

NATIONAL UNIVERSITY



Syllabus

Subject: Mathematics

Three Years B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Subject: Mathematics
Syllabus for Three Year B.Sc. Pass Course
Session: 2013-2014
Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
Third Year				
133701	Paper-V	Computer Programming and Numerical Analysis	100	4
133703	Paper-VI	Ordinary Differential Equations	100	4
133704	Paper-VII	Math Lab	100	4
		Total =	700	28

Detailed Syllabus

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133701	Paper-V	Computer Programming and Numerical Analysis	100	4

Part-I: Computer Programming

Algorithm and programs: Problem analysis and development of algorithms. Program coding, execution, design, validation and refinement.

Basic FORTRAN: Data type, operations functions, assignment statement, input-output, stop and end statement.

Control structure: Logical data type, logical if and block if, do and continue, Go to statement, While statement.

Input-output: formatted input and output, File processing.

Dimensional arrays: Arrays and subscripted variables, dimension statement, parameter and data statement, examples average group data, sorting and searching.

Multidimensional arrays: Matrix operations, Solving linear system, Functions and subroutines: Library functions and statement functions, function subprogram, subroutine, subprogram, Common statement.

Part-II: Numerical Analysis

Solutions of equations of one variable: Bisection method, Fixed point iteration, Newton-Raphson method, Error analysis for iterative method.

Interpolation and polynomial approximation: Taylor polynomials, Interpolation and Lagrange polynomial, Iterated interpolation.

Numerical differentiation & integration: Numerical differentiation with backward – difference formula, forward difference formula, Adaptive quadrature method, Trapezium method, Simpson method,

Matrix algebra and system of equations. Matrix operations, Gauss-Jordan elimination method. SOR Method. (Successive over-Relaxation method).

Books Recommended:

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|--------------------------------|---|---|
| 1. Schaum's Outline Series | : | Fortram 77 |
| 2. V. Rajaraman | : | Fortram 90/95 |
| 3. S. S. Kuo | : | <i>Numerical methods & Computers</i> |
| 4. Burdin & J. D. Faires | : | <i>Numerical Analysis</i> |
| 5. S. S. Shastri | : | <i>Introductory Methods of Numerical Analysis</i> |
| 6. হোসাইন, ভট্টাচার্য, ইলিয়াস | : | সাংখ্যিক বিশ্লেষণ |

Paper Code	Paper	Paper Title	Marks	Credits
133703	Paper-VI	Ordinary Differential Equations	100	4

- Ordinary differential equations and their solutions:** Definition and formation of differential equations. Classification of differential equations. Solutions. Implicit solutions. Singular solutions. Initial value problems. Boundary value problems. Basic existence and uniqueness theorems (statement and illustration only). Direction fields. Phase line.
- Solution of first order Differential equations :** Separable equations. Linear equations. Exact equations. Special integrating factors. Substitutions and transformations. Homogeneous equations. Bernoulli equation. Riccati equation. First order higher degree equation-solvable for x, y and p . Clairaut's equation.
- Modelling with first order differential equations:** Construction of differential equations as mathematical models (exponential growth and decay, heating and cooling, mixture of solution. Series circuit, logistic growth, chemical reaction, falling bodies). Model solutions . and interpretation of results. Orthogonal trajectories.
- Solution of higher order linear equations:** Linear differential operators. Basic theory of linear differential equations. Solution space of homogeneous linear equations. Fundamental solutions of homogeneous solutions. Reduction of orders, Homogeneous linear equations with constant coefficients. Non-homogeneous equation. Method of undetermined coefficients. Variation of parameters. Euler-Cauchy differential equation.
- Series solutions of second order linear equations :** Taylor series solutions. Frobenius series solutions. Series solutions of Legendre, Bessel, Laguerre and Hermite equations and their solutions.

Books Recommended:

- S.L. Ross- *Differential Equations*.

2. Denis Gill-*Introduction to Differential Equations*.
3. Frank Ayres, J R. *Theory and Problems of Differential Equations*.
4. Martin Braun. *An introduction to Differential Equations and their Applications*.
5. কুদ্দুস, আওয়াল, হাফিজ - *Ordinary differential Equation*

Paper Code	Paper	Paper Title	Marks	Credits
133704	Paper-VII	Math Lab	100	4

Problem-solving using Mathematica: Running the package. Numerical computation. Algebraic computation. Mathematical functions. Derivatives and integrals. Limits and series. Determinants and matrices. Graphics. Standard packages. Solving problems in Algebra, Geometry, Calculus, differential equations and Computing. Problems will be selected from courses studied in the first and second years.

Students are required to work on their assignments in the sessions.

Evaluation: Internal Assessment (Laboratory works): 30 marks. Final Exam (Lab) (4 hours): 70 marks.

Books Recommended:

1. Schaum's Outline Series – *Mathematica*
2. Worlfarm's Research (Student edition) – *Mathematica*