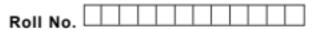


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Total No. of Pages : 02

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M.Tech (EE) EI-II (2018 Batch) (Sem.-1) OPTIMAL AND ADAPTIVE CONTROL Subject Code : MTEE-104D-18 M.Code : 75224

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

- 1. Attempt any FIVE questions out of EIGHT questions.
- 2. Each question carries TWELVE marks.
- Q1. (a) Define optimal control problem.
 - (b) Find the curve with the minimum arc length joining the point (0, 0) and line θ (t) = 2 - t.
- Q2. (a) Discuss the steps in solving optimal control problem using Hamilton-Jacobi method.
 - (b) Consider the system

Is to be controlled to minimize the performance index

$$J = \frac{1}{2} \int_0^2 u^2 dt$$

Find a set of necessary conditions for optimal control problem.

- Q3. (a) Discuss various performance indices used in optimal control.
 - (b) Find the trajectory in the (t, x) plane that will extremize

$$J = \int_{0}^{t_1} (t \dot{x} + \dot{x}^2) dt ; x (0) = 1, x (1) = 5$$

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Q4. What is Hamiltonian? What is the use of Hamiltonian in solving optimal control problem?

For given plant equation $\dot{x}=-x+u$ with boundary conditions x(0) = 0, x(1) = 1 and performance index $J = \frac{1}{2} \int_0^1 (3x^2 + u^2) dt$ find the optimal control using Hamiltonian method.

- Q5. What is Pontryagin's minimum principle? Discuss the procedure for finding optimal control using pontryagin minimum principle with control variable and state variable inequality constraints.
- Q.6. (a) Discuss Dynamic programming and its use in control.
 - (b) Discuss the model reference adaptive control and draw one scheme.
- Q7. (a) Discuss MRAC using Lyapunov method.

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(b) For the process and reference models respectively described by $\dot{x} = Ax + Bu$, $\dot{x}_m = A_m X_m + B_m r$, obtain MRAC with state feedback using Liapunov method.

Q8. (a) The transfer function of a second order plant is

$$G(s) = \frac{(s+b)}{(s^2 + a_1 s + a_0)}$$

With normal values $a_1 = 3$, $a_0 = 10$ and b = 2. Use a suitable control law and determine the response of the MRAC scheme with unit step input r(t) = u(t), if the desired response is specified by the reference models $G_m(s) = \frac{1}{(s+1)}$.

(b) Discuss design of variable structure and adaptive model following control.

NOTE : Disclosure of Identity by writing Mobile No. or making of passing request on any page of Answer sheet will lead to UMC against the Student.



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