Exam Date & Time: 20-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

B. Tech Chemical Engineering
VI Semester End Semester Examination (Make Up) June 2024
PROCESS DYNAMICS AND CONTROL [CHE 3252]

Marks: 50 **Duration: 180 mins.**

Descriptive Questions

Answer all the questions. Section Duration: 180 mins

1) Differentiate between open loop and close loop system. (3)

A)

B) Why do we need mathematical modelling in process control? (3)

C) Solve $\frac{dy}{dt} + 2y = 12e^{3t}$ given, $y(0) = 3$. (4)

2) Describe the dynamic response of a first order system. (3)

A)

B) Obtain the response of a system whose transfer function is $G(s) = \frac{1}{(s+2)}$ when the input change is by i) unit step. ii) unit impulse. (3)

C) Consider a second order system with the following transfer function $G_p(s) = \frac{1}{(S^2+2S+4)}$. find a) overshoot percentage b) rise time c) period of oscillation. (4)

3) Why an equal percentage valve is called as "equal percentage" valve? (3)

A)

B) With the help of a block diagram, explain various elements in a typical negative feedback control system (3)

C) A closed loop control system has two first order systems in series with time constants of 1 and 2 min and gains of 4 and 6 respectively. Proportional control is used. For a servo problem, determine what value of K_c gives a damping coefficient of 0.65 for closed loop response? (4)

4) Define stability. Explain it based on the roots of the characteristic equation. (3)

A)

B) Name any two performance criteria for controlling tuning. Discuss. (3)

C) Check for stability by using Routh Hurwitz method.

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 10s + 16 = 0$$ (4)

5) What are the main advantages and disadvantages of combining two controllers in series? Explain with neat sketch. (3)

A)

B) Why is it necessary to choose controller settings that satisfy both gain margin and phase margin? Justify. (3)

C) Find the amplitude ratio and phase lag for various values of frequency to the transfer function $G(s) = \frac{5}{(s+1)(2s+1)(3s+1)}$. (4)

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