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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2021

First Degree Programme Under CBCSS

Mathematics

Complementary Course for Statistics

Mathematics III

MM 1331.4 – FOURIER SERIES, NUMERICAL METHODS AND ODE

(2018 Admission)

Time : 3 Hours Max. Marks : 80

PART – A

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

1. Define periodic function.

2. Test whether $f(x) = \sin 3x$ is odd function?

3. What is the value of $f(x)$ at the point of discontinuity?

4. What is the degree of a differential equation?

5. Find the order of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^3 = \left(\frac{d^2y}{dx^2}\right)^2$.

6. Find the integrating factor of $x\frac{dy}{dx} + y\log y = xye^x$

P.T.O.

7. Write down the condition for the differential equation $Mdx + Ndy = 0$.

8. Give the general form of homogeneous linear equation.

9. Is $x^4 + x^3 - 7 = 0$ algebraic equation?

10. Which expression is known as trapezoidal rule?

(10 × 1 = 10 Marks)

PART – B

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

11. Write down at least three Dirichlet's condition for a Fourier series.

12. Find the Fourier coefficient b_n of the function $f(x) = \begin{cases} -k \text{ if } -\pi < x < 0 \\ k \text{ if } 0 < x < \pi \end{cases}$.

13. Write down Fourier Cosine Transforms.

14. Find the Fourier transform of $f(x) = \begin{cases} 1 \text{ for } |x| < a \\ 0 \text{ for } |x| > a \end{cases}$

15. Obtain the differential equation associated with the primitive $Ax^2 + By^2 = 1$.

16. Solve the equation $\frac{dy}{x} = \tan y.dy$.

17. Solve $\frac{dy}{dx} + 3y = 2e^{2x}$.

18. Solve $xp^2 + 4x = 2yp$.

19. Find the complementary function of $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 0$.

20. Find the integrating factor of $x\frac{dy}{dx} + y\log y = xye^x$.

21. Define a transcendental function with two examples.

22. Write short note about Gaussian elimination method for system of linear equations.

(8 × 2 = 16 Marks)

PART – C

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

23. Find the Fourier series of the function $f(x) = \pi - x \ for \ 0 < x < 2\pi$.

24. Find the Fourier series of the function $f(x)$ if $f(x) = \begin{cases} -\pi \ if \ -\pi < x < 0 \\ x \ if \ 0 < x < \pi \end{cases}$.

Deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots\ldots\ldots = \frac{\pi^2}{8}$.

25. Obtain the complex form of the Fourier series of the function

$$f(x) = \begin{cases} 0 \ if - \pi < x \leq 0 \\ 1 \ if \ 0 \leq x < \pi \end{cases}$$

26. Solve $\cos(x + y)dy = dx$.

27. Solve $x^2 dy + y(x + y)dx = 0$.

28. Solve $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$.

29. Find the solution of $(D^2 - 5D + 6)y = e^x \cos 2x$.

30. Use Taylor's series method, solve the equation $\frac{dy}{dx} = -xy, y(0) = 1$.

31. Starting from $x_0 = 3$, find a rot of $x^3 - 3x - 5 = 0$, correct to three decimal place use Newton-Raphson method.

(6 × 4 = 24 Marks)

PART – D

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

32. Obtain the Fourier series of $f(x) = \pi \sin \pi x$ if $0 < x < 1$.

33. Solve the differential equation $(2x + y + 1)dx(4x + 2y - 1)dy = 0$.

34. Solve completely $(D^2 - 4D + 4)y = e^{2x} + x^2 + \cos 2x$.

35. Use Gauss – Seidel method solve the system of equations

$3x + y + z = 1; x + 3y - z = 11; x - 2y + 4y = 21$.

(2 × 15 = 30 Marks)