MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

## V SEMESTER B. TECH (MECHANICAL/IP ENGG.) END SEMESTER EXAMINATIONS, DECEMBER 2019

## SUBJECT: METROLOGY AND MEASUREMENTS [MME 3104]

## **REVISED CREDIT SYSTEM**

Time: 3 Hours

MAX. MARKS: 50

## Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- 1A. Draw neat sketch of Bourdon Tube Pressure Gauge with electrical read-out and show its generalized measurement system block diagram with various functional elements.
- **1B.** Define and derive an expression for gauge factor.

- 3
- **1C.** Explain with neat sketch the calibration of strain gauge using shunt **4** resistance and derive the expression for strain. Also calculate the strain undergone by a strain gauge having gauge factor 2 and initial resistance of  $200\Omega$ . The change in resistance is  $0.016\Omega$ .
- 2A. With the help of a neat sketch explain the working of a Hydraulic Load Cell. 3
- 2B. With the help of a neat sketch explain the working of a Rope brake drum 3 dynamometer and derive the expression for Brake Power related to it.
- 2C. With the help of neat sketch explain the working of Bridgeman gauge and 4 derive the expression for unknown pressure.
- **3A.** Give details of M112 slip gauge set. Wring a dimension of 64.3485 using this **3** set. Also show the setup schematically.
- **3B.** Draw neat sketch of taper plug gauge and explain the procedure of checking **3** a taper hole with it.
- **3C.** Design a plug and ring gauge for the fit  $\phi$ 32E<sub>8</sub>d<sub>5</sub>. Refer table 1 for data. **4**
- **4A.** Explain Periodic and Progressive pitch errors usually found in screw threads **3** in detail.

- **4B.** With the help of neat sketch derive the expression for effective diameter **3** using 2-wire method.
- **4C.** Explain with neat sketch the procedure for flatness measurement of a surface **4** plate.
- **5A.** With the help of neat sketch and schematic layout, explain the working of **5** Taylor Hobson Talysurf.
- 5B. A M 20 x 2.5 plug screw gauge is checked for effective diameter by a floating 3 carriage micrometer with best size wire and the following readings were noted:

Diameter of standard cylinder = 18.001mm.

Micrometer reading over standard cylinder with two wires of same diameter = 14.6420mm.

Micrometer reading over the plug screw gauge with two wires of same diameter = 14.2616mm.

Calculate the effective diameter of the gauge

5C. Calculate the CLA (Ra) value of a surface for which the sampling length was
0.6 mm. The graph was drawn to a vertical magnification of 5000 and a horizontal magnification of 200 and the areas above and below the datum line were

Above :	200	120	160	130	mm <sup>2</sup>
Below :	30	40	80	60	mm <sup>2</sup>

Table1 for Question No. 3C											
Basic Size (mm)		Tolerance Grades	IT5	IT6	IT7	IT8	ΙΟΤ9	IT10			
Above	Up to and including	Xi (µm)	<b>7</b> i	10i	16i	25i	40i	64i			
6	10										
10	18	Туре	Fundamental Deviation (µm)								
18	30	D	16D <sup>0.44</sup>								
30	50	E	11D <sup>0.41</sup>								
50	80	F	5.5D <sup>0.41</sup>								
80	120	G	2.5D <sup>0.34</sup>								