G 1529 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Fourth Semester

Branch : Electrical and Electronics Engineering

EE 010 403—LINEAR SYSTEM ANALYSIS (EE)

(New scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

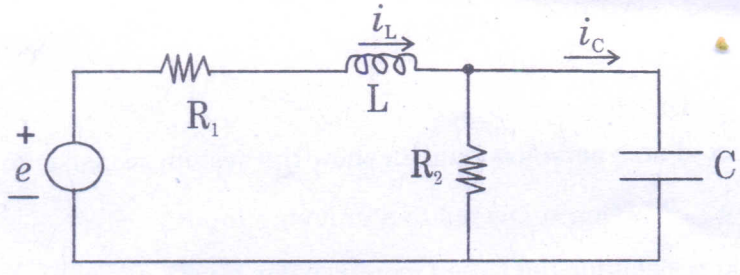
1. Define transfer function of a linear time invariant system ? Also define the order of the system.
2. State the advantages of state variable analysis over transfer function method.
3. Define steady state error and list out various error constants.
4. Define the term BIBO stability. Briefly explain the effect of location of poles on stability.
5. Write down various open circuit impedance parameters.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Describe the techniques of linearization of non-linear models.
7. Consider the circuit shown below (Fig 1).
   (a) Identify a set of state variables.
   (b) Draw the signal flow graph of the circuit.



(fig 1)

Turn over

8. Explain in detail the various time domain specifications with diagram.

9. Describe the Lyapunov's Direct method for stability analysis.

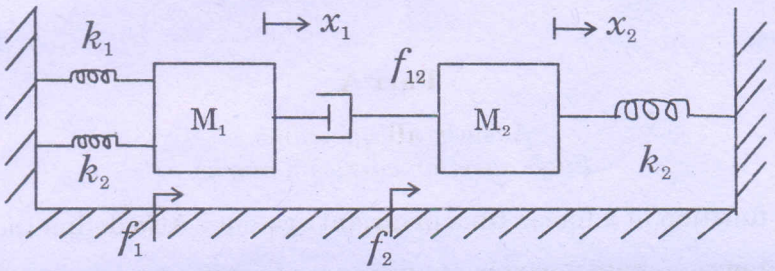
10. Describe the procedure for obtaining residues by pole zero plot.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Write the differential equations and hence find out the transfer function of the mechanical system shown below.



Or

12. Explain in detail the procedure of linearizing the non-linear models of electrical systems and linearize the following non-linear equation Z = XY in the region $5 \leq X \leq 7$, $10 \leq Y \leq 12$. Find the error if the linearized equation is used to calculate the value of Z when X = 5, Y = 10

13. For the system represented by the following equations, find the transfer function $X(s) / U(s)$ by signal flow graph technique

$$x = x_1 + \beta_3 u$$

$$\dot{x}_1 = -a_1 x_1 + x_2 + \beta_2 u$$

$$\dot{x}_2 = -a_2 x_1 + \beta_1 u.$$

Or

14. Obtain the state space representation of :
    (a) Armature controlled DC Motor.
    (b) Field controlled DC Motor.

15. Measurements conducted on a servomechanism show the system response to be $c(t) = 1 + 0{\cdot}2\, e^{-60t} - 1{\cdot}2\, e^{-10t}$ when subjected to a unit step input :
    (a) Obtain the expression for the closed loop transfer function.
    (b) Determine the undamped natural frequency and damping ratio of the system.

Or

16. A servo mechanism is used to control the angular position ϕ_0 of a mass through a command signal ϕ_1. The moment of inertia of load is 200 kg.m^2 and the motor torque at load is $6{\cdot}88 \times 10^4$ N/m/rad of error. The damping torque coefficient is 5×10^3 N-m/rad/sec. Find the time response for a step input of 1 radian.

17. A unity feedback system has an open-loop transfer function $G(s) = K / s^2 (s+2)$

    (a) By sketching a root locus plot, show that the system is unstable for all values of K.

    (b) Add a zero at $S = -a\ (0 \le a \le 2)$ and show that addition of zero stabilizes the system.

Or

18. Using Routh-Hurwitz criterion for the unity feedback system with open loop transfer function :

$$G(s) = \frac{k}{s(s+1)(s+2)(s+5)}$$

    (a) Find the range of k for stability.

    (b) Find the value of k for marginally stable.

    (c) Find the actual location of closed loop poles when the system is marginally stable.

19. Write notes on the following :

    (a) Inverse transmission (A′ B′ C′ D′) parameters.

    (b) Impedance converter.

    (c) Hybrid (g) parameters.

Or

20. Write notes on the following :

    (a) Gyrator.

    (b) Ideal transformers.

    (c) Transmission parameters (A B C D).

(5 × 12 = 60 marks)