Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

PEEL 5301

Fifth Semester (Back/Special) Examination – 2013

SENSORS AND TRANSDUCERS

BRANCH : EEE, ELECTRICAL

QUESTION CODE : D 330

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) List the different types of errors in instrumentation systems.

   b) In a Wheatstone bridge determine the value of unknown "R, and its limiting error given R1=50Ω ± 0. 1%, R2 = 200Ω ± 1% and R3 = 200Ω ± 2%'.

   (c) A strain gauge with G.F. of 10 has a R= 250 Ω is used to measure the strain equal to 10e-6. Compute the ΔR.

   (d) Why the residual voltage at null position of LVDT is not zero ?

   (e) Define static, dynamic, steady state and transient response.

   (f) Find the time response of a second order system to a step input.

   (g) What I s the output voltage of a bridge at null condition ?

   (h) What is the function of current mirror in OP amp ?

   (i) Explain the working principle of thermistor.

   (j) Explain the working principle of pressure gauge.

2. (a) For a second order system mass and spring stiffness are given 0.005 kg and 100 N/m respectively. Compute damping coefficient under critical condition assuming second order system. 5

   (b) Compute the probable error for power using voltage and current formula given I = 15 ± 2%, R = 20 Ω ± 2 % V = 300 ± 2%. 5

P.T.O.

3. (a) Derive the expression for time response of 2nd order over damped system when subjected to unit step input and hence find the steady state error. 5

(b) A first order system when subjected to a step input has a temperature rise of 20°C after one hour and 40°C after two hours starting from cold conditions. Calculate its final temperature rise and thermal time constant. 5

4. A variable reluctance sensor, consist of a core, variable air gap, and an armature. Dia of core is 2 cm, relative permeability 100, diameter 5 cm, number of turns = 50. Armature thickness = 0.5 cm. compute the inductance, assuming air gap of 0.5 mm. 10

5. (a) For a variable parallel plate capacitive transducer find the response. 5

(b) How will you extract phase and amplitude information for an LVDT ? Draw its schematic diagram and explain its transfer characteristics. 5

6. (a) State all the laws of thermocouples. 5

(b) For a PT-100 RTD compute the nonlinearity at 100°C as a per cent full scale deflection. 5

7. (a) Explain with neat sketch the working principle of Pressure transmitter. 5

(b) Distinguish between open-loop and closed-loop transmitter. 5

8. Write short notes on any **two** of the following : 5×2

(a) Push-pull transducer

(b) Electromagnetic sensor

(c) Types of errors in instrumentation system

(d) Probable errors for normal distribution.