K16U 1576

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CCSS–Supple./Imp.) Examination,
November 2016
CORE COURSE IN MATHEMATICS
5B09 – MAT : Differential Equations and Numerical Analysis
(2013 and Earlier Admissions)

Time : 3 Hours Max. Weightage : 30

1. Fill in the blanks :
   a) Characteristic equation of $8y'' - 5y' + 7y = 0$ is _____.
   b) If $\lambda = \alpha \pm i\beta$ are the complex roots of the characteristic equation of $ay'' + by' + cy = 0$, then the general solution is _____.
   c) Wronskian of sint and cost is_____.
   d) Two functions f(t) and g(t) are said to be linearly independent if _____.

(Weightage 1)

Answer **any six** from the following. Weightage **1 each**.

2. What do you mean by linear differential equation ? Give an example.
3. Solve $\frac{dy}{dt} = -2y + 10$, $y(0) = y_0$.
4. Find the general solution of $y'' - 2y' + y = 0$.
5. Find the Wronskian of the vectors $x^{(1)}(t) = \begin{pmatrix} t \\ 1 \end{pmatrix}$ and $x^{(2)}(t) = \begin{pmatrix} t^2 \\ 2t \end{pmatrix}$.
6. Solve the boundary value problem $y'' + 2y = 0$, $y(0) = 1$, $y(\pi) = 0$.
7. Explain Laplace's equation.

P.T.O.

8. Using Newton-Raphson method, find a positive solution of $x^3 + x - 1 = 0$.

9. What do you mean by divided differences ? State Newton's divided difference interpolation formula.

10. Find by Taylor's series method the value of y at x = 0.1 from $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$.

(Weightage 6×1=6)

Answer **any seven** from the following. Weightage **2 each**.

11. Determine the value of r for which the differential equation $t^2y'' - 4ty' + 4y = 0$ has solution of the form $y = t^r$, $r > 0$.

12. Solve $\frac{dy}{dt} - 2y = 4 - t$.

13. Find the solution of the initial value problem $y'' - y' + 0.25y = 0$, $y(0) = 2$, $y'(0) = \frac{1}{3}$.

14. Find the particular integral of $y'' + 4y = 3 \cos 2t$.

15. Find the general solution of $y'' - 2y' - 3y = 3e^{2t}$.

16. Using the method of separation of variables, solve one dimensional wave equation.

17. Find the temperature u(x, t) in a metal rod of length 25 cm that is insulated on the ends as well as on the sides and whose initial temperature distribution $u(x, 0) = x$ for $0 < x < 25$.

18. Using Gauss elimination method, solve the equations $x + y + z = 6$; $3x + y + z = 8$; $2x + 2y - 3z = -7$.

19. Using trapezoidal rule evaluate $\int_0^6 \frac{dx}{1+x^2}$ by dividing the interval into 6 sub-intervals.

20. Apply Euler's modified method to solve the initial value problem $y' = x + y$, $y(0) = 1$ to find y (0.2).

(Weightage 7×2=14)

Answer **any three** from the following. (Weightage **3 each**).

21. Solve the initial value problem $\frac{dy}{dx} = y^2$, $y(0) = 1$ and determine the interval in which the solution exist.

22. Find an integrating factor for the equation and solve $(x + 2)\,\text{sin}y\,dx + x\,\text{cos}y\,dy = 0$.

23. Using method of variation of parameters, solve $y'' + 4y = \tan 2t$.

24. Given that the values

x :	20	25	30	35	40	45
f(x) :	354	332	291	260	231	204

Evaluate f(22) using Newton's forward interpolation formula.

25. Using Runge-Kutta method of fourth order, compute y(0.2) and y(0.4) from $10\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$.

(Weightage 3×3=9)