NR

Code No: 52120/MT

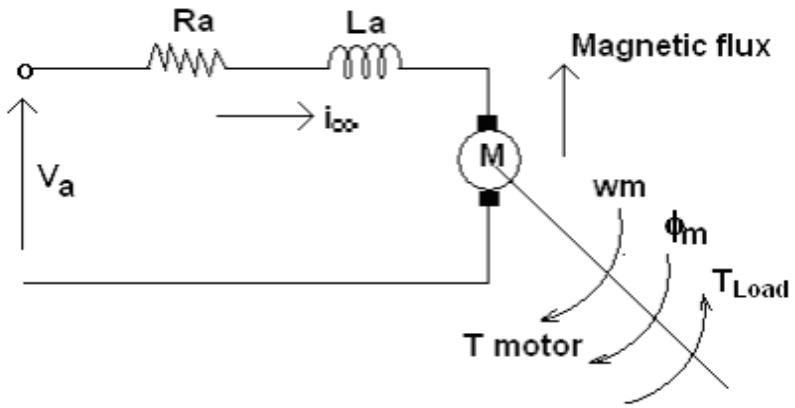
M.Tech. – I Semester Supplementary Examinations,
September, 2008

MODERN CONTROL THEORY
(Common to Power Electronics/ Electrical Power Engineering/ Power Engineering & Energy Systems)

Time: 3hours **Max. Marks:60**

Answer any FIVE questions
All questions carry equal marks
- - -

1.a) Define the following
i) Eigen values ii) Eigen vectors ii) State of a system
b) Consider the system shown for the d.c. motor



Obtain the state space model. Obtain its state diagram and also the block diagram.

2.a) Explain the properties of state transition matrix.
b) Find $x_1(t)$ and $x_2(t)$ of the system described by

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & -2 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

Where the initial condition are

$$\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

Contd...2

3.a) Explain with an example the concept of controllability in continuous time invariant systems.

b) Show that the dynamic system described by the following equation with usual notation is completely output controllable if and only if the composite [m x nr] matrix P_1 where

$[P] = \left[CB \vdots CAB \vdots CA^2B \vdots \cdots \vdots CA^{n-1}B \right]$ is of rank m.

$\dot{\underline{x}} = [A]\underline{x} + [B]\underline{u}$

$\underline{y} = [C]\underline{x}$

4.a) What are the various types of non-linearities that occur in control systems. What are their characteristics and effects on the operations of a control system.

b) What is a describing function? Explain how an element with dead-zone can be analysed using describing function method.

5.a) What are singular paints and how are they classified. Sketch them and explain

b) Explain how phase plane trajectory using method of isoclines can be constructed for the system described by $\frac{d^2x}{dt^2} + \frac{dx}{dt} + x(t) = 0$

6.a) Explain the terms-stability in the sense of Liapunov, asymptotic stability and instability with graphic representation.

b) State and prove the Liapunov's stability theorem for linear time invariant systems.

7.a) Explain the method of control system design by pole placement.

b) What are state observes? Explain. Sketch the block diagram of fall order state obscener.

8.a) Explain the fixed end point problem and derive the euler-Lagrange equation.

b) Explain the term-Linear quadratic regulator.

^*^*^