Code No: R1922024 **R19** SET - 1

II B. Tech II Semester Supplementary Examinations, February - 2022
CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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1 a) Explain the open-loop operation of traffic signals at a road crossing. How can improved traffic control be achieved by means of a closed-loop scheme? 8M

b) Find the rotational mechanical system which is an analogous to an electrical system shown in fig. 2.65 by using a torque –current analogy. 7M

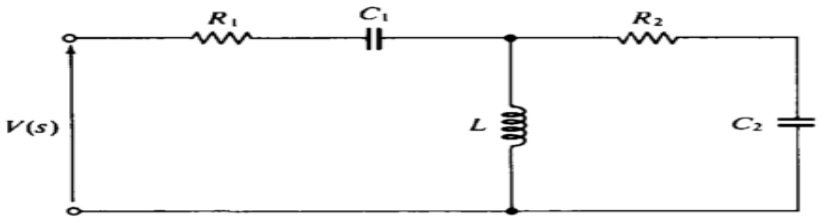

Fig. 2.65

Or

2 a) What is AC servomotor? Derive its transfer function and explain its characteristics. 7M

b) Find the transfer function of the electrical circuit shown in fig.2.65 by considering the voltage across second capacitor $V_{C2}(s)$ as output quantity. 8M

3 a) Determine the range of values of K for the system to be stable 7M
$S^4 + 20KS^3 + 5S^2 + 10S + 15 = 0$.

b) A unity feedback system has $G(s) = \frac{K}{s(s+1)(0.1s+1)}$ and $r(t) = 10t$ (i) If $K=2s^{-1}$, 8M
Determine $e_{ss}(t)$ (ii) Find the minimum value of K for $e_{ss}(t) < 0.1$, for a unit ramp input.

Or

4 a) State the advantages of RH Stability criterion? 5M

b) Determine the stability of the system by means of Routh criterion. 10M
$S^6 + S^5 - 2S^4 - 3S^3 - 7S^2 - 4S - 4 = 0$.

5 a) Consider the open-loop transfer function: 9M

$$G(s) = \frac{K}{(s+1)(s+2)(s+3)}$$

Obtain a frequency response plot for this system when k greater than zero and less than infinity and by using the Nyquist criterion, find the range of values for K over which the unity feedback closed-loop system will be stable.

b) Write the advantages and disadvantages of Bode plot. 6M

Or
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6 a) Sketch the Bode plot and determine the following 9M
(i)Gain cross over frequency (ii)Phase cross over frequency (iii)Gain margin (iv)Phase margin

For the transfer function is given, $G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$.

b) State and explain the Nyquist stability criterion. 6M

7 a) Derive the transfer function of Electrical lead compensator and draw pole-zero plot. 7M

b) Explain the different steps to be followed for the design of compensator using Bode plot? 8M

Or

8 The open loop transfer function of a unity feedback system is $G(S)\ \frac{1}{S\ (S+1)(0.5\ S+1)}$. Design a lag compensator for the system so that the static velocity error constant $k_v = 5\ sec^{-1}$, the phase margin is at least 40^0, and the gain margin is at least 10 dB. 15M

9 a) Obtain the state model of the system whose transfer function is given as. 8M

$$\frac{Y(s)}{U(s)} = \frac{10}{s^3 + 4s^2 + 2s + 1}$$

b) Define controllability and observability with an example. 7M

Or

10 Write short notes on the following: 15M
i) State variable approach
ii) Effect of Proportional derivative systems
iii) Methods of decomposition of transfer functions.