GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 714703 Date: 16-01-2013 Subject Name: Sensor Technology Time: 02.30 pm – 05.00 pm **Total Marks: 70 Instructions:** 1. Attempt all questions. 2. Make suitable assumptions wherever necessary and clearly mention the same. 3. Figures to the right indicate full marks. 4. Shabbily drawn diagrams/sketches may not be awarded credit. (a) Evaluate the following sentences. 0.1 1. Fabry-Perot sensor is basically a frequency filter used to detect 03 small displacement with high precision. 2. Vibration slip sensing is highly sensitive but is not meant for 02 measuring amount of slip. 3. Set of strain gauges measure directional forces acting on it. 02 (b) Explain the following with neat sketch and/or circuit: 07 1. Parallel plate capacitive bridge sensor for displacement measurement 2. Inclination sensor for flatness measurement Q.2 **(a)** 1. Explain in brief the working of laminated two-layer piezoelectric 04 capacitive sensor for force measurement. 2. How does a bimetal plate and bimetal coil work as a transducer of 03 temperature into a displacement? (b) Illustrate the following: 07 1. a pressure measuring system using potentiometer 2. a pressure measuring system using LVDT 3. a pressure measuring system using optical sensors Compare the relative significance of these pressure measuring systems over each other. OR (b) Describe with neat schematic diagrams the sensor developed for the 07

- (b) Describe with neat schematic diagrams the sensor developed for the measurement of boiler-drum water level, where the hazardous environment causes difficulties with conventional sensors. Also discuss the problems and merits associated with the suggested sensor.
- Q.3 (a) 1. Evaluate the statement: "Synchronization of the motions of two 04 shafts without mechanical coupling is possible with synchros".
 - 2. How is direction-control possible using incremental encoder? 03
 - (b) Explain the role of high-end and low-end trimmer in a potentiometric 07 circuit.

- Q.3 (a) 1. Evaluate the statement: "Synchro differentials can be utilized to 04 position receiver shaft at sum angle as well as difference angle".
 - 2. Explain Vee-scanning in absolute encoder using schematic 03 diagram. What is the importance of Vee-scanning?
 - (b) Design a complete sensing system for the fulfillment of following applications. Use the most appropriate sensor/s to design a system.
 - 1. To find out diameter of hexagonal head bolt
 - 2. Gold coating thickness on silver
- Q.4 (a) 1. Explain with the help of an electronic circuit that the tactile sensor 04 array can be used as analog sensors.
 - Explain with suitable example that the binary switch array is used for object recognition as well as for slip sensing.
 - (b) Describe the working principle of magnetostrictive sensor with schematic diagram. Give appropriate applications of this sensor with suitable examples.

OR

- Q.4 (a) Determine the control resolution, spatial resolution and accuracy of two individual rotational joints having a link length of 20 cm and 40 cm respectively. The maximum limit of rotation is 180⁰ and mechanical inaccuracy is 0.01 mm for both joints. Assume 10 bit DACS (Digital Analog Control System) is used for position and feedback control. Comment on the resolution of both rotational joints.
 - (b) With increasing environmental concern, design two different 07 alternatives of sensing system to measure acidity of chemical waste. Compare the relative merits and demerits of both suggested sensing systems over each other.
- Q.5 (a) Illustrate the working principle of Hall effect sensor. Explain both the digital and analog method of distance measurement using Hall effect sensor with suitable example.
 - (b) What is called a seebeck effect? Explain working of a sensor, which is based on seebeck effect principle, with suitable example.

OR

- Q.5 (a) Explain briefly the following surface processing techniques used for 07 thin film deposition on sensing material:
 - 1. Vacuum deposition
 - 2. Sputtering
 - (b) Explain the complete manufacturing process of ceramic PZT sensor, 07 which is a piezoelectric sensor.
