

	P.R.Government College (Autonomous): KAKINADA	Program&Semester I B.Sc Major & Minor (II Sem) w.e.f.2023-24 admitted Batch			
Course Code MAT-201	TITLE OF THE COURSE Differential Equations & Problem Solving Session				
Teaching	HoursAllocated:60(Theory)	L	T	P	C
Pre-requisites:	Calculus and Linear Algebra	3	-	-	3

Course

Objectives:

To provide students with an introduction to the theory of ordinary differential equations through applications, methods of solution, and numerical approximations.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Solve linear differential equations
CO2	Convert non - exact homogeneous equations to exact differential equations by using integrating factors.
CO3	Know the methods of finding solutions of differential equations of the first order but not of the first degree.
CO4	Understand the concept and apply appropriate methods for solving differential equations.

Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	
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COURSE SYLLABUS:

UNIT – I: Differential Equations of first order and first degree

Linear Differential Equations; Differential equations reducible to linear form; Exact differential equations; Integrating factors, Equations reducible exact equations by integrating factors:

1. Inspection Method 2. $1 / Mx + Ny$ 3. $1 / Mx - Ny$

UNIT – II: Orthogonal Trajectory and Differential Equations of first order but not of the first degree

Differential Equations of first order but not of the first degree :

Equations solvable for p; Equations solvable for y, Equations solvable for x - Clairaut's Equation.

Orthogonal trajectories : Cartesian and polar co-ordinates.

UNIT – III: Higher order linear differential equations

Solution of homogeneous linear differential equations of order n with constant coefficients;
Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators.

P.I. of $f(D)y = Q$ when $Q = e^{ax}$

P.I. of $f(D)y = Q$ when Q is $b \sin ax$ or $b \cos ax$.

UNIT – IV: Higher order linear differential equations (continued)

Solution of the non-homogeneous linear differential equations with constant coefficients. P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = be^{ax} V$

P.I. of $f(D)y = Q$ when $Q = x^r V$

UNIT –V: Higher order linear differential equations with non-constant coefficients

Linear differential equations with non-constant coefficients : The Cauchy-Euler Equation
;Legendre's Equations, Method of variation of parameters.

Activities

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving Sessions.

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand & Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University Press.

Additional Inputs :

Total Differential Equations

CO-PO Mapping:

(1:Slight[Low];

2:Moderate[Medium];

3:Substantial[High],

'-':NoCorrelation)

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PS01	PS02	PS03
CO1	3	3	2	3	3	3	1	2	2	3	2	3	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1
CO3	2	3	2	3	2	3	2	2	2	3	2	2	3
CO4	3	2	3	2	2	2	3	3	1	1	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-IV- DIFFERENTIAL EQUATIONS

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	Differential Equations of first order and first degree	2	2	30
II	Orthogonal Trajectory and Differential Equations of first order but not of the first degree	2	1	20
III	Higher order linear differential equations	1	1	15
IV	Higher order linear differential equations (continued)	1	1	15
V	Higher order linear differential equations with non-constant coefficients	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

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Total Marks = 50 M

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PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
I year B.Sc., Degree Examinations - II Semester
Mathematics Course-IV: Differential Equations
(w.e.f. 2024-25Admitted Batch)
Model Paper (w.e.f. 2024-2025)

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Time: 2 Hours

Max Marks: 50M

Section -I

Answer any three of the following questions. Must attempt atleast one question from each part.

Each question carries 10 Marks.

3 X 10 = 30M

Part – A

1. Essay question from unit – I.
2. Essay question from unit – I
3. Essay question from unit – II.

Part - B

4. Essay question from unit - III.
5. Essay question from unit – IV.
6. Essay question from unit - V.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Short answer question from unit - I
8. Short answer question from unit - I.
9. Short answer question from unit - II.
10. Short answer question from unit - II.
11. Short answer question from Unit - III.
12. Short answer question from unit - IV.
13. Short answer question from unit - V.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(AUTONOMOUS), KAKINADA

**I year B.Sc., Degree Examinations - II Semester
Mathematics Course Major - I: Differential Equations**

(w.e.f. 2024-2025 Admitted Batch)

**QUESTION BANK
Short Answer Questions**

Unit-I

1. Solve $(e^y + 1) \cos x \, dx + e^y \sin x \, dy = 0$.
2. Solve $\frac{dy}{dx} + \frac{ax+hy+g}{hx+by+f} = 0$ and show that this differential equation represents a family of conics.
3. Solve $x \, dy - y \, dx = xy^2 \, dx$.
4. Solve $(1 + xy)x \, dy + (1 - xy)y \, dx = 0$.
5. Solve $x \frac{dy}{dx} + 2y - x^2 \log x = 0$
6. Solve $\cos^2 x \frac{dy}{dx} + y = \tan x$.
7. solve $x \frac{dy}{dx} + y = y^2 \log x$
8. Solve $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$.

Unit - II

9. Find the Orthogonal trajectories of family of curves $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.
10. Find the orthogonal trajectories of the family of curves in polar coordinates $r = a(1 + \cos \theta)$.
11. Solve $y^2 \log y = xpy + p^2$.
12. Solve $y = 2xp + x^2 p^4$.
13. Solve $(y - xp)(p - 1) = p$.
14. Solve $xy^2(p^2 + 2) = 2py^3 + x^3$.

Unit - III

15. Solve $(D^3 - 2D^2 - 3D)x = 0$ where $D = d/dt$.
16. Solve $(D^4 - 4D^3 + 6D^2 - 4D + 1)y = 0$.
17. Solve $(D^4 + 8D^2 + 16)y = 0$.
18. Solve $(D^2 - 2D - 3)y = 5$.
19. Solve $(D^2 - 3D + 2)y = \cosh x$.
20. Solve $(D^2 + 9)y = \cos 3x$.
21. Solve $(D^2 - 5D + 6)y = e^{4x}$.
22. Solve $(D^2 + 4)y = \sin 2x$.

Unit - IV

23. Solve $(D^2 - 4D + 4)y = x^3$
24. Solve $(D^2 - 2D + 4)y = 8(x^2 + e^{2x} + \sin 2x)$

25. Solve $(D^2 - 2D + 1)y = x^2e^{3x}$.

26. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = 8e^{3x}\sin 2x$

27. Solve $(D^2 + 4)y = x \sin x$

28. Solve $(D^2 + 2D + 1)y = x \cos x$

Unit – V

29. Solve $(D^2 + 1)y = \sec x$ by method of variation of parameters.

30. Solve $(D^2 + a^2)y = \tan ax$ by method of variation of parameters.

31. Solve $(D^2 - 2D)y = e^x \sin x$ by the method of variation of parameters.

32. Solve $(x^2D^2 + xD - 1)y = x^3$.

33. Solve $(x^2D^2 - xD + 1)y = 2 \log x$.

34. Solve $(x^4D^3 + 2x^3D^2 - x^2D + x)y = 1$.

Essay Answer Questions

Unit -I

1. Solve $x^2y dx - (x^3 + y^3)dy = 0$.
2. Solve $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$.
3. Solve $y(xy + 2x^2y^2)dx + x(xy - x^2y^2)dy = 0$.
4. Solve $(x^2y^2 + xy + 1)ydx + (x^2y^2 - xy + 1)xdy = 0$
5. Solve $x \cos x \frac{dy}{dx} + (x \sin x + \cos x)y = 1$.
6. Solve $(1 - x^2)\frac{dy}{dx} + 2xy = x\sqrt{1 - x^2}$.
7. Solve $\frac{dy}{dx}(x^2y^3 + xy) = 1$

8.

Unit - II

Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2} + \frac{y^2}{a^2 + \lambda} = 1$ where λ is the parameter.

9. Show that the family of confocal conics $\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$ is self-orthogonal, where λ is the Parameter.
10. Show that the orthogonal trajectories of the parabola $y^2 = 4a(x + a)$ belongs to the same itself, a being parameter.
11. Find the Orthogonal trajectories of the family of curves in polar coordinates $r = \frac{2a}{(1 + \cos \theta)}$
Where 'a' is the parameter?
12. Solve $p^2 + 2py \cot x = y^2$
13. Solve $y^2 \log y = xpy + p^2$
14. Solve $y + px = p^2 x^4$

Unit - III

15. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.
16. Solve $(D^2 - 3D + 2)y = \cos 3x \cos 2x$.
17. Solve $(D^2 + 4)y = e^x + \sin 2x + \cos 2x$.
18. Solve $(D^2 + 9)y = \cos^3 x$
19. Solve $(D^2 - 4)y = e^x + \sin 2x + \cos^2 x$

Unit - IV

20. Solve $(D^2 - 2D + 4)y = 8(x^2 + e^{2x} + \sin 2x)$
21. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = 8e^{3x}\sin 2x$
22. Solve $(D^2 + 4)y = x^2e^{3x} + e^x \cos 2x$
23. Solve $(D^2 - 4D + 4)y = 8x^2e^{2x}\sin 2x$
24. Solve $(D^4 + 2D^2 + 1)y = x^2 \cos x$

Unit - V

25. Solve $(x^3D^3 + 2x^2D^2 + 2)y = 10(x + \frac{1}{x})$.
26. Solve $(x^2D^3 + 3xD^2 + D)y = x^2 \log x$.
27. Solve $(x^2D^2 - xD + 2)y = x \log x$.
28. Solve $[(1 + 2x)^2D^2 - 6(1 + 2x)D + 16]y = 8(1 + 2x)^2$.
29. Solve $[(1 + x)^2D^2 + (1 + x)D + 1]y = 4 \cos \log(1 + x)$.
30. Solve $[(2x + 3)^2D^2 - 2(2x + 3)D - 12]y = 6x$.
