



K18U 1901

Reg. No. :

Name :

III Semester B.Sc. Degree (CBCSS-Reg./Sup./Imp.) Examination,
November 2018

(2014 Admn. Onwards)

Complementary Course in Mathematics

3C03MAT-PH : MATHEMATICS FOR PHYSICS AND ELECTRONICS – III

Time : 3 Hours

Max. Marks : 40

SECTION – A

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

1. Find the particular solution of $y' = 5$; given that when $x = 0$, $y = 2$.
2. Give the standard form of a second-order linear ODE.
3. What is the Laplace transform of $\sin \omega t$?
4. Give the two-dimensional Laplace equation. (4×1=4)

SECTION – B

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

5. Test for exactness and solve : $(x - y) (dx - dy) = 0$.
6. Find the general solution to $y' = 4y + x$.
7. Find the orthogonal trajectories of the family of curves, $y = ce^{-3x}$.
8. Reduce to first order and solve : $yy'' = 4(y')^2$.
9. Find the Laplace transform of $\frac{15}{s^2 + 4s + 29}$.
10. Solve the initial value problem $y'' - y' - 6y = 0$, $y(0) = 6$, $y'(0) = 13$, by Laplace transform.

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11. Find the Fourier series of the following function which is assumed to have the period 2π .

$$f(x) = \begin{cases} -4x & \text{if } -\pi < x < 0 \\ 4x & \text{if } 0 < x < \pi \end{cases}$$

12. Solve the equation $u_x = 1$ subject to the initial condition $u(0, y) = y$.

13. Find the general solution to the PDE, $u_{yy} - u = 0$. (7×2=14)

SECTION - C

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

14. Solve the initial value problem : $y' - 3y = -12y^2$, $y(0) = 2$.

15. Find a basis of solutions of the ODE $(x^2 - x)y'' - xy' + y = 0$.

16. Solve the following initial value problem by the method of undetermined coefficients.

$$y'' + y = 0.001x^2, y(0) = 0, y'(0) = 1.5.$$

17. Using the convolution theorem, solve :

$$y'' + 5y' + 4y = 2e^{-2t}, y(0) = 0, y'(0) = 0.$$

18. Find the Fourier series of the function f of period 1 where $f(x) = \cos \pi x$; $-\frac{1}{2} < x < \frac{1}{2}$.

19. Find the type, transform to normal form and solve : $u_{xx} - 2u_{xy} + u_{yy} = 0$. (4×3=12)

SECTION - D

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

20. The time rate of change of a rabbit population P is proportional to the square root of P . At time $t = 0$ (months) the population numbers 100 rabbits and is increasing at the rate of 20 rabbits per month. How many rabbits will there be one year later ?

21. Solve $y'' + y = \sec x$ by variation of parameters.

22. Applying Laplace transform, solve the following system.

$$y_1' = 6y_1 + y_2, \quad y_1(0) = -3$$

$$y_2' = 9y_1 + 6y_2, \quad y_2(0) = -3.$$

23. Find (a) the Fourier cosine series and (b) the Fourier sine series of the function, $f(x) = x$; $0 < x < L$. (5×2=10)