EC5.101 – Network, Signals and Systems
Assignment 4
Total Marks – 40

Release date: 16th Sep 2023 | Due date: 27th Sep 2023

Instructions:

1. The handwritten assignment must be submitted individually.
2. Students are free to refer to class notes and textbooks. Discussions are allowed but copying and plagiarism will attract strict penalty.
3. Late submission: 10 % penalty per day (up to at most 3 days after deadline).
4. Mention any additional assumptions you make that is not given in the question.
5. Clearly show the steps used to arrive at the solutions.

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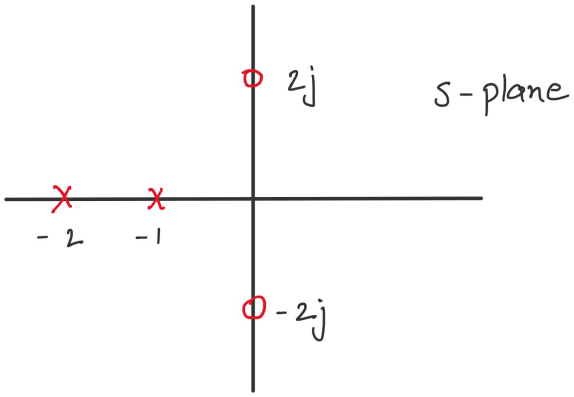
1. [10 marks] Find the Laplace transform and the corresponding ROC for the following signal:

$$x(t) = u(t) + e^{-2(t-1)}u(t-1) + e^{-2(t+1)}u(t+1).$$

Find two other signals in time domain which have the same Laplace transform expression as that derived above. Justify your answer.

2. [5 marks] Pole-zero plot of the Laplace transform of a signal is shown below.



(a) [2] If the Laplace transform is known to be of the rational form, write down its expression.

(b) [3] How many distinct signals can have the above Laplace transform? Identify their ROC.

3. [5 marks] Find the Laplace transform and the corresponding ROC for the following signal:

$$x(t) = \sum_{k=0}^{\infty} \delta(t - kt_0), \quad t_0 > 0.$$

4. [20 marks] Solve the following questions from the SAS text book.

   (a) [7] 9.13

   (b) [6] 9.54

   (c) [7] 9.61 (except Fourier transform question in part b)

5. [Optional, not graded] Solve the following questions from the SAS text book:

   (a) 2.64 (a,b,c)

   (b) 2.67 and 2.68