



K18U 1903



Reg. No. :

Name :

III Semester B.Sc. Degree (CBCSS – Reg./Sup./Imp.)
Examination, November 2018
(2014 Admn. Onwards)
COMPLEMENTARY COURSE IN MATHEMATICS
3C03 MAT-ST : Mathematics for Statistics – III

Time : 3 Hours

Max. Marks : 40

SECTION – A

All the first 4 questions are compulsory. They carry 1 mark each.

1. Solve : $y' = x^2\sqrt{y}$, $y(0) = 1$.
2. Find $W(e^{-2t}, te^{-2t})$.
3. Find the Laplace transform of $\cos 2\pi t$.
4. Give the two-dimensional wave equation.

SECTION – B

Answer **any 7** questions from among the questions **5 to 13**. These questions carry **2 marks each**.

5. Find the orthogonal trajectory of the family of curves $x = c\sqrt{y}$.
6. Find the general solution to $x^3y' + 3x^2y = 5 \sin h 10x$.
7. Solve : $(2x + 1/y - y/x^2)dx + (2y + 1/x - x/y^2) dy = 0$.
8. Determine whether the equation, $3y'' + 2y' + y = x^5$ is linear or nonlinear. If it is linear, write it in standard form and state whether it is homogeneous or nonhomogeneous.

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9. Find the inverse Laplace transform of $\frac{\pi}{(s+\pi)^2}$.
10. Find $\mathcal{L}(f)$ if $f(t)$ equals $\cos^2 \pi t$.
11. Find the Fourier series of the following function which is assumed to have the period 2π .
- $$f(x) = \begin{cases} 0 & \text{if } -\pi < x \leq -\pi/2 \\ x & \text{if } -\pi/2 < x \leq \pi/2 \\ 0 & \text{if } \pi/2 < x \leq \pi \end{cases}$$
12. Solve for $u = u(x, y) : u_{yy} + 16u = 0$.
13. Show that $u = \cos x \sin y$ satisfies the Poisson equation with $f = -2 \cos x \sin y$.

SECTION - C

Answer **any 4** questions from among the questions **14 to 19**. These questions carry **3** marks **each**.

14. Solve by reducing to separable form, $2xy y' = y^2 - x^2$.
15. Solve the initial value problem :
 $y'' - 2y' = 12e^{2x} - 8e^{-2x}, y(0) = -2, y'(0) = 12$.
16. Solve : $y'' + 2y' + 2y = 0, y(0) = 1, y'(0) = -1$.
17. Using Laplace transform, solve : $y(t) + 2 \int_0^t y(\tau) \cos(t-\tau) d\tau = \cos t$.
18. Find the Fourier series of the function f of period 4 where
- $$f(x) = \begin{cases} 0 & \text{if } -2 < x < 0 \\ x & \text{if } 0 < x < 2 \end{cases}$$
19. Find the type, transform to normal form and solve : $xu_{xy} - yu_{yy} = 0$.



SECTION - D

Answer **any 2** questions from among the questions **20 to 23**. These questions carry **5** marks **each**.

20. If in a population of bacteria the birth rate and death rate are proportional to the number of individuals present, what is the population as a function of time ?
21. Solve $(x^2 D^2 + xD - \frac{1}{4}I)y = 3x^{-1} + 3x$ by variation of parameters.
22. Applying Laplace transform, solve the following system.
- $$y_1' = -\frac{8}{100}y_1 + \frac{2}{100}y_2 + 6, \quad y_1(0) = 0,$$
- $$y_2' = \frac{8}{100}y_1 - \frac{8}{100}y_2, \quad y_2(0) = 150.$$
23. Find (a) the Fourier cosine series and (b) the Fourier sine series of the function f defined by

$$f(x) = \begin{cases} 1 & \text{if } 0 < x < 1 \\ 2 & \text{if } 1 < x < 2 \end{cases}$$