Gujarat University

Choice Based Credit System (CBCS)

Syllabus for Semester II (Mathematics)

MAT 103: Differential Equations and Co-ordinate Geometry(Theory)

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: Variable separable, 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 $p = \frac{dy}{dx}$), 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: Sphere and Introduction to conicoid:

(a) 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.

(b) Introduction to different types of cone and cylinder, Equations of enveloping cone/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

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Choice Based Credit System (CBCS)

Syllabus for Semester II (Mathematics)

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

Hours: 4 /week **Credits: 3**

Number of Practicals: 20 (Each Practical is of 2-hours)

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

Unit I: Graphs of standard curves and graphical solution. Introduction to definite integral as a limit of sum, Method of integration by substitution/ partial fractions/ by parts, Reduction formulae ($\sin^n x$, $\cos^n x$ and $\sin^m x \cos^n x$). Five practicals (Practical number 1 to 5)

Unit II: Application of reduction formulae. Application of integration (area, volume, length of arc and surface area formulae without proof). Five practicals (Practical number 6 to 10)

Unit III: Applications of Differential equations. Four practicals (Practical number 11 to 14)

Unit IV: Polar coordinates, spherical and cylindrical co-ordinates, sphere, cone, cylinder. Six Practicals (Practical number 15 to 20).

List of Practicals:

(1) Graphical solution of Cartesian equations
(2) Graphs of parametric equations of some standard curves.
(3) Graphs of polar equations: cardioids, Limacön with a loop, Limacön with a dimple, spirals, rose curves
(4) Problems on definite integral as a limit of sum, method of integration by substitution/by partial fractions/by parts(10 problems)
(5) Derivation of reduction formulae
(6) Evaluate the following using reduction formulae only: $\sin^n x$, $\cos^n x$, $\tan^n x$ for different odd/even $n \in N$ (10 problems)
(7) Evaluate $\sin^m x \cos^n x$ using reduction formulae only: for different odd/even $m, n \in N$ (10 problems)
(8) Find the area of a bounded plane region between curves and the volume of a solid body on revolution of a bounded plane region about the co-ordinate axes using definite integral. (5+5=10 problems)
(9) Find the length of arcs and curves in Cartesian & parametric forms using definite integral. (5+5=10 problems)
(10) Find the area of a surface of revolution of a bounded curve about the co-ordinate axes using definite integral. (5+5=10 problems)
(11) Solve the differential equations of order 1 and degree 1 & also higher degree.(10 problems)
(12) Solve the differential equations of higher order and degree 1 with constant coefficients.(10 problems)
(13) Solve the differential equations of higher order and degree 1 with variable coefficients. (8 problems)
(14) Applications of differential equations and orthogonal trajectories
(15) The mutual relation between polar and Cartesian co-ordinate systems in R^2 and R^3. Transformation of equations from one system to another. (10 problems)
(16) The mutual relations among Cartesian, cylindrical and spherical co-ordinate system in R^3 (10 problems)
(17) The mutual relations among Cartesian, cylindrical and spherical co-ordinate system in R^3. Transformation of equations from one system to another (8 problems)
(18) Problems on sphere (8 problems)
(19) Problems on cone(8 problems)
(20) Problems on cylinder(8 problems).