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Total Number of Pages: 3

M.TECH
EIPC-102

1st Semester Regular/Back Examination – 2015-16
SUBJECT-PROCESS DYNAMICS CONTROL
BRANCH(S): INSTRUMENTATION AND ELECTRONICS
Time: 3 Hours
Max marks: 70
Q.CODE-T1144

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 closed loop control system is used to accurately position components in a production operation. The amplifier valve positioned part of the system provides 10mm of displacement per 1mV change in input. The feedback element provides 0.01mV per mm change in displacement. What will be the instantaneous error signal when reference signal is suddenly changed by 10mV?
 - A stepper motor has 10 degree per step and must rotate at 250 rpm. What input pulse rate, in pulse per second, is required?
 - The pressure in a tank varies from 20 psi to 100 psi. The pressure in the tank is desired to be kept at 50psi. What is the full scale error when the pressure inside the tank is 30psi?
 - State the advantages of Electronic Controllers.
 - Define the degree of freedom and how degree of freedom related with variables in the equation?
 - State the advantages of PI controllers in control systems.
 - Write the control valve principles with diagram.
 - Define final control element and signal conversion.

i) Write the measuring device of Temperature, pressure and Flow.

j) What are design aspects of process control system?

Q2 a) Compare P, PI, and PID controllers in terms of their transient and steady state performance. (5)

b) Explain the basic hardware components of feedback control loop. (5)

Q3 Consider a system modeled by the following set of equations (10)

$$\frac{dx_1}{dt} = f_1(x_1, x_2, m_1, m_2, m_3, d_1, d_2)$$

$$\frac{dx_2}{dt} = f_2(x_1, x_3, m_1, d_2)$$

$$\frac{dx_3}{dt} = f_3(x_1, x_2, x_3, m_2, m_3, d_1, d_2, d_3)$$

Where x_1 , x_2 and x_3 are the state variables, m_1, m_2 and m_3 are the manipulated variables, and d_1, d_2 , and d_3 are the external disturbances.

i) How many degree of freedom does the system process?

ii) How many control objectives can you specify at most?

iii) Consider this system at steady state. How many degrees of freedom does it process?

Q4 a) The characteristics equation of a servo system is given by $a_0 s^4 + a_1 s^3 + a_2 s^2 + a_3 s + a_4 = 0$. Determine the conditions which must be satisfied by the co-efficient of the characteristics equation for the system to be stable. (5)

b) Explain the different types of actuators. (5)

Q5 a) Explain the functioning of pneumatic relay. (5)

b) List the advantages and disadvantages of feed forward and feedback control configuration. (5)

- Q6 What is adaptive control? Names the different adaptive schemes. (10)
Explain all these adaptive schemes.
- Q7 a) Write rules for selecting valve characteristics and explain globe valve and write its limitations. (5)
b) Find the working force resulting from 200N applied to a 1cm radius forcing piston of a hydraulic actuator if the working piston has a radius of 6cm. Find the hydraulic pressure? (5)
- Q8 Write Short Notes (Any Two) (5 x 2)
a) Ratio Control
b) Performances indices
c) Hydraulic Actuator