Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 3: DIFFERENTIAL EQUATIONS

(w.e.f. 2023-24)

Course Code: 23MATM21

Course outcomes – Mapping with Blooms Taxonomy levels	
CO1. solve first order first degree linear differential equations.	Level-1, Level-2
CO2. convert a non-exact homogeneous equation to exact differential equation by using an integrating factor.	Level-1, Level-2, Level-3
CO3. know the methods of finding solution of a differential equation of first order but not of firstdegree.	Level-2, Level-3, Level-5
CO4. solve higher-order linear differential equations for both homogeneous and non-homogeneous,with constant coefficients.	Level-3, Level-4, Level-5
CO5. understand and apply the appropriate methods for solving higher order differential equations.	Level-3, Level-4, Level-5

CO-PO Mapping
1-Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	-	1	-	-	-	2	-	3
CO 2	2	-	1	-	-	-	2	-	3
CO 3	3	-	1	-	-	-	2	-	3
CO 4	3	-	1	-	-	-	2	-	3
CO 5	3	1	1	-	-	-	3	-	3

CO-PSO Mapping
1-Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	1	2	2	1
CO 2	3	1	2	2	1
CO 3	2	2	2	3	2
CO 4	2	2	2	3	2
CO 5	2	2	3	3	2

Course Content

Unit – 1

Differential Equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations –Integrating factors - Equations reducible to Exact Equations by Integrating Factors -

Unit – 2

Differential Equations of first order but not of first degree

Equations solvable for p, Equations solvable for y, Equations solvable for x – Clairaut's equation - Orthogonal Trajectories: Cartesian and Polar forms.

Unit – 3

Higher order linear differential equations

Solutions of homogeneous linear differential equations of order n with constant coefficients - Solutions of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators

(i) $Q(x) = e^{ax}$ (ii) $Q(x) = Sin\ ax$ (or) $Cos\ ax$

Unit – 4

Higher order linear differential equations (continued.)

Solution to a non-homogeneous linear differential equation with constant coefficients

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax}V$, where V is a function of x

P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x

Unit-5

Higher order linear differential equations with non-constant coefficients

Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; Legendre Equation; Method of variation of parameters

Activities

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

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall ofIndia 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 UniversityPress.

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Signed and approved by

Prof. N. Ramakrishna,
Subject Expert
(University Nominee)

Sri. P. Mahalakshmi Naidu,
Subject Experts
(from outside the parent university)

Sri. R. Ravi Shankar
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SEMESTER END EXAMINATIONS MODEL PAPER
SEMESTER- II
B.Sc Hons Mathematics

COURSE 3: DIFFERENTIAL EQUATIONS

(w.e.f. 2023-24)

Course Code: 23MATM21

Time: 3 hours Maximum Marks: 60

SECTION –A

Answer any FIVE questions 5x4=20M
Each question carries 5 marks

1. Solve $y(1+xy)dx + x(1-xy)dy = 0$.
2. Solve $(1+y^2)dx = (\tan^{-1}y - x)dy$.
3. Solve $p^2-5p+6=0$.
4. Solve $(D^4-4D^3+6D^2-4D+1)y = 0$.
5. Solve $(D^2-3D+2)y = \text{Cosh}x$.
6. Solve $(D^2+2D+1)y = x\text{Cos}x$.
7. Solve $\frac{d2y}{dx2} - 6\frac{dy}{dx} + 13y = 8e^{3x}\sin 2x$.
8. Solve $(D^2+1)y = \text{cosec } x$ by the method of variation of parameters
9. Write formula to solution of $\frac{dy}{dx} + P(x)\,y = Q(x)$
10. Explain the Clairauts method for the problem $y = px + \sin p$

SECTION-B

Answer any FIVE questions. 5x8=40M
Each question carries 10 marks.

11 a) Solve $x\frac{dy}{dx} + y = y^2 \log x$.

(or)

b) Solve $y^2dx = (x^2 - xy - y^2)dy$.

12 a). Solve $y = 2xp + x^2p^4$.

(or)

b). Solve $p^2 + 2pyCotx = y^2$.

13 a). Solve $(D^2-4D+3)y = \text{Sin}3x\ \text{Cos}2x$.

(or)

b). Solve $(D^2+9)y = \text{Cos}^3x$

14. a). Solve $(D^4+2D^2+1)y = x^2\cos x$

(or)

b). Solve $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y = xe^x\sin x$

15 a). Solve $(x^3D^3+2x^2D^2+2)y = 10(x+\frac{1}{x})$

(or)

b). Solve $(D^2+a^2)y = \cot ax$ by the method of variation of parameters.

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 4: ANALYTICAL SOLID GEOMETRY

(w.e.f. 2023-24)

Course Code: 23MATM22

Course outcomes – Mapping with Blooms Taxonomy levels	
CO1. understand planes and system of planes	Level-1, Level-2, Level-3
CO2. know the detailed idea of lines	Level-2, Level-3, Level-4, Level-6
CO3. understand spheres and their properties	Level-2, Level-3, Level-4, Level-5
CO4. know system of spheres and coaxial system of spheres	Level-4, Level-5, Level-6
CO5. understand various types of cones	Level-2, Level-3, Level-4

CO-PO Mapping
1-Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	1	-	-	-	1	3	-	3
CO 2	2	1	-	-	-	1	3	-	3
CO 3	3	1	-	-	-	1	3	-	3
CO 4	3	1	-	-	-	1	3	-	3
CO 5	2	1	-	-	-	1	3	-	3

CO-PSO Mapping
2- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	3	2
CO 2	3	2	2	3	2
CO 3	3	2	2	3	2
CO 4	3	2	2	3	2
CO 5	3	2	2	3	2

Course Content

Unit – 1 The Plane

Three dimensional coordinates, direction cosines and direction ratios of a line ,Equation of plane in terms of its intercepts on the axis - Equations of the plane through the given points - Length of the perpendicular from a given point to a given plane - Bisectors of angles between two planes - Combined equation of two planes - Orthogonal projection on a plane.

Unit – 2
The Line

Equation of a line - Angle between a line and a plane - The condition that a given line may lie in a given plane - The condition that two given lines are coplanar - Number of arbitrary constants in the equations of straight line - Sets of conditions which determine a line - The shortest distance between two lines - The length and equations of the line of shortest distance between two straight lines - Lengthof the perpendicular from a given point to a given line.

Unit – 3
The Sphere

Definition and equation of the sphere - Equation of the sphere through four given points - Plane sections of a sphere - Intersection of two spheres - Equation of a circle - Sphere through a given circle Intersection of a sphere and a line - Power of a point - Tangent plane - Plane of contact; Polar plane Pole of a Plane - Conjugate points - Conjugate planes.

Unit – 4
Spheres (continued)

Angle of intersection of two spheres - Conditions for two spheres to be orthogonal - Radical plane;Coaxial system of spheres - Simplified from of the equation of two spheres. Definitions of a cone – vertex, guiding curve and generators - Equation of the cone with a given vertexand guiding curve - Equations of cones with vertex at origin are homogenous - Condition that the general equation of the second degree should represent a cone.

Unit – 5
Cones

- Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle. Introduction to cylinder, Right circular cylinder.

Activities

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and its applications/ Problem Solving Sessions.

Text Book

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

Reference Books

1. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

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SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- II
B.Sc Hons Mathematics
COURSE 4: ANALYTICAL SOLID GEOMETRY

(w.e.f. 2023-24)

Course Code: 23MATM22

Time: 3 hours Maximum Marks: 60

SECTION – A

Answer any Five questions . Each question carries 04 Marks. 5 x 4M = 20M

1. A variable plane is at a constant distance 'P' from the origin meets the axis in A,B,C. Show that the locus of the tetrahedron OABC is $x^{-2}+y^{-2}+z^{-2} = 16p^{-2}$

2. Find the equation of the plane that passes through the point (3,-3,1) and is normal to the line joining the points (3,4,-1) and (2,-1,5).

3. Find the image of (2,- Find the an1,3) in the plane $3x-2y-z-9 = 0$.

4.Find the Angle between the lines $x-2y+z = 0$, $x+y-z = 0$ and $x+2y+z = 5$, $8x+12y+5z = 0$.

5. Find the equation of a sphere passing through the circle $x^2+y^2+z^2= 4$, $z=0$ and is intersected by the plane $x+2y+2z=0$ in a circle of radius 3.

6. Find the pole of the plane $x-y-z+9 = 0$ w.r.t the sphere $x^2+y^2+z^2-2x+4y-6z+5 = 0$.

7. Find the length of the tangent line from the point (3, 1, -1) to the sphere $x^2+y^2+z^2-3x+5y+7 = 0$.

8. Find the equation to the right circular cone whose vertex is (3,2,1), axis line $\frac{x-3}{4} = \frac{y-2}{1} = \frac{z-1}{3}$ and semi vertical angle 30°.

9. Find the vertex of the cone $7x^2+2y^2+2z^2-10zx+10xy+26x-2y+2z-17 = 0$.

10. Find the Enveloping cone of the sphere $x^2+y^2+z^2+2x-2y-2 = 0$ with vertex (1,1,1).

SECTION – B

Answer all questions , Each question carries 08 marks. 5 x 8M = 40M

11. (a). A Variable plane makes intercepts on the axes , the sum of whose squares is K^2 (a constant). Show that the locus of the foot of the perpendicular from the region is $(x^{-2}+y^{-2}+z^{-2})(x^2+y^2+z^2)^2 = k^2$

OR

(b) Find the equations of the planes bisecting the angle between the planes $x+2y+2z-3 = 0$, $3x+4y+12z+1 = 0$ and specify the one which bisects the acute angle.

12. (a). Prove that the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$; $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ are coplanar. Also find their point of the intersection and the plane containing the lines.

OR

(b) Find the length and equations to the line of shortest distance between the lines $\frac{x}{4}=\frac{y+1}{3}=\frac{z-2}{2}$; $5x-2y-3z+6=0 = x-3y+2z-3$.

13. (a). Show that the two circles $x^2+y^2+z^2-y+2z = 0$, $x-y+z = 2$ and $x^2+y^2+z^2+x-3y+z-5 = 0$, $2x-y+4z-1 = 0$ lie on the same sphere and find its equation.

OR

(b) Show that the spheres $x^2+y^2+z^2 = 25$, $x^2+y^2+z^2-24x-40y-18z+225 = 0$ touch externally. Find the point of contact.

14. (a). Find the limiting points of the coaxial system of spheres determined by the spheres $x^2+y^2+z^2+3x-3y+6 = 0$, $x^2+y^2+z^2-6y-6z+6 = 0$.

OR

(b) If the line $\frac{x}{1}=\frac{y}{2}=\frac{z}{1}$ represents one of the three mutually perpendicular generators of the cone $11yz+6zx-14xy = 0$. Find the equations of the other two.

15. (a). Find the equation of the tangent plane at the point (-3,0,-1) of the cone $7x^2+2y^2+2z^2-10zx+10xy+26x-2y+2z-17 = 0$.

OR

(b) Find the equation to the right circular cone whose vertex is P(2,-3,5), axis PQ which makes equal angles with coordinate axes and which passes through A(1,-2,3).

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