## BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI (MID SEMESTER EXAMINATION SP2023)

CLASS: IMSc SEMESTER: IV SESSION: SP/2023

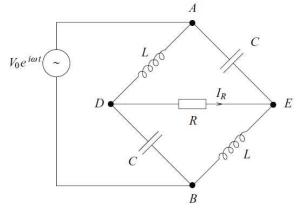
SUBJECT: PH207R1 MATHEMATICAL PHYSICS III

TIME: 03 Hours FULL MARKS: 50

## **INSTRUCTIONS:**

- 1. The question paper contains 5 questions each of 10 marks and total 50 marks.
- 2. Attempt all questions.
- 3. The missing data, if any, may be assumed suitably.
- 4. Before attempting the question paper, be sure that you have got the correct question paper.
- 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

- Q.1 Define and give examples of multivalued functions, branch cuts, Singularities and [10] 1 1,2 conformal transformations in a complex plane.
- Q.2 By applying the residue theorem around a wedge-shaped contour of angle  $2\pi/n$ , [10] 2 3 with one side along the real axis, prove that the integral  $\int_0^\infty \frac{dx}{1+x^n}$ , where n is real and  $\ge 2$ , has the value  $(\pi/n)$  cosec $(\pi/n)$ .
- Q.3 Find the Fourier transform of  $\frac{a}{\sqrt{4a^4+w^4}}$ , where a is a positive number. [10] 3 3
- Q.4 Find the function f(x) whose Laplace transform is  $\bar{f}(s) = \frac{s}{s^2 k^2}$  [10] 4 3 where k is a constant.
- Q.5 Show that, in the circuit given below, if the resistance R is chosen as  $R = \sqrt{L/C}$  [10] 5 3,4 then the amplitude of the current,  $I_R$  through it, is independent of the angular frequency  $\omega$  of the applied a.c. voltage  $V_{OB}^{int}$ . Determine how the phase of IR, relative to that of the voltage source, varies with the angular frequency  $\omega$ .



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