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**University Examinations 2016/2017**

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN ELECTRICAL ENGINEERING.

**EET 3301: ANALOGUE AND DIGITAL CONTROL SYSTEM**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. Explain what is meant by the term ‘control’ (2 marks)
2. State three advantages of Closed loop and Control System (3 marks)
3. Define the term transfer function (1 mark)
4. Draw the response curve of an LVDT (3 marks)
5. State two merits of a thermocouple temperature sensor (2 marks)
6. Draw the response curves of the following; (4 marks)
7. Thermistor
8. Resistance temperature detector
9. Describe the operation of shaft position encoder (4 marks)
10. State the necessary conditions for determining the stability of a control system using the Routh criteria (2 marks)
11. Distinguish between a DC and a stepper motor (2 marks)
12. Highlight any two advantages of digital control systems over analog systems (2 marks)
13. A strain gauge with GF=2.0 and resistance 120 Ohms. It is subjected to a strain of 5 microstrain. Determine the percentage change in resistance. (5 marks)

**QUESTION TWO (20 MARKS)**

1. With the aid of a diagram, explain the principle of operation of; (12 marks)
2. Thermocouple
3. Optocoupler
4. A control system has a characteristic equation given by . Using Routh stability criteria, determine the range of k so that the system is stable. (8 marks)

**QUESTION THREE (20 MARKS)**

1. Figure 1 shows as RLC circuit. Determine the transfer function of the circuit. (7 marks)
2. Describe with aid of a labelled diagram, the principle of an R-2R ladder network digital-to-analogue (D to A) converter. (7 marks)
3. With the aid of a diagram explain the operation of a solenoid (6 marks)

**QUESTION FOUR (20 MARKS)**

1. With the aid of a diagram, describe the operation of an LVDT (7 marks)
2. Describe the hall effect principle (3 marks)
3. With the aid of a diagram, describe the operation of a bipolar stepper motor (7 marks)
4. Determine the step angle of a three phase stepper motor which 12 rotor teeth. (3 marks)