	P.R.Government College (Autonomous): KAKINADA	**Program&Semester** I B.Sc Major (I Sem) w.e.f.2025-26 admitted Batch			
Course Code MAT-101 T	**TITLE OF THE COURSE** **DIFFERENTIAL EQUATIONS**				
Teaching	HoursAllocated:60(**Theory**)	L	T	P	C
Pre-requisites:	Calculus and Linear Algebra	5	-	-	4

Course Objectives:

1. To introduce the concepts and methods for solving first-order differential equations, including exact, linear, and Bernoulli equations.
2. To understand special types of first-order differential equations such as Clairaut's equations and those solvable for p, x or y.
3. To develop techniques for solving higher-order linear differential equations with constant coefficients.
4. To apply the operator method for finding particular integrals of non-homogeneous differential equations with various types of right-hand side functions.
5. To learn the method of variation of parameters for solving non-homogeneous differential equations.

Course Outcomes

On Completion of the course, the students will be able to-	
CO1	Solve exact differential equations, linear equations, Bernoulli's equations, and equations reducible to exact form using integrating factors.
CO2	Analyze and solve first-order differential equations that are solvable for p, , and y, including Clairaut's equations.
CO3	Solve homogeneous and non-homogeneous linear differential equations of higher order with constant coefficients using operator methods.
CO4	Compute particular integrals for non-homogeneous equations when the right-hand side is a polynomial, exponential, or trigonometric function.
CO5	Solve non-homogeneous differential equations using the method of variation of parameters and other applicable techniques.

Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development			Employability			Entrepreneurship	

COURSE SYLLABUS:

UNIT – I:

Exact differential equations- Integrating factors- Equations reducible exact equations by integrating factors (i). 1 / Mx + Ny (ii) 1 / Mx – Ny - Linear Differential Equations – Bernoulli's equations

UNIT – II:

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

UNIT – III: Higher order linear differential equations

Solutions of homogeneous linear differential equations of second and higher order with constant coefficients f(D)y = 0 - Solutions of non-homogeneous linear differential equations f(D)y = Q(x) of second order with constant coefficients by means of polynomial operators (i)$Q(x) = b\ eax$ where b is a real constant - (ii) $Q(x) = Sin\ ax$ (or) $Cos\ ax$ where a is a real constant.

UNIT – IV:

Solution to a non-homogeneous linear differential equation of second order with constant coefficients by means of polynomial operators $Q(x) = b\ x^k$, $Q(x) = e^{ax}\ V$, where V is a function of x.

UNIT –V:

Solution of the non-homogeneous linear differential equations of second order with constant coefficients by means of polynomial operators $Q(x) = x\ V$, where V is a function of x – Problems on Method of Variation of parameters to find solutions of linear differential equations with variable coefficients.

Activities

The activities planned throughout the Differential Equations course include a variety of interactive and evaluative methods such as quizzes, assignments, seminars, and student presentations. Students will also engage in a mini project, prepare concept flowcharts, and participate in operator method chart activities. Peer teaching sessions, LMS-based online quizzes, and board work challenges will foster collaborative and digital learning. Additionally, poster presentations on applications and visual aids like chalk talks will be incorporated to support diverse learning styles and deepen conceptual clarity.

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.

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':NoCorrelation)

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-I- DIFFERENTIAL EQUATIONS

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	UNIT – I	2	2	30
II	UNIT – II	1	1	15
III	UNIT – III	2	1	20
IV	UNIT – IV	1	1	15
V	UNIT - V	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 - I Semester

Mathematics Course-I: Differential Equations

(w.e.f. 2025-26Admitted Batch)

Model Paper (w.e.f. 2025-2026)

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Time: 2 Hours **Max Marks: 50M**

Section -I

Answer any three of the following questions. Must attempt at least one question from each part. Each question carries 10 Marks. **3 × 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 - III.
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 - I Semester

Mathematics Course Major - I: Differential Equations

(w.e.f. 2025-2026 Admitted Batch)

QUESTION BANK

Short Answer Questions

Unit-I

1. Solve (e^y +1) cosx dx + e^y sinx 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 $(1 + xy)x\,dy + (1 - xy)ydx = 0$.
5. Solve $x\frac{dy}{dx} + 2y - x^2 \log x = 0$
6. Solve $Cos^2x\ \frac{dy}{dx} + y = \tan x$.
7. Solve $x\frac{dy}{dx} + y = y^2 \log x$
8. Solve $\frac{dy}{dx}$ + x sin2y = x^3 $\cos^2$y.

Unit - II

9. Solve $xyp^2 + p(3x^2 - 2y^2) - 6xy = 0$
10. Solve y^2 logy = xpy + p^2 .
11. Solve y = 2xp + x^2 p^4.
12. Solve (y – xp)(p – 1) = p.
13. Solve $xy^2(p^2+2) = 2py^3 + x^3$.

Unit - III

14. Solve ($D^4 - 4D^3 + 6D^2 - 4D + 1$)y = 0 .
15. Solve ($D^4 + 8D^2 + 16$) y = 0 .
16. Solve ($D^2 -$ 2D – 3) y = 5 .
17. Solve $(D^2 - 3D + 2)y = Coshx$.
18. Solve $(D^2 + 9)y = Cos\ 3x$.
19. Solve$(D^2 - 5D + 6)y = e^{4x}$.
20. Solve$(D^2 + 4)y = Sin2x$.

Unit - IV

21. Solve$(D^2 - 4D + 4)y = x^3$
22. Solve ($D^4 - 2D^3 + D^2$)y = x^3
23. Solve (D^2 – 2D + 5) y = e^{2x} sinx

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

25. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = 8e^{3x}sin2x$

Unit – V

26. Solve $(D^2 + 4)y = x\ Sinx$

27. Solve $(D^2 + 2D + 1)y = x\ Cosx$

28. Solve$(D^2 + 1)y = Secx$ by method of variation of parameters.

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

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

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

Unit - II

8. Solve $p^2 + 2py\cot x = y^2$
9. Solve $2px = 2\tan y + p^3\cos^2 y$
10. Solve $y + px = p^2x^4$
11. Solve $2xp^3 - 6yp^2 + x^4 = 0$
12. Solve $(py + x)(px - y) = 2p$

Unit - III

13. Solve $(D^2 - 4D + 3)y = sin3xCos2x.$
14. Solve $(D^2 - 3D + 2)y = Cos3x.Cos2x.$
15. Solve $(D^2 + 4)y = e^x + sin2x + Cos2x.$
16. Solve $(D^2 + 9)y = cos^3\ x$
17. Solve $(D^2 - 4)y = e^x + \sin 2x + cos^2\ x$

Unit - IV

18. Solve $D^2(D^2 + 4)y = 320(x^3 + 2x^2)$
19. Solve $(\ D^2 - 2D + 4\ )\ y = 8\ (\ x^2 + e^{2x} + \sin 2x\ )$

20. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = 8e^{3x}sin2x$

21. Solve $(D^2 + 4)y = x^2e^{3x} + e^xCos2x$

Unit - V

22. Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = xe^xsinx$

23. Solve $(D^2 - 4D + 4)y = 8x^2e^{2x}sin2x$

24. Solve ($D^4 + 2D^2 + 1$) y = x^2 Cos x

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

26. Solve$\frac{d^2y}{dx^2} + 4y = 4\,Tan\,2x$ by method of variation of parameters.

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