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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 : $x^2y'' + \frac{3}{2}xy' - \frac{1}{2}y = 0$
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 $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots = \frac{\pi}{4}$.

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.

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

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

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

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