



University School of Automation and Robotics  
GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY  
East Delhi Campus, Surajmal Vihar  
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<http://ipu.ac.in/eastcampusmain.php>

Subject Name: Engineering Mathematics-II  
Subject Code: BS106

Max Marks: 30  
Duration: 1hr

Mid Term 2<sup>nd</sup> Semester Examination June 2022

**Section –A (One compulsory question carrying 10 marks)**

1. (a.)  $f(z) = u(x, y) + iv(x, y)$  is an analytic function such that  $v(x, y) = y + 3x^2y - y^3$  then find the conjugate harmonic function  $u(x, y)$  and the analytic function corresponding  $f(z)$ . **(Marks 7)**
- (b.) Consider the complex valued function  $f(z) = \frac{z^2 - 1}{(\sin \pi z)^3}, \forall z \in \mathbb{C}$  and find all the singularities of  $f(z)$  with their Classification (Removable, poles, essential singularities) **(Marks 3)**

**Section –B (This section comprises of 3 questions. Attempt any 2 questions from this section. Every question carries 10 marks.)**

2. (a.) Find the value of the constants  $a, b, c$  such that  $f(z) = x^2 + axy + by^2 + i(x^2 + xy + cy^2)$  is analytic. **(Marks 5)**
- (b.) Evaluate the Integral  $\oint_C \frac{(z-1)dz}{z(z+i)(z+3i)}$ ;  $C: |z+i| = \frac{1}{2}$  **(Marks 5)**
3. (a.) Evaluate  $\int_C (x^2 + iy^3) dz$ ,  $C$ : the straight line path from  $z = 1$  to  $z = 1 + 2i$ . **(Marks 5)**
- (b.) Find the bilinear transformation which maps  $0, 1, \infty$  in  $z$ -plane onto  $-i, 1, i$  in  $w$ -plane. **(Marks 5)**
4. (a.) Evaluate the Integral  $\oint_C \frac{z^2 + 1}{z(2z-1)} dz$ ;  $C: |z| = 1$ . **(Marks 4)**
- (b.) Show that the bilinear transformation  $w = \frac{2z+3}{z-4}$  maps the circle  $x^2 + y^2 - 4x = 0$  into the Straight line  $4u + 3 = 0$  **(Marks 6)**