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EE-801-GS

B.E. VIII Semester

Examination, December 2020

Grading System (GS)

Control Systems

Time : Three Hours

Maximum Marks : 70

Note : i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Derive the transfer function of a armature controlled d.c. motor.

   b) Explain the principle of stepper motors.

2. a) Derive the expression for rise time, peak time and maximum over shoot of a second order system.

   b) Explain the principle of operation of AC servomotor.

3. a) Plot the magnitude and phase angle plot of the following:

   i) K (constant)

   ii) s

   iii) $\frac{1}{s}$

   b) Sketch the Bode plot for the transfer function.

$$G(s)=\frac{50}{s(s+1)(s+2)}$$

Determine:

i) Gain cross over frequency

ii) GM and PM

iii) Stability

4. A unity feedback control system has G(s) = 10 / s(s+1) (s+2). Draw Nyquist plot and comment on closed loop stability.

5. a) Derive the expression for second order control system when input is subject to unit step.

   b) The open loop transfer function of unity feedback system is given by $G(S) = K/S(S+1)(S+2)$ Find the minimum value of K for which the steady state error is less than 0.1 for unit ramp input.

6. a) With the help of a neat block diagram explain the working of PI controller.

   b) Explain with a neat sketch explain the working of "Potentiometer" error detector.

7. Construct Bode plot for the system whose open loop transfer function is given by below and determine

   a) The gain margin

   b) The phase margin and

   c) The closed loop stability.

8. a) The transfer function of a unity feedback control system is given by $\frac{C(s)}{R(s)} = \frac{25}{s^2 + 5s + 25}$. Calculate w_n, z_u, w_d, % m_p.

   b) Apply Routh criterion to determine the stability of the system having characteristics equation as
   $s^5 + 1.5\, s^4 + 2\, s^3 + 4\, s^2 + 5s + 10$

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