

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

CLASS: IMSc
BRANCH: PHYSICS

SEMESTER : IV
SESSION : SP2023

SUBJECT: PH207R1 MATHEMATICAL PHYSICS III

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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|--------|---|-----|-----|-------|
| Q.1(a) | Define analytic functions in a complex plane. Give two examples. | [2] | CO1 | BL1,2 |
| Q.1(b) | Derive Cauchy Riemann relations. State it's properties. | [3] | CO1 | BL1 |
| Q.2(a) | Explain multivalued function with two examples. | [2] | CO1 | BL1,2 |
| Q.2(b) | How to make the following function $f(z) = (1 - z^2)^{\frac{1}{2}}$ single valued using branch cuts. | [3] | CO1 | BL3 |
| Q.3(a) | Find the singularities of the function $f(z) = \tanh z$. | [2] | CO1 | BL3 |
| Q.3(b) | Show that, if a is a positive real constant, the function $\exp(iaz^2)$ is analytic and $\rightarrow 0$ as $ z \rightarrow \infty$ for $0 < \arg z \leq \pi/4$. | [3] | CO1 | BL3 |
| Q.4(a) | What is a residue of a function. State the Cauchy's residue theorem. | [2] | CO2 | BL1 |
| Q.4(b) | By applying Cauchy's theorem to a suitable contour prove that $\int_0^{\infty} \cos(ax^2) dx = \sqrt{\frac{\pi}{8a}}$ | [3] | CO2 | BL2,3 |
| Q.5(a) | What are the properties a conformal transformation. Give one example. | [2] | CO2 | BL1,2 |
| Q.5(b) | Find the principal value of $\int_{-\infty}^{\infty} \frac{\cos mx}{(x-a)} dx$ for real a and $m > 0$. | [3] | CO2 | BL3 |

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