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Total Number of Pages: 2

B.Tech
FEEE6301

6th Semester Regular / Back Examination 2016-17
INDUSTRIAL PROCESS CONTROL AND DYNAMICS

BRANCH(S): EEE, ELECTRICAL, METTA, MME

Time: 3 Hours

Max Marks: 70

Q.CODE: Z880

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

- Q1 Answer the following questions: (2 x 10)**
- a) What is the output voltage of a 10 bit DAC with a 10.0 V reference, if the input is $(0010110101)_2$ and $(20F6)_{16}$.
 - b) Explain Peltier effect and its application.
 - c) Find the strain that results from a tensile force of 1000N applied to a 10m Aluminum beam (Modulus, $E = 6.89 \times 10^{10} \text{N/m}^2$) having a $4 \times 10^{-4} \text{m}^2$ cross sectional area.
 - d) Germanium has band gap of 0.67 eV. Find the maximum wavelength for resistance by photon absorption.
 - e) Draw the elements of the final control operation.
 - f) What are the advantages of ladder logic programming over hardwired relay logic.
 - g) What do you mean by process equation, explain with a suitable process example?
 - h) Briefly explain working and application of Bimetal strip.
 - i) Ratio control is a type of feedforward control, justify your answer.
 - j) What are the three major functions of adaptive control process.
- Q2 a) Explain the concept of loading. Represent how loading occur using Thevenin equivalent circuit. (2)**
- b) A bridge circuit has $R_1=R_2=R_3=R_4=120.0 \Omega$ resistance and a 10.0 V supply. The bridge is nulled. Suppose a $3\frac{1}{2}$ DVM on a 200 mV scale will be used for the null detector. Find the smallest change in resistance that can be measured. (8)**
- Q3 a) A bipolar DAC has 10 bits and a reference of 5V. What outputs will result from inputs of 04FH and 2A4H? What digital input gives a zero output voltage? (5)**
- b) Explain working of any type of ADC. (5)**

Q4 a) An RTD has α_0 has $0.005/^\circ\text{C}$, $R_0=500\Omega$ and a dissipation constant of $P_D = 30 \text{ mW}/^\circ\text{C}$ at 20°C . The RTD is used in a bridge circuit with one arm has 500Ω resistor and a variable resistor. The other arm is another 500Ω resistor and the RTD. If the supply is 10 V connected to 500Ω resistors node. RTD is placed in a 0°C bath. Find the value of variable resistor to null the bridge. **(5)**

b) Explain the construction, working and application of LVDT. **(5)**

Q5 a) Explain the construction, working and characteristics of photovoltaic detector. **(5)**

b) Find the working force resulting from 200N applied to a 1 cm radius of forcing piston, if the working piston has a radius of 6 cm . Find the hydraulic pressure. **(5)**

Q6 a) Draw the plot of the PID controller output for the given error profile, $e_p\%$ vs. time, t . $K_P=5$, $K_I=0.7\text{s}^{-1}$, $K_D=0.5\text{s}$ and $P_I(0)=20\%$. For $t= 0$ to 1 sec , $e_p= t\%$, for $t= 1$ to 3 sec , $e_p= 1\%$, for $t= 3$ to 5 sec , $e_p= -0.5t+2.5 \%$. **(5)**

b) Design and discuss working of an electronic two position controller using OPAMP. **(5)**

Q7 The transfer function for a cascade system are given as : **(10)**

$$G_{p1} = \frac{4}{(2s+1)(4s+1)}; G_{p2} = \frac{5}{s+1}; G_{c1} \text{ is a 'P' controller}; G_{c2} = 4; G_{m1} = 0.05; G_{m2} = 0.2$$

Calculate the ultimate value of K_{P1} for primary controller for which simple feedback and cascade loop go into oscillation.

Q8 Write short answer on any TWO: **(5 x 2)**

a) Ladder diagram element: symbol and description

b) PLC architecture

c) Auctioneering control system for a Tubular Catalytic Reactor

d) Model Reference Adaptive Control