**Module 3: Complex Variables I**

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| **Q.No** | **Question** |
| 1. | 1. If is analytic, then prove that Cauchy- Riemann equations are true. 2. If is analytic, then prove that Cauchy- Riemann equations in polar form are true. |
| 2. | 1. Prove that the real and imaginary part of an analytic functions are harmonic in Cartesian form. 2. If Show that are harmonic functions but is not analytic. |
| 3. | 1. If , and then show that the curve and are orthogonal but is not an analytic function. 2. Show that is analytic. Hence find its derivative. |
| 4. | 1. Show that the function is analytic and hence find its derivative. 2. Show that is analytic and hence find . |
| 5. | 1. Show that the function is analytic and hence find its derivative. 2. Find the analytic function , where u + |
| 6. | 1. Find the analytic function whose real part is . 2. Find the analytic function , where . |
| 7. | 1. Find the analytic function , where . 2. Find the analytic function , where . |
| 8. | 1. Find the analytic function , where 2. Find the analytic function , where . |
| 9. | 1. Find the analytic function , where . 2. Show that is harmonic and find its harmonic conjugate and also find the corresponding analytic function. |
| 10. | 1. Show that () is harmonic and find its harmonic conjugate. 2. Show that is harmonic and find its harmonic conjugate and also find the corresponding analytic function. |
| 11. | 1. Show that is harmonic and find its harmonic conjugate and also find the corresponding analytic function. 2. Show that is harmonic and find its harmonic conjugate. |
| 12. | 1. Show that is harmonic and find its harmonic conjugate. 2. Show that is harmonic and find its harmonic conjugate. |
| 13. | 1. Show that is harmonic and find its harmonic conjugate and also find the corresponding analytic function. 2. If are harmonic functions show that is analytic. |
| 14. | 1. If is analytic , then show that . 2. If is analytic , then show that . |
| 15. | 1. If is a differentiable function and is a regular function, show that 2. Find the analytic function if . |
| 16. | 1. Find the analytic function if 2. Find the analytic function as a function of gives the sum of its real and imaginary part is. |
| 17. | 1. Find the analytic function if 2. Find the analytic function if |
| 18. | 1. Discuss the conformal transformation. 2. Obtain the image of the region bounded by the lines x=1 , y=1 , x=2 , y =2 under |
| 19. | 1. Find the images of lines parallel to x-axis and lines parallel to y-axis under the transformation. 2. Find the transformation of under . |
| 20. | 1. Find the images of the circles and under the conformal transformation and sketch the region. 2. Discuss the conformal transformation. |