

K15U 0279

Reg. No. :

Name :

Third Semester B.Sc. Degree (CCSS – 2014 Admn. – Regular)
Examination, November 2015
Complementary Course in Mathematics for Physics/Electronics
3C03 MAT-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. Solve : $y' = -\sin \pi x$.
2. When do we say a second-order ODE is linear ?
3. Give the Laplace transform of $\cosh at$.
4. Write the one-dimensional wave equation.

SECTION – B

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

5. Solve : $\cos(x+y) dx + (3y^2 + 2y + \cos(x+y)) dy = 0$.
6. Solve the initial value problem, $y' + y \tan x = \sin 2x$; $y(0) = 1$.
7. Find the orthogonal trajectories of the family of parabolas, $y = cx^2$.
8. Solve : $x^2 y'' + \frac{3}{2} xy' - \frac{1}{2} y = 0$
9. If $H(s) = \frac{1}{s(s-a)}$, find $h(t)$.

P.T.O.



10. Find the inverse transform of $\frac{3s+1}{(s-1)(s^2+1)}$.

11. Solve for $u = u(x, y) : u_y + u = e^{xy}$.

12. Find the Fourier series of the function $f(x) = x + \pi$ if $-\pi < x < \pi$ and

$$f(x + 2\pi) = f(x).$$

13. Show that $u = \arctan(y/x)$ is a solution to the two-dimensional Laplace equation.

SECTION - C

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

14. Find an integrating factor and solve, $(e^{x+y} + ye^y) dx + (xe^y - 1) dy = 0, y(0) = -1$.

15. Solve the initial value problem, $y'' + 4y = 16 \cos 2x; y(0) = 0, y'(0) = 0$.

16. Reduce to first order and solve, $yy'' = 4y'^2$.

17. Solve the initial value problem $y'' - y = t; y(0) = 1, y'(0) = 1$, using Laplace transforms.

18. Find the Fourier series of the 2π -periodic function f defined by

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

Deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots = \frac{\pi}{4}$.

19. Find the type, transform to normal form and solve : $u_{xy} - u_{yy} = 0$.



SECTION - D

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

20. Suppose that in Winter the daytime temperature in a certain office building is maintained at 70°F . The heating is shut off at 10 pm and turned on again at 6 am. On a certain day the temperature inside the building at 2 am was found to be 65°F . The outside temperature was 50°F at 10 pm and had dropped to 40°F by 6 am. What was the temperature inside the building when the heat was turned on at 6 am ?

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

22. Applying Laplace transform, solve the following system.

$$y_1' = 3y_1 - 3y_2 + 2 \quad y_1(0) = 1,$$

$$y_2' = -6y_1 - t \quad y_2(0) = -1.$$

23. Find the two half-range expansions of the function f defined by

$$f(x) = \begin{cases} \frac{2K}{L}x & \text{if } 0 < x < \frac{L}{2} \\ \frac{2k}{L}(L-x) & \text{if } \frac{L}{2} < x < L. \end{cases}$$