Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: MEASUREMENTS AND INSTRUMENTATION [MTE 2204]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. A robotic arm is used to grip objects. For such an application it becomes very important to control the force with which it grips the objects. Improper force may lead to either crushing or falling of the object. Suggest a sensor to measure the force produced by the robotic arm on the object. (The sensors are mounted on the fingers). Also explain the working of the sensor. **3**

1B. What do you mean by "standard" in measurement? Explain any one standard. **2**

1C. What are the various static characteristics in measurement? Explain any 4 static characteristics. **5**

2A. A wattmeter having a range of 1000W has an error of ±1% of full scale deflection. If the true power is 100W, what would be the range of readings? Suppose the error is specified as percentage of true value, what would be the range of the readings? **2**

2B. Explain the constructional features of synchro transmitter and synchro receiver. Discuss how the synchro transmitter-receiver pair can be used as error detectors in position control systems. **4**

2C. Derive the balance equation for Kelvin's double bridge and explain why Kelvin's double bridge is advantageous over Wheatstone bridge. **4**

3A. Differentiate between moving coil and moving iron instruments. **2**

3B. Explain with neat diagrams how an ultrasonic sensor can be used for the measurement of a) Flow and b) Distance **4**

3C. Explain with supporting equations the procedure of finding ground faults using Varley Loop Test. **4**

4A. Explain the working of a Hall Effect sensor. State two applications of the same. **4**

4B. A chemical industry manufacturing corrosive acids (conductive in nature) produces a huge quantity of waste water which should be treated before being disposed or recycled. What kind of flowmeter can be used to measure the flowrate of such waste water? Explain its working. **3**

4C. Explain the steps involved in signal conditioning in a DAQ system. **3**

5A. Explain with neat diagram the different types of fits in metrology. **5**

5B. Explain with a neat diagram the working of an optical pyrometer. State an application of the same. **3**

5C. The coil of moving coil galvanometer has 250 turns and is suspended in a uniform magnetic field of $0.3Wb/m^2$. The control constant is 0.2x10-6N-m/rad. The coil is 20mm wide and 25mm high, with a moment of inertia of $0.15x10\text{-}6kgm^2$. If the galvanometer resistance is 200Ω, calculate the value of the resistance which when connected in the galvanometer terminals, will give critical damping. Assume the damping to be entirely electromagnetic. **2**