

Morning  
Date: 03/01/2015

Exam No:

GANPAT UNIVERSITY

M.TECH SEM-I(Electrical Engg.), Regular Examination-Nov-Dec.2014

Subject Code-3EE103

Subject Name-Advanced Control Systems.

SECTION-I

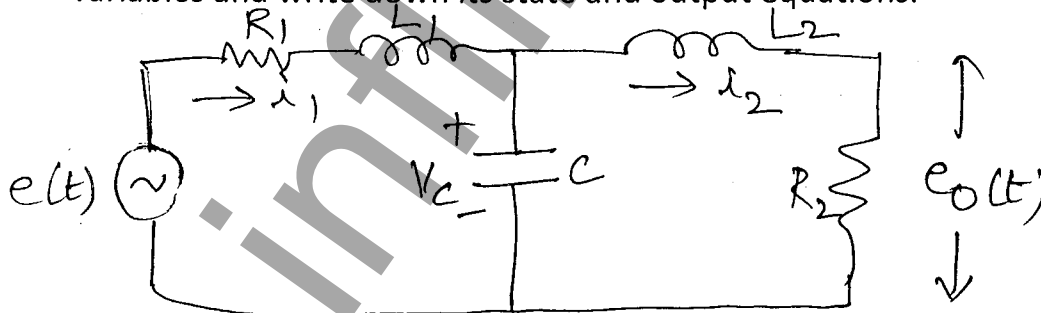
- Q1) a Discuss in brief, the common types of non-linearities. (05)  
Q1) b Write a short note on Poincare-Bendixson theorem. (05)

OR

- Q1) a Derive the describing function for dead zone non-linearity. (10)  
Q2) a Explain the principle of duality. (05)  
Q2) b Use parallel decomposition to represent the following system in the state space form. (05)

$$Y(s)/U(s) = (8s^2 + 17s + 8) / ((s+1)(s+3)(s+5))$$

- Q2) a Obtain the state space representation of a system given by (05)  
 $Y(s)/U(s) = (10s^2 + 5s + 100) / (s^4 + 20s^3 + 45s^2 + 18s + 100)$   
Q2) b For the electrical network shown, select  $i_1$ ,  $i_2$  and  $v_c$  as the state variables and write down its state and output equations. (05)



- Q3)a According to Kalman, what is the necessary and sufficient condition for a system to be state controllable? (05)  
Q3)b Consider a system with the state equation (05)

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = x_3$$

$$\dot{x}_3 = -6x_1 - 11x_2 - 6x_3 + u$$

Estimate the state controllability using Kalman's test.

SECTION-II

- Q4) a Explain the classification of singular points. (05)  
Q4) b Find out the singular points for the system given. (05)

$$\ddot{x} + 0.5\dot{x} + x = 0$$

OR

- Q4) a Discuss the method of constructing trajectories using the delta method. (05)  
Q4) b Write a short note on limit cycles. (05)

- Q5) a Discuss uniform stability, asymptotic and exponential stability in the state plane with trajectories. (05)  
Q5) b Explain LaSalle's theorem. (05)

OR

- Q5) Explain the design of state feedback controller. (10)

- Q6) a Explain Lyapunov's stability theorem. (05)  
Q6) b Determine the stability of a non-linear system given by the equation (05)

$$\dot{x}_1 = -x_1 + 2x_1^2 x_2$$
$$\dot{x}_2 = -x_2$$

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END OF PAPER

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