R18 Regulation *Subject code:2P4DB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech IV Semester Regular/Supplementary Examinations, July 2021

CONTROL SYSTEMS

(ECE)

Maximum Marks: 70 Date:15.07.2021 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks **(10x2M=20 Marks)**

1 Define transfer function.

2 Express the moment of inertia (J) and frictional element (B) mathematically.

3 Determine the type and order of the system G (s) = K / {s(s + 2)}

4 Define maximum peak overshoot.

5 Identify the stability for the system $G(S) = \frac{1}{(S+2)(S-3)}$ and give reasons.

6 Find the corner frequency? $G(s) = 100/(s^2+5s+100)$

7 Identify the type of compensator.
$G(S) = 10(S+2)/(S+3)$

8 State Nyquist criterion for the system stability.

9 Deduce the reasons for modeling systems in state-space.

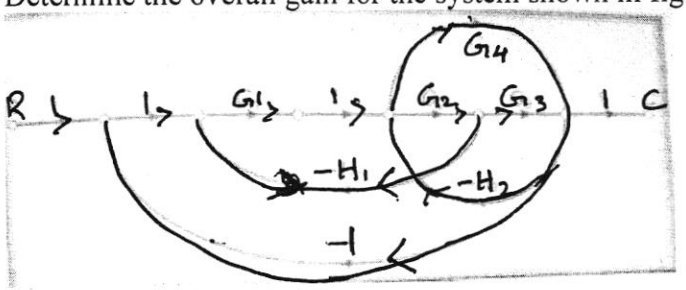
10 Write the properties of state transition matrix.

Part-B

Answer All the following questions. **(10MX 5=50Marks)**

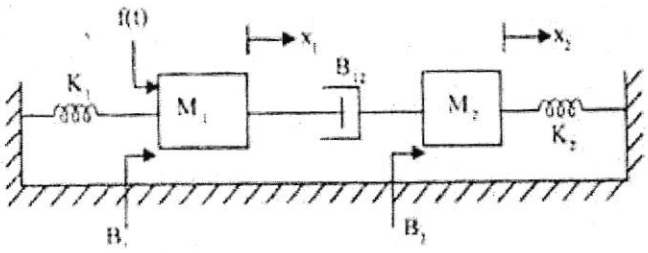
11 A. State Masons gain formula. (2)

B. Determine the overall gain for the system shown in fig. (8)



OR

12 Determine the transfer function $X_1(S)/F(S)$ and $X_2(S)/F(S)$ for the mechanical system shown in fig. (10)



13 In a steady state AC position control system having unity feedback has $G(S) = \frac{10K}{S(1+0.1S)}$. Find the minimum value of amplifier gain, K so that the input shaft's velocity error constant is 900. With the above value of K, what will be the value of damping factor and natural frequency. (10)

OR

14 Determine the steady state errors for the following inputs 5u(t), 5tu(t), $5t^2u(t)$ to a system whose open loop transfer function is given by $G(s) = \frac{100(s+2)(s+6)}{s(s+4)(s+3)}$ (10)

15 A. State Routh Hurwitz criterion. (3)

B. Given: Characteristic equation $S^4+4S^3+7S^2+16S+12=0$. Determine the location of roots on S-plane. (7)

OR

16 Sketch the bode plot for the system having $G(S) = \frac{1}{S(1+0.5S)(1+0.1S)}$. Also determine gain cross over frequency. (10M)

17 Sketch the polar plot of $G(S) = \frac{10}{S(1+0.5S)(1+0.2S)}$. Also determine gain margin and phase margin. (10)

OR

18 Design a lag compensator for a unity feedback system having open loop transfer function, $G(S) = \frac{5K}{S(S+2)}$ to meet the following specifications. (10)

(i) Velocity error constant, $K_v=20S^{-1}$. (ii) Phase margin is atleast 55°.

19 Check whether the system is controllable and observable where $A=\begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}$, $B=\begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}$ and C=[1 0 0] (10)

OR

20 Develop the state space model for the following system shown in fig. (10)