B.E. PRINTING ENGINEERING THIRD YEAR SECOND SEMESTER -2017

CONTROL APPLICATION IN PRINTING

TIME: 3 h

FULL MARKS: 100

ANSWER ANY FIVE QUESTIONS

(Use graph paper and semi-log graph paper of 5 cycles as required)

1. i. For the system represented by the given equations. Find the transfer function $(\frac{x_5}{x_1})$, where x_1

is input variable and x5 is output variable.

 $x_2=a_{12}x_1+a_{23}x_3+a_{42}x_4+a_{52}x_5$

 $x_3 = a_{23}x_2$

X4=a34X3+a44X4

 $x_5 = a_{35}x_3 + a_{45}x_4$

- ii. Consider a unity feedback control system with closed loop transfer function
- $T.F = \frac{ks+b}{(s^2+as+b)}$, Determine open loop transfer function. Show that steady state error in the

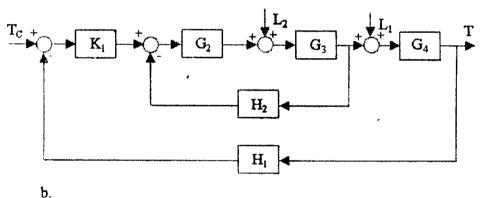
unit ramp input response is given by $e_{ss} = \frac{a-k}{b}$. Also calculate k_p , k_v and k_a .

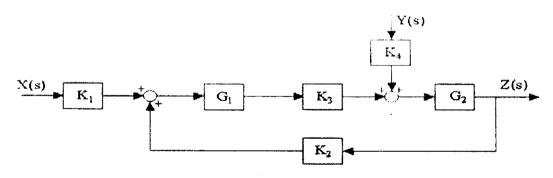
iii. Write short notes on

- a. Rise Time
- b. Peak Overshoot
- c. Peak time

iv. Reduce the block diagram

a.





[3+4+3+5+5=20 marks]

- a. Using the transfer function, $G(S) = \frac{10k}{s(s+4)(s+5)}$, sketch the root locus for unity feedbases, system.
- b. Open loop transfer function of k feedback system is $\frac{1000}{s(1+5s)(1+3.75s)}$. Find the restriction "k", so that the closed loop is stable.
- 3. Using Bode Plot find the stability of the system, $G(S) = \frac{1000}{s(1+0.1s)(1+0.001s)}$. Also calculate the phase margin and gain margin. [20 mar]
- 4. i. Find the z-inverse of the following

a.
$$\frac{z^2}{(z+2)(z^2+4)}$$

$$b. \quad \frac{z^2}{\left(z^2+2z+2\right)}$$

- ii. Find the z-transformation of the following
- a. sin(t+T)
- b. $(t+T)e^{-(t+T)}$

c. e - iat

iii. Verify the initial value theorem for the following

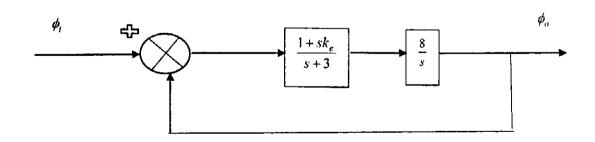
b. naⁿ

[5+5+6+4=20 marl

- 5. Sketch the Nyquist plot and Nyquist criterion for stability and also the polar plot for the transfer function, $G(S) = \frac{10}{s(1+s)(1+3s)}$. [10+10=20 mark
- 6. Write short note of the followings:
 - a. Different types of input signals in control systems
 - b. Rules of Block Diagram Reduction Technique
 - c. Actuators and Time Delay Relays

[6+6+8=20 mark]

7. Determine the value of k_o so that damping ratio is 0.55. Also find the output response, peak time, maximum peak overshoot for step unit. [20 mark



8.

a. Obtain the Laplace transformation of the waveform:

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restriction

5=20 marl

o calculate

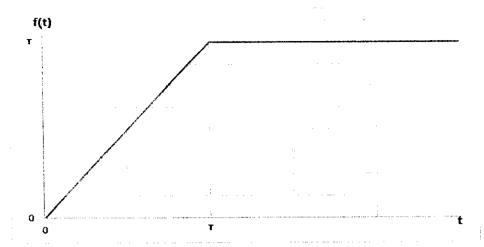
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-10=20 mark

5+8=20 mark onse, peak [20 mark





- b. The output voltage of a particular thermocouple sensor is registered to be 42.3 mV at temperature 106°C. it had previously been set to emit a zero voltage at 0°C. Since an output/input relationship exists between the two temperatures, determine (1) the transfer function of the thermocouple, and (2) the temperature corresponding to a voltage output of 15.8 mV.
- c. A stepper motor has a step angle = 4.2°. (1) how many pulses are required for the motor to rotate through ten complete revolutions? (2) what pulse frequency is required for the motor to rotate at a speed of 100 rev/min?
- d. Write short notes on any three of the followings
 - i. Counters
 - ii. Twisted pair cables
 - iii. EIA-422 Basics
 - iv. Sensors
 - v. Analog to Digital Conversion

[6+4+4+6=20 marks]

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