Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

V SEMESTER B.TECH (MECHANICAL/IP ENGG.) END SEMESTER MAKE-UP, EXAMINATIONS, DECEMBER 2018

SUBJECT: METROLOGY & 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.
- Draw neat sketches wherever required.

1A.	Explain three stages with functional elements of a generalized measurement system	**03**
1B.	What is Hysteresis? How it is eliminated? Explain with output-input relationship.	**02**
1C.	Explain the working of a McLeod gauge with a neat sketch and derive the equation to measure unknown vacuum pressure.	**03**
1D.	A pressure of 256 kPa acting on a flat diaphragm produces a displacement 0.2 mm at the centre. What pressure would produce the same displacement if the diameter of the diaphragm is made twice and its thickness is reduced to half?	**02**
2A.	State and explain laws of thermocouples with sketches.	**03**
2B.	Explain the basic principle on which the bimetallic thermometer works. How the deflection of the bimetallic strip is related to temperature change.	**02**
2C.	Explain with neat sketch how the torque & power can be measured using cradled dynamometer.	**02½**
2D	Explain the working of a proving ring with LVDT is used to measure force.	**02½**
3A.	Show all the possible arrangement of four strain gauges on elastic members, for measuring axial force and bending force with signal enhancement factor.	**03**
3B.	Why shunting method is used to calibrate strain gauge? A strain gauge bridge comprises of two fixed 120Ω resistors, two active gauges connected across adjacent arms. The two gauges have an unstrained resistance value of 120Ω each. The gauge factor is 2.2. Find the strain which would be represented by 100 kΩ calibration resistance shunting one arm of the bridge.	**02**
3C.	Explain the method of checking squareness of Engineer`s square.	**02**

3D	On a number of interchangeable shafts and holes, the basic size of the hole is 100 mm. It is required that the maximum allowance and minimum allowance should be 0.052 mm and 0.028 mm respectively. The tolerance on the hole in unilateral form of tolerance is to be twice that on the shaft. The standard system adopted is hole basis system. Find the limit of size with in which the shaft and hole should be produced.	**03**
4A.	With the help of neat sketches state the essential conditions for (i) Clearance fit (ii) Interference fit.	**04**
4B.	Design the Go and No Go plug gauge for inspecting a hole of 25 D8. Use the following data: Diameter 25 lies in the diameter step of 18 – 30 mm. Fundamental tolerance unit in μm, $i = 0.45\sqrt[3]{D} + 0.001\,D$, where D is geometric mean of the diameter steps in mm. The fundamental deviation for hole D is 16 $D^{0.44}$. Tolerance value for IT8 = 25i. Also show the disposition of tolerances and allowances on gauge.	**04**
4C.	List the slip gauges to be wrung together to produce an overall dimension of 92.3575 mm using two protection slips of 2.5 mm size.(Use M112 Slip gauge set). Also show schematically the sequence of wrung slip gauges.	**02**
5A.	Derive an expression for effective diameter of screw thread by two-wire method, which depends on the diameter of the wires, dimension over the wires, the pitch and angle of the screw thread.	**03**
5B.	For M 16 x 2 mm external threads, calculate the best size wire diameter and the difference between size under wire and effective diameter.	**02**
5C.	What are the primary reasons for surface irregularities? Differentiate between first, second, third, and fourth order geometrical irregularities.	**03**
5D.	Explain symbolic representation with example of indicating the main characteristics of surface texture on drawing.	**02**