Reg. No. : ....

Name : ....

**III Semester B.Sc.(Hon's) (Mathematics) Degree (Reg./Supple./Improv.)
Examination, November 2020
(2016 Admission Onwards)
BHM – 303 : ORDINARY DIFFERENTIAL EQUATIONS**

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **any 4** questions out of 5 questions. **Each** question carries **1** mark.

1. What do you mean by order of a differential equation ?

2. Verify that $y = x^2$ is a solution of $xy' = 2y$ for all x.

3. Give an example for a second order non linear ordinary differential equation.

4. What is the auxiliary equation of $x^2y'' + axy' + by = 0$?

5. Write fourth order Runge-Kutta formula for solving ordinary differential equation.

(4×1=4)

SECTION – B

Answer **any 6** questions out of 9 questions. **Each** question carries **2** marks.

6. Solve the differential equation $y' = 1 + y^2$.

7. Solve the differential equation $y' = (y + 4x)^2$ using the substitution $y + 4x = u$.

8. Solve the differential equation $y' + 2y = e^x (3 \sin 2x + 2 \cos 2x)$.

9. Solve $y'' + y' - 2y = 0$.

10. Solve $x^2y'' - 3xy' + 4y = 0$.

11. Check whether e^x and xe^x are linearly dependent or not.

12. State existence and uniqueness theorem for initial value problem.

13. What do you mean by a boundary value problem ? Give an example.

14. Using Euler's method find $y(0.02)$, given that $y' = -y$, $y(0) = 1$ (Take $h = 0.01$).

(6×2=12)

P.T.O.

SECTION – C

Answer **any 8** questions out of 12 questions. **Each** question carries **4** marks.

15. Solve the Bernoulli's equation $y' - Ay = - By^2$, A and B are positive constants.

16. Solve $(2x - 4y + 5)y' + (x - 2y + 3) = 0$.

17. Find the orthogonal trajectories of the family of curves $xy = c$.

18. Solve the differential equation $e^x y' = 2(x + 1)y^2$, $y(0) = \dfrac{1}{6}$.

19. Using the method of variation of parameters, solve $y'' + y = \tan x$.

20. Solve $y'' - 4y' + 4y = \sin 2x$.

21. Solve $y'' + y = \sinh 2x$.

22. Solve $y''' - y'' - 3y' + y = 0$, $y(0) = 2$, $y'(0) = 1$, $y''(0) = 0$.

23. Solve $x^3 y''' - 3x^2 y'' + 6xy' - 6y = x^4 \ln x$, $x > 0$.

24. Using Taylor's series method, find y when $x = 0.1$ for the differential equations :
    $y' = x^2 y - 1$, $y(0) = 1$.

25. Using Picards method solve the equation $y' = x + y^2$, $y(0) = 1$.

26. Using modified Euler's method, find $y(0.1)$ for the differential equations :
    $\dfrac{dy}{dx} = x + y$, $y(0) = 1$. $\hspace{4cm}$ **(8×4=32)**

SECTION – D

Answer **any 2** questions out of 4 questions. **Each** question carries **6** marks.

27. Solve $y''' + 3y'' + 3y' + y = 30e^{-x}$, $y(0) = 3$, $y'(0) = - 3$, $y''(0) = - 47$.

28. Find a general solution of the non-homogeneous linear system :

$$y' = Ay + g = \begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix} y + \begin{bmatrix} -6 \\ 2 \end{bmatrix} e^{-2t}$$

29. Solve the differential equation $y'' + 2y' + 4y = e^{-2x} + \sin 3x + x^2$.

30. Using Runge-Kutta's fourth order formula, find $y(0.1)$ and $y(0.2)$ for the differential
    equations : $\dfrac{dy}{dx} = x + y^2$, $y(0) = 1$. $\hspace{2cm}$ **(2×6=12)**

_____