Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

V SEMESTER B.TECH. (MECHANICAL / I & P ENGG.)

END SEMESTER MAKE UP EXAMINATIONS, DEC 2016/JAN 2017

SUBJECT: METROLOGY & MEASUREMENTS [MME 3104]

REVISED CREDIT SYSTEM

(03/01/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Draw neat sketches wherever is required.

1A. Define the terms that are employed to describe the quality of an instrument reading. **03**

1B. Define the transducer. Differentiate between the primary and the secondary transducers. Give one example for each. **02**

1C. How are plain plug gauges designated? Draw a neat sketch of double ended plug gauge. **02**

1D. A 25 mm H8/f7 fit is to be checked. The limits of size for the H8 hole are: High limit = 25.03 mm and Low limit equal to basic size. The limits of the size for an f7 shaft are: High limit = 24.97 mm and Low limit = 24.95 mm. Taking gauge maker`s tolerance equal to 10% of the work tolerance, design a plug gauge and snap gauge to check the fit. Take wear allowance only if work tolerance exceeds 100 microns. **03**

2A. Derive the equation to measure unknown vacuum pressure with a neat sketch of a McLeod gauge. **03**

2B. A Vacuum gauge is made up of diaphragm, one end of the diaphragm would be subjected to atmospheric pressure and the other end to the vacuum to be measured. The diaphragm is to be constructed of steel ($\rho = 7.9 \times 10^{-6}$ Kg/mm^3, $E = 2.07 \times 10^5$ N/mm^2, $\mu = 0.3$) with a diameter of 15cm. Calculate the diaphragm thickness so that the maximum deflection does not exceed one-third of its thickness. Also find the lowest vacuum in mm of Hg, if the resolution of the gauge is 2.5 microns. **02**

2C. Explain the method of checking squareness by autocollimator with optical squares. **02**

2D In a hole and shaft assembly of 30 mm nominal size, the tolerances for hole and shaft are as specified below: Hole: $30^{(0.00,\ +0.02)}$ mm, Shaft: $30^{(-0.070,\ -0.040)}$ mm. Determine: (i) Maximum and minimum clearance available (ii) Allowance (iii) MML shaft and hole (iv) The type of fit. **03**

3A. State and explain laws of thermocouples (with sketches). Write expression for the relationship between thermoelectric e. m. f and temperature gradient. **03**

3B. A platinum resistance thermometer has a resistance of 140.5Ω and 100Ω at 100^0C and 0^0C, respectively. If its resistance becomes 305.3Ω when it is in contact with a hot gas, determine the temperature of the gas. The temperature coefficient of platinum is 0.00390C^{-1}. **02**

3C. With the help of neat sketches state the essential conditions for (i) Clearance fit (ii) Interference fit. **03**

3D State how the surface texture is designated on drawings as per IS: 3073. **02**

4A. Explain the shunting method used to calibrate the strain gauge and derive the expression for equivalent strain. **03**

4B. In order to measure strain in a cantilever, two gauges are used on top of the cantilever with Poisson`s configuration. The resistance of strain gauges is 1K Ω each and a gauge factor of 2. The other two resistances in the circuit have resistance of 100 Ω each. The bridge detector resistance is 100 Ω and its sensitivity is 10mm / μA. Calculate the deflection of the galvanometer for 0.1% strain. The bridge supply voltage is 10V. **02**

4C. Derive an expression for effective diameter of screw thread by three-wire method, which depends on the diameter of the wires, dimension over the wires, the pitch and angle of the screw thread. **03**

4D In the measurement of surface roughness, heights of 20 successive peaks and valleys measured from a datum are as follows: 45, 25, 40, 25, 35, 16, 40, 22, 25, 34, 25, 40, 20, 36, 28, 18, 20, 25, 30, 38 microns. If these measurements were made over a length of 20 mm, determine the CLA and RMS values of the surface. **02**

5A. Explain with neat sketch how the torque & power can be measured using strain gauge Torque meter. **03**

5B. Explain the method of measuring force using a strain gauge load cell. **02**

5C. Differentiate between Tolerance and Allowance. **02**

5D For measuring the effective diameter by two-wire method for an M 10 x 1.5 mm thread gauge for a wire of 0.895 mm by using floating carriage micrometer, readings are taken as,
(a) Micrometer reading over standard cylinder of 8 mm diameter with two wires = 2.4326 mm **03**
(b) Micrometer reading over gauge with two wires = 3.0708 mm
Calculate the effective diameter.