

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL/MAY 2015

(U.G.-CCSS)

Complementary Course—Mathematics

MM 4C 04—MATHEMATICS

Time : Three Hours

Maximum : 30 Weightage

Unit I

*Answer all twelve questions.*1. Which of the following is not a solution of $y'' - y = 0$?(a) e^x .(b) e^{-x} (c) $e^x + e^{-x}$.(d) $1 + e^x$.2. Find the general solution of $y'' + 9y' + 20y = 0$.3. Write a pair of basis solutions of $x^2 y'' - 4xy' + 6y = 0$.4. If $y_1 = e^{2x}$ and $y_2 = e^{-x}$ find y_3 .5. Find the Laplace transform of $\sin wt$.6. Find $L^{-1} \frac{60 + 6s^2 + s^4}{s^7}$ 7. $f(x) = x^3 + 2x^2$ is an :

(a) Even Function.

(b) Odd function.

(c) Neither even nor odd.

(d) Either even or odd.

8. Write the one dimensional wave equation.

9. Find the smallest period p of $\cos \pi x$.10. Plot the function $f(x) = \sin x$ for $\pi < x < 2\pi$.11. Find a solution of the partial differential equation $u_{xx} - u = 0$.

12. Write the iteration formula for the Picard's methods.

(12 x $\frac{1}{4}$ = 3 weightage)

Turn over

Unit II

Answer any nine questions.

13. Apply $(D + 5)^2$ to $\sin 5x + 5x$.
14. Find the general solution of $y'' + 10y' + 25 = 0$.
15. Find two linearly independent solutions of $x^2 y'' - 2.5x y' - 2 = 0$.
16. Find a particular solution of $y'' - 5y' + 6y = e^x$.
17. Reduce to first order and solve $2xy'' = 3y'$.
18. Find the Laplace transform of $(t + 1)^2 e^t$.
19. If $L[f(x)] = F(s)$ prove that

$$L\left\{x \frac{d}{dx} f(x)\right\} = -s F(s) + f(0).$$

20. Find $L^{-1} \frac{1}{s(1+2s)}$
21. Show that $u = x^2 + y^2$, $f = 4$ satisfies the Poissons equation.
22. Find the solutions of $u_{xx} + u_{yy} = 0$ by separating the variables.
23. Find a_0 in the Fourier series expansion of $f(x) = \begin{cases} 0 & \text{if } -2 < x < -1 \\ k & \text{if } -1 < x < 1. \\ 0 & \text{if } 1 < x < 2 \end{cases}$
24. Find first two approximate solutions $y_1(x)$ and $y_2(x)$ of the initial value problem $y' = x + y$, $y(0) = -1$ using Picard's method.

(9 x 1 = 9 weightage)

Unit III

Answer any five questions.

25. Solve the initial value problem $y'' + 1.5y' - y = 12x^2 - 6x^3 - x^4$, $y(0) = 4$, $y'(0) = 8$.
26. Using method of variation of parameters solve $y'' + y = \sec x$.
27. Find $t * e^t$ where $*$ denotes convolution.
28. Using method of partial fractions find $L^{-1} \left| \frac{s^2 + 9s - 9}{s^2 - 9s} \right|$

29. Using convolution find the inverse Laplace transform of $\frac{1}{s(s^2 + 4)}$.

30. Solve the integral equation $y(t) = t + \int_0^t y(\tau) \sin(t - \tau) d\tau$.

31. Find the Fourier series expansion of $f(x) = x^2$, $-\pi < x < \pi$.

32. Using Simpson's rule with $n = 4$ estimate $\int_0^1 5x^4 dx$.

(5 x 2 = 10 weightage)

Unit IV

Answer any two questions.

33. Solve $x^2 y'' - 4xy' + 6y = 21x^{-4}$

34. Using **Runge-Kutta** method solve the initial value problem
 $y' = x + y$, $y(0) = 0$, $h = 0.2$.

35. Find the Fourier series of $f(x)$ $\left| \begin{array}{ll} 1 & + x), \quad x < 0 \\ 2 & \\ 2 & \pi - x), \quad 0 < x < \pi \end{array} \right.$

(2 x 4 = 8 weightage)