RAJ KUMAR GOEL INSTITUTE OF TECHNOLOGY & MANAGEMENT, GZB

1st Sessional Examination 2017-18 (Odd Semester)

Roll No.: **Subject Name: Control System - I**

Year/Branch: 3rd Year /EC **Subject Code: NIC-501**

Max Time: 1Hour 30 Minute **Max Marks: 50**

SECTION-A

Q.1 Attempt all parts carry equal marks. Write answer of each part in short. **(2x5=10)**

(a) Distinguish open loop and closed loop control systems.
(b) Analyze the SFG terminologies. (i)Node (ii) Path (iii) Forward path (iv) self loop
(c) How can be find out controllability of the system?
(d) What are the advantages of state space technique?
(e) Explain state transition matrix property?

SECTION-B

Note: Attempt any five questions from this section. **(5x5=25)**

Q.2 Obtain the state matrix for the given transfer function.

$$G(s) = \frac{y(s)}{u(s)} = \frac{K\,c1}{s^3 + a_3 s^2 + a_2 s + a_1}$$

Q.3 Obtain the state matrix of the system shown in fig. 1.

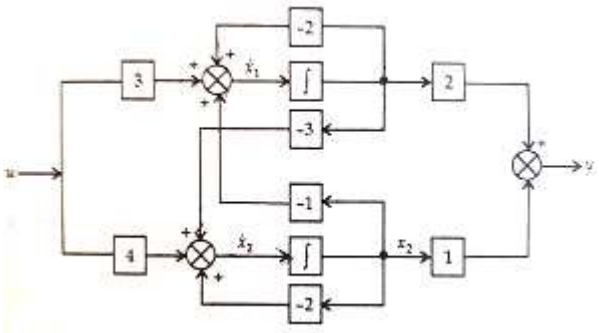

Fig .1

Q.4 Represent the following set of equations by a signal flow graph and determine the overall gain relating x_5 and x_1.

$$x_2 = ax_1 + fx_2$$
$$x_3 = bx_2 + ex_4$$
$$x_4 = cx_3 + hx_3$$
$$x_5 = dx_4 + gx_2$$

Q.5 Determine the SFG for given transfer function using parallel decomposition.

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

Q.6 Determine the transfer function, when a system represented by the following dynamic equation:

$$\dot{x} = \begin{bmatrix} 0 & 3 \\ -5 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 3 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Q.7 For electrical network shown in fig. 2, form the state equations.

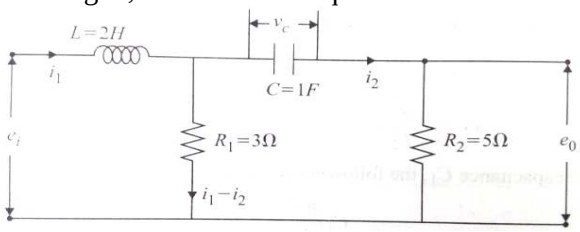

Fig.2

Q.8 Explain the solution of homogeneous state equations.

Q.9 Determine the state transition matrix of given equation:

$$\frac{d^3x}{dt^3} + 9\frac{d^2x}{dt^2} + 24\frac{dx}{dt} + 10\,x = 9\,u_1 + 10\,u_2$$

SECTION-C

Note: Attempt any two questions from this section. **(7.5x2=15)**

Q.10 Determine the transfer function for the system shown in fig. 3 by using block reduction method.

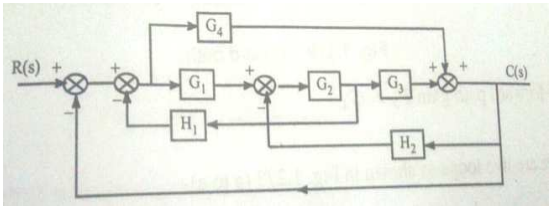

Fig.3

Q.11 Obtain the transfer function C/R from the signal flow graph shown in fig.4.

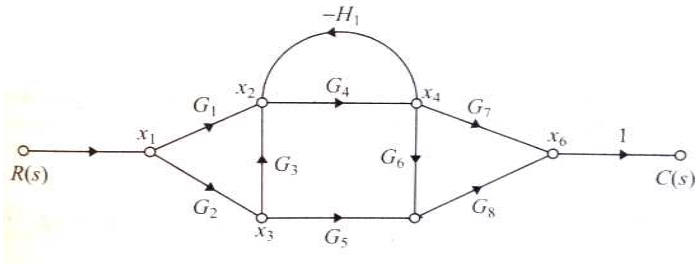

Fig.4

Q.12 Determine the signal flow graph for the system shown in fig. 3 and determine transfer function using Mason's gain formula.