Total No. of Questions : 10]

SEAT No. :

P1489

[Total No. of Pages : 3

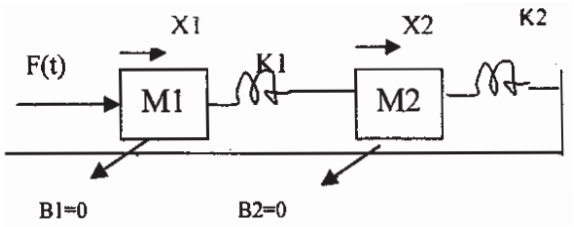
[5460] - 166
T.E. (Electrical)
CONTROL SYSTEM - I
(2012 Pattern) (End-Semester - II) (303147)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8 and Q.9 or Q.10.***
2) ***Use of non programmable calculator is allowed.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Explain D' Alembert's principle and find the Transfer function of write the differential equation describing dynamics of system as shown in fig. **[5]**

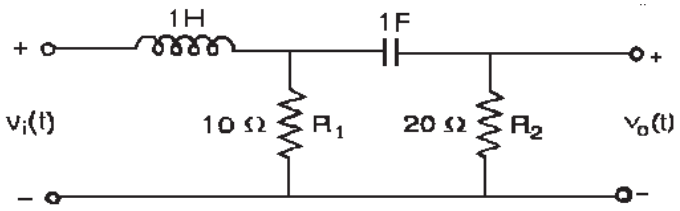


b) Draw block diagram of closed loop control system. State function of each block. Also explain why negative feedback is commonly used. **[5]**

OR

Q2) a) Derive the transfer function of two tank system. **[5]**

b) Derive the transfer function of the electrical network as shown in fig & sketch the pole zero map if given L = 1 H, R_1 = 10 ohm, R_2 = 20 ohm, C_1 = 1 F **[5]**



Q3) a) Define response of system. Explain unit step response for a first order system. **[4]**

b) For unity feedback system G(s) = 20 (s + 1)/s (s + 2)(s^2 + 2s+ 2) find the static error coefficient and steady state error if r (t)= 10 + 20t. **[6]**

OR

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Q4) a) What do you mean by potentiometer and derive the transfer function of potentiometer. **[6]**

b) Determine the values of the damping ratio and natural frequency of oscillations for each of the following systems and hence specify and draw the nature of the step response with respect to the value of the damping ratio. **[4]**

i) $C(s)/ R(s) = 8 / (s^2 + 3s + 8)$

ii) $C(s)/ R(s) = 4/ (s^2 + 16)$

Q5) a) Sketch the root locus of Unity feedback system whose open loop transfer function is $G(s) = 1/s(s + 3)(s^2 + 5s+ 4)$. **[12]**

b) Define following terms: **[6]**

i) Stability

ii) Relative Stability

iii) Absolute Stability

iv) Marginal Stability

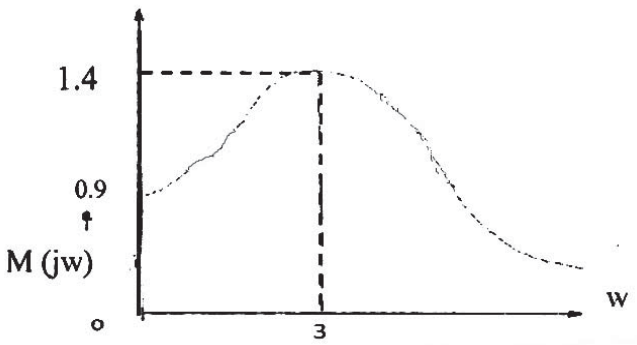
OR

Q6) a) What is Routh's Hurwitz Criterion for stability analysis ? How many roots of the following polynomial are in the right half plane, the left half plane and on jw axis $P(s) = s^5+2s^4 + 2s^3 + 4s^2 + s + 2 = 0$ **[9]**

b) i) What are angle and magnitude condition for a stable system.

ii) Write a note on Root contour design concept. **[9]**

Q7) a) The closed loop frequency response magnitude versus frequency of a second order system is shown in fig. Find frequency domain specifications. **[8]**



b) Sketch polar plot fot the unity feedback system with open loop tranfer function $G(s) = 1/s(s + 2)$ **[8]**

OR

Q8) a) The open loop transfer function of an unity feedback system is given by $G(s) = 10 (s + 3)/s(s + 2)(s^2 + 4s + 100)$. Draw the bode plot and hence find the gain margin and phase margin. **[12]**

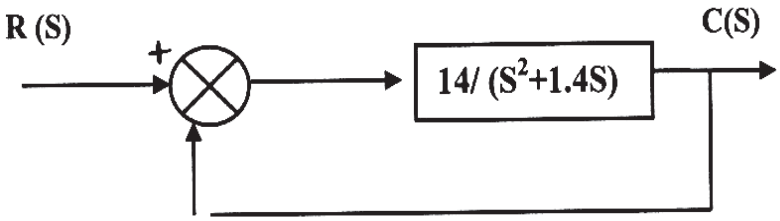
b) State and explain Nyquist Stability Criterion. **[4]**

Q9) a) Explain PID controller with its characteristics and its effect on system performance. **[8]**

b) Explain tuning of PID controllers using Ziegler - Nichols Method. **[8]**

OR

Q10) A closed loop control system with unity feedback is shown in figure by using derivative control the damping ratio is to be made 0.7. Determine the value of Td, also determine the rise time, peak time and maximum overshoot without derivative control and with derivative control. The input to the system is unit step. **[16]**



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