SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous institution)

SRM Nagar, Kattankulathur– 603203

DEPARTMENTOF MECHANICAL ENGINEERING

QUESTIONBANK

V SEMESTER

1909503 - METROLOGY AND MEASUREMENTS

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SUBJECT NAME : METROLOGY AND MEASUREMENTS

Sem / Year: V/III

UNIT 1: BASICS OF METROLOGY

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

PART-A

Q.No.	Questions	BT Level	Competence
1.	What is the difference between allowance and tolerance?	BT-2	Understanding
2.	Distinguish between Line standard and End standard.	BT-2	Understanding
3.	Define primary measurement. Give an example.	BT-1	Remembering
4.	List the Seismic instruments.	BT-1	Remembering
5.	What are the factors affecting the measuring system?	BT-4	Analyzing
6.	Define legal metrology.	BT-1	Remembering
7.	Explain the role of N.P.L.	BT-3	Applying
8.	Summarize the basic components of a measuring system.	BT-2	Understanding
9.	Differentiate between repeatability and reproducibility.	BT-2	Understanding
10.	Explain the term Sensitivity of an instrument.	BT-5	Evaluating
11.	Differentiate between precision and accuracy.	BT-2	Understanding
12.	Define the term reliability and Traceability.	BT-1	Remembering
13.	Give any four methods of measurement.	BT-2	Understanding
14.	Define Span.	BT-1	Remembering
15.	Give classification of measuring instruments.	BT-3	Applying
16.	Explain the term parasitic and illegitimate error.	BT-2	Understanding
17.	Point out the sources of error.	BT-4	Analyzing
18.	Illustrate the objectives of metrology	BT-3	Applying

19.	Compare the term correction and correction factor?	BT-4	Analyzing
20.	Differentiate between static and random error.	BT-4	Analyzing
21.	Define the term metrology as applied to engineering industry.	BT-1	Remembering
22.	Explain the significance of measurements.	BT-2	Understanding
23.	State the uses of metrology.	BT-1	Remembering
24.	Difference between gauging and measurements?	BT-4	Analyzing
25.	While taking measurements, the operator is often advised to use of an instruments in the middle third of its range. Why?	BT-3	Applying

PART-B

Q.No	Questions	Marks	BT Level	Competence
1.	Explain the classification of various measuring methods.	13	BT-4	Analyzing
2.	Explain the need of standards of measurements in the modern industrial system and describe the term traceability in connection with standards.	13	BT-2	Understanding
3.	What are the various elements of metrology? With examples, explain how these elements influence the accuracy of measurements.	13	BT-3	Applying
4.	Give the structure of generalized measurements system and explain in detail.	13	BT-6	Creating
5.	(a)Illustrate the desirable characteristics of precision measuring instruments. (b) Discuss the fundamental and derived units in details.	6 7	BT-3 BT-2	Applying Understanding
6.	Explain briefly about,(a) Uncertainty, (b) Reporting results.	13	BT-5	Evaluating
7.	(a)With suitable example explain the difference between precision and accuracy. (b) Give an example for the Zero order system.	7 6	BT-5 BT-2	Evaluating Understanding
8.	Distinguish between and give appropriate examples in each case, (a) Repeatability and Reproducibility (b) Systematic and random error	13	BT-4	Analyzing

	(c) Static and dynamic Response			
9.	Obtain the expression for the step response of a second order system with neat diagram.	13	BT-2	Understanding
10.	Describe briefly about, (a) Sensitivity and readability. (b) Calibration.	 7 6	 BT-1 BT-1	 Remembering Remembering
11.	Briefly explain the various types of input signals.	13	BT-4	Analyzing
12.	Explain the various errors in measurements.	13	BT-5	Evaluating
13.	What are the various possible sources of errors in measurements? Explain in detail.	13	BT-5	Evaluating
14.	What is the need of calibration? Explain the classifications of various standards.	13	BT-4	Analyzing
15.	(a) List and explain the factors to be considered for selecting an instrument. (b) Explain the applications of measuring instruments.	6 7	BT-2 BT-2	Understanding Understanding
16.	Explain with neat sketch about, (a) Imperial Standard yard (b) International Prototype meter	 7 6	 BT-2 BT-2	 Understanding Understanding
17.	(a) Describe wavelength standard with neat diagram and its advantages. (b) Define material standard. State the limitations of material standard.	8 5	BT-2 BT-1	Understanding Remembering
18.	Explain briefly about primary standard, secondary standard, territory standard and working standard with example.	13	BT-2	Understanding

PART-C				
1.	Briefly explain the significance of Metrology and Measurements in industrial application.	15	BT-4	Analyzing
2.	Explain various errors observed in measuring any industrial product.	15	BT-2	Understanding
3.	Enumerate the desirable characteristics of precision measuring instruments.	15	BT-1	Remembering
4.	Explain the steps to be followed in the measurement	15	BT-2	Understanding

	process.			
5.	Explain the characteristics of line standard and end standard with suitable example. And also how to transfer from line standard to end standard with example.	15	BT-4	Analyzing

UNIT-II: LINEAR AND ANGULAR MEASUREMENT

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology– procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

PART-A

Q.No.	Questions	BT Level	Competence
1.	Point out any four precautions to be taken while using gauge blocks.	BT-1	Remembering
2.	Why rocking procedure is followed when measuring with a dial bore gauge?	BT-5	Evaluating
3.	A vernier scale consists of 25 divisions on 12 mm spacing and the main scale has 24 divisions on12 mm. What is the least count?	BT-3	Applying
4.	What is difference between gauging and measurements?	BT-4	Analyzing
5.	Summarize the various types of linear measuring instruments.	BT-2	Understanding
6.	What is the use of Feeler gauges?	BT-2	Understanding
7.	List out any four angular measuring instruments used in metrology.	BT-1	Remembering
8.	A 100 mm sine bar was used to measure the tapper angle of the specimen and the gauge block was 5.055mm. Calculate the tapper angle.	BT-3	Applying
9.	List different types of fits.	BT-1	Remembering
10.	Define sine center.	BT-1	Remembering
11.	What are the construction requirements of a good sine bar?	BT-2	Understanding
12.	Explain Taylor principle in gauge design.	BT-2	Understanding
13.	Illustrate briefly about wringing of slip gauges.	BT-3	Applying
14.	Name any four instruments used measuring internal diameters in components.	BT-1	Remembering
15.	Explain the concept of selective assembly.	BT-2	Understanding
16.	Define clinometers.	BT-1	Remembering
17.	Describe the usage of autocollimator.	BT-2	Understanding
18.	Explain an angle alignment telescope.	BT-2	Understanding
19.	List out the need of angle gauges.	BT-1	Remembering

20.	Explain the concept of interchangeability.	BT-2	Understanding
21.	State the possible source of error in micrometer.	BT-1	Remembering
22.	Differentiate between vernier caliper and micrometer.	BT-4	Analyzing
23.	Write the difference between measuring instrument and comparator.	BT-4	Analyzing
24.	Write the difference between allowance and tolerance.	BT-4	Analyzing
25.	Write short note on bevel protractor.	BT-2	Understanding

PART-B

Q.No	Questions	Marks	BT Level	Competence
1.	Describe briefly about, (a) Write notes on interchangeability. (b) Sketch the construction and working of solex pneumatic comparator.	6 7	BT-1 BT-2	Remembering Understanding
2.	i) Explain with suitable sketches measurements of straightness using suitable method. ii) Describe the GO and NOGO gauge design procedure with a sketch.	7 6	BT-2 BT-2	Understanding Understanding
3.	Explain the construction and working principle of an autocollimator with neat a diagram and its application.	13	BT-2	Understanding
4.	(a)Explain the classification of linear measuring instruments. (b) Explain the vernier height gauge with neat sketch.	6 7	BT-3 BT-2	Applying Understanding
5.	Explain the following with neat sketches. (a) Differential screw micrometer and (b) Thread micrometer	13	BT-2	Understanding
6.	(a) What is a slip gauge? Write notes on its classifications. (b) How slip gauges are manufactured? Write notes on slip gauge accessories and its calibration.	6 7	BT-2 BT-4	Understanding Analyzing
7.	(a)What is a comparator? Explain Dial gauge type of Mechanical comparator. (b)Describe the working principle, advantages and	6 7	BT-2 BT-2	Understanding Understanding

	disadvantages of optical comparator.			
8.	Calculate the limits for a hole shaft pair designated 25 H8/d9.Show graphically the deposition of tolerance zones with reference to the zero line. The lower deviation for a H type hole is zero. 25 mm lies in the diameter range 18mm to 30 mm. Standard tolerance foe IT 8 is 25i and IT 9 is 40i, where "i" is the standard tolerance unit in microns and is given as $i(\mu m)=0.45\sqrt[3]{D}+0.001D$, (D is in mm).The upper deviation for d shaft is -16 D 0.44.	13	BT-6	Creating
9.	Describe with the help of a neat, any two bevel protractors.	13	BT-2	Understanding
10.	Define straightness. Describe any one method of measuring straightness of the surface.	13	BT-1	Remembering
11.	Explain working principle of sine bar and why sine bars are not suitable for measuring angles above 45^0?	13	BT-4	Analyzing
12.	Describe working principle of angle Dekkor with the neat sketch and also write its application.	13	BT-2	Understanding
13.	Explain the following methods, (a) Measurements of angle by using rollers, (b) Checking the angle of taper plug gauge using roller, (c) Measuring of included angle of an internal dovetail.	13	BT-2	Understanding
14.	Describe briefly on laser as a means of alignment checking.	13	BT-4	Analyzing
15.	(a) Compare between plug gauge and ring gauge with neat sketch. (b) List the advantages and disadvantages of limit gauges.	8 5	BT-4 BT-1	Analyzing Remembering
16.	Explain the concept of selective assembly with neat sketch, Discuss its significance in manufacturing.	13	BT-3	Applying
17.	Explain the construction and working principle of vernier bevel protractor with neat sketch and also uses of vernier bevel protractor for checking V block and measuring acute angle.	13	BT-2	Understanding

18.	Explain read type of Mechanical comparator with neat sketch and also explain the concept of Sigma comparator with sketch.	13	BT-2	Understanding

PART-C				
1.	Calculate the tolerances, fundamental deviations and limits of sizes for the shaft designated as 40H8/f7.Standard tolerance for IT 7 is 16i and IT 8is 25i. Where 'i' is the standard tolerance unit. Upper deviation for 'f' shaft is $-5.5D^{0.41}$,40 mm lies in the diameter range 30-50 mm.	15	BT-6	Creating
2.	Design a workshop type progressive type Go-Not-GO plug gauge suitable for 25H7, with following information: i. 25 mm lies in the diameter step of 18-30 mm ii. $i = 0.45\sqrt[3]{D}+0.001D$ iii. IT7 = 16i	15	BT-6	Creating
3.	Explain the significance of Linear and angular measurements.	15	BT-2	Understanding
4.	How laser is used in measurement? Explain the basic principle involved in anyone applications.	15	BT-4	Analyzing
5.	Discuss in detail about the various types of limit gauges with neat diagram.	15	BT-2	Understanding

UNIT III: ADVANCES IN METROLOGY

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer –Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

PART A

Q.No.	Questions	BT Level	Competence
1.	Name the different types of interferometer.	BT-1	Remembering
2.	Why is laser preferred in engineering metrology?	BT-4	Analyzing
3.	On what factor the accuracy of laser interferometer mainly depends?	BT-4	Analyzing
4.	Point out the application of Laser Interferometry.	BT-1	Remembering
5.	Give the advantages of laser interferometer.	BT-1	Remembering
6.	Why monochromatic light used in an interferometer instead of white light?	BT-4	Analyzing
7.	Name the various geometric checks made in machine tools.	BT-1	Remembering
8.	Differentiate straightness and flatness.	BT-4	Analyzing
9.	Discuss the applications of computer aided inspection.	BT-2	Understanding
10.	Define axial slip of a machine tool.	BT-1	Remembering
11.	Explain briefly about wavelength.	BT-2	Understanding
12.	List any four possible causes of errors in CMM.	BT-1	Remembering
13.	Point out the applications of CMM in machine tool metrology	BT-1	Remembering
14.	Describe the term “Qualifying the tip” in CMMs?	BT-2	Understanding
15.	Illustrate briefly about alignment test on machine tools.	BT-3	Applying
16.	Give the disadvantages of CMM.	BT-1	Remembering
17.	Briefly describe the term Machine vision.	BT-2	Understanding
18.	Describe the term CNC CMM?	BT-2	Understanding
19.	Point out the advantages of machine vision system?	BT-1	Remembering
20.	List out any four application of artificial vision system in manufacturing industries.	BT-1	Remembering
21.	What are the properties of Laser?	BT-2	Understanding
22.	Write the features of CMM.	BT-2	Understanding

23.	List the types of CMM?	BT-1	Remembering
24.	Name the different stages involved in the machine vision based measurement.	BT-1	Remembering
25.	Define gray scale analysis.	BT-1	Remembering

PART-B				
Q.No	**Questions**	**Marks**	**BT Level**	**Competence**
1.	(a) Discuss the different types of light sources? (b)Explain the working principle of DC Laser interferometer with neat diagram.	6 7	BT-2 BT-2	Understanding Understanding
2.	(a)Describe the different types of ACLI. (b) Discuss the sources of errors in ACLI.	6 7	BT-1 BT-2	Remembering Understanding
3.	Explain the construction and working of a laser Telemetric system with a neat sketch.	13	BT-2	Understanding
4.	(a)With a neat sketch explain the dimensional measurements using laser gauge. (b)Summarize how to use laser interferometer to predict machine tool accuracies.	6 7	BT-2 BT-4	Understanding Analyzing
5.	(a)With a neat sketch describe the working of AC laser interferometer. (b)Explain the usage of laser interferometer in straightness testing.	6 7	BT-2 BT-2	Understanding Understanding
6.	Explain the construction and working of various types of CMM.	13	BT-2	Understanding
7.	(a)Explain the working principle of laser scanning gauge. (b) What is meant by alignment test on machine tools? Give its importance.	7 6	BT-2 BT-4	Understanding Analyzing
8.	Describe the working principle of a dual frequency laser interferometer with a neat sketch.	13	BT-2	Understanding
9.	(a) List out the applications of CMM. (b) Point out the advantages and disadvantages of CMM.	6 7	BT-1 BT-1	Remembering Remembering

10.	(a) Discuss about the various causes of errors in CMM. (b)List out the methods of operating and controlling a Coordinated measuring machine.	6 7	BT-2 BT-1	Understanding Remembering
11.	(a) Briefly explain the important features available in CMM software. (b) With neat diagram explain the working principle of tough trigger probes.	7 6	BT-2 BT-2	Understanding Understanding
12.	(a) Define machine vision. Name four types of machine vision systems. (b) Describe the functions of machine vision system.	6 7	BT-1 BT-2	Remembering Understanding
13.	(a) Illustrate the features of flexible inspection system. (b)Explain the various steps of machine vision system in metrology.	6 7	BT-3 BT-2	Applying Understanding
14.	(a) Explain the applications of machine vision system. (b)Discuss the advantages and disadvantages of Machine vision system.	6 7	BT-2 BT-1	Understanding Remembering
15.	(a) Explain briefly about the causes of error in coordinated measuring machine. (b)Explain the different types of coordinated measuring machine controls.	6 7	BT-2 BT-2	Understanding Understanding
16.	What is optical flat? Explain how interference fringes are formed when optical flat is placed on a surface to be tested.	13	BT-4	Analyzing
17.	Sketch and interpret the different pattern of interference bands observed through optical flats for the following: i) A perfectly flat surface ii) A concave surface iii) A convex surface iv) A block with beveled edge v) A gauge block with edges rounded off.	13	BT-4	Analyzing

18.	Discuss the working principle of the NPL Flatness interferometer with neat diagram.	13	BT-2	Understanding

PART-C				
1.	Explain any two advanced measurement techniques used in the metrology and measurement.	15	BT-2	Understanding
2.	Generalize the needs, types & constructional features of Co-ordinated Measuring Machine.	15	BT-2	Understanding
3.	A Machine Vision system recovers useful information about a scene from its two dimensional digitized image. Explain the stages in machine vision process?	15	BT-5	Evaluating
4.	What are the significance of CMM? How Gears are measured using CMM	15	BT-4	Analyzing
5.	Sketch and describe the optical system used in Michelson interferometer and also explain the method of checking the height of the component with the help of optical flat.	15	BT-3	Applying

UNIT IV: FORM MEASUREMENT

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

PART A

Q.No.	Questions	BT Level	Competence
1.	Define straightness of axes.	BT-1	Remembering
2.	Calculate the "best size wire" for checking a effective diameter of a M10 X 2.5 thread.	BT-3	Applying
3.	Define a) Lead and b) Pitch.	BT-1	Remembering
4.	Express the helix of M 50 x 3 2-start threads?	BT-2	Understanding
5.	List out the reasons for the occurrence of progressive errors in screw threads.	BT-1	Remembering
6.	Define straightness of a line in two planes.	BT-1	Remembering
7.	Explain the drunken error in screw threads.	BT-2	Understanding
8.	Name the various methods for measuring pitch diameter.	BT-1	Remembering
9.	Summarize how Taylor's principle is applied for screw thread gauge?	BT-2	Understanding
10.	The outside diameter of a gear is 110 mm and the number of teeth is 20. Calculate the module of gear?	BT-3	Applying
11.	Describe the term back lash and run out in the spur gear?	BT-1	Remembering
12.	Discuss about "material ratio" with reference to surface finish measurement.	BT-2	Understanding
13.	Give any four methods by which surface finish can be measured.	BT-1	Remembering
14.	Discuss about a profilometer.	BT-2	Understanding
15.	How surface roughness is assessed?	BT-4	Analyzing
16.	Name the devices used for roundness measurement.	BT-1	Remembering
17.	Point out any four methods of measuring roundness.	BT-1	Remembering
18.	List out the sources of Out of roundness.	BT-1	Remembering
19.	How is roundness measured in the laser squared circle method?	BT-4	Analyzing
20.	Summarize the limitations of using V block to check lobes on work piece.	BT-2	Understanding

21.	List out the methods of measuring flatness.	BT-1	Remembering
22.	Define flatness of any surface measurements.	BT-1	Remembering
23.	Explain the term base circle, pitch circle and pitch circle diameter with the help of diagram.	BT-2	Understanding
24.	Differentiate between direct and indirect method of measurement of surface roughness.	BT-4	Analyzing
25.	Define the term form factor.	BT-1	Remembering

PART - B				
Q.No	**Questions**	**Marks**	**BT Level**	**Competence**
1.	(a)Define straightness. Explain the principle of testing straightness using laser interferometer. (b)How will you test the straightness using Spirit level and autocollimator?	6 7	BT-1 BT-4	Remembering Analyzing
2.	Briefly explain the step by step procedure for determining the flatness of a surface with the neat sketch.	13	BT-2	Understanding
3.	(a)Explain gear tooth vernier method of measuring the gear tooth thickness. (b) Explain Constant chord method of measuring the gear tooth thickness.	6 7	BT-2 BT-2	Understanding Understanding
4.	(a) Summarize how the tooth thickness of the gear is measured in the base tangent method. (b) Derive the expression for the tooth thickness of the gear in this method.	6 7	BT-2 BT-6	Understanding Creating
5.	(a) Compare plug and Ring screw gauges. (b) Explain adjustable thread gauge.	6 7	BT-4 BT-2	Analyzing Understanding
6.	Explain how a gear can be checked using Parkinson gear tester also mentions its limitations.	13	BT-3	Applying
7.	With a neat diagram describe the working principle of measurement of minor diameter of internal and external threads.	13	BT-2	Understanding
8	(a) Discuss about Tomlinson surface meter.	6	BT-2	Understanding

	(b) Describe a method to find out flatness of a surface plate.	7	BT-2	Understanding
9.	(a)Describe the method of roundness measurement using V- block. (b)Explain V block and three point probe methods of measurement of roundness.	6 7	BT-2 BT-4	Understanding Analyzing
10.	Explain the important elements of screw thread with neat sketch.	13	BT-2	Understanding
11.	(a) Write the difference between surface roughness and surface waviness (b)Describe the various symbols used for representation of surface texture.	6 7	BT-4 BT-2	Analyzing Understanding
12.	(a) Illustrate briefly the measurement of effective diameter of a screw thread using three wires. (b)Explain how to measure the specifications of the screw thread by using the tool makers' microscope? Discuss in details.	6 7	BT-3 BT-4	Applying Analyzing
13.	(a)Show graphically the laser source and interferometer arrangement for measuring straightness error along the main axis of a horizontal machining centre. (b)Explain various orders of geometrical irregularities with example.	7 6	BT-3 BT-2	Applying Understanding
14.	(a) Describe briefly about roundness error definitions. (b) Write notes on circumferential confining gauge.	6 7	BT-2 BT-1	Understanding Remembering
15.	(a) Explain about bench micrometer for measuring major diameter of threads. (b)Explain the thread micrometer with a neat sketch.	7 6	BT-2 BT-2	Understanding Understanding
16.	With neat sketch, discuss the gear tooth nomenclature by indicating the different parts.	13	BT-2	Understanding
17.	Discuss the various elements of surface roughness, and explain the importance of sampling length in surface roughness measurement.	13	BT-4	Analyzing

18.	Explain the different methods of measuring surface finish with example.	13	BT-2	Understanding

PART-C				
1.	With neat sketch explain the Talysurf measurement for surface measurement.	15	BT-2	Understanding
2.	Explain how V block and 3 point probes are used for measurement roundness.	15	BT-4	Analyzing
3.	What are the applications of surface roughness measurements in production industry and its significance?	15	BT-4	Analyzing
4.	Explain roundness measuring methods with neat diagram.	15	BT-2	Understanding
5.	Describe the various methods of numerical assessment of surface finish with neat diagram, and also explain the profilometer with neat sketch.	15	BT-4	Analyzing

UNIT V: MEASUREMENT OF POWER, FLOW AND TEMPERATURE

Force, torque, power - mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, Pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

PART A

Q.No.	Questions	BT Level	Competence
1.	Describe the working principle behind strain gauges.	BT-2	Understanding
2.	Name any four methods employed for measuring torque.	BT-1	Remembering
3.	Distinguish between force and torque.	BT-4	Analyzing
4.	Describe the term “bourdon tube”.	BT-1	Remembering
5.	Explain why measuring instruments are calibrated?	BT-2	Understanding
6.	Describe the working principle of thermocouple.	BT-1	Remembering
7.	Point out any two advantages of thermocouples.	BT-1	Remembering
8.	Describe the principle behind electrical resistance thermometer.	BT-2	Understanding
9.	State the function of load cells.	BT-1	Remembering
10.	Name any four instruments used for measuring temperature.	BT-1	Remembering
11.	Explain the principle of temperature measurement using thermocouple.	BT-2	Understanding
12.	Illustrate the principle of bimetallic thermometer?	BT-3	Applying
13.	Give the applications of a bimetallic strips.	BT-1	Remembering
14.	Differentiate primary and secondary transducers.	BT-4	Analyzing
15.	Define the principle of electrical resistance thermistor.	BT-1	Remembering
16.	Explain the principle involved in fluid expansion thermometer.	BT-2	Understanding
17.	Explain the principles of hot wire anemometer.	BT-2	Understanding
18.	Examine how flow in a draft is measured?	BT-4	Analyzing
19.	Illustrate the principle of optical pyrometer?	BT-3	Applying
20.	Point out the use of pyrometer.	BT-1	Remembering
21.	List the types of dynamometers.	BT-1	Remembering
22.	State the advantages and disadvantages of eddy current dynamometer.	BT-1	Remembering
23.	Explain are flow meters? List out the different types of flow meters.	BT-2	Understanding

24.	State the various types of commercially available thermocouples.	BT-1	Remembering
25.	What are torque meters?	BT-1	Remembering

PART-B				
Q.No	**Questions**	**Marks**	**BT Level**	**Competence**
1.	(a)Explain the method of measuring force using strain gauge load cell. (b)Explain how an eddy current dynamometer works.	7 6	BT-2 BT-4	Understanding Analyzing
2.	(a)Explain the working principle of an electrical resistance thermometer. (b)Explain thermocouples? State its applications.	7 6	BT-2 BT-2	Understanding Understanding
3.	(a)Describe briefly how the following are used to measure the temperature. (i) Thermocouples (ii) Pyrometer (b)Describe briefly the following, (i) Venturimeter (ii) Rotometer	7 6	BT-1 BT-1	Remembering Remembering
4.	(a)Describe with a neat sketch the proving ring for force measurement. (b)Describe the working principle of hydraulic dynamometer for measuring the shaft power.	7 6	BT-2 BT-2	Understanding Understanding
5.	(a)With a neat sketch explain the torque measurement using strain gauges. (b)With neat sketch explain how metallic strips are used for temperature measurements.	7 6	BT-2 BT-4	Understanding Analyzing
6.	(a) Explain the following with neat sketch. (i) Pitot Tube (ii) Optical Pyrometer. (b)Explain the working principle of electrical resistance thermisters.	6 7	BT-2 BT-2	Understanding Understanding
7.	(a)With neat sketch explain the velocity	7	BT-2	Understanding

	measurement using of hot wire anemometer. (b)Explain with neat sketch the construction and working of a McLeod gauge.	6	BT-2	Understanding
8.	(a) Illustrate briefly the working of Pressure thermometer. (b) Illustrate briefly the working of Resistance thermometer.	6 7	BT-3 BT-3	Applying Applying
9.	(a) Explain the following, (i) Reliability (ii) Calibration (b) Explain readability and reliability.	6 7	BT-1 BT-1	Understanding Understanding
10.	(a)Illustrate the advantages and disadvantages of non-conducting type Thermometers. (b)Illustrate the applications of Pitot tube in flow measurements.	6 7	BT-3 BT-3	Applying Applying
11.	(a)Compare and contrast venturimeter and orifice meter. (b)Discuss the advantages of using electrical type measuring instruments?	6 7	BT-4 BT-2	Analyzing Understanding
12.	(a)Explain how cup type anemometers are used to measure the air movement. (b)Discuss with neat sketch the working principle of Electromagnetic flow meter.	7 6	BT-4 BT-2	Analyzing Understanding
13.	(a) List out the advantages of resistance thermisters. (b)Describe the vane type anemometers are used to measure the air movement.	5 8	BT-1 BT-2	Remembering Understanding
14.	(a)With neat sketch explain the working principle of ultrasonic flow meter. (b) Generalize the use of bellows in pressure measurement.	7 6	BT-2 BT-2	Understanding Understanding
15.	Discuss the working principle of bourdon tube pressure gauge with neat sketch.	13	BT-2	Understanding

16.	Explain how spring balances can be used for measurement of force. Describe their working, advantages and limitations.	13	BT-4	Analyzing
17.	Explain the measurement of force using pneumatic and hydraulic load cell with neat diagram.	13	BT-2	Understanding
18.	Explain the thermocouple laws and their practical significance, and also enumerate the sources of error in thermocouples and explain how they are prevented.	13	BT-4	Analyzing

	PART-C			
1.	With neat sketch explain different types of torque measurement techniques and explain any two.	15	BT-2	Understanding
2.	Discuss the significance of Power flow and temperature measurement inmetrology and measurements.	15	BT-4	Analyzing
3.	Write a detailed note on calibration of temperature measuring device.	15	BT-2	Understanding
4.	Explain the working of a bimetallic strip type temperature measurement system with industrial application.	15	BT-2	Understanding
5.	What are the difference between base metal thermocouple and rare metal thermocouple and also differentiate RTD and Thermistor.	15	BT-4	Analyzing

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