Reg. No. : ....

Name : ....

**Third Semester B.Sc. Degree (CBCSS – Reg./Supple./Imp.)
Examination, November 2016
(2014 Admn. Onwards)
COMPLEMENTARY COURSE IN MATHEMATICS FOR CHEMISTRY
3C03 MAT-CH : Mathematics for Chemistry – III**

Time : 3 Hours

Max. Marks : 40

SECTION – A

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

1. Express the ODE $x^{-3}y' - 4y^2 = 0$ (where $x \neq 0$) in the explicit form.

2. Find a general solution to the differential equation, $y'' + 9\pi^2 y = 0$.

3. Give the Laplace transform of $\sin at$.

4. Write the three-dimensional Laplace equation.

$(4 \times 1 = 4)$

SECTION – B

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

5. Solve : $2xyy' = y^2 - x^2$.

6. Solve the linear ODE, $y' - y = e^{2x}$.

7. Find the orthogonal trajectories of the family of curves, $x^2 y = c$.

8. Reduce to first order and solve : $y'' + y'^3 \sin y = 0$.

P.T.O.
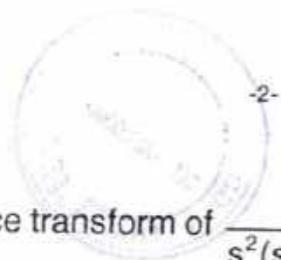
9. Find the inverse Laplace transform of $\dfrac{1}{s^2(s^2 + \omega^2)}$.

10. Find the Laplace transform of $\dfrac{15}{s^2 + 4s + 29}$.

11. Solve for $u = u(x, y) : y^2 u_{yy} + 2y u_y - 2u = 0$.

12. Show that $u = \sin 8x \cos 2t$ is a solution to the one-dimensional wave equation.

13. Solve : $U_{xx} = 0,\ u_{xy} = 0$.

$(7 \times 2 = 14)$

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,

$(y + xy^3)dx + 2(x^2y^2 + x + y^4)\, dy = 0$.

15. Solve by variation of parameters,

$x^2 y'' - 2xy' + 2y = x^3 \cos x$.

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

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

17. Using convolution theorem, solve :

$y'' + 4y = \sin 3t,\ y(0) = 0,\ y'(0) = 0$.

18. Find the Fourier series of $f(x) = 1 - x^2$ in the interval $(-1, 1)$.

19. Find the type, transform to normal form and solve :

$u_{xx} + 2u_{xy} + u_{yy} = 0$.

$(4 \times 3 = 12)$

SECTION – D

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

20. A tank contains 800 gal of water in which 200 lb of salt is dissolved. Two gallons of fresh water runs in per minute and 2 gal of the mixture in the tank, kept uniform by stirring, runs out per minute. How much salt is left in the tank after 5 hours ?

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. Solve by applying Laplace transforms :

$y'' + y = 2t,\ y\left(\dfrac{1}{4}\pi\right) = \dfrac{1}{2}\pi,\ y'\left(\dfrac{1}{4}\pi\right) = 2 - \sqrt{2}$.

23. Find :

a) The Fourier cosine series and

b) The Fourier sine series of the function,

$f(x) = \begin{cases} 1 & 0 < x < 1 \\ 2 & 1 < x < 2 \end{cases}$.

$(2 \times 5 = 10)$