TB144430B **Reg. No: ………………….**

Name: ……………………

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION MARCH 2017

(Supplementary – 2014 Admission)

SEMESTER IV - COMPLEMENTARY COURSE (MATHEMATICS)

MAT4FDN - 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. Find the fundamental period of $\cos\frac{2\pi x}{k}$.
2. Check whether the function f(x) = $x^3 sinx$ is odd or even.
3. Write Legendre's equation.
4. Write Rodrigue's formula.
5. If $F = ax^2 + by^2 + cz^2 - 1$ *and* $H = x + y + z - 1$, find $\frac{\partial(F,H)}{\partial(y,z)}$.
6. Obtain the partial differential equation associated with an equation of the form $z = f(x^2 + y^2)$ where the function f is arbitrary.
7. Write the equation of representing set of all spheres whose centers lie on the y- axis .
8. What is meant by relative error.
9. Write Newton Raphson's formula for approximation.
10. Give an example of a cyclic group of order 6.

(10x1=10)

PART B

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

11. Sketch the graph of $|x|$ for $-\pi < x < \pi$.
12. Write Fourier series of odd 2L periodic function f(x) over the interval [-L,L]. Write formula for Fourier coefficients.
13. If n is a positive integer then show that $\Gamma(n + 1) = n!$.
14. Write the first four Legendre polynomials.
15. Solve $y' + y = 0$ *using* power series method.
16. Obtain the partial differential equation that associated with an equation of the form $z = f(x^2 + y^2)$ where the function f is arbitrary.
17. Form the partial differential equation by eliminating the arbitrary function from f(x+y+z , $x^2+y^2+z^2$) = 0.
18. Find the integral curves of the equation $\frac{dx}{xy} = \frac{dy}{yz} = \frac{dz}{zy}$.
19. Form the partial differential equation by eliminating the constants a and b from z = (x+a)(y+b).

20. Find the real root of the equation $x^3 - x - 1 = 0$ using bisection method.
21. Define ring.
22. Find all the orders of subgroups of $\mathbb{Z}_8$.

(8x2=16)

PART C

III. Answer any six questions. Each question carries 4 marks.

23. Find the Fourier series for f(x) = x^2 in $[-\pi, \pi]$ with f(x) = f(x+2π).
24. Find the Fourier series of f(x) = $\begin{cases} 1+x & -1 < x < 0 \\ 1-x & 0 < x < 1 \end{cases}$ with f(x) = f(x+2).
25. Find the integral curves of the equation $\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}$.
26. Find the general integral of the linear partial differential equation
$$y^2\frac{\partial z}{\partial x} - xy\frac{\partial z}{\partial y} = (z-2y)x.$$
27. Find by Newton's method, a root of the equation $x^3 - 6x + 4 = 0$ correct to 3 decimal places.
28. Prove that subgroup of a cyclic group is cyclic.
29. Let n be a positive integer. $\mathbb{R}^n$ is the set of all ordered n-tuples $(x_1, x_2, x_3, \dots x_n)$ where $x_i \in \mathbb{R}$. Show that $\mathbb{R}^n$ is a vector space over $\mathbb{R}$ *where* $\mathbf{x}+\mathbf{y} = (x_1+y_1, x_2+y_2, \dots, x_n+y_n)$, r**x** = $(rx_1, rx_2, \dots, rx_n)$ and **x** = $(x_1, x_2, x_3, \dots x_n)$, y = $(y_1 y_2, y_3, \dots y_n)$.
30. Show that $\mathbb{Z}_n = \{0,1,2,3, \dots n-1\}$ is a cyclic group under addition modulo n.
31. Write the composition table of S_3.

(6x4=24)

PART D

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

32. Obtain Fourier Cosine and sine series of f(x) = $\begin{cases} \frac{2k}{l}x & \text{when } 0 \le x \le \frac{l}{2} \\ \frac{2k}{l}(l-x) & \text{when } \frac{l}{2} \le x \le l \end{cases}$
33. Solve $(1 - x^2)y'' = 2xy$ by using power series.
34. Use iteration method to obtain the root of the equation $x^3 - 2x - 5$ correct to three decimal places.
35. Show that the set of all numbers of the form a +b $\sqrt{2}$, where a and b are rational numbers, with usual addition and multiplication is a field.

(2x15=30)