AE-777A (Optimal Space Flight Control)

Quiz No. 2

Quiz Procedure

1. Clearly write out your solution to the quiz problems within the specified time on blank sheets of paper. (Marks will be given only for complete calculation/derivation steps.)

2. Take *low-resolution* pictures of your solution, convert them into a single PDF file (about 1MB), and send it to me by email (ashtew@iitk.ac.in) from your *registered* email account.

3. Submit your solution only *once*. In case of multiple submissions, only the *earliest* one will be accepted.

4. The time limit will be *strictly enforced*, and late submissions will *not* be accepted.

Quiz No. 2 (Time 60 min)

(Marks for each problem are indicated in parentheses.)

1. For the following function:

$$L(u) = \frac{1}{4}u^4 + \frac{2}{3}u^3 + \frac{1}{2}u^2$$

where $u \in \mathbb{R}$, find the stationary points (if any) and determine if they are the minimum points.

(15)

2. Consider the following function:

$$L(u) = \frac{1}{3}u_1^3 - u_1u_2^2 + u_2$$

where $u = (u_1, u_2)^T \in \mathbb{R}^2$, find the stationary points (if any) and determine if they are the minimum points.

(25)

3. For the minimization of

$$L(x, u) = \frac{1}{2}x^2 + \frac{1}{2}u^T \begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix} u$$

with respect to $u \in \mathbb{R}^2$, where $x \in \mathbb{R}$, subject to the constraint

$$f(x, u) = x - [3\ , \quad -1]u + 1 = 0$$

find the stationary points, (x^*, u^*), (if any).

(20)

Please send your solution to me (ashtew@iitk.ac.in) before 1:00 p.m. today.