QP CODE: 24020653

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR EXAMINATIONS, APRIL 2024

Fourth Semester

Complementary Course - MM4CMT01 - MATHEMATICS - FOURIER SERIES, LAPLACE TRANSFORM AND COMPLEX ANALYSIS

(Common for B.Sc Chemistry Model I, B.Sc Chemistry Model II Industrial Chemistry, B.Sc Chemistry Model III Petrochemicals, B.Sc Electronics and Computer Maintenance Model III, B.Sc Food Science & Quality Control Model III, B.Sc Geology and Water Management Model III, B.Sc Geology Model I, B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications, B.Sc Physics Model III Electronic Equipment Maintenance)

2017 Admission Onwards

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Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*
*Each question carries **2** marks.*

1. Define the fourier Sine series.
2. Define a power series with examples.
3. Define Laplace transform of a function.
4. Find the $\mathscr{L}^{-1}\left(\frac{1}{s^2+25}\right)$.
5. Write $\mathscr{L}\{\frac{f(t)}{t}\}$ in terms of an integral.
6. Find the real and imaginary parts of $z_1 z_2$ where $z_1 = 8 - 3i$ and $z_2 = 9 + 2i$.
7. Find the value of i^{16}.
8. Evaluate $(cos\frac{\pi}{9} + isin\frac{\pi}{9})^9$.
9. Define the natural logarithm $ln(z)$ of a complex number z.
10. What is the parametric representation of a circle with centre origin and radius unity in the complex plane?
11. State Cauchy's integral formula.
12. State Cauchy's inequality.

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Find the fourier series expansion of $f(x) = \begin{cases} a & 0 < x < \frac{\pi}{2} \\ 0 & \frac{\pi}{2} < x < \frac{3\pi}{2} \\ a & \frac{3\pi}{2} < x < 2\pi \end{cases}$ where $f(x + 2\pi) = f(x)$

14. Find fourier series of $f(t) = 1 - t^2, -1 < t < 1$ with period $2L = 2$.

15. Find $\mathscr{L}(\cos at)$ and $\mathscr{L}(\sin at)$ using linearity property of Laplace Transforms.

16. Solve using Laplace transforms $y'' + 5y' + 6y = 0$ with $y(0) = 0$ and $y'(0) = 1$.

17. Find all the roots of $\sqrt[3]{1+i}$.

18. Check the analyticity of the function $f(z) = e^x(cosy + isiny)$.

19. Prove that $|sinz|^2 = sin^2x + sinh^2y$.

20. Evaluate $\int_C z^2 dz$, C is any curve joining 0 to 1+i.

21. Apply Cauchy's integral theorem to show that the integral of f(z) = tanz is zero, over the curve C :|z| =1.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. Write the Ledendre's equation and then derive its solution by power series method. Also differentiate between Legendre polynomials and Legender functions.

23. Evaluate (a) $\mathscr{L}^{-1}\{\frac{s-a}{s(s+a)}\}$ (b) $\mathscr{L}^{-1}\{\frac{s+1}{s^2(s^2+1)}\}$ (c) $\mathscr{L}^{-1}\{\frac{s-2}{s^2(s^2+4)}\}$

24. Check whether $v = -e^{-x}siny$ is harmonic or not. If YES, find a corresponding analytic function.

25. Integrate the function $\frac{z^2}{(2z-1)^3}$ in counter clockwise sense around the circle |z| =1.

(2×15=30)