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M.TECH
EIPC102

1st Semester Regular/Back Examination – 2014
PROCESS DYNAMICS AND CONTROL
BRANCH(S): APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING,ELECTRONICS & INSTRUMENTATION ENGINEERING

Time: 3 Hours
Max marks: 70

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: (2x10)

a) Draw the block diagram of control loop which defines the basic elements and signals involved.
b) A stepper motor has 10 degree per step and must rotate at 250 rpm. What input pulse rate, in pulse per second, is required?
c) Define the proportional Band?
d) State the self- regulation of the control system.
e) Define the degree of freedom and how degree of freedom related with variables in the equation?
f) State the advantages of PID controllers in control systems.
g) Write the limitations of R-H criterion when check the stability.
h) Define final control element and signal conversion.
i) Write the measuring device of Flow, Liquid Level and Composition.
j) Define the control system parameters.

Q2 a) State the control system objective and explain these factors related to control systems. (5)
b) A magnetic amplifier requires 5-10V input signals from a 4-20mA control signals. Design a signal conversion system to provide this relationship. (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) A controller outputs a 4-to-20-mA signal to control motor speed from 140 to 600 rpm with a linear dependence. Calculate (i) current corresponding to 310 rpm, and (ii) the value of (i) expressed as the percent of control output. (5)
b) Explain the reverse and direct action (5)

Q5 a) Explain three mode PID controllers with proper diagram. (5)
b) Describe three general types of control configuration with neat block diagram. (5)

Q6 a) What is actuator? Explain the electrical and pneumatic actuators. (5)
b) Explain the concept of feedback control and types of feedback controllers (5)

Q7 a) An integral controller is used for speed control with a set point of 12 rpm within range 10 to 15 rpm. The controller output is 22% initially. The constant K_I = -0.15% controller output per second per percentage error. If the speed jumps to 13.5 rpm, calculate the controller output after 2s for constant e_p. (5)
b) Describe the time integral performance criteria. (5)

Q8 Write Short Notes (Any Two) (5x2)

a) Nozzle/ Flapper system
b) Ratio Control
c) Gain Scheduling
d) Composite Control Modes