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 $\dfrac{15}{s^2+4s+29}$.

10. Solve the initial value problem $y'' - y' - 6y = 0$, $y(0) = 6$, $y'(0) = 13$, by Laplace transform.

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 $f(x) = \cos \pi x$; $-\dfrac{1}{2} < x < \dfrac{1}{2}$.

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.

    $y'_1 = 6y_1 + y_2 \qquad y_1(0) = -3$

    $y'_2 = 9y_1 + 6y_2 \qquad y_2(0) = -3$

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)