

Total No. of Questions : 6]

SEAT No. :

P3893

[Total No. of Pages : 2

[5462] - 605

M.E. (Electrical) (Control Systems)

MULTIVARIABLE AND OPTIMAL CONTROL SYSTEM

(2017 Course) (Semester - II)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of algorithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain representation and advantages of multivariable control system into **[5]**
- i) Transfer matrix form
 - ii) State space form
- b) Define and explain the concepts of controllability and observability of multivariable control system. **[4]**
- c) What is the necessity of observer? Explain the neat block diagram of state estimation problem using observer. **[5]**
- d) Explain the factors to be considered in formulation of an optimal control problem using quadratic performance criterion. **[4]**

OR

- Q2)** a) Outline the procedure for obtaining the optimal control law for time invariant state regulator problem. **[5]**
- b) Explain in briefly decoupling or non-interactive control for multivariable control system design. **[4]**
- c) Explain briefly model matching control. **[4]**
- d) Explain with block diagram pole allocation using Linear state variable feedback in multivariable control system. **[5]**

P.T.O.

Q3) a) Define Hamiltonian and explain in short the procedure for obtaining optimal control using Hamiltonian method. [8]

b) Explain the Pontryagin's minimum principle. [8]

OR

Q4) a) Explain the Bang-Bang control strategy and state the merits of Bang-Bang controller. [8]

b) Find the optimal control u for the system $\dot{x} = u$; $x(0) = 1$ which minimizes

$$J = \frac{1}{2}x^2(4) + \frac{1}{2}\int_0^4 u^2 dt \quad [8]$$

Q5) a) Define and explain the singular control solutions. [8]

b) Explain in details the applications of optimal control in discrete and continuous systems. [8]

OR

Q6) a) Explain in details Numerical solution of matrix Riccati equation. [8]

b) State and explain comparison between sliding mode observer and nonlinear Extended state observer (Nonlinear ESO) [8]

