



**Syllabus Of
Mathematics
B.Sc. (Hons.)
Course Code: EMT**

NETAJI SUBHAS OPEN UNIVERSITY

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Course Structure for the Bachelor's Degree Programme (BDP) in Mathematics

1. Compulsory Subjects : Foundation Course

(a) Humanities and Social Science (FHS)	8 Credits
(b) Science and Technology (FST)	8 Credits
(c) Bengali (FBG)	4 Credits
(d) English (FEG)	4 Credits

24 Credits

2. Elective Subjects : Honours Course (EMT)

Course 01 : Differential Calculus and its Geometric Application	4 Credits
Course 02 : Integral Calculus and Differential Equations	4 Credits
Course 03 : Classical Algebra & Abstract Algebra	4 Credits
Course 04 : Vector Algebra & Vector Calculus	4 Credits
Course 05 : Linear Algebra & Transformation	4 Credits
Course 06 : Analytical Geometry	4 Credits
Course 07 : Mathematical Analysis - I	4 Credits
Course 08 : Mathematical Analysis - II	4 Credits
Course 09 : Analytical Dynamics	4 Credits
Course 10 : Analytical Statics	4 Credits
Course 11 : Numerical Analysis	4 Credits
Course 12 : Probability Theory	4 Credits
Course 13 : Statistics and its Application	4 Credits
Course 14 : Linear Programming and Game Theory	4 Credits
Course 15 : Complex Analysis and Integral Transform	4 Credits
Course 16 : Computer Programming	4 Credits

64 Credits

3. Subsidiary Course :

One subsidiary Course from (SPH, SCH, SBT, SZO, SGO)	24 Credits
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4. Application Oriented Course (Any one)

8 Credits

- (a) Basic Accounting (AOC-01)
- (b) Food Processing (AOC-02)
- (c) Household Chemistry (AOC-03)

5. Environmental Studies

4 Credits

Total Credits for the Course = $(24+64+24+8+4) = 124$ Credits or 1550 Marks.

Evaluation System :

Internal Assessment : 30%

Term-end Examinations : 70%



Detailed Syllabus

EMT 01 :

Block 1 : Differential Calculus

- Unit-1 : Real numbers and their properties
- Unit-2 : One variable function, limit and properties
- Unit-3 : Continuity at a point of a function of one variable
- Unit-4 : Derivatives of functions of one variable and higher order derivatives
- Unit-5 : Rolle's Th., Meanvalue Ths., L' Hospital's rule
- Unit-6 : Taylor's expansion with Semainder and infinite series expansion
- Unit-7 : Function of several variables, Limit, Continuity and Partial Derivatives

Reference :

1. Differential Calculus - Shantinakaran.
2. Differential & Integral Calculus – Courant & John.
3. Advanced Calculus – W. Kaplan
4. Infinitesimal Calculus Vol I. – J. dela Vallece Poussain

Block 2 : Geometric Application

- Unit-8 : Tangent, normal and linear asymptote
- Unit-9 : Envelope, cusp, node, double point, point of inflection
- Unit-10 : Curvature of a curve
- Unit-11 : Some typical curves
- Unit-12 : Minimum, maximum and stationary values of one variable functions
- Unit-13 : Minimum, maximum and stationary values of multivariate functions

Reference :

1. Coordinate Geometry–S. L. Loney
2. Coordinate Geometry of Three Dimensions–J. T. Bell
3. Solid Analytic Geometry–C. Smith
4. Elementary Treatise on Conic Sections – C. Smith

EMT 02 :

Block 1 : Integral Calculus

- Unit-1 : Definite Integral
- Unit-2 : Different methods of integration
- Unit-3 : Reduction Formulas and Integration by Consecutive Reduction
- Unit-4 : Improper Integral
- Unit-5 : Line Integral and determination of the length of a curved line
- Unit-6 : Double Integral, Tripple Integral and Determination of Surface and Volume

Reference :

1. Integral Calculus : Shantinakaran



2. Differential & Integral Calculus (Vol-I & II)—Courant & John
3. Theory of Integrals & Fourier Series—H. S. Carslaw
4. Differential Equation—Lester R. Ford \ Shepley L. Ross \ H. T. H. Piaggio \ H. B. Phillips
5. Differential Equation with Application & Programme – S. Bala Chandra Rao, M. R. Anuradha
6. Text Book of ordinary Differential Equations – S. G. Deo, V. Lakshmi Kantham & V. Raghavendra

Block 2 : Differential Equations

Unit-7 : Differential Equation—Genesis, Order and Degree

Unit-8 : Differential Equations

Unit-9 : First Order Differential Equations

Unit-10 : Singular Solution

Unit-11 : Simultaneous Linear Differential Equations with Constant Coefficients

Unit-12 : Differential Equations of Second and Higher Order—Methods of Solutions

Reference :

1. An Introductory Course on Ordinary Differential Equations – D. A. Murray
2. Differential Equations—Lester R. Ford
3. Differential Equations—Shepley L. Ross
4. Differential Equations—H. T. H. Piaggio

EMT 03 :

Block 1 : Classical Algebra

Unit-1 : Inequalities

Unit-2 : Complex Number, De-moivre's Theorem etc.

Unit-3 : Function of complex Numbers

Unit-4 : Polynomials, Roots and Properties of Polynomial Equations

Unit-5 : Cubic and Bi-quadratic Equations

Unit-6 : Special Reciprocal Equation

Unit-7 : Continued Fraction

Unit-8 : Elementary Theory of Numbers

Reference :

- (1) The Theory of Equations (Vol.1)—Burnside & Panton
- (2) Higher Algebra—Barnard & Child

Block-2 : Abstract Algebra

Unit-9 : Sets

Unit-10 : Relations and Mapping



Unit-11 : Group-Definition and Properties

Unit-12 : Cyclic Group, Normal Subgroup

Unit-13 : Ring

Unit-14 : Field

Reference :

- (1) Abstract Algebra – N. P. Chaudhuri
- (2) Elements of Abstract Algebra – Sharma, Gokhroo, Saini
- (3) First Course in Abstract Algebra–Fraleigh

EMT 04 :

Block 1 : Vector Algebra

Unit-1 : Cartesian Coordinates of Three-Dimensional Geometry, Direction Cosine etc.

Unit-2 : Vector

Unit-3 : Vector Multiplication

Unit-4 : Geometric Application of Vectors

Unit-5 : Other Applications of Vectors

Reference :

- (1) Vector Analysis – Louis Brand
- (2) Vector Analysis – Barry Spain
- (3) Elementary Vector Analysis – C.E. Weather Burn (Vol I & II)

Block 2 : Vector Calculus

Unit-6 : Derivatives of Vector

Unit-7 : Integration of Vectors

Unit-8 : Gradient, Divergence, Curl etc.

Unit-9 : Gauss and Stoke's Theorem

Unit-10 : Applications of Vector Calculus

Reference :

- (1) Vector Analysis – Spiegel (Schaum)
- (2) Vector Calculus – C. E. Weatherburn

EMT 05 :

Block 1 : Linear Algebra

Unit-1 : Introduction to Matrix Algebra, Its Properties & Application From Classical Approach

Unit-2 : Determinant

Unit-3 : Solution of Linear Equations of Three Variables, Cramer's Rule

Unit-4 : Vector Space or Linear Space

Unit-5 : Basis and Dimension



Unit-6 : Three Elementary Operations and Elementary Matrices

Unit-7 : Rank of a matrix

Unit-8 : System of Linear Equations and its Solution

Reference :

- (1) Linear Algebra – B. C. Chatterjee
- (2) Introduction to Linear Algebra with Applications – Kolman Bernard
- (3) Elementary Linear Algebra – Anton Howard
- (4) Elements of Linear Algebra – N. C. Mazumdar
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Block 2 : Linear Transformation

Unit-9 : Inner Product Space

Unit-10 : Linear Transformation / Mapping

Unit-11 : Linear Transformation in the form of a Matrix

Unit-12 : Eigen Vector

Unit-13 : Quadratic Form

Unit-14 : Geometric Applications

Reference :

- (1) Linear Algebra – G. Hadley
- (2) Linear Algebra—Schaum's Outline Series
- (3) Linear Algebra with Application – H. G. Campbell
- (4) Higher Algebra – S. K. Mapa

EMT 06 :

Block 1 : Analytical Geometry (2 & 3 Dimensions)

Unit-1 : Transformation of Coordinates and Invariant

Unit-2 : Pair of Straight Lines

Unit-3 : Common Quadratic Equations : Classification

Unit-4 : Tangent, Normal, Diameter

Unit-5 : Polar Equation of Conics

Reference :

- (1) Coordinate Geometry – S. L. Loney
- (2) Coordinate Geometry of Three Dimensions – J. T. Bell
- (3) Elementary Treatise on Conic Sections – C. Smith
- (4) Solid Analytic Geometry – C. Smith

Block 2 : Three Dimensional Geometry

Unit-6 : Coordinates and Transformartion

Unit-7 : Plane

Unit-8 : Straight Line

Unit-9 : Rotational Plane, Generating Line



- Unit-10 : Sphere
- Unit-11 : Cone, Cylinder
- Unit-12 : Quadratic Surface
- Unit-13 : Tangent, Normal, Diameter
- Unit-14 : General Equation of 2nd degree : Classification

Reference :

- (1) M. C. Chaki — Analytical Co-ordinate Geometry
- (2) J. G. Chakravorty & P. R. Ghosh — Advanced Analytic Geometry, U.N. Dhar Pub., Kolkata.
- (3) 'p. x#p>!•pîûOš ö<pî™%îû#éôôôöçpQîû î# ^!"•p G !eÿy!e†p PíyşyA†p Äy!ÿ!•p– p>!ØpÿîA^ îûy Ä p>%hßî†p p>£îÄ~Ð

EMT 07 :

Block 1 : Mathematical Analysis - I

- Unit-1 : Sets of Real Numbers and Properties
- Unit-2 : Limit Point Properties and Heine Borel Properties of Sets of Real Numbers
- Unit-3 : Infinite Sequences of Real Numbers
- Unit-4 : Infinite Series of Real Numbers
- Unit-5 : Sufficient Conditions of Convergence of Sequence of Real Numbers and Examples
- Unit-6 : Sufficient Condition for Convergence of Infinite Series

Reference :

- (1) Mathematical Analysis – Par Zynski
- (2) Mathematical Analysis – Shantinarayan

Block 2 : Mathematical Analysis - I

- Unit-7 : Properties of Functions Continuous in a Closed Interval
- Unit-8 : Monotonic Increasing and Decreasing Functions of Bounded Variation and Their Properties
- Unit-9 : Inverse Functions : Conditions of Existence, Trigonometric Inverse Functions : e^x , $\log_e x$, a^x .
- Unit-10 : Convergence of Series of Functions and Power Series.
- Unit-11 : Uniform Convergence of Sequences and Series of Functions.
- Unit-12 : Theorems Concerning Limit, Continuity, Partial Derivatives of Function of Several Variables.
- Unit-13 : Implicit Function Theory for Function of Single Variable, Jacobians etc.

Reference :

- (1) Problems in Mathematical Analysis–B. P. Demidovich
- (2) Problems in Mathematical Analysis – Berman

EMT 08 :



Block 1 : Mathematical Analysis - II

- Unit-1 : Riemann Integral of Bounded Functions of one Variable.
- Unit-2 : Darboux's Theorem on Integration
- Unit-3 : Properties of Riemann Integral
- Unit-4 : Riemann Integrable Functions
- Unit-5 : Meanvalue Theorem of Riemann Integrals
- Unit-6 : Riemann Integral of Functions of Several Variables
- Unit-7 : Differentiation and Integration of Functions of Several Variables

Reference :

- (1) Elements of Real Analysis (2nd Edition, John Wiley)—Robert G. Bartle
- (2) A Course of Analysis – Phillips
- (3) Mathematical Analysis – Shantinarayan

Block 2 : Mathematical Analysis - II

- Unit-8 : Improper Riemann Integration
- Unit-9 : Differentiation and Integration of an Infinite integral w.r.t. a Parameter
- Unit-10 : Beta / Gamma Functions and other Related Improper Integrals
- Unit-11 : Convergence of Series by term Integration and Differentiation of Power Series
- Unit-12 : Fourier Series of Bounded, Integrable and Periodic Functions.
- Unit-13 : Different types of Fourier Series, such as Cosine, Sine Series etc. and other Applicable Examples.

Reference :

- (1) Advanced Calculus – David V. Widder
- (2) Methods of Real Analysis – Richard R. Goldberg
- (3) Introductions to the Theory of Fourier Series and Integrals – H. S. Carslaw
- (4) Mathematical Analysis – Malik and Arora
- (5) A Course of Mathematical Analysis – Shantinarayan

EMT 09 :

Block 1 : Particle Dynamics

- Unit-1 : Introduction : Galilean System – Kinematics I
- Unit-2 : Kinematics II
- Unit-3 : Newton's Laws of Motion and Different Principles of Conservation (Impulsive Motion)
- Unit-4 : Motion in a Straight Line – SHM and Other Forced Motions
- Unit-5 : Motion of a Particle in a Plane (Friction with Elastic Bodies)
- Unit-6 : Central Forces and Stability of Orbits
- Unit-7 : Motion under Inverse Square Law : Planetary Motion
- Unit-8 : Change of Elliptical Path due to Disturbance



Unit-9 : Motion of a Particle in Resisting Medium (Planar)

Unit-10 : Constrained Motion

Unit-11 : Motion of a Particle of Varying Mass

Reference :

(1) Dynamics of a Particle and of Rigid Bodies – S. L. Loney.

(2) Hydrostatics – A. S. Ramsay.

Block 2 : Rigid Dynamics

Unit-12 : Motion of a Rigid body ; Motion of Centre of Gravity, motion with respect to Centre of Gravity, Conservation of Momentum & Angular Momentum.

Unit-13 : Kinematics of a Rigid body.

Unit-14 : Moment of Inertia of Rigid body

Unit-15 : D'Alembert's Equations of Motion and its Application in laws of Motions of Rigid Bodies

Unit-16 : Principles of Conservation of Motions of Rigid Bodies.

Unit-17 : Two Dimensional Motion of Rigid Bodies (Under limiting Force)

Unit-18 : Impulsive Motion of rigid bodies

Unit-19 : Motion of Rigid Bodies about a fixed Axis.

Unit-20 : Different Examples and Exercises on Motion of Broad Cylinder and Spheres with two Dimensional Motion

Reference :

(1) An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies – S. L. Loney.

EMT 10 :

Block 1 : Analytical Statics

Unit-1 : Force and Other Ideas

Unit-2 : Concurrent Forces, Resultant and Equilibrium

Unit-3 : Forces, Their Resultant, Moment of Forces and Couple

Unit-4 : Statical Equivalence of Force Systems

Unit-5 : Equilibrium of Force Systems

Unit-6 : Force of Friction

Unit-7 : Centre of Gravity

Unit-8 : Beam, Wire and Chain

Unit-9 : Work, Principle of Virtual Work.

Unit-10 : Stability of Equilibrium

Reference :

(1) Analytical Statics – S. L. Loney

Block 2 : Fluid Statics



- Unit-11 : Applied force and Its Effect
- Unit-12 : Liquid Pressure
- Unit-13 : Centre of Pressure on a Plane Area
- Unit-14 : Thrust, Couple etc.
- Unit-15 : Equilibrium of Rotating Fluid
- Unit-16 : Principles of Archimedes, Equilibrium of Floating & Emerged Bodies
- Unit-17 : Stability of Equilibrium of Floating Bodies & Metacentre
- Unit-18 : Equilibrium in Atmosphere

Reference :

- (1) Hydrostatics for Degree Classes–J. M. Kar (The Globe library, Kolkata, 1972)
- (2) $\text{èPûìè}»\text{Pô } \text{øóìÇPèùÚìæ} \text{ ‘} \ll *Çâ \hat{O}, \text{’}_\text{-è÷+ëJæ } \text{óìÐl:}$

EMT 11 :

Block 1 : Numerical Analysis

- Unit-1 : Introduction, Errors in Numerical Computation
- Unit-2 : Different types of Differences and Divided Differences
- Unit-3 : Deduction of Newtons forward and Backward Interpolation Formulae (with errors)
- Unit-4 : Deduction of Lagrange’s Interpolation Formulae, Error terms and Newton’s General Interpolation Formula
- Unit-5 : Statements of Starlings and Bessel’s Interpolation Formulae
- Unit-6 : Inverse Interpolation
- Unit-7 : Numerical Differentiation and Numerical Integration
- Unit-8 : Different Methods of Integration (Trapezoidal, Simpson’s and Weddle’s rule)

Reference :

- (1) Numerical Analysis and Computational Procedures – S. A. Mollah
- (2) Introduction to Numerical Analysis – F. B. Hildebrand

Block 2 : Numerical Analysis

- Unit-9 : Numerical Solution of Equations – I
- Unit-10 : Numerical solution of Equations - II
- Unit-11 : Numerical Solution of Equations - III
- Unit-12 : Determination of Inverse Matrix of a Square Matrix
- Unit-13 : Eigenvalues and Eigenvectors of Matrices
- Unit-14 : Solution of Systems of Linear Equations - I
- Unit-15 : Solution of Systems of Linear Equations - II
- Unit-16 : Numerical Solution of Ordinary Differential Equations



Reference :

- (1) Numerical Analysis–J. Scarborough
- (2) Introduction to Numerical Analysis – Carl Erik Froberg
- (3) Numerical Methods – E. Balaguruswamy
- (4) Numerical Methods for Science and Engineering–R. G. Stantois

EMT 12 :

Block 1 : Probability Theory

- Unit-1 : Event Spaces
- Unit-2 : Historical Background
- Unit-3 : Axioms of Mathematical Probability
- Unit-4 : Conditional Probability
- Unit-5 : Compound Experiments
- Unit-6 : Probability Distributions
- Unit-7 : Transformation of Random Variables and Mathematical Expectations
- Unit-8 : Characteristics of Distributions.

Reference :

- (1) The Elements of Probability Theory and some of its Applications – H. Cramer
- (2) An Introduction to Probability theory and its Application (Vol I)—W. Feller
- (3) Theory of Probability – B. V. Gnedenko
- (4) Mathematical Probability – J. V. Uspensky

Block 2 :

- Unit-9 : Two-dimensional Distributions
- Unit-10 : Conditional Distributions and two-dimensional transformation
- Unit-11 : Expectation and Characteristics of two-dimensional Distributions
- Unit-12 : Expectation and Characteristics for Independent Random Variables
- Unit-13 : Conditional expectation and regression
- Unit-14 : Some Special distributions
- Unit-15 : Convergence in Probability
- Unit-16 : Theorems on limit.

Reference :

- (1) Theory of Probability – B. V. Gnedenko
- (2) An introduction to Probability theory and its Application (Vol I)—W. Feller
- (3) $\text{Theory of Probability} - \text{B. V. Gnedenko}$

EMT 13 :

Block 1 : Statistics and Its Application



- Unit-1 : Preliminary Discussion, Presentation of Data
- Unit-2 : Measures of Central Tendencies–AM, GM, HM ; Mean, Median, Mode.
- Unit-3 : Measures of Dispersion
- Unit-4 : Bivariate and Multivariate Correlation
- Unit-5 : Sampling and Random Sampling Techniques
- Unit-6 : Sampling Distribution and Statistic
- Unit-7 : Sampling Average and Variation
- Unit-8 : Normal Distribution : Sampling and Distributions Collected there from.

Block 2 :

- Unit-9 : Point Estimation and its Techniques
- Unit-10 : Different Characteristics of Point Estimation, Interval Estimation
- Unit-11 : Standard Normal Distribution, Critical Region
- Unit-12 : Test of Hypothesis Relating to Statistics Simple Hypothesis and its test, (In case of distributions derived from the Normal)
- Unit-13 : Null Hypothesis and its tests in case of Normal Distribution
- Unit-14 : Chi-Square test.

Reference :

- (1) Mathematical Methods and Statistics – H. Cramer
- (2) Statistics – N. G. Das
- (3) Statistics – Sen and Dey

EMT 14 :

Block 1 : Linear Programming and Game Theory

- Unit-1 : Preliminary Discussions (Relating to Application)
- Unit-2 : Problems of Linear Programming
- Unit-3 : Graphical Solution of Bivariant L.P.P. and Idea of Sets
- Unit-4 : Algebraic form of L. P. Model Vector Space, convex set and Related Properties
- Unit-5 : Feasible Solutions and there Properties
- Unit-6 : Principle theorems Related to Solution of L. P. P.
- Unit-7 : Simplex Method of Solution of L. P. P.
- Unit-8 : Different Steps of Simplex Method
- Unit-9 : Set of Bounded, Feasible Solutions,
Unbounded set of Solution, Multiple set of Solutions, Discussion of Degeneracy
in set of Solutions (Through Simplex Method).

Reference :

- (1) Linear Programming – Ghosh & Chakraborty
- (2) Linear Programming : Method and Application–S. I. Gass
- (3) Linear Programming – G. Hadley



(4) An Introduction to Linear Programming and Theory of Games – S. Vajda

Block 2 : Linear Programming

Unit-10 : Duality in L. P. P.

Unit-11 : Transportation Model as L. P. P.

Unit-12 : Application of Different Methods in Transportation Model

Unit-13 : Assignment Problem

Unit-14 : Game Theory - Saddle Point

Unit-15 : Mixed Strategies and Two-Person Zero-sum Game.

Unit-16 : Solution of Game Problem as L. P. P.

References :

(1) Linear Programming : Method and Application–S. I. Gass

(2) Linear Programming – G. Hadley

(3) An Introduction to Linear Programming and Theory of Games – S. Vajda

EMT- 15 :

Block 1: Complex Analysis

Unit 1 : Complex Numbers

Unit 2 : Functions of Complex Variable

Unit 3 : Limit, Continuity and Differentiability

Unit 4 : Bilinear Transformation

Block 2: Laplace Transformation

Unit 1 : Properties of Laplace Transform

Unit 2 : Laplace Transforms of derivatives and integrals

Unit 3 : Differentiation and Integration of Laplace transform

Unit 4 : Convolution Theorem

Unit 5 : Inverse Laplace Transform

Unit 6 : Application of Laplace Transform to Ordinary Differential Equation

EMT – 16:

Block 1: Computer Programming in C

Unit 1 : Evolution of Computer

Unit 2 : Representation of Data

Unit 3 : Programming Language

Unit 4 : Algorithm and Flow Chart



Unit 5 : Elements of ANSI C

Unit 6 : C- Programming for problems of Numerical Analysis and Statistics

Block 2: Computer Programming for Numerical and Statistical Problem (Practical Paper)

Unit 1: Problems of Numerical Analysis

Unit 2: Problems of Statistics