Code No: 154AK **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, March - 2022
CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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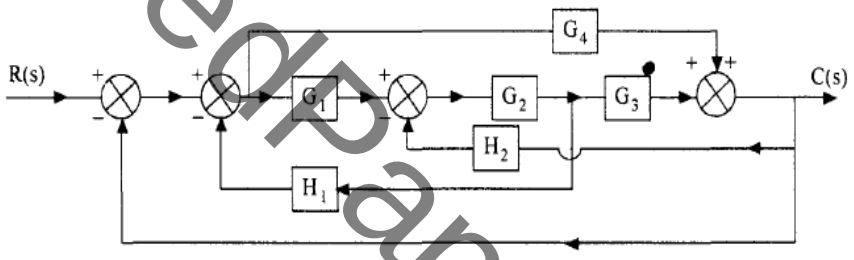
1. Explain with a neat block diagram of an Automatic Steering Control system with labelling of each block along with its significance. [15]

2. Reduce the following block diagram and obtain the overall transfer function. [15]



3. The open loop transfer function of a servo system is given by

$$G(s) = \frac{10}{s(0.2s+1)}$$

Evaluate the error series for the input,

$$r(t) = 1 + 2t + \frac{3t^2}{2}$$

[15]

4. Examine the stability of the characteristics polynomial for k ranging from 0 to α.
$D(s) = s^4 + 20Ks^3 + 5s^2 + 10s + 15$. [15]

5. Compare between Time domain analysis and Frequency domain analysis. [15]

6. Obtain the range of values of K for which the system with open loop transfer function is stable $G(s)H(s) = \frac{K(s+1)}{s^2(s+2)(s+4)}$. [15]

7.a) Explain in detail about the lead compensator along with its characteristics.
b) For a proportional controller, the controlled variable is a temperature with a range of 50 to 130^0 C with a set point of 74^0 C. The controller output is 50% for zero error. The offset error is corresponding to a load change which causes 55% controller output. If the proportional gain is 3, find the % controller output if the temperature is 60^0 C. [8+7]

8.a) Obtain the normal form of state model for the system whose transfer function is given by

$$T(s) = \frac{Y(s)}{U(s)} = \frac{s+1}{s(s+2)(s+4)}$$

b) Determine whether the following system is completely state controllable and observable.

[7+8]

$$\dot{X} = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 3 & 1 \end{bmatrix} X + \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} u \qquad Y = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} X$$

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