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324555(24)

B. E. (Fifth Semester) Examination,
April-May / Nov.-Dec. 2020

(New Scheme)

(Elect. Engg. Branch)

CONTROL SYSTEM ENGINEERING

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) is compulsory, attempt any* ***two*** *parts from (b), (c) and (d) of each question. The figures in the right-hand margin indicate marks.*

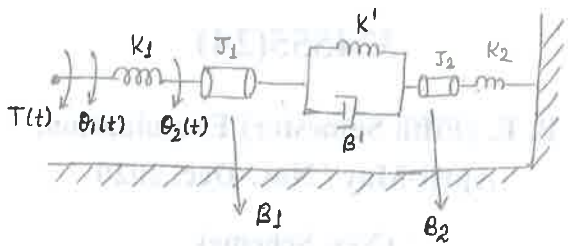
Unit-I

1. (a) Define open loop and close loop system with example. 2

(b) For a given Rotational system, obtain analogous electrical system based on analogy and write mathematical equations. 7

(i) F-V analogy

(ii) F-I- analogy



(c) Prove that steady state accuracy and transient accuracy of closed loop system is better than open loop system. 7

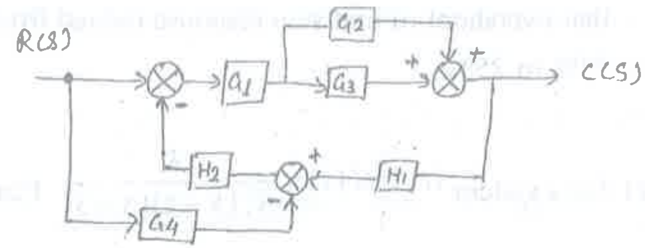
(d) Explain thermal system is detail. Find transfer function of thermal system. 7

Unit-II

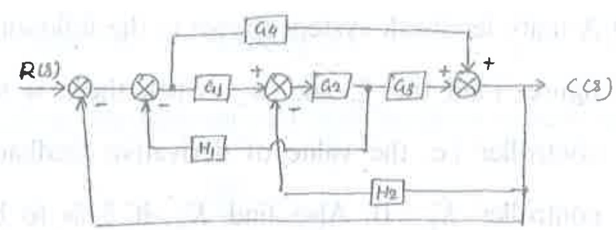
2. (a) Define Servomotor. 2

(b) Armature controlled D.C. servomotor in detail. Also draw block diagram and find Transfer function of above. 7

(c) Reduce the following block diagram of the system shown in figure into a single equivalent block by block diagram reduction techniques. 7



(d) Draw signal flow graph and find $C(s)/R(s)$ by using Mason's gain rule. 7



Unit-III

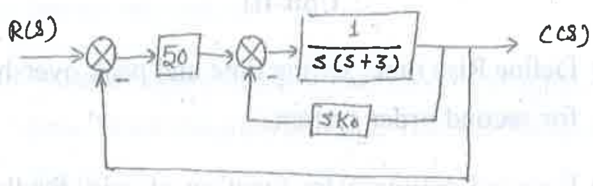
3. (a) Define Rise time, setting time and peak overshoot for second order system. 2

(b) Forward path transfer function of unity feedback system is $G(s) = \dfrac{K}{S(S+1)}$, where K is constant.

Calculate factor by which K should be multiplied so that overshoot of unit step response redued from 75% to 25%. 7

(c) For a system $G(s)H(s) = \dfrac{K}{S^2(S+2)(S+3)}$. Find the value of K to limit steady state error to 10. When input to system is $1 + 10t + \dfrac{40}{2}t^2$. 7

(d) A unity feedback system shown in the following figure. Find the ξ and w_n, when there is no controller i.e. the value of derivative feedback controller $K_0 = 0$. Also find K_0, if ξ is to be modified to 0·5 by use of controller. 7



Unit-IV

4. (a) Define gain margin and phase margin. 2

(b) Sketch the Polar Plot for a system with $G(s)H(s) = \dfrac{10}{S(S+1)(S+2)}$. Calculate its gain margin in dB and check stability of system. 7

(c) Sketch the Nyquist plot for a system with

$$G(s)H(s) = \frac{10(S+1)}{(1+2s)(1+0{\cdot}1s)+(1+0{\cdot}02s)}$$

comment on its stability. 7

(d) Draw the bode plot for unity feedback system with

$$G(s) = \frac{80}{S(S+2)(S+20)}$$ 7

5. (a) Define types of compensator. 2

(b) What is the difference between lead compensator and lag compensator. 7

(c) Draw the Blode plots on a semilog graph paper of a typical lead compensator. Explain the effects and limitations of phase lead compensators. 7

(d) Write short notes (steps) for lag compensator design using Root locus method. 7