Ref No. Ex/PRN/T/323/2017

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 x_5 is output variable.

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

$x_3=a_{23}x_2$

$x_4=a_{34}x_3+a_{44}x_4$

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

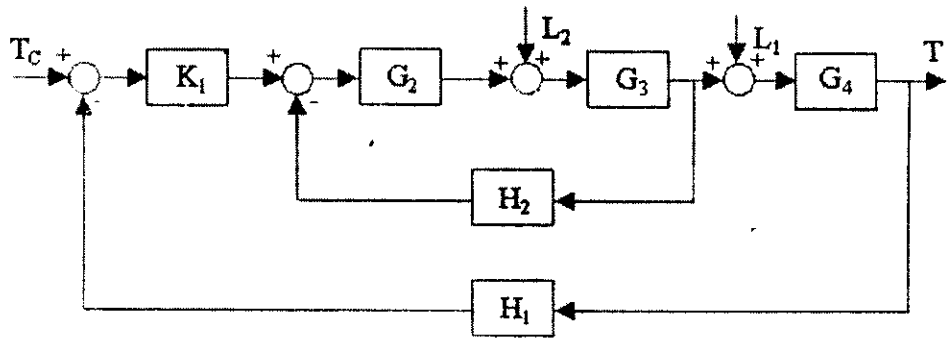
ii. Consider a unity feedback control system with closed loop transfer function $T.F=\frac{ks+b}{(s^2+as+b)}$, Determine open loop transfer function . Show that steady state error in the unit ramp input response is given by $e_{ss}=\frac{a-k}{b}$. Also calculate k_p, k_v and k_a.

iii. Write short notes on

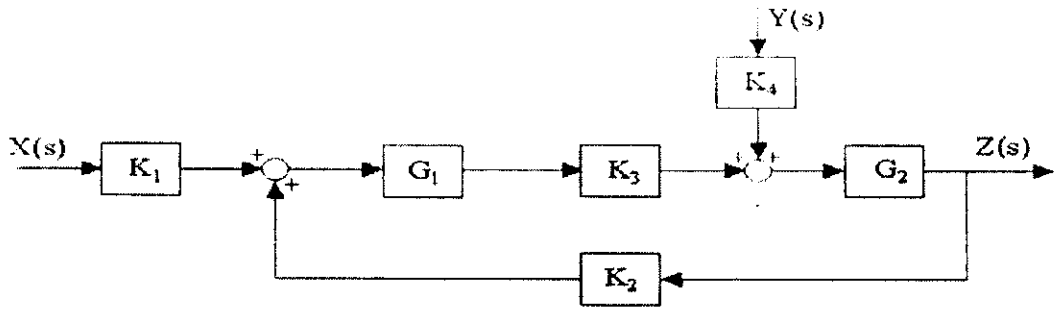
a. Rise Time b. Peak Overshoot c. Peak time

iv. Reduce the block diagram

a.



b.



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

2.

a. Using the transfer function, $G(S)=\frac{10k}{s(s+4)(s+5)}$, sketch the root locus for unity feedb 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. [15+5=20 mar

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

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

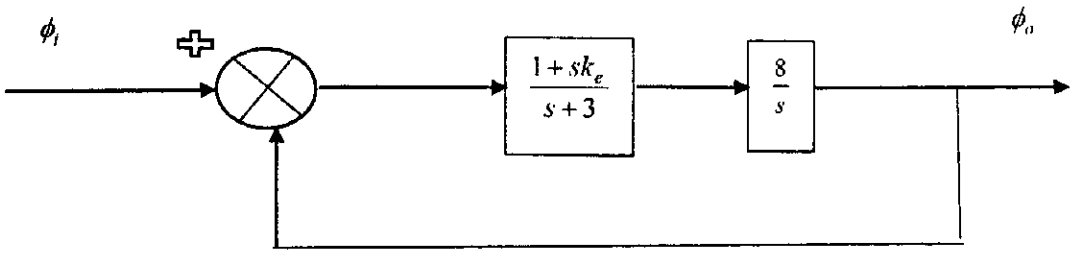
a. a^n b. na^n

[5+5+6+4=20 mar

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

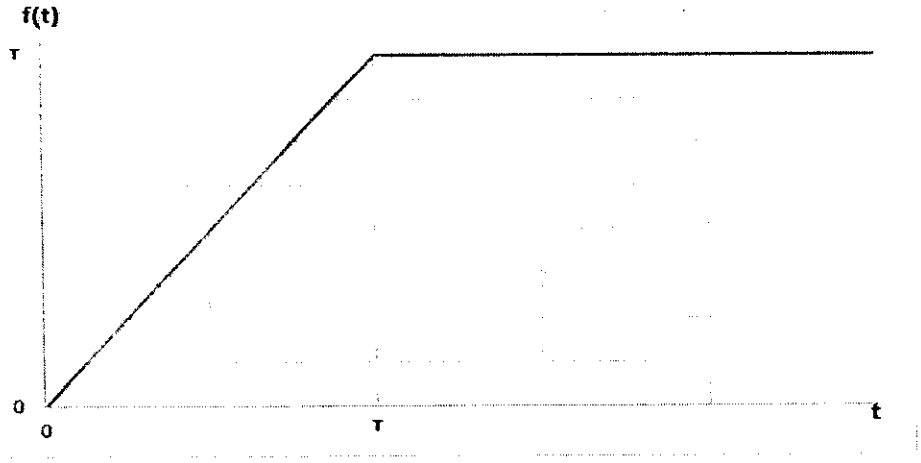
6. Write short note of the followings:
   a. Different types of input signals in control systems
   b. Rules of Block Diagram Reduction Technique
   c. Actuators and Time Delay Relays [6+6+8=20 mark

7. Determine the value of k_e 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:



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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Name:

Roll Number: