

Reg. No. :

Name :

Third Semester B.Sc. Degree (CBCSS – Reg./Sup./Imp.)
Examination, November 2017
(2014 Admn. Onwards)

COMPLEMENTARY COURSE IN MATHEMATICS
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. Find the particular solution for the differential equation $dy + 7x dx = 0$; given that $y(0) = 3$.
2. Find the Wronskian of y_1 and y_2 where $y_1(t) = e^{3t}$ and $y_2(t) = te^{3t}$.
3. What is the Laplace transform of $\cos \omega t$?
4. Find the fundamental period of $\cos 2x$. **(4×1=4)**

SECTION – B

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

5. Verify that the given differential equation is exact; then solve it.

$$\frac{1}{x} \sin y dx + (\ln x \cos y + y) dy = 0.$$

6. Find the orthogonal trajectories of the family of curves, $xy = c$.
7. Solve : $y' + y \sec x = \tan x$.
8. Solve the initial value problem :
 $y'' + 2y' + 2y = 0, y(0) = 1, y'(0) = -1$.
9. Find the inverse transform of $\frac{3s - 137}{s^2 + 2s + 401}$.
10. If $f(t) = t \sin \omega t$, show that $L(f'') = s^2 L(f)$. Deduce that $L(f) = \frac{2\omega s}{(s^2 + \omega^2)^2}$.



11. Find the Fourier series of $f(x) = x^2$; $-\pi < x < \pi$, which is assumed to have the period 2π .
12. Find the first order PDE, by eliminating the arbitrary constants a and b , satisfied by u where $u(x, y) = ax + by$.
13. Show that $u(x, y) = e^{-y} f(x - y)$ is the general solution of $u_x + u_y + u = 0$. (7x2=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 : $y' - y = 2xe^{2x}$, $y(1) = 0$.
15. State the fundamental theorem for the homogeneous linear ODE. Show by examples that the theorem does not hold for nonhomogeneous linear and nonlinear ODEs.
16. Solve by the method of variation of parameters, $2y'' + 2y = \sec x$.
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 function f of period 2 where $f(x) = \pi x^3 / 2$; $-1 < x < 1$.
19. Find the type, transform to normal form and solve : $u_{xy} - u_{yy} = 0$. (4x3=12)

SECTION - D

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

20. Find an integrating factor and solve, $(e^{x+y} + ye^y) dx + (xe^y - 1) dy = 0$, $y(0) = -1$.
21. Solve the initial value problem :
 $y'' + 2y' + 5y = e^{0.5x} + 40 \cos 10x - 190 \sin 10x$, $y(0) = 0.16$, $y'(0) = 40.08$.
22. Applying Laplace transform, solve the following system :
 $y_1' = -4y_1 - 2y_2 + t$ $y_1(0) = 5.75$,
 $y_2' = 3y_1 + y_2 - t$ $y_2(0) = -6.75$.
23. Find :
 a) the Fourier cosine series and
 b) the Fourier sine series of the function $f(x) = x$; $0 < x < \frac{1}{2}$. (2x5=10)