Total No. of printed pages = 4

19/5th Sem/UECE502

2021

CONTROL SYSTEMS

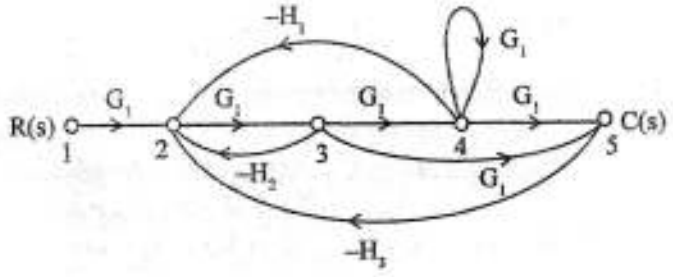
Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. Write and explain the Manson's gain formula. Using the formula derive the C(s)/R(s) of the following signal flow graph : 5+15=20



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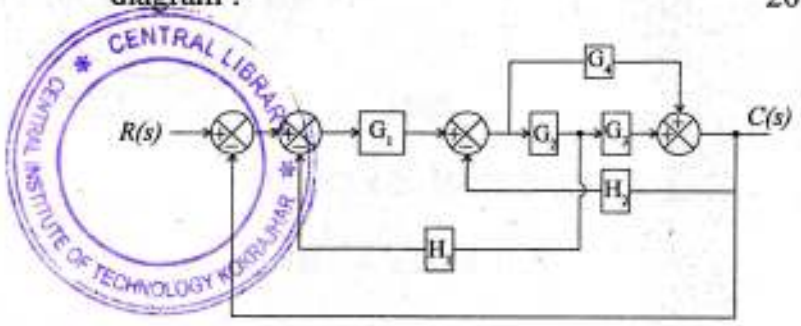
2. Using the block diagram reduction method find the transfer function of the following block diagram : 20



3. (a) Derive an expression for time response of a second order under damped system to step input. 10

(b) Define rise time. Derive an expression for rise time of a second order system. 10

4. (a) A unity feedback control system has a open loop transfer function

$G(s) = k(s+9)/s(s+3)(s+5)$. Sketch the root locus. 10

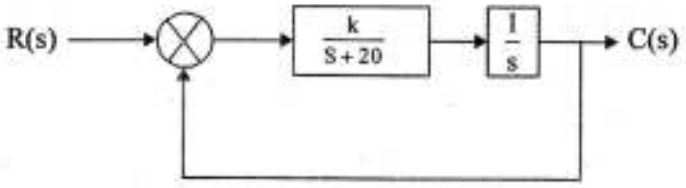
(b) The characteristic polynomial of a system is $s^7+9s^6+24s^5+24s^4+24s^3+23s+15 = 0$. Determine the location of roots on s-plane and hence comment on the stability of the system using Routh-Hurwitz criterion. 10

5. (a) Sketch the bode plot for the following transfer function and determine phase margin and gain margin. 20

$$G(s) = \frac{75\,(1+0.2s)}{s(s^2+25s+100)}.$$

6. With examples explain open loop and closed loop systems. Write the advantages and disadvantages of both the systems. 20

7. (a) The block diagram of a unity feedback (negative) system is shown in figure. Determine the steady state error for unit ramp input when $K = 400$. Also determine the value of K for which the steady state error to unit ramp will be 0.02. 10



(b) State and explain Nyquist stability criteria. 5

(c) List out the properties of state transition matrix. Obtain the state transition matrix of : 5

$$A = \begin{bmatrix} 2 & 0 \\ -1 & 2 \end{bmatrix}.$$