K16U 2583

Reg. No. : ....

Name : ....

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

Time : 3 Hours Max. Marks : 80

Answer **all** the **ten** questions. **(10x1=10)**

1. Solve $y' = y^2e^{-x}$.
2. Examine whether the differential equation 2 sin $(y^2)dx + xy\cos(y^2)dy = 0$ is exact.
3. Give the general solution of $y'' + 2y' + 6y = 0$.
4. If $y_1 = e^x$, $y_2 = xe^x$ are solution of $y'' - 2y' + y = 0$, find their Wronskian.
5. Give the solution of the linear equation $\frac{dy}{dx} + P(x)y = Q(x)$, where P(x) and Q(x) are the variable functions in x.
6. Define an integrating factor of a differential equation.
7. State the formula in Euler's method for solving the initial value problem $\frac{dy}{dx} = f(x, y),\ y(x_0) = y_0$.
8. If the characteristic equation of the differential equation $y'' + ay' + by = 0$ has complex roots, write the general solution.
9. Obtain the auxiliary equation of the Euler-Cauchy equation $x^2y'' + axy' + by = 0$.
10. State Adams-Bashforth predictor formula for solving $y' = f(x, y),\ y(x_0) = y_0$.

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Answer **any ten** short answer questions out of 14. **(10×3=30)**

11. Solve : $y' = {}^{-y}\!/_{x}$, $y(1) = 1$.
12. Find a value of α for which the equation $2xy^3 - 3y - (3x + \alpha x^2y^2 - 2\alpha y)y' = 0$ is exact.
13. Find the orthogonal trajectory of $xy = c$.
14. Solve $(4xy + 2x)\,dx + (2x^2 + 3y^2)dy = 0$.
15. Show that $y = x^2$ and $y = 1$ are solutions of the equation $y''y - xy' = 0$, where as their sum is not a solution.
16. Solve $y' - \frac{3y}{x} = 2x^2$.
17. Find a general solution of the equation $x^2y'' + xy' + y = 0$.
18. Solve : $y'' + 2y' + 101y = 10.4e^x$.
19. Determine the type and stability of the critical point of the system $y_1' = y_2,\ y_2' = -9y_1$.
20. Solve the equation $y'' - 9y = 0$ by converting it to two system of first order equation.
21. Explain the modified Euler's method for the solution of the initial value problem $y' = f(x, y),\ y(x_0) = y_0$.
22. Use Runge-Kutta fourth order formula to find y(0.2) given that $y' = \frac{y^2 - x^2}{x + 2y},\ y(0) = 1$.
23. State Milne's predictor-corrector formula for the solution of the problem $y' = f(x, y),\ y(x_0) = y_0$.
24. If $y' = {}^{x^2}\!/_{y^2+1}$, $y(0) = 0$, using Picard's method, find $y^{(1)}$.

Answer **any six** short essay question out of 9. **(6×5=30)**

25. Solve : $(1 + y + 2x)\,y' = 1 - 2y - 4x$.
26. Solve : $y' + 2y = y^2$.
27. If $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$, find y(0.1) and y(0.2) by Taylor series method.
28. Reduce to first order and solve the differential equation $x^2y'' - xy + y = 0$, where $y_1 = x$ is one solution.
29. Solve : $(x^2D^2 - 3xD + 3)\,y = 3\ln x - 4$, $y(1) = 0$, $y'(1) = 1$.
30. Solve $(D^2 + 1)\,y = e^{-x}$, $y(0) = -1$, $y'(0) = -1$.
31. Solve $y'' + 2y' + y = e^{-x}\cos x$.
32. Find the general solution of $y'' + y = \sec x$.
33. Find a general solution of the system of equation $y_1' = -3y_1 + y_2,\ y_2' = y_1 - 3y_2$.

Answer **any one** essay question out of two. **(10×1=10)**

34. Given the problem $y' + y = 0$, $y(0) = 1$, find y(0.1), y(0.2) and y(0.3) by fourth-order Runge-Kutta formula and hence obtain y(0.4) by Adam's formulae.
35. Given the initial value problem defined by $y' = y^2 + xy$, $y(0) = 1$, find y(0.1), y(0.2) and y(0.3) by Taylor series. Use these values to compute y(0.4) by Milne's formulae.

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