



Reg. No. : 2361514.....

Name :

Third Semester B.Sc. Degree Examination, December 2017
First Degree Programme under CBCSS
COMPLEMENTARY COURSE FOR PHYSICS
MM 1331.1 : Differential Equations, Theory of Equations and
Theory of Matrices
(2014 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION - I

All the first 10 questions are **compulsory**. They carry 1 mark each.

1. Define solutions of differential equation.
2. Write the most general form a linear first order differential equation.
3. Find the auxiliary equation of $y'' + ay' + by = 0$.
4. Give an example of a one parameter family of curves.

5. Find the rank of $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$.

6. When we say the system of linear equations $AX = B$ is consistent ?
7. Define reduced Echelon form of a matrix.

8. Find the degree of the equation $6x^4 + 6x^2 + 6x + \frac{6}{x^2} + \frac{1}{x^4} = 0$.

9. Form the equation whose roots are 4 and $3 + 2i$.

10. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$ find $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma}$.

P.T.O.



SECTION - II

Answer **any 8** questions from among the questions **11 to 22**. These questions carry **2 marks each**.

11. Solve $\frac{dy}{dx} + \frac{x}{y} = 0$.

12. Solve $y'' + 5y' + 6y = 0$.

13. Solve $y'' + 3y' - 10y = e^{2x}$.

14. Solve $y'' + 4y' + 4y = \cos x$.

15. Find the eigen value of $A = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 3 \end{bmatrix}$.

16. Prove that a homogeneous system $AX = 0$ has a nontrivial solution if and only if A is singular.

17. If λ is an eigen value of a non-singular matrix A then prove that λ^{-1} is an eigen value of A^{-1} .

18. If α, β, γ are the roots of the equation $x^3 + px + q = 0$ find $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$.

19. Prove that the inverse of a symmetric matrix is symmetric.

20. Form an equation of lowest degree with rational coefficients and one of its roots is whose roots are $\sqrt{2} + \sqrt{3} + i$.

21. State Descartes's rule of signs and apply it to prove the equation $x^3 + 4x + 3 = 0$ has one negative and two imaginary roots.

22. Solve the equation $2x^3 - x^2 - 22x - 24 = 0$, two of its roots are in the ratio 3 : 4.



SECTION - III

Answer **any 6** questions from among the questions **23 to 31**. These questions carry **4 marks each**.

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

24. Find the orthogonal trajectory of the parabolas $x^2 (y - c)^2 = c^2$.

25. Solve $y'' - y' = 0$.

26. Show that $A = \begin{pmatrix} -1 & 1 & 3 \\ 2 & 1 & 4 \\ 1 & 0 & 2 \end{pmatrix}$ is diagonalizable.

27. If $AB = A$ and $BA = B$ then show that $A^2 = A$ and $B^2 = B$.

28. Prove that the eigen values of a real symmetric matrix are real.

29. Find the real roots of $5x^3 + 10x^2 - 86 = 0$ by Newton-Raphson method.

30. Explain bisection method.

31. If the product of two roots of the equation $x^4 + 10x^3 + 9x - 2 = 0$ be unity find all the roots.

SECTION - IV

Answer **any 2** questions from among the questions **32 to 35**. These questions carry **15 marks each**.

32. Solve $\frac{d^2 y}{dx^2} + 4 \frac{dy}{dx} + 5y = e^{3x} + \cos 4x + x^3$.

33. Find the eigen values and corresponding eigen vectors of the matrix $\begin{pmatrix} 0 & 1 & 0 \\ 3 & 0 & 1 \\ 1 & -3 & 3 \end{pmatrix}$.



34. i) Let A be an $n \times m$ matrix. Prove that the system $AX = 0$ and $A_R X = 0$ have the same solutions.
- ii) Solve the system $x - 3y + 2z = 0$, $-2x + y - 3z = 0$ by finding the reduced system $A_R X = 0$.
35. i) Show that the equation $x^5 - 2x^2 + 7 = 0$ has at least two imaginary roots.
- ii) If q, r, s are positive, show that the equation $x^4 + qx^2 + rx - s = 0$ has one positive, one negative and two imaginary roots.