**Lecture-2**

**Inverse Laplace transforms:**

If the Laplace transform of a function is  i.e., if then is called the inverse Laplace transforms of and we write

.

**Important formulae of Inverse Laplace transformation:**

|  |  |  |  |
| --- | --- | --- | --- |
| 1 |  | 2 |  |
| 3 |  | 4 |  |
| 5 |  | 6 |  |
| 7 |  |  |  |

**Some workout examples on Inverse Laplace transformation:**

|  |  |
| --- | --- |
| **Example: 1** |  |
| **Example: 2** |  |
| **Example: 3** |  |
| **Example: 4** |  |
| **Example: 5** | . |
| **Example: 6** | . |

**First translation property:**

**If then**

|  |  |
| --- | --- |
| **Example: 01**  . | **Example: 02**  . |
| **Example: 03** | **Example: 04**  . |
| **Example: 05** | **Example: 06**  . |
| **Example: 07** | |
| **Example: 08** | |

**Inverse Laplace transformation using partial fraction:**

|  |  |
| --- | --- |
| **Example: 01** | Let, |
| **Example: 02** | Let,  Comparing both sides, we get  By solving, we get |
| **Example: 03** | Let,  Comparing both sides, we get  By solving, we get |
| **Example: 04** | Let,  Comparing both sides, we get  By solving, we get |

**Problem set: 2.1**

**Find the inverse Laplace transform of the following functions and also sketch**

**(1-19) [if free hand sketching is getting complex then use MATLAB]**

**Using direct formula**

1. **Ans:**

2. **Ans:**

3. **Ans:**

4. **Ans:**

5. **Ans:**

6. **Ans:** (Using .)

**First translation property**

7. **Ans:**

8. **Ans:**

9. **Ans:** (Using )

10. **Ans:** .

11. **Ans:**

12. **Ans:**

**Using partial fraction**

**Type unrepeated factors –**

13. **Ans:**

14. **Ans:**

15. **Ans:**

**Type repeated factors –**

16. **Ans:**

17. **Ans:**

**Type complex or irrational factors --**

18. **Ans:**

19. **Ans:**

**Inverse Laplace transformation associated with unit step function:**

Laplace transform of **unit step function**is

So,.

If then

**Some workout examples are given bellow:**

|  |  |
| --- | --- |
| **Example 1:**  Find and sketch , where .  **Solution:** we know that  **So,**  **.** |  |
| **Example 2:**  Find and sketch , where .  **Solution:**  Let,and.  We know that,  So,  . | **C:\Users\aiub\Downloads\2.jpg** |
| **Example 3:**  Find and sketch , where .  **Solution:**  Let,and.  We know that,  So,  . |  |
| **Example 4:**  Find and sketch , where .  **Solution:**  and.  So,  Since, and , so the first two terms cancel each other when   |  |  | | --- | --- | | Hence, we obtain . |  | | |

**Problem set 2.2**

**Find inverse Laplace of the following functions and also sketch : (24-31)**

**Associated with unit step function**

|  |  |
| --- | --- |
| 24. | **Ans:** |
| 25. | **Ans:** |
| 26. | **Ans:** |
| 27. | **Ans:** |
| 28. | **Ans:** |

.

**Associated with Dirac’s delta function**

|  |  |
| --- | --- |
| 29. | **Ans:** |
| 30. | **Ans:** |
| 31. | **Ans:** |