


Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: MECHANICAL MEASUREMENTS		
	Scheme (L:T:P) : 4:0:0	Total Contact Hours: 52	Course Code: 15ME33T
	Type of Course: Lectures, Self Study & Quiz	Credit :04	Core/ Elective: Core
CIE- 25 Marks		SEE- 100 Marks	

Prerequisites: Knowledge of basic mathematics and Science. Basic Electrical and Electronics Engineering

Course Objectives:

1. Understand the advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
2. To learn various flow measurement techniques.

On successful completion of the course, the students will be able to CO:

NOTE: The theory should be taught in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Course Outcomes:

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Know the terms of the measurements, and Understand the principle of operation of an instrument, Choose Suitable measuring instruments for a particular application and Apply ethical principles while measuring dimensions	<i>R/U/A</i>	1,2,3,10	12
CO2	Appreciate Measurement of strain by using a basic strain gauge and hence verify the stress induced and application of transducers in mechanical engineering applications for sustainable development	<i>R/U/A</i>	1,2,3,10	10
CO3	Apply the principles of instrumentation for transducers & measurement of non electrical parameters like temperature, pressure, flow, speed, force and stress in mechanical engineering applications for sustainable development	<i>R/U/A</i>	1,2,3,6, 10	15
CO4	Apply the principles of Miscellaneous measurements for humidity, density, level and blood pressure.	<i>U/A</i>	1,2,3,4,6, 10	06
CO5	Apply the principles of limits, fits, tolerance and Analyse the process alignment testing of machine tools for manufacturing field.	<i>R/U/A</i>	1,2,3,4,6, 10	09
		Total sessions		52

R-Remember; U-Understanding; A-Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHANICAL MEASUREMENTS	3	3	3	1	-	2	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks weightage	weightage (%)
			R	U	A		
1	Measuring instruments	12	10	10	10	30	21
2	Transducers and strain gauges	10	5	10	15	30	21
3	Measurement of force, torque, and pressure	06	05	05	10	20	14
4	Applied mechanical measurements	09	05	05	15	25	17
5	Miscellaneous measurements	06	--	5	10	15	10
6	Limits, Fits, Tolerance & Testing of Geometric Dimensions	09	5	10	10	25	17
	Total	52	30	45	70	145	100

R-Remember; U-Understanding; A-Application

UNIT I: MEASURING INSTRUMENTS**12Hrs**

Measurement-definition-methods of measurement-Significance-Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration -Errors in Measurements-Systematic and Random error. Measuring instruments- Factors in selecting the measuring instruments -Thread measurements:-Bench micrometer- Thread gauge micrometer- Angle measurements- Bevel protractor, Sine Bar, Gauges: plain plug gauge, snap gauge, ring gauge-Surface finish-Measurement of surface finish by Talysurf surface roughness tester-Co-ordinating measuring machine.

UNIT II: TRANSDUCERS AND STRAIN GAUGES**10 Hrs**

Transducers- concept-Characteristics, Transducers selection factors, classifications of Transducer, actuating mechanisms. Voltage and current generating analog transducers-Types-Piezoelectric transducer. Strain Measurements: Strain gauge, Classification, Berry-type mechanical strain gauge, optical strain gauges, mounting of strain gauges, Strain gauge rosettes-two and three elements, Gauge factor

UNIT III: MEASUREMENT OF FORCE, TORQUE, AND PRESSURE**06Hrs**

Force measuring devices- Spring Balance, Proving ring, Strain gauge type Load cell- Torque measuring devices- Prony brake, Hydraulic dynamometer-.pressure measuring devices- - Diaphragm type pressure gauge- Bourdon tube pressure gauge- Mcloed gauge, Construction, working and applications.

UNIT IV: APPLIED MECHANICAL MEASUREMENTS**09Hrs**

Speed measurement- Classification of tachometers. Working principle, construction, working of Revolution counters and Eddy current tachometers. Displacement measurement- Working principle, construction, working of Linear variable Differential transformers (LVDT)-Flow measurement- Working principle, construction, working of Rotometers-Temperature measurement. Principle, construction, working of Resistance thermometers and Optical Pyrometer, Thermocouples.

UNIT V: MISCELLANEOUS MEASUREMENTS**06 Hrs**

Humidity measurement-construction, working of hair hygrometer-Density measurement-Measurement of density using hydrometer, Liquid level measurement --Measurement of liquid level by using sight glass, Float gauge-Biomedical measurement- construction, working of Sphygmo monometer

UNIT VI: LIMITS, FITS, TOLERANCE & TESTING OF GEOMETRIC DIMENSIONS**09 Hrs**

Concepts- Interchangeability, Selective Assembly, Basic Definitions, Graphical illustration of limits and Tolerances. Fit-Classification of fits. Systems of fits-Hole Basis System and Shaft Basis system, Systems of tolerancing-Unilateral System and Bilateral System, Machine tools alignment testing-Checking Parallelism, Straightness, runout, alignment testing of machine tool during erection as per IS standard procedure



TEXT BOOKS

1. *Mechanical Engineering Measurement* - Thomas Beckwith, N.Lewis Buck, Roy Marangoni - Narosa Publishing House, Bombay

REFERENCES

1. *Mechanical Engineering Measurements* - A. K. Sawhney - Dhanpat Rai & Sons, New Delhi.
2. “*Metrology & Measurement*” by Anand K Bewoor, Vinay kulakarni ,Tata McGraw hill New delhi 2009
3. “*Principles of Engineering metrology*” by Rega Rajendra Jaico publishers-2008
4. “*Dimensional Metrology*” by Connie Dotson, DELMAR ,cenage learning,2007
5. “*Engineering Metrology*” by R.K.Jain, Khanna Publishers, 1994

LIST OF SOFTWARES/ LEARNING WEBSITES:

1. <http://en.wikipedia.org/wiki/Metrology> (metrology).
2. <https://www.youtube.com/watch?v=4hINi0jdoeQ> (vernier).
3. <https://www.youtube.com/watch?v=FNdkYIVJ3Vc>(vernier).
4. <https://www.youtube.com/watch?v=O8vMFFYNIfo> (micrometer)
5. <https://www.youtube.com/watch?v=h98HPVuWjLA> (depth micrometer)
6. https://www.youtube.com/watch?v=SmXfGan_NXQ (telescopic gauge)
7. <http://www.authorstream.com/Presentation/007sandeepks-1858141-angular-measurment/> (angular measurement).
8. <http://askguru.net/t-Angular-Measurement-ppt>
9. <https://www.youtube.com/watch?v=aBzh6i5fQ70> (surface roughness)
10. <https://www.youtube.com/watch?v=S7SXD6sKQ-I>(surface roughness)
11. <https://www.youtube.com/watch?v=eVpoJzLJa0U>(surface roughness)
12. <https://www.youtube.com/watch?v=3Od7vnoMwGg>(surface roughness)
13. <https://www.youtube.com/watch?v=XnLiTPGE6pk> (three wire thread measurement)
14. <https://www.youtube.com/watch?v=Gdvtw0pTAOs> (thread pitch).
15. <https://www.youtube.com/watch?v=qMgXGedDffw> (dial indicator)
16. <http://www.authorstream.com/Presentation/donzvasanth-1501139-unit-2-linear-angular-measurment/>
17. http://en.wikipedia.org/wiki/List_of_gear_nomenclature#Addendum (gear nomenclature).

18. <https://www.google.co.in/search?q=gear+tooth+vernier+caliper&tbm=isch&tbo=u&source=univ&sa=X&ei=MiuEUsqS0siKrQeywIFQ&ved=0CCgQsAQ&biw=1600&bih=804> (gear tooth vernier).
19. <http://www.youtube.com/watch?v=lc4dsNvm2Ks> (principle of mech. meas).
20. <http://www.youtube.com/watch?v=nv3GuJARjNU> (Transducers).
21. <http://www.youtube.com/watch?v=iMlZApq1CQ0> (pressure measurement).
22. <http://www.youtube.com/watch?v=JKuoQ5FV2c8> (temperature meas.).
23. http://www.youtube.com/watch?v=GNOI_7ftbQ0(temperature meas.) .
24. <http://www.youtube.com/watch?v=7xUdPVpafyI> (flow measurement).
25. <http://www.ignou.ac.in/upload/Unit-4-62.pdf> (limit gauges).
26. <http://www.scribd.com/doc/55242715/8/Types-of-limit-gauges>
27. http://www.youtube.com/watch?v=v25PCV_IJCw (sensors)
28. <http://www.youtube.com/watch?v=QItuf6lNvmI>(sensors)
29. <http://www.youtube.com/watch?v=pOvTyvBqzgM> (displacement sensors)
30. <http://www.youtube.com/watch?v=inLkCOwVgyM> (force sensors)
31. <http://www.youtube.com/watch?v=jxv0ITAr74A>(force sensors)
32. http://www.youtube.com/watch?v=0MP_9n08urA(force sensors)
33. <http://www.youtube.com/watch?v=zAddvPHfKnw>(force sensors)
34. http://www.youtube.com/watch?v=_fQSMVf3hdM (calibration).
35. http://www.youtube.com/watch?v=HwSxBRaxn_4(calibration).
36. <http://www.youtube.com/watch?v=ZymDMUuVuyY> (geometrical Tol.)
37. <http://www.gobokee.org/measurement-of-geometric-tolerances-in-manufacturing/>
38. <http://www.me.metu.edu.tr/courses/me410/exp1/410exp1theory.pdf>
39. <http://www.youtube.com/watch?v=5eaSkU6Ecik> (flatness measurement)
40. <http://www.youtube.com/watch?v=1tBnpzyhVXU> (measuring straightness)

41. <http://www.youtube.com/watch?v=1JNCe9fwRUw> (measuring perpendicularity)
42. <http://www.youtube.com/watch?v=eJ8a0k8kQIE>(Roundness and cylindricity)

Course Delivery:

- The course will be delivered through lectures and Power point presentations/ Video
- Teachers can prepare or download ppt of different topic's measuring instruments usage in mechanical engineering application, can prepare alternative slides.

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. Each student should conduct different activity and no repeating should occur

1	Each student will select and bring at least one mechanical component. Sketch each component. Sketch and label main parts of instruments to be used. Calculate least count of the instrument/s to be used. Measure and record applicable dimensions of each
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	component using suitable instrument
2	Sketch the part and setup, list the instruments used, list the steps followed and record the observations for checking straightness
3	Select appropriate limit gauge for given dimension/part and check the dimension with gauge.

• **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
	1	2	3	4	5	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
	CIE	IA					
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5
				Student Activities	05	activities sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: The following documents to be verified by CIE verifier at the end of semester

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks		
Ex: I test/6 th week of sem 10-11 Am	I/II SEM	MECHANICAL MEASUREMENTS	20		
	Year:	Course code:15ME33T			
Name of Course coordinator : CO's: _____			Units: __		
Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks				
Ex: I test/6 th week of sem 10-11 Am	III SEM	MECHANICAL MEASUREMENTS	20				
	Year: 2015-16	Course code:15ME33T					
Name of Course coordinator :			Units:1, Co: 1,2,3.				
Note: Answer all questions							
Question no	Question				CL	CO	PO
1	Explain Systematic and Random Errors. 4 MARKS				U	1	1,2,3,4
2	Define i) Sensitivity, ii)Accuracy. iii)Calibration 3 MARKS				R	1	1,2,3,4
3	Draw a neat sketch of Bevel Protractor and labels its parts. OR Explain with neat sketch Taysurf surface roughness tester 7 MARKS				A	1	1,2,3,4,10
4	Explain with neat sketch measurement of thread by Bench micrometer. 6 MARKS				A	1	1,2,3,4,10

MODEL QUESTION PAPER

3- Semester Diploma Examination

Course Title: MECHANICAL MEASUREMENTS

Time: 3 Hours]

[Max Marks: 100

Note: Answer any SIX from **Part A** and any SEVEN from Part B

Time: 3 hrs

Max :100marks:100

PART-A

6x5=30 marks

1. Define Measurement and mention its requirements. 05
2. List the advantages of Resistance thermometer. 05
3. List the various types of testing equipment's used for machine tool alignment test 05
4. Explain the calibration procedure for measuring instrument 05
5. Explain the mounting of strain gauge. 05
6. Differentiate Resistance thermometer and thermocouple. 05
7. Compare Hole Basis System with Shaft Basis System. 05
8. Explain with a neat sketch the working of Rotameter. 05
9. Explain with a neat sketch Diaphragm type pressure gauge

PART-B

10. a)List the various factors in selection of measuring instruments. 05
b)Explain with neat sketch measurement of thread by Bench micrometer. 05
11. a)Explain Strain Gauge Rosettes. 05
b)Sketch the schematic diagram of the following transducer actuating mechanisms. 05
i) Circular bourdon tube ii)Straight tube.
12. a)List the advantages of Resistance thermometer. 05
b).Classify the various of tachometers. 05
13. Explain with a neat sketch the working principle Mcloed gauge. 10
14. a)Explain with a neat sketch Hydrometer. 05
b)Explain with neat sketch the working of Proving ring 05
15. Explain with a neat sketch Hole Basis System and Shaft Basis System. 10
16. a)Explain Uni-lateral and Bi-lateral tolerance. 05
b)Write short notes on sphygmomanometer. 05
17. a)Predict the advantages and disadvantages of LVDT. 05
b)Explain with neat sketch progressive plug gauge. 05
18. Sketch a neat block diagram of Optical strain gauge and label its parts. 10
19. a)Write the classification of Strain gauge. 05
b)Briefly explain the various classification of transducers. 05

Model Question Bank

3rd Semester Diploma in Mechanical Engineering Course title: Mechanical Measurements

CO-I Know the terms of the measurements, and Understand the principle of operation of an instrument, Choose Suitable measuring instruments for a particular application and Apply ethical principles while measuring dimensions

Remember

1. Define Measurement and mention its requirements.
2. Define a) Precision b) Repeatability.
3. Define a) Calibration. b) Threshold
4. Define a) Hysteresis. b) Range
5. Define a) Sensitivity b) Accuracy.
6. Define i) Sensitivity, ii) Accuracy. iii) Calibration
7. Define error and mention types of errors.
8. Name the various types of error.
9. List the various factors in selection of measuring instruments.
10. State the advantages of CMM.
11. State the types of error.

Understand

1. Explain the signification of measurement.
2. Explain the various methods of measurements.
3. Explain the calibration procedure for measuring instrument
4. Explain Systematic and Random Errors.
5. Explain the various methods of measurements with suitable examples.
6. Explain Taysurf surface roughness tester.

Application

1. Explain with neat sketch thread gauge micrometer.
2. Explain with neat sketch measurement of thread by Bench micrometer.
3. Explain with neat sketch Bevel Protractor.
4. Draw a neat sketch of Bevel Protractor and label its parts.
5. Explain with neat sketch the use of sine bar.
6. Explain with neat sketch progressive plug gauge.
7. Explain with neat sketch plain plug gauge.
8. Explain with neat sketch snap gauge.
9. Explain with neat sketch Ring gauge.
10. Explain with neat sketch of CMM.
11. Explain with neat sketch thread gauge micrometer. And its uses.
12. Explain with neat sketch Taysurf surface roughness tester

13. Explain with neat sketch CMM and its use.
14. Write short notes on CMM.

CO-2: Appreciate Measurement of strain by using a basic strain gauge and hence verify the stress induced and application of transducers in mechanical engineering applications for sustainable development

Remember

1. Define transducer, list the uses of transducer.
2. List out the major transducer characteristics.
3. List the various classifications of transducers. With examples.
4. List out the any five typical transducer actuating mechanisms.
5. State the various types of self-generating transducers.
6. List the various piezo-electric materials that exhibit piezoelectric effect.
7. Define strain gauge and list its purposes
8. State the advantages and limitation of mechanical strain gauge..
9. State the various transducers selection factors.
10. List any four transducer characteristics
11. List the various classification of transducers with examples on each.
12. State the various typical transducer actuating mechanisms.
13. Name any four type of self-generating Analog transducers.
14. State various transducer characteristics
15. List the various piezo-electric materials.
16. Define gauge factor

Understanding

1. Explain the concept of variable and current generating analog transducers.
2. Explain the mounting of strain gauge.
3. Explain gauge factor.
4. Explain Strain Gauge Rosettes.
5. Explain briefly the working of optical strain gauge.
6. Explain the concept of variable and current generating analog transducers and mention its types.
7. Classify the Strain gauges.
8. Briefly explain the various classification of transducers.

Application

1. Explain with a neat sketch piezoelectric transducer.
2. Write the various transducers selection factors.
3. Sketch the schematic diagram of the following transducer actuating mechanisms.
i) Corrugated diaphragm ii) Bellows.
4. Sketch the schematic diagram of the following transducer actuating mechanisms.
i) Capsule ii) Twisted bourdon tube,
5. Sketch the schematic diagram of the following transducer actuating mechanisms.
i) Circular bourdon tube ii) Straight tube.
6. Write the advantages and limitation of mechanical strain gauge..
7. Write short notes on gauge factor.
8. Write short notes on Strain Gauge Rosettes.
9. Explain with a neat sketch two element Rosette gauge.
10. Explain with a neat sketch three element Rosette gauge.
11. Sketch a neat block diagram of Optical strain gauge and label its parts.

12. Write various transducer characteristics
13. Explain with neat sketch Berry type strain gauge.
14. Explain with neat sketch piezoelectric transducer.
15. Write short notes on gauge factor.
16. Explain with a neat sketch the working principle of Optical strain gauge.
17. Write the classification of Strain gauge.

CO-3: Apply the principles of instrumentation for transducers & measurement of non electrical parameters like temperature, pressure, flow, speed, force and stress in mechanical engineering applications for sustainable development

Remember

1. Define force and List any three force measuring instruments.
2. Define torque? What is the reason for measuring it.
3. Describe dynamometer and list its applications.
4. Define pressure. List the pressure measuring instruments.
5. Define force and List any three force measuring instruments.
6. State the principle of thermocouple.
7. List the advantages of Resistance thermometer.
8. List the types of mechanical tachometers.

Understanding

1. Explain the working of Proving ring and its use.
2. Explain the principle working Optical pyrometer.
3. Classify tachometer.
4. Explain the working principle of thermocouple.
5. Explain Resistance thermometer.
6. Differentiate Resistance thermometer and thermocouple.
7. Describe tachometer and Mention types of mechanical tachometers.
8. Classify the various types of tachometers.
9. Predict the advantages and disadvantages of LVDT.
10. Express the advantages and disadvantages of the Rotameter.
11. Express the advantages of Resistance thermometer.
12. Identify the advantages and Disadvantages of the Resistance thermometer.
13. Distinguish between thermocouple and Resistance thermometer.
14. Explain thermocouple and mention any three commonly used thermocouple material.
15. Classify the various of tachometers.
16. Identify the advantages and disadvantages of LVDT.
17. Indicate the advantages of Resistance thermometer
18. Identify the advantages and disadvantages of the Rotameter.
19. Explain phenomena of piezo-electric effect.

Application

1. Explain with neat sketch Spring Balance.
2. Sketch and Explain the instrument commonly used for measurement of heavy loads in Industries.
3. Explain with a neat sketch the working of Hydraulic Dynamometer
4. Explain with neat sketch the construction and working of Proving ring.

5. Explain with a neat sketch working of Strain gauge type load cell..
6. Explain with neat sketch the working of Proving ring
7. Explain with neat sketch Prony Brake Dynamometer.
8. Explain with a neat sketch Diaphragm type pressure gauge.
9. Explain with neat sketch the working of Bourdon tube pressure gauge.
10. Explain with a neat sketch the working principle Mcloed gauge.
11. Explain with a neat sketch the working principle of Mcloed gauge and its use.
12. Explain with a neat sketch the working of Revolution counter.
13. Explain with a neat sketch the working of Eddy current tachometer.
14. Explain with a neat sketch of LVDT.
15. Explain with a neat sketch the working of Rotameter.
16. Write the advantages and disadvantages of the Rotameter.
17. Write the advantages of Resistance thermometer.
18. Explain with a neat sketch Resistance thermometer.
19. Write the advantages and Disadvantages of the Resistance thermometer.
20. Explain with neat sketch Optical pyrometer.
21. Explain with a neat sketch, the principle working of thermocouples.
22. Explain with a neat sketch of LVDT and show its characteristics.
23. With a neat sketch Explain the principle working of thermocouples.

CO-4: Apply the principles of miscellaneous measurements for humidity, density, level and blood pressure.

Understanding

1. Explain measurement of blood pressure using sphygmomanometer.
2. Explain the terms a) Humidity b) Density

Applications

1. Explain the working of hair hygrometer with a neat sketch.
2. Explain with a neat sketch Hydrometer.
3. Explain with a neat sketch liquid level measurement by using sight glass.
4. Explain with a neat sketch the principle of float gauge for liquid level measurement .
5. Explain with sketch measurement of blood pressure using sphygmomanometer.
6. Write short notes on sphygmomanometer.

CO-5: Apply the principles of limits, fits, tolerance and Analyse the process alignment testing of machine tools for manufacturing field.

Remember

1. Define the following terms
 - a) Limit b) Allowance
2. Define the following terms
 - a) Basic Size b) Tolerance
3. Define the following terms
 - a) Zero line b) Fit
4. Define the following terms
 - a) Deviation b) Actual size
5. a) Define the following terms

- i)Limit ii)Allowance iii)Basic size
6. Define tolerance and briefly explain its types.
 - 7..Define deviation and explain types of deviation.
 - 8.Define fit and mention its types of fits.
 9. List the various types of testing equipment's used for machine tool Alignment test.
 10. Define Interchangeability. State its importance.
 11. Quote the reason for adopting hole basis system as the standard practice.

Understanding

- 1.Distinguish Hole Basis System and Shaft Basis System.
- 2.Explain Uni-lateral and Bi-lateral tolerance.
- 3.Differentiate between unilateral and Bilateral tolerance.
- 4.Express the reason for adopting hole basis system as the standard practice.
- 5.Explain the importance of Geometric test on machine tools.
- 6.Compare Hole Basis System with Shaft Basis System.

Applications

- 1.Explain with neat sketch clearance fit.
2. Explain with neat sketch interference fit.
3. Explain with neat sketch transition fit.
4. Explain with a neat sketch Hole Basis System and Shaft Basis System.
5. Write the reason for adopting hole basis system as the standard practice.
6. Write short note on Interchangeability.
7. Write short note on selective assembly.
8. Explain with neat sketch interference fit.
9. Write a neat sketch of Graphical illustration of limits and tolerances.
10. Explain with neat sketch he procedure for checking the parallelism of spindle axis to carriage movement in lathe.
- 11..Explain with neat sketch the procedure for checking the straightness of the carriage movement in lathe.
- 12..Explain with neat sketch checking of run out of axis of centre in lathe.
13. With neat sketch explain shaft basis system.
14. With neat sketch explain Hole Basis system.

