Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

MAKEUP EXAMINATION-JAN 2023

Course Code: MAT 106

Course Name: Calculus, Differential Equations and Complex Variable

Program : B.Tech – All Programs

Date: 20-JAN-2023

Time: 01.00PM TO 04.00PM

Max Marks: 100

Weightage: 50%

Instructions:

(i) Read all the questions carefully and answer accordingly.

(ii) Scientific and non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries ONE mark. (10Q x 1M = 10M)

1. The complementary factor of $\left(D^2+D-6\right)y=0$ is _____ (C.O.No.2) [Knowledge]
2. The particular integral of $\left(D^2-9\right)y=0$ is _____ (C.O.No.2) [Knowledge]
3. $\frac{dy}{dx}+P.y=Q.y^n$ is called _____ (C.O.No.1) [Knowledge]
4. $\frac{dy}{dx}+P.y=Q$ then I.F = _____ (C.O.No.1) [Knowledge]
5. The integral value of $I=\int_0^1\int_0^y dx\,dy$ _____ (C.O.No.3) [Knowledge]
6. A vector field $\vec{F}$ is said to be solenoidal if _____ (C.O.No.3) [Knowledge]
7. If $f(z)=u+iv$ in polar form is analytic then $\frac{\partial u}{\partial r}$ is_____ (C.O.No.4) [Knowledge]
8. A function u is harmonic if and only if _____ (C.O.No.4) [Knowledge]
9. If $f(z)$ is analytic at all points inside and on a simple closed curve C then by _____ we have $\oint_c f(z)dz=0$ (C.O.No.5) [Knowledge]
10. If $f(z)$ is analytic inside and on a simple closed curve C and if a is any point within C then $f(z)$ = _____ (C.O.No.5) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TEN marks. (5Q x 10M = 50M)

11. Solve $x \log x \frac{dy}{dx} + y = \log x^2$ (C.O.No.1) [Comprehension]

12. Solve $\left(D^2 + 9\right)y = \sin^2 x$ (C.O.No.2) [Comprehension]

13. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y \, dxdy$ (C.O.No.3) [Comprehension]

14. Show that $f\left(z\right) = z^2$ is analytic also find its derivatives. (C.O.No.4) [Comprehension]

15. (a) Evaluate $\oint_c \frac{e^z}{z-2} dz$ over $c : |z| = 3$. (C.O.No.5) [Comprehension]

(b) Evaluate $\oint_c \frac{z^2+1}{z^2-1} dz$ where c is the circle $|z-1| = 1$.

Part C [Problem Solving Question]

Answer the following Question. It carries TWENTY marks. (2Q x 20M = 40M)

16. (a) Solve $x \frac{dy}{dx} + y = x^3 y^6$ (C.O.No.1) [Application]

(b) Solve $y'' + y = \sec x$ by the method of variation of parameter. (C.O.No.2) [Application]

17. (a) Show that $\vec{F} = \frac{x\vec{i} + y\vec{j}}{x^2 + y^2}$ is both solenoidal and irrotational (C.O.No.3) [Application]

(b) Show that $v = r^2 \cos 2\theta - r \cos \theta + 2$ is harmonic and its conjugate (C.O.No.4) [Application]