Reg. No.. Name.. **19U437**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH/APRIL 2019

SEMESTER – 4: MATHEMATICS (COMPLEMENTARY COURSE FOR PHYSICS AND CHEMISTRY)

COURSE: 15U4CPMAT04, FOURIER SERIES, DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND ABSTRACT ALGEBRA

(Common for Regular 2017 admission and improvement 2016/ supplementary 2016/2015/2014 admission)

Time: Three Hours Max. Marks: 75

PART A

*Answer **all** questions. Each question carries **1** mark.*

1. Define Fundamental period.
2. Define Fourier Series of a 2L Periodic function $f(x)$
3. Define Rodriques's formula
4. State Newton Raphson formula
5. State intermediate value property.
6. Form the partial differential equation by eliminating the constants for $z = (x + a)(y + b)$
7. Give the direction ratios of the tangent Line L at a point to the curve of intersection of two surfaces F and G
8. Find solution of the differential equation $p - q = 1$
9. Find the order of the cyclic subgroup generated by $3 \in \mathbb{Z}_{18}$
10. Is R a vector space over the field C. Justify? (1 × 10 = 10)

PART B

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

11. Find the half range sine series of $f(x) = x,\ 0 < x < 1$
12. Find the power series solution of $y' = 2xy$
13. Solve the differential equation $x^2y'' + xy' + \left(x^2 - \frac{1}{9}\right)y = 0$
14. Three approximate values of the number $\frac{1}{6}$ are given as 0.20, 0.16, 0.17. Which of these is the best approximation?
15. Using bisection method find a real root between 2 and 4 of the equation $x^3 - 9x + 1 = 0$ correct to three decimal places
16. Explain Aitken's Δ^2-Process
17. Form the partial differential equation by eliminating function from $z = f(\frac{xy}{z})$
18. Obtain the partial differential equation that represent the family of all right circular cones whose axes coincide with positive side of z-axis
19. If $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 1 & 4 & 5 & 6 & 2 \end{pmatrix}$ and $\mu = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 5 & 2 & 4 & 3 & 1 & 6 \end{pmatrix}$ Find $\mu\sigma^2$
20. Show that $\{(1,2,3), (2,3,1), (3,1,2)\}$ is a linearly independent subset of R^3

(2 × 8 = 16)

PART C

*Answer **any five** questions. Each question carries **5** marks.*

21. Find the Fourier series of $f(x) = xsinx$ in $[-\pi, \pi]$ with $f(x) = f(x + 2\pi),\ x\epsilon R$
22. Find the half range sine-series of $f(x) = x(l - x),\ 0 < x < l$
23. Use the method of iteration to determine a real root of the equation $e^{-x} = 10x$, correct to four decimal places
24. Using Newton Raphson Method, find a root of the equation $xsinx + cosx = 0$
25. Form the partial differential equation by eliminating the arbitrary function from $f(x + y + z, x^2 + y^2 + z^2) = 0$
26. Solve the equation $y^2p - xyq = x(z - 2y)$
27. Prove that set $\{a + b\sqrt{2} : a, b \in Z\}$ is a ring with respect to ordinary addition and ordinary multiplication (5 × 5 = 25)

PART D

*Answer **any two** questions. Each question carries **12** marks.*

28. Find the Fourier series of the function $f(x) = \begin{cases} x + x^2 & -\pi < x < \pi \\ \pi^2 & when\ x = \pm\pi \end{cases}$, hence deduce that $1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots = \frac{\pi^2}{6}$
29. Find the real root of the equation $x^3 - 6x^2 + 11x - 6 = 0$ using Quotient Difference method
30. a) Find the integral curves of the equations $\frac{dx}{y+xz} = \frac{dy}{-(x+yz)} = \frac{dz}{x^2-y^2}$

    b) Find the general integral of $px(z - 2y^2) = (z - qy)(z - y^2 - 2x^3)$
31. a) Let G be the set of all real numbers $a \neq 1$. Define the operation * on G by $a * b = a + b + ab$ for all $a, b \in G$. Prove that G is an abelian group under the operation *

    b) Find all subgroups of $\mathbb{Z}_{18}$ and draw the lattice diagram (12 × 2 = 24)

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