Code: 15A02303

R15

B.Tech II Year II Semester (R15) Supplementary Examinations December 2018

CONTROL SYSTEMS ENGINEERING

(Common to ECE and EIE)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

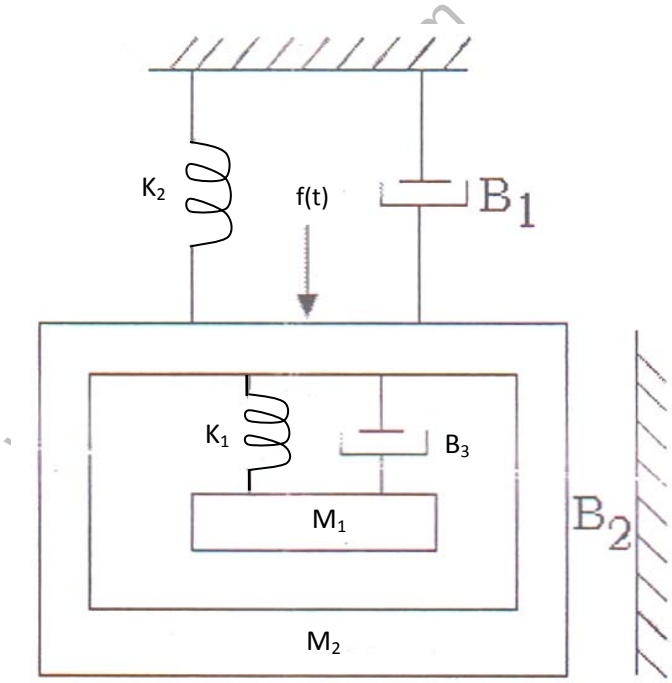
(a) Derive transfer function.
(b) Write any two advantages of block diagram representation.
(c) List out any four time-domain specifications.
(d) Define peak time, peak overshoot, rise time and settling time.
(e) What do you mean by dominant pole?
(f) State Routh's stability criteria.
(g) Define bandwidth, phase margin and gain margin.
(h) What is frequency response? And define corner frequency.
(i) What are the drawbacks in transfer function model analysis?
(j) Write the properties of state transition matrix.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 For the mechanical system shown in figure below, draw the force-voltage and force-current electrical analogous circuit.



OR

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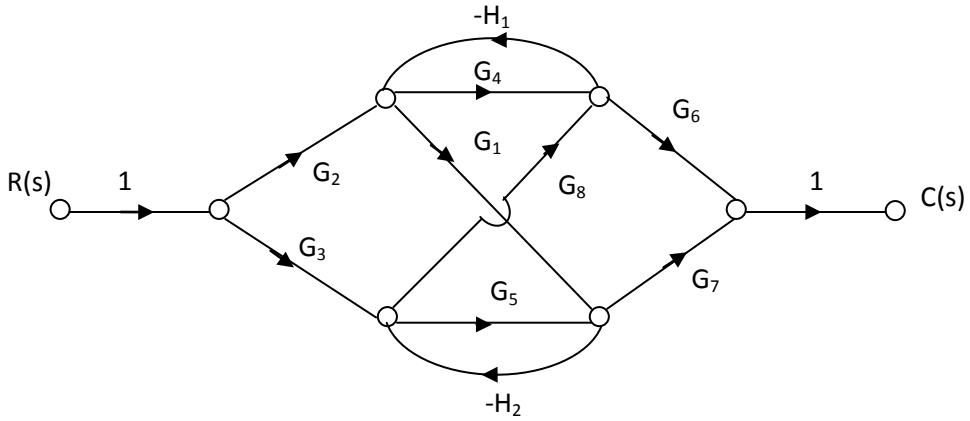
3 Find the overall gain of the system whose signal flow graph is shown in figure below.



UNIT – II

4 If x is the input and y is the output of the system described by a differential equation, d^2y/dt^2+4 dy/dt+8y=8x, determine the undamped natural frequency, damping ratio, damped natural frequency time for peak overshoot and settling time.

OR

5 Derive an expression for the time response of an under damped second order system subjected to unit step input.

UNIT – III

6 Construct Routh array and determine the stability of the system represented by the characteristic equation $S^5+S^4+2S^3+2S^2+3S+5=0$. Comment on the location of the roots of characteristic equation.

OR

7 Construct the root locus for a closed-loop control system with $G(s)=\frac{K(S+9)}{S(S^2+4S+11)}, H(S)=1$. Locate the closed loop poles so that the dominant closed-loop poles have a damping ratio of 0.5. Determine the corresponding value of gain K.

UNIT – IV

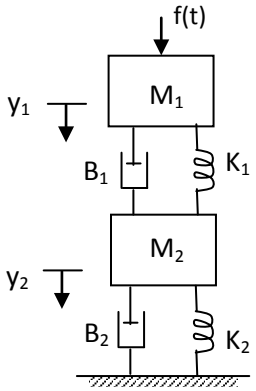
8 Draw the bode plot for the function, $G(S)=\frac{Ks^2}{(1+0.2s)(1+0.02s)}$. Determine the value of K for a gain cross over frequency of 20 rad/sec.

OR

9 The open loop transfer function of a unity feedback system is given by $G(S)=\frac{1}{S(S+1)(2S+1)}$. Sketch the polar plot and determine the gain margin & phase margin.

UNIT – V

10 Construct the state model of mechanical system shown in figure below.



OR

11 Obtain the state model of the system whose transfer function is : $\frac{Y(s)}{U(s)}=\frac{10}{s^3+4s^2+2s+1}$

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