOV/DEC 2015) (i) Rake corrections Compression correction
7. What is best size of wire? Best size of wire is a wire of such diameter that it makes contact with the flanks of the thread on the pitch line.
8. Define. Drunken thread This is one, having erratic pitch, in which the advance Of the helix is irregular in one complete revolution of thread.
9. What is the effect of flank angle error? (NOV/DEC2012) Errors in the flank cause a virtual increase in the effective diameter of a bolt and decrease in that, of nut.
10. What are the applications of toolmaker's microscope? (i) Linear measurement. (ii) Measurement of pitch of the screw. (iii) Measurement of thread angle.
11. Define: Periodic error. The periodic error repeats itself at equal intervals along the thread.
12. What are the commonly used forms of gear teeth? (1) Involutes. (2) Cycloidal.
13. What are the types of gears? (NOV/DEC2012) (i) Spur. (ii) Helical. (iii) Bevel. (iv) Worth and Worm wheel. (v) Rack and pinion.
14. Define: Module. Module= pitch circle diameter/ number of teeth.
15. Define: Lead angle. It is the angle between the tangent to the helix and plane perpendicular to the axis of cylinder.
16. What are the various methods used for measuring the gear tooth thickness? (i) Gear tooth Vernier. (ii) Constant chord method.
(iii) Base tangent method.

(iv) Measurement over pins.
17. Name four gear errors. (NOV/DEC 2013) (i) Pitch error. (ii) Alignment error. (iii) Composite error. (iv) Thickness error.
18. Name the method used for checking the pitch of the gear. ?(MAY/JUNE2014) (i) Step by step method. (ii) Direct angular measurement.
19. What are the direct angular measurements methods? 1. Profile checking: a) Optical projection method. b) Involute measuring method. 2. Thickness measurement: a) Chordal thickness method. b) Constant chord method.
20. Define: constant chord. Constant chord is the chord joining those points, or opposite Arcs of the tooth.
21. Give the formula for measuring radius of circle. $R = \frac{(I - d)^2}{8d}$ Where, R=Radius of the job I = Distance between the balls d = Diameter of pins.
22. What are the two methods used in measuring radius of concave surface? (NOV/DEC2012) a) Edges are well defined. b) Edges are rounded up.
23. What are the factors affecting surface roughness? a) Vibrations. b) Material of the work piece. c) Tool d) Machining type.
24. What are the methods used for evaluating the surface finish? a) Peak to valley height method. b) The average roughness method. c) Form factor method.
25. Define fullness and emptiness in form factor. ?(MAY/JUNE2014) Degree of fullness (K)= area of metal /Area of enveloping rectangle Degree of emptiness = 1 – K.
26. What are the methods used for measuring surface roughness? a) Inspection by comparison b) Direct instrument measurements.
27. What are the stylus probe instruments? a) Profilometer. b) Taylor Hobson Talysurf. c) Tomlinson surface meter.
28. Define: Straightness of a line in two planes. A line is said to be straight over a given length, if the variation of the distance of its points from two planes perpendicular to each other and parallel to the direction of a line remaining within the

specified tolerance limits
<p>29. Define: Roundness. Name the four measurement of roundness. It is a surface of revolution where all the surfaces intersected 'by any plane perpendicular to a common axis in case of, cylinder and cone.</p> <ol style="list-style-type: none"> Heart square circle. Minimum radial separation circle. Maximum inscribed circle. Minimum circumscribed circle
<p>30. Name the devices used for measurement of roundness.</p> <ol style="list-style-type: none"> Diametral. Circumferential confining gauge. Rotating on center. V-Block. Three point probe. Accurate spindle.
<p>31. What is run out? ?(MAY/JUNE2014) Run out. -Total range of reading of a fixed indicate Or with the contact points applied to a Surface rotated, without axial movement, about 3 fixed axis</p>
<p>PART-B (16 MARKS)</p> <p>DESCRIPTIVE TYPE QUESTIONS</p>
<p>1. Explain the following Direct Instrument Measurements: (i)Stylus Probe type Instrument ii)Tomlinson Surface meter.(NOV/DEC2013)</p>
<p>2. Explain how V-Block and three point probe are used for measurement of roundness . What are the Limitation of V-Block?(NOV/DEC2013)</p>
<p>3. Explain with a neat sketch the working of Talysurf instrument for surface finish measurement?(MAY/JUNE 2014)</p>
<p>4. Describe the two wire method of finding the effective diameter of screw threads?(MAY/JUNE 2014)</p>
<p>5. Expaline the following tooth thickness measurement (i)Constant chord method(ii)Chordal thickness method? (NOV/DEC2012)</p>
<p>6. Write briefly about the Various stages involved in Machine Vision?(NOV/DEC2015)</p>
<p>UNIT 4</p> <p>LASER AND ADVANCES IN METROLOGY</p>
<p>1. Explain briefly the three important fields of machine vision system ?(NOV/DEC 2015) Inspection: it is the ability of an automated vision system to recognize well-defined pattern and if these pattern match these stored in the system makes machine vision ideal for inspection of raw materials, parts, assemblies etc. Part identification: It is the ability of part recognition provides positive identifications of an object for decision-making purposes. Guidance and Control. Machine vision systems are used to provide sensor feedback for real time guidance.</p>
<p>2 What is interferometer? Interferometer is optical instruments used for measuring flatness and determining the lengths of slip gauges by direct reference to the wavelength of light.</p>
<p>3 Name the different types of interferometer ?(NOV/DEC 2015) 1) NPL flatness interferometer.</p>

<p>2) Michelson interferometer.</p> <p>3) Laser interferometer.</p> <p>4) Zesis gauge block interferometer.</p>
<p>4 Name the common source of light used for interferometer?</p> <p>a. Mercury 198.</p> <p>b. Cad minus.</p> <p>c. Krypton 86.</p> <p>d. Helium.</p> <p>e. Hydrogen.</p>
<p>5 What is crest and trough?</p> <p>The light is a form of energy being propagated by electromagnetic waves, which is a sine curve. The high point of the wave is called crust and the low Point is called is trough.</p>
<p>6. What is meant by alignment test on machine tools?</p> <p>The alignment test is carried out to check the grade of manufacturing accuracy of the machine tool.</p>
<p>7. List the various geometrical checks made on machine tools.</p> <p>a. Straghtness of guide ways and slide ways of machine tool.</p> <p>b. Flatness of machine tables and slide ways.</p> <p>c. Parallelism, equidistance and alignment of the slide ways.</p> <p>d. True running and alignment of shaft and spindle.</p> <p>e. The pitch error or lead of lead screw.</p> <p>f. Pitch errors of gears.</p>
<p>8. What is wavelength?</p> <p>The distance between two crusts or two rough is called the wavelength.</p>
<p>9. Distinguish between geometrical test and practical test on a machine tool.</p> <p>The alignment test is carried out to check the grade of manufacturing accuracy of the machine tool. Performance test consist of checking the accuracy of the finished component. Alignment test consist of checking the relationship between various machine elements when the machine tool is idle. Performance test consists of preparing the actual test jobs on the machine and checking the accuracy of the jobs produced.</p>
<p>10. What are the main spindle errors? (NOV/DEC 2013)</p> <p>a) Out of round.</p> <p>b) Eccentricity.</p> <p>c) Radial throws of an axis.</p> <p>d) Run out.</p> <p>e) Periodical axial slip.</p>
<p>11. Write the various tests conducted on any machine tools?(NOV/DEC 2015)</p> <p>1. Test for level of installation of machine tool in horizontal and vertical planes.</p> <p>2. Test for flatness of machine bed and for straightness and parallelism of bed ways on bearing surface.</p> <p>3. Test for perpendicularity of guide ways to other guide ways.</p> <p>4. Test for true running of the main spindle and its axial movements.</p>
<p>12. Why the laser is used in alignment testing?</p> <p>The alignment tests can be carried out over greater distances and to a greater degree of accuracy using laser equipment. Laser equipment produces real straight line, whereas an alignment telescope provides a, imaginary line that cannot be seen in space.</p>
<p>13. Classify the machine tool test.</p> <p>It can be classified into</p> <p>1. Static tests.</p> <p>2. Dynamic tests.</p>
<p>14. What are the different types of geometrical tests conducted on machine tools?</p> <p>1. Straightness.</p>

2. Flatness. 3. Parallelism, equi-distance and coincidence
15. What is CMM? ?(MAY/JUNE2014) It is a three dimensional measurements for various components. These machines have precise movement is x, y, z coordinates which can be easily controlled and measured. Each slide in three directions is equipped with a precision linear measurement transducer which gives digital display and senses positive and negative direction.
16. What is the principle of laser? The photon emitted during stimulated emission has the same energy, phase and frequency as the incident photon. This principle states that the photon comes in contact with another atom or molecule in the higher energy level E_2 then it will cause the atom to return to ground state energy level E_1 , by releasing another photon. The sequence of triggered identical photon from stimulated at E_2 is known as stimulated emission. This multiplication of photon through stimulated emission' leads to coherent, powerful, monochromatic, collimated beam of light emission. This light emission is called laser
17. Define axial length measuring accuracy. It is defined as difference between the references lengths of gauges aligned with a machine axis and the corresponding measurement results from the machine.
18. Write the types of coordinate measuring machines? 1. Bridge type. 2. Horizontal bore mill. 3. Vertical bore mill. 4. Spherical coordinate measuring machine.
19. Explain CNC, CMM briefly. A computer numerical control system can be used with CN4M to do calculations while measuring complex parts. Error can be stored in memory while doing calculations. For automatic calibration of probe, determination of co-ordinate system, calculation, evaluation and recording etc., special software's are incorporated.
20. Write some features of CMM software. Measurement of diameter, center distance can be measured as follows: 1. Measurement of plane and spatial curves. 2. Minimize CNC programme. 3. Data communications. 4. Digital input and output command 5. Interface to CAD software.
21. What are the four basic types of machine, vision system? (NOV/DEC 2013) (i) Image formation. (ii) Processing of image. (iii) Analyzing the image. (iv) Interpretation of image.
22. Write the advantages of machine vision system. (i) Reduction of tooling and fixture cash. (ii) Elimination of need for precise part location. (iii) Integrated automation of dimensional verification (iv) Defect detection.
23. Define machine vision. (NOV/DEC 2013) Machine vision can be defined as a means of simulating the image recognition and analysis capabilities of the human system with electronic and electromechanical techniques.
24. Define grayscale analysis. In these techniques, discrete areas or windows are formed around only the portions of the image to be inspected. For determining if brackets are present, high intensity lighting is positioned. This type of

discrete area analysis is a powerful tool and can be used for inspection of absence, correct part assembly, orientation, part, integrity, etc.
25. Mention the advantages of CMM. (i) The inspection rate is increased. (ii) Accuracy is reduced. (iii) Operator's error can be minimized. Skill of the operator is reduced. (iv) Reduction in calculating, recording and set up time. (v) No need of GO/NOGO gauges. Reduction of scrap and good part rejection
26. Mention the disadvantages of CMM. (i) The table and probe may not be in perfect alignment. (ii) The stylus may have run out. (iii) The stylus moving in z-axis may have some perpendicularity errors. (iv) Stylus while moving in x and y direction may not be square to each other. (v) There may be errors in digital system.
27. Mention the application of CMM. ?(MAY/JUNE2014) (i) CMM's to find application in automobile., machine to.,electronics, space and many other large companies. (ii) These are best suited for the test and inspection Of test equipment, gauges and tools. (iii) For aircraft and space vehicles of hundred Percent inspections is carried out by using CMM. (iv) CMM can be used for determining dimensional accuracy of the component. (v) CMM can also be used for sorting tasks to achieve optimum pacing of components within tolerance limits.
28. Describe the features of a flexible inspection system. ?(MAY/JUNE2014) (i) A powerful computer serves as a real time processor to handle part dimensional data and as a multi 'programming system to perform such tasks as manufacturing process control. (ii) The terminal provides interactive communication with personnel Computer where the programmes are stored. (iii) Input devices microprocessor based gauges and other inspection devices are used in CMM.
29. Write brief note about (i) Co-ordinate measuring machine equipped with a laser probe? (ii) Virtual measuring system
PART-B (16 MARKS)
DESCRIPTIVE TYPE QUESTIONS
1. Explain the construction details of column type of CMM? Mention the Advantages and Disadvantages ?(MAY/JUNE 2014)
2. Explain in Details the various method of testing accuracy of horizontal milling m/c and lathe using laser Interferometer? (MAY/JUNE 2014)
3. Explain the Various types of co-ordinate measuring machine with a neat sketch? (NOV/DEC2013)
4. With a neat sketch explain the dimensional measurement using scanning laser gauge? (NOV/DEC2013)
5. Explain the construction and working of a laser Telemetric with a neat sketch? (NOV/DEC2012)
6. Explain the construction and working principle of various bridge type co-ordinate measuring machine? (NOV/DEC2012)

UNIT 5
MEASUREMENT OF MECHANICAL PARAMETERS

1. What are load cells?

Are devices for the measurement of force through indirect methods

2. Give the principle of hot wire anemometer.

When a fluid flows over a heated surface heat is transferred from the surface and so the temperature reduces. The rate of reduction of temperature is related to flow rate.

3. State any four inferential type of flow meters ?(NOV/DEC 2015)

- **Venturi meter.**
- **Orifice meter.**
- **Rota meter.**
- **Pitot tube.**

4 What is the principle involved in fluid expansion thermometer?

Change in pressure in the bulb is taken as an indication of the temperature.

5. Mention some instruments used to measure negative pressures.

- McLeod gauge
- Kundsens Gauge.
- Pirani Gauge.
- Ionization Type Gauge.

6. Name the two types of hot wire anemometer. ?(NOV/DEC 2015)

- Costant Current Type.
- Constant Temperature Type.

7. What is an Anemometer?

An anemometer is a device for measuring mean and fluctuating velocities in fluid flows. The reduction of temperature of a surface resulting from the heat transferred owing to the fluid flow is related to flow rate.

8 What is thermocouple?

When two metals are joined together it will create an emf and it is primarily a function of the junction temperature.

9. What is a Kentometer? ?(MAY/JUNE2014)

It is a device for measurement of absolute pressure

10. What is thermopile?

When thermocouples are connected in series it is called thermopile.

11. Write the working principles of hot wire anemometer.

When the fluid flows over heated surface heat is transferred from the surface and so, its temperature reduces. The rate of reduction of temperature is related to flow rate.

12. What is the use of thermometer and pyrometer? ?(MAY/JUNE2014)

Thermometer is used to measure the absolute temperatures. The pyrometer is used to measure high temperatures.

13. Name the instruments used for measurement of torque. ?(MAY/JUNE2014)

- Mechanical torsion meter (Stroboscopic method).

<ul style="list-style-type: none"> • Optical torsion meter. • Electrical torsion meter. • Strain gauge torsion meter.
<p>14. classify the types of strain gauges.</p> <ul style="list-style-type: none"> • Unbonded strain gauge. • Bonded strain gauge. • Fine wire strain gauge. • Metal foil strain gauge. • Piezo-resistive strain gauge.
<p>15. Mention a few materials used in binding of strain gauges. (NOV/DEC 2013)</p> <ul style="list-style-type: none"> • Ceramic cement. • Epoxy. • Nitrocellulose.
<p>16. Mention the types of dynamometers.</p> <ul style="list-style-type: none"> • Absorption dynamometer. • Driving dynamometer. • Transmission dynamometer.
<p>17. Mention the types of electrical strain gauges. (NOV/DEC 2013)</p> <ul style="list-style-type: none"> • Inductive. • Capacitive. • Piezo electric. • Resistance types.
<p>18. mention the uses of rotometer, hotwire anemometer. ?(MAY/JUNE2014)</p> <p>Both are used to measure flow rate.</p>
<p>19. Give any two applications of an ultrasonic flow meter.</p> <ul style="list-style-type: none"> • Measurement of flow between the blades of turbines. • Remote sensing of wind velocities.
<p>20. Name any four inferential types of flow meters. (NOV/DEC 2013)</p> <ul style="list-style-type: none"> • A venturimeter. • A orifice meter. • A rotometer. • A pitot tube.
<p>21. what is the principle involved in fluid expansion thermometer? (NOV/DEC 2013)</p> <p>In fluid expansion thermometers, the change in pressure in the bulb is taken as an indication of the temperature.</p>
<p>PART-B (16 MARKS) DESCRIPTIVE TYPE QUESTIONS</p>
<p>1. Explain the construction and working of a Venturimeter and Rotometer? (NOV/DEC 2013)</p>
<p>2. With the neat Sketch explain how bimetallic strips are used for temperature measurement?(MAY/JUNE2012)</p>
<p>3. Explain the working and purpose of electrical resistance thermistors.(MAY/JUNE2013)</p>
<p>4. With the neat sketch explain the working of thermocouple and Pitot tube?(NOV/DEC2012)</p>

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| 5. | With the neat sketch explain the Torque measurement using Strain Gauges and Hydraulic Dynamometer?(MAY/JUNE2014) |
| 6. | With the neat sketch explain the velocity measurement using hot wire anemometer?(NOV/DEC 2013) |
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