TB154405A **Reg. No: ……**

Name: ……

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2017
SEMESTER IV – COMPLEMENTARY COURSE (MATHEMATICS)
MT4CPC04B – FOURIER SERIES, DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND ABSTRACT ALGEBRA
(Common For Physics And Chemistry)

Time: Three Hours **Maximum Marks: 80**

PART A

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

1. Write the Rodrigue's formula for Legendre polynomial.
2. Is $e^{-|x|}$, $-\pi < x < \pi$, an even function or odd function.
3. Evaluate f (1) using Taylor's series for $f(x) = x^3-3x^2+5x-10$.
4. Define a group.
5. Define isomorphism.
6. What are the direction cosines normal to the surface z = f(x, y) at the point (x ,y, z).

(6x1=6)

PART B

II. Answer any seven questions. Each question carries 2 marks.

7. What is the expression for $P_0(x)$, $P_2(x)$ and $P_4(x)$.
8. Write the first four Legendre polynomials.
9. Derive a partial differential equation by eliminating f and g from the relation Z = f (x+ay) + g (x-ay)
10. Define partial differential equation. Write the Lagranges partial differential equation.
11. Find the equation of the tangent to the surface $x^2+y^2+z^2=1$ at the point (1/3, 2/3, -1).
12. Evaluate $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits and find its absolute and relative error.
13. Write the computational steps for false position method.
14. Define permutation of a set.
15. Write any one subgroup of klein 4-group {e, a, b, c}
16. Let * be defined on Q^+ by $a * b = \frac{ab}{2}$. Prove that Q^+ is a group.

(7x2=14)

PART C

III. Answer any five questions. Each question carries 6 marks.

17. Find the fourier series of the function $f(x) = \begin{cases} -1, if\ 0 < x < \frac{\pi}{2} \\ 0, if\ \frac{\pi}{2} < x < 2\pi \end{cases}$
18. Find series solution of the equation $(1-x^2)y''-2xy'+2y=0$.

19. Find the integral curves of $\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}$.
20. Find the general integral of $y^2p - xyq = x(z - 2y)$.
21. Using Newton-Raphson method find a positive real root of $x^3 - 6x + 4 = 0$.
22. Given $f(x) = \sin x$, construct the Taylor series approximations of orders 0 to 4 at $x = \frac{\pi}{3}$ and state their absolute errors.
23. Prove that the subgroup of a cyclic group is cyclic.
24. Write the group table for the 4th dihedral group, D_4.

(5x6=30)

PART D

IV. Answer any two questions. Each question carries 15 marks.

25. (i)State and prove Cayley's theorem.
    (ii)Show that the set of all complex numbers with usual addition and multiplication is a field.
26. (i) Use method of iteration to find the root of $xe^x = 1$, with an accuracy of 10^{-4}.
    (ii) Find a root of the equation $x^2 - 4x - 10 = 0$ using bisection method.
27. (i)Find the general solution of $px(z-2y^2) = (z-qy)(z^2-y^2-2x^3)$.
    (ii) Solve $\frac{dx}{x+z} = \frac{dy}{y} = \frac{dz}{z+y^2}$
28. Find the Fourier cosine series and Fourier sine series for the function $f(x) = \pi - x$, $0<x<\pi$.

(2x15=30)