



K20U 1534

Reg. No. :

Name :

V Semester B.Sc. Degree (CBCSS-Reg./Sup./Imp.) Examination,
November 2020

(2014 Admn. Onwards)

CORE COURSE IN MATHEMATICS

5B07 MAT : Differential Equations, Laplace Transform and Fourier Series

Time : 3 Hours

Max. Marks : 48

PART - A

Answer all 4 questions :

(4x1=4)

1. Why the differential equation $y' + x^2y = \frac{1}{y}$ is linear ? Justify.
2. Find the Wronskian of $y_1 = e^{2t}$, $y_2 = e^{-3t}$.
3. Define Unit step function.
4. Show that the sum of two even functions is even.

PART - B

Answer any 8 questions :

(8x2=16)

5. Solve the differential equation $y' = (1+x)(1+y^2)$.
6. Check whether the equation $\cos(x+y)dx + (3y^2 + 2y + \cos(x+y))dy = 0$ is exact.
7. Solve the differential equation $y'' - 6y' + 9y = 0$.
8. Find a particular solution of $y'' - 2y' - 3y = 3e^{2t}$.
9. Find the general solution of $(D^2 + 3I)y = 0$, where D is the differential operator.

P.T.O.



10. Find the Laplace transform of the function $f(t) = \begin{cases} 2, & 0 < t < \pi \\ 0, & \pi < t < \infty \end{cases}$.
11. Find $L(te^{-t} \sin 3t)$.
12. Find the inverse Laplace transform of the function $\frac{1}{s(s^2 + \omega^2)}$.
13. Sketch the graph of the function $f(x) = |x|$ if $-2 \leq x \leq 2$ and $f(x+4) = f(x)$.
14. If f and g are periodic functions with same period T , show that any linear combinations of f and g is also T -periodic.

PART – C

Answer any 4 questions :

(4×4=16)

15. Solve the differential equation $xy' + y = xy^3$.
16. Given that Y_1 and Y_2 are solutions of the equation $y'' + p(t)y' + q(t)y = 0$. Prove that for any two constants c_1 and c_2 , the linear combination $c_1Y_1 + c_2Y_2$ is also a solution for the differential equation.
17. Find the general solution of $t^2y'' - 4ty' + 6y = 0$, $t > 0$.
18. Assuming the required conditions, prove that $L[f'(t)] = sL[f(t)] - f(0)$.
19. Find the Fourier cosine series expansion of $f(x) = 2 - x$ when $0 \leq x \leq 2$ with period 4.
20. Find the Fourier integral representation of the function $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$.

PART – D

Answer any 2 questions :

(2×6=12)

21. Find the orthogonal trajectories of the families of curves $\frac{1}{2}x^2 + y^2 = c$.
22. By method of variation of parameters, solve the differential equation, $y'' - 5y' + 6y = 2e^t$.
23. State and prove convolution theorem for Laplace transform.
24. Find the Fourier series of the function $f(x) = x + \pi$ if $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$.