QP CODE: 26019760

26019760

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) IMPROVEMENT/ REAPPEARANCE / MERCY CHANCE EXAMINATIONS, APRIL 2026

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

92B70674

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Write the general form of fourier series expansion of a function $f(x)$ with period $2L$?
2. Define a power series with examples
3. Find $\mathscr{L}(e^{at})$
4. State the shifting property of Laplace Transform.
5. Write $\mathscr{L}\{t^3 f(t)\}$ using a derivative of $\mathscr{L}\{f(t)\}$
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 real and imaginary parts of $\frac{1}{z}$ where $z = 4 - 5i$.
8. Represent $z = -2 + 2i$ in the polar form.
9. Define the principal value $L_n(z)$ of the natural logaritm of a complex number z.
10. Define simple closed contour.
11. What is principle of deformation of path?
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 $f(x) = \begin{cases} x & 0 < x < \frac{\pi}{2} \\ \pi\text{-}x & \frac{\pi}{2} < x < \frac{3\pi}{2} \\ \pi\text{-}2x & \frac{3\pi}{2} < x < 2\pi \end{cases}$ where $f(x + 2\pi) = f(x)$

14. Define Legendre polynomials. How is it different from Legendre functions?

15. Evaluate $\mathcal{L}^{-1}\{\frac{s-a}{s^2(s+a)}\}$

16. Solve $y'' + 4y = 0$ given $y(0) = 2$ and $y'(0) = -8$, applying Laplace transforms.

17. Solve the equation $z^4 + 4 = 0$.

18. Check the analyticity of $\frac{i}{z^5}$.

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

20. Find an upper bound for the absolute value of the integral $\int_C z^2 dz$, where C is the straight line segment from 0 to 3+ 4i.

21. Evaluate $\oint_C \frac{z^4 - 3z^2 + 6}{(z+i)^3} dz$, C is the circle |z| = 3/2.

(6×5=30)

Part C

*Answer any **two** questions.*

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

22. (a.) Find the fourier series expansion of $f(x) = \begin{cases} x(\pi - x) & 0 < x < \pi \\ -\pi(\pi - x) & \pi < x < 2\pi \end{cases}$ with $f(x + 2\pi) = f(x)$

(b.) Find the fourier series expansion of $f(x) = \begin{cases} 1 & \frac{-\pi}{2} < x < \frac{\pi}{2} \\ 0 & \frac{\pi}{2} < x < \frac{3\pi}{2} \end{cases}$ with $f(x + 2\pi) = f(x)$

23. Find (a) $\mathcal{L}^{-1}(\frac{4s+1}{s^2-16})$

(b) $\mathcal{L}^{-1}\{\frac{4}{(s+1)(s+2)}\}$

24. Verify that $u = x^2 - y^2 - y$ is harmonic or not in the entire complex plane and find a conjugate harmonic function v of u. Also find the corresponding analytic function $f(z)$.

25. Evaluate $\oint_C \frac{z^2 - \frac{1}{3}}{z^3 - z} dz$ where C is the circle |x- 1/2| =1 oriented in the counter clockwse direction.

(2×15=30)