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Ref No. : Ex/ EE/5/T/314/2017(OLD)(S)

Bachelor of Electrical Engineering (Evening), 3rd Year 1st Semester Supplementary Examination, 2017

CONTROL SYSTEM ENGINEERING(OLD)

Time: Three Hours Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part

PART - I

Answer Question No. 1 and any two from the rest.

1. i) A system has an open loop transfer function of **5x4=20**

$$G(s) = Y(s) / U(s) = 1/(2s^4 + 5s^3 + 5s^2 + 7s + 15).$$

Determine the state-space representation of the system

ii) What is the force-voltage analogy?

iii) For the system $\mathbf{G(s) = \frac{2}{s+2}}$ determine the approximate time for a step response of the system to reach 98% of the final value.

iv) A type-one system has a transfer function of $G(s) = 1/(5s^2 + 3s)$. Determine error constants, K_p, K_v, K_a of the system.

v) The dominant pole of a servo system is located at $s = (-2 \pm j2)$. Determine the damping ratio of the system.

8+7=15

2. i) Show how a second order system can be realized using Op-amp.

ii) Draw the mechanical equivalent of the same system.

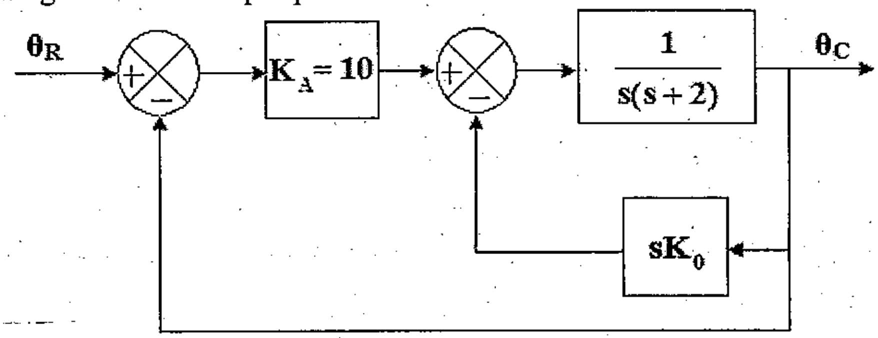
5+10=15

3. i) The frequency response of a system is $\mathbf{G(f) = \frac{2}{1 + j20\pi f}}$

Determine the step response of the system.

PART - I

ii) A feedback system employing output rate damping is shown in the figure. In the absence of the derivative feedback, i.e., $K_o = 0$, determine the damping ratio and natural frequency of the system. What is the steady state error resulting from unit ramp input?



Determine the derivative feedback constant, K_o, which will increase the damping ratio of the system to 0.7. What is the steady state error resulting from unit ramp input for this new setting of derivative feedback constant.

4. i) The System Matrix, A of an L.T.I system is 8+7 =15

$$\begin{bmatrix} 1 & 0 \\ 1 & -1 \end{bmatrix}$$

Determine the state-transition matrix

ii) Check whether the above system is completely controllable and completely observable if the input matrix, B and output matrix are as follows
$B = [2 \quad 1]^T$, $C = [1 \quad 2]$

5. Write short notes on (any two). 15

i) Solution of homogeneous State-equation

ii) Potentiometers

iii) Synchros

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B. ELECTRICALENGG. (EVENING) 3RD YEAR 1ST SEMESTER EXAM, 2017(OLD)

SUBJECT: -CONTROL SYSTEM ENGG

Full Marks 100

Time: Three hours (50 marks for each part)

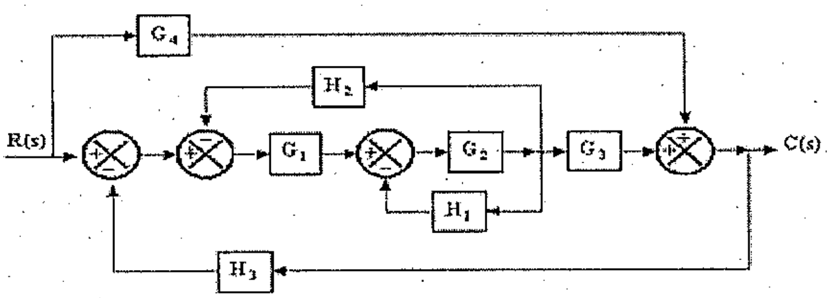
Use a separate Answer-Script for each part

No. of Questions	PART II	Marks

Answer any three questions.
Two marks reserved for neatness and well organized answers.

1.(a) Define stable, unstable and marginally stable system. — 6

(b) Using block diagram reduction technique, find the closed loop transfer function for the block diagram shown below. — 10



2. (a) Describe Routh Stability criterion. — 6

(b) For the following characteristic equation, determine the range of K for stability. — 10

$$s^4 + Ks^3 + 5s^2 + 10s + 10k = 0$$

3. A unity feedback control system has an open loop transfer function — 16

$$G(s) = \frac{K}{s(s+5)(s+10)}$$

Sketch the Root Locus of the system on a graph paper by determining the following:

(i)Number of root loci, number of asymptotes, angle of asymptotes.
(ii) Calculate centroid.
(iii)Breakaway points, if any.
(iv) Imaginary axis intercepts.

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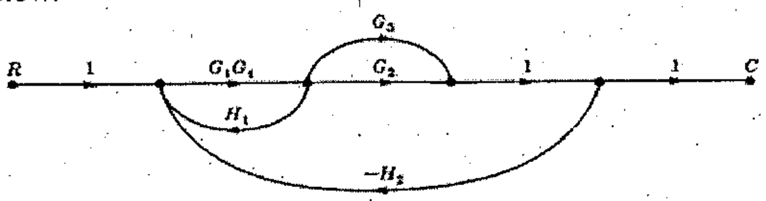
B. ELECTRICAL ENGG. (EVENING) 3RD YEAR 1ST SEMESTER EXAM, 2017

SUBJECT: - CONTROL SYSTEM ENGG

Full Marks 100

Time: Three hours (50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART II	Marks
4.	Construct the BODE plot for a system having the open loop TF as $$G(s)H(s) = \frac{200(s+10)}{s(s+5)(s+20)}$$ Determine GM, PM, ω_{gc}, ω_{pc}. Comment on stability.	16
5. (a)	Determine the overall gain of the system using SFG shown in figure below. 	10
(b)	Check the stability of the system represented by $3s^7+5s^6+8s^5+12s^4+20s^3+87s^2+91s+120=0$	6