

Gujarat University
Choice Based Credit System (CBCS)
Syllabus for Semester II (Mathematics)
MAT 103: Differential Equations and Co-ordinate Geometry

Hours: 4 /week

Credits: 4

Prerequisites (not to be asked but must be done): Introduction of Differential equations, its order and degree. Family of curves leading to differential equation and its solution in family of curves. Different types of solutions (viz. General, Particular and Singular solutions). Constant of integration. Boundary/initial conditions. Differential equations of first order and first degree.

Unit I

- (a) **Methods of solving Differential Equations of first order and first degree:** Variableseparable, Homogeneous and non-homogeneous differential equations, Exact differential equations(**without proof**), Integrating factors, Linear differential equation of first order and first degree, Bernoulli's differential equation & Differential Equations reducible to them.
- (b) **Method of solving differential equations of first order and higher degree:** solvable for y , solvable for x , solvable for p (where $p = dy/dx$), Clairaut's differential equation (both general and singular), Lagrange's differential equation.

Unit II Linear differential equations of higher order and degree one : Differential operators (D and θ), Linear differential equations of higher order and degree one with constant coefficients. Complementary and Particular Integrals (Solutions). Inverse operator. Operational methods for its solutions. Euler form of homogeneous linear differential equations with variable coefficients.

Unit III Co-ordinate Geometry, Sphere and Introduction to conicoid:

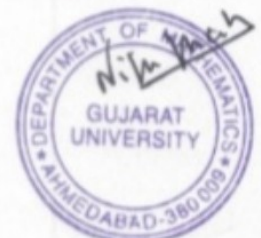
- (a) **Sphere:** Definition of a sphere in R^3 , Cartesian equaton of a sphere, General equation of a sphere, Equation of a sphere with diametrically opposite end points, Intersection of a sphere with Line/plane/sphere(No theory but only problems), Equation of a tangent plane to a sphere. The tangency of a plane and normality of a line to a sphere, Orthogonal spheres.
- (b) **Conicoids:** Introduction to conicoid, types of central and non-central conicoids in R^3 , figures of conicoids.

Unit IV Polar coordinate system and Cone and cylinder in R^3 :

- (a) Polar coordinates in R^2 & R^3 and its Relationships with Cartesian coordinates, polar equation of line-/circle /conic and properties of conics. Mutual relationship between Spherical, Cylindrical and Cartesian coordinates.
- (b) Introduction to different types of cone and cylinder, Equations of enveloping cone and cylinder. Right circular cone/cylinder (**without proof**). Problems on cone and cylinder.

Reference Books:

1. Calculus - JAMES STEWART , THOMSON BROOKS/COLE
2. Calculus - T.M.Apostol
3. Calculus - Thomas and Finney , Pearson Education , Asian edition
4. Calculus - Dr. Elliot Mendel son, Mc GrawHill Book co.
5. A first course in calculus fifth edition By Serge Lang , Springer India
6. Ordinary and Partial Differential Equations Theory and Applications,By:Nita H. Shah, PHI
7. Introductory course in Differential equations-Murray
8. Differential equations and their applications, Prentice Hall of India- Zafar Ahsan (1999)
9. Elementary Differential equations –Kella
10. Co-ordinate Geometry By : R.J.T. Bell
11. Solid Geometry(three dimension) – H. K. Das ,S. C. Saxena and Raisinghania , S. Chand



Gujarat University
Choice Based Credit System (CBCS)

Syllabus for Semester II (Mathematics)

MAT 104: Differential Equations and Co-ordinate Geometry (PRACTICALS)

Hours: 4/week

Credits: 3

Duration: 2 hrs/practical

Number of Practicals: 16

Special Instructions: Before starting each Practical necessary Introduction, Basic Definitions, Intuitive inspiring ideas and Prerequisites must be discussed.

Unit I

Practicals based on tracing of standard curves and Reduction formulae ($\sin^n x$, $\cos^n x$ And $\sin^m x \cos^n x$) (Practical Number 1- 4).

Unit II

Practicals based on application of integration (length of arc, surface area, volume formulae **without proof**), differential equation of order 1 & degree 1. (Practical Number 5 - 8).

Unit III

Practicals based on Differential equations, Polar coordinates in R^2 . (Practical Number 9 - 12).

Unit IV

Practicals based on Spherical and cylindrical co-ordinates in R^3 , sphere, cone, cylinder. (Practical Number 13 - 16)

List of Practicals:

1. Graphs of Cartesian curves (circle, parabola, ellipse, hyperbola, asteroid).
2. Graphs of Cartesian curves (logarithm function, exponential function, $\sinh x$, $\cosh x$, $\tanh x$).
3. Evaluate the following using reduction formulae only: $\sin^n x$, $\cos^n x$, $\tan^n x$ for different odd/even $n \in \mathbb{N}$. (10 problems)
4. Evaluate the $\sin^m x \cos^n x$ using reduction formulae for different odd/even $m, n \in \mathbb{N}$. (10 problems)
5. Find the length of arc and curves in Cartesian & parametric forms using definite integral. (5+5=10 problems)
6. Find the surface area of a surface generated by rotating the arc of a continuous curve $y = f(x)$ cut off by straight lines $x = a$, $x = b$ about x-axis or by similar situation about y-axis, using definite integral. (5+5 problems)
7. Find the volume of a solid generated by the continuous curve $y = f(x)$ defined on interval $[a, b]$ and straight lines $x = a$, $x = b$ about x-axis or by similar situation about y-axis, using definite integral. (5+5 problems)
8. Solve the differential equations of order 1 & degree 1.
9. Solve the differential equations of order 1 & higher degree.
10. Solve the linear differential equations of higher order with constant coefficient.
11. Solve the linear differential equations of higher order with variable coefficient.
12. The mutual relation between polar and Cartesian co-ordinate system in R^2 . Transformation of equations from one system to another system.
13. The mutual relation among Cartesian, cylindrical and spherical co-ordinate system in R^3 . Transformation of equations from one system to another system.
14. Problems on Sphere.
15. Problems on Cone.
16. Problems on Cylinder.

