DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS) :: OSMANIA UNIVERSITY
I - B.Sc., – I - Semester
Paper - I - DIFFERENTIAL EQUATIONS

Theory: 4 Credits — Practicals: 1 credits
Theory: 4 hours /week — Practicals: 2 hours /week

Objective: The main aim of this course is to introduce the students to the techniques Of solving differential equations and to train to apply their skills in solving some of the problems of engineering and science.

Outcomes: After learning the course the students will be equipped with the various tools to solve few types differential equations that arise in several branches of science.

Unit – I:
Differential Equations of first order and first degree:
Exact differential equations – Integrating Factors – Linear differential equations – Bernoullis equations – Change in variables – Total Differential Equations – Simultaneous Total Differential Equations – Equations of the form dx/ P = dy/ Q = dz/ R

Unit – II:
Higher order linear differential equations: Solution of homogeneous linear differential equations with constant coefficients – Solution of non-homogeneous differential equations P(D)y= Q(x) with constant coefficients by means of polynomial operators when Q(x)= e^{ax} , $sinbx, cosbx, x^k, e^{ax}V, xv$ where v is a function of x.

Unit – III:
Method of undetermined coefficients – Method of variation of parameters – Linear differential equations with non constant coefficients – The Cauchy – Euler Equation

Unit – IV:
Partial Differential equations- Formation and solution- Equations easily integrable – Linear equations of first order – Non linear equations of first order – Charpit's method – Non homogeneous linear partial differential equations – Separation of variables

Text: Daniel Murray, *Differential Equations*

References: Frank Ayres Jr, *Theory and Problems of Differential Equations*
Ford, L.R, *Differential Equations.*
Zafar Ahsan, *Differential Equations and Their Applications*
S. Balachandra Rao, *Differential Equations with Applications and Programs*
Stuart P Hastings, J Bryce McLead; *Classical Methods in Ordinary Differential Equations*

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS):: OSMANIA UNIVERSITY
I - B.Sc., – II - Semester
Paper – II - DIFFERENTIAL CALCULUS

Theory: 4 credits
Theory: 4 hours /week

Practicals: 1 credits
Practicals: 2 hours /week

Objective: The course is aimed at exposing the students to some basic notions in Differential calculus.

Outcome: By the time students completes the course they realize wide ranging Applications.

Unit- I:
Successive differentiation- Expansions of Functions- Mean value theorems (Lagrange's, Roll's Cauchy –mean value theorem and Taylor's theorem)

Unit – II:
Indeterminate forms – Curvature and Evolutes, Involutes,Curve Tracing in Cartesian co-ordinates

Unit – III:
Partial differentiation – Homogeneous functions- Eulers Theorem- Total derivative

Unit – IV:
Maxima and Minima of functions of two variables – Lagrange's Method of multipliers –Asymptotes- Envelopes

Text : Shanti Narayan and Mittal, *Differential Calculus*

References: William Anthony Granville, Percey F Smith and William Raymond Longley*;*
Elements of the differential and integral calculus
Joseph Edwards , *Differential calculus for beginners*
Smith and Minton, *Calculus*
Elis Pine, *How to Enjoy Calculus*
Hari Kishan ,*Differential Calculus*

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
II - B.Sc., – III - Semester
Paper - III - REAL ANALYSIS

Theory: 4 Credits
Theory: 4 hours /week

Practicals: 1 credits
Practicals: 2 hours /week

Objective: The course is aimed at exposing the students to the foundations of analysis which will be useful in understanding various physical phenomena.

Outcome: After the completion of the course students will be in a position to Appreciate beauty and applicability of the course.

Unit – I
Sequences: Limits of Sequences- A Discussion about Proofs-Limit Theorems for Sequences-Monotone Sequences and Cauchy Sequences

Unit – II
Subsequence-Lim sup's and Lim inf's-Series-Alternating Series and Integral Tests

Unit – III
Sequences and Series of Functions: Power Series-Uniform Convergence-More on Uniform Convergence-Differentiation and Integration of Power Series (Theorems in this section without Proofs)

Unit – IV
Integration: The Riemann Integral – Properties of Riemann Integral-Fundamental Theorem of Calculus

Text: Kenneth A Ross, *Elementary Analysis-The Theory of Calculus*

References: William F. Trench, *Introduction to Real Analysis*
Lee Larson, *Introduction to Real Analysis I*
Shanti Narayan and Mittal, *Mathematical Analysis*
Brian S. Thomson, Judith B. Bruckner, Andrew M. Bruckner; *Elementary Real analysis*
Sudhir R. Ghorpade Balmohan V. Limaye ,*A Course in Calculus and Real Analysis*

NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
II - B.Sc., – IV - Semester
Paper - IV - ALGEBRA

Theory: 4 Credits
Theory: 4 hours /week

Practicals: 1 credits
Practicals: 2 hours /week

Objective: The course is aimed at exposing the students to learn some basic algebraic structures like groups, rings etc.
Outcome: On successful completion of the course students will be able to recognize algebraic structures that arise in matrix algebra, linear algebra and will be able to apply the skills learnt in understanding various such subjects.

Unit – I

Groups: Definition and Examples of Groups- Elementary Properties of Groups - Finite Groups; Subgroups -Terminology and Notation -Subgroup Tests - Examples of Subgroups Cyclic Groups: Properties of Cyclic Groups – Classification of Subgroups Cyclic Groups-Permutation Groups: Definition and Notation -Cycle Notation - Properties of Permutations -A Check Digit Scheme Based on D5

Unit – II

Isomorphism's ; Motivation- Definition and Examples -Cayley's Theorem Properties of Isomorphism's -Automorphisms- Cosets and Lagrange's Theorem Properties of Cosets | Lagrange's Theorem and Consequences-An Application of Cosets to Permutation Groups -The Rotation Group of a Cube and a Soccer Ball –Normal Subgroups and Factor Groups ; Normal Subgroups-Factor Groups -Applications of Factor Groups -Group Homomorphism's - Definition and Examples -Properties of Homomorphism's -The First Isomorphism Theorem

Unit – III

Introduction to Rings: Motivation and Definition -Examples of Rings -Properties of Rings -Sub rings -Integral Domains: Definition and Examples –Characteristics of a Ring -Ideals and Factor Rings; Ideals -Factor Rings -Prime Ideals and Maximal Ideals

Unit – IV

Ring Homeomorphisms: Definition and Examples-Properties of Ring-Homomorphism -The Field of Quotients Polynomial Rings: Notation and Terminology

Text: Joseph A Gallian, *Contemporary Abstract algebra (9th edition)*
References: Bhattacharya, P.B Jain, S.K.; and Nagpaul, S.R, *Basic Abstract Algebra*Fraleigh, J.B. *A First Course in Abstract Algebra*.
Herstein, I.N. *Topics in Algebra*
Robert B. Ash, *Basic Abstract Algebra*
I Martin Isaacs, *Finite Group Theory*
Joseph J Rotman, *Advanced Modern Algebr*

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
III - B.Sc., – V - Semester
Paper - V - LINEAR ALGEBRA

Theory: 4 Credits
Theory: 3 hours /week

Practicals: 1 credits
Practicals: 3 hours /week

Objective: The students are exposed to various concepts like vector spaces , bases ,dimension, Eigen values etc .

Outcome: After completion this course students appreciate its interdisciplinary nature.

Unit I
Vector Spaces: Vector Spaces and Subspaces -Null Spaces, Column Spaces, and Linear Transformations -Linearly Independent Sets; Bases -Coordinate Systems –The Dimension of a Vector Space

Unit II
Rank-Change of Basis – Eigen values and Eigenvectors - The Characteristic Equation

Unit III
Diagonalization -Eigenvectors and Linear Transformations -Complex Eigen values - Applications to Differential Equations - Orthogonality and Least Squares: Inner Product, Length, and Orthogonality -Orthogonal Sets

Text : David C Lay , *Linear Algebra and its Applications*

References: S Lang, *Introduction to Linear Algebra*
Gilbert Strang, Linear *Algebra and its Applications*

Stephen H Friedberg et al, *Linear Algebra*

Kuldeep Singh, *Linear Algebra*

Sheldon Axler, *Linear Algebra Done Right*

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
III - B.Sc., – V - Semester
Paper – VI (A) - SOLID GEOMETRY

Theory: 4 Credits
Theory: 3 hours /week

Practicals: 1 credits
Practicals: 3 hours /week

Objective: Students learn to describe some of the surfaces by using analytical Geometry.
Outcome: Students understand the beautiful interplay between algebra and geometry.

Unit I
Sphere: Definition-The Sphere through Four Given Points-Equations of a Circle-Intersection of a Sphere and a Line-Equation of a Tangent Plane-Angle of Intersection of Two Spheres-Radical Plane

Unit II
Cones and Cylinders: Definition-Condition that the General Equation of second Degree Represents a Cone-Cone and a Plane through its Vertex –Intersection of a Line with a Cone- The Right Circular Cone-The Cylinder- The Right Circular Cylinder

Unit III
The Conicoid: The General Equation of the Second Degree-Intersection of Line with a Conicoid-Plane of contact-Enveloping Cone and Cylinder

Text : Shanti Narayan and P K Mittal , *Analytical Solid Geometry (17e)*

References: Khaleel Ahmed , *Analytical Solid Geometry*

S L Loney, *Solid Geometry*

Smith and Minton, *Calculus*

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
III - B.Sc., – V - Semester
Paper – VI (B) - INTEGRAL CALCULUS

Theory: 4 Credits
Theory: 3 hours /week

Practicals: 1 credits
Practicals: 3 hours /week

Objective: Techniques of multiple integrals will be taught.
Outcome: Students will come to know about its applications in finding areas and volumes of some solids.

Unit I

Areas and Volumes: Double Integrals-Double Integrals over a Rectangle-Double Integrals over General Regions in the Plane-Changing the order of Integration

Unit II

Triple Integrals: The Integrals over a Box- Elementary Regions in Space-Triple Integrals in General

Unit III

Change of Variables: Coordinate Transformations-Change of Variables in Triple Integrals

Text: Susan Jane Colley, *Vector Calculus*

References: Smith and Minton , *Calculus*

Shanti Narayan and Mittal, *Integral calculus*

Ulrich L. Rohde , G. C. Jain , Ajay K. Poddar and A. K. Ghosh, *Introduction to Integral Calculus*

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
III - B.Sc., – VI - Semester
Paper – VII - NUMERICAL ANALYSIS

Theory: 4 Credits
Theory: 3 hours /week

Practicals: 1 credits
Practicals: 3 hours /week

Objective: Students will be made to understand some methods of numerical analysis.
Outcome: Students realize the importance of the subject in solving some problems of algebra and calculus.

Unit – I
Solutions of Equations in One Variable: The Bisection Method - Fixed-Point Iteration - Newton's Method and Its Extensions - Error Analysis for Iterative Methods- Accelerating Convergence - Zeros of Polynomials and Muller's Method - Survey of Methods and Software

Unit – II
Interpolation and Polynomial Approximation: Interpolation and the Lagrange Polynomial - Data Approximation and Neville's Method - Divided Differences - Hermite Interpolation - Cubic Spline Interpolation

Unit – III
Numerical Differentiation and Integration: Numerical Differentiation - Richardson's Extrapolation - Elements of Numerical Integration- Composite Numerical Integration- Romberg Integration - Adaptive Quadrature Methods - Gaussian Quadrature

Text : Richard L. Burden and J. Douglas Faires, *Numerical Analysis (9e)*

References: M K Jain, S R K Iyengar and R k Jain, *Numerical Methods for Scientificand Engineering computation*
B.Bradie, *A Friendly introduction to Numerical Analysis*
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DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
III - B.Sc., – VI - Semester
Paper – VIII (A)- COMPLEX ANALYSIS

Theory: 4 Credits
Theory: 3 hours /week

Practicals: 1 credits
Practicals: 3 hours /week

Objective: Analytic Functions, contour integration and calculus of residues will be introduced to the students.
Outcome: Students realize calculus of residues is one of the power tools in solving some problems, like improper and definite integrals, effortlessly.

Unit – I
Regions in the Complex Plane - Analytic Functions - Functions of a Complex Variable - Mappings - Mappings by the Exponential Function - Limits - Theorems on Limits - Limits Involving the Point at Infinity - Continuity - Derivatives - Differentiation Formulas - Cauchy–Riemann Equations - Sufficient Conditions for Differentiability - Polar Coordinates-Harmonic Functions
Elementary Functions: The Exponential Function - The Logarithmic Function - Branches and Derivatives of Logarithms - Some Identities Involving Logarithms Complex Exponents - Trigonometric Functions - Hyperbolic Functions

Unit – II
Integrals: Derivatives of Functions w (t) - Definite Integrals of Functions w(t) - Contours - Contour Integrals - Some Examples - Examples with Branch Cuts - Upper Bounds for Module of Contour Integrals –Anti derivatives

Unit – III
Cauchy–Goursat Theorem - Proof of the Theorem - Simply Connected Domains - Multiply Connected Domains - Cauchy Integral Formula - An Extension of the Cauchy Integral Formula - Some Consequences of the Extension - Liouville's Theorem and the Fundamental Theorem of Algebra- Maximum Modulus Principle

Text: James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications (8e)*
References: Joseph Bak and Donald J Newman, Complex *analysis*
Lars V Ahlfors, *Complex Analysis*
S.Lang, Complex *Analysis*
B Choudary, *The Elements Complex Analysis*

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS): OSMANIA UNIVERSITY
III - B.Sc., – VI - Semester
Paper – VIII (B)- VECTOR CALCULUS

Theory: 4 Credits
Theory: 3 hours /week

Practicals: 1 credits
Practicals: 3 hours /week

Objective: Concepts like gradient, divergence, curl and their physical relevance will be taught.
Outcome: Students realize the way vector calculus is used to addresses some of the problems of physics.

Unit I
Line Integrals: Introductory Example: Work done against a Force-Evaluation of Line Integrals-Conservative Vector Fields-Surface Integrals: Introductory Example: Flow Through a Pipe-Evaluation of Surface Integrals

Unit II
Volume Integrals: Evaluation of Volume integrals Gradient, Divergence and Curl: Partial differentiation and Taylor series-Partial differentiation-Taylor series in more than one variable-Gradient of a scalar field-Gradients, conservative fields and potentials-Physical applications of the gradient

Unit III
Divergence of a vector field -Physical interpretation of divergence-Laplacian of a scalar field-Curl of a vector field-Physical interpretation of curl-Relation between curl and rotation-Curl and conservative vector fields.

Text: P.C. Matthews, Vector *Calculus.*

References: G.B. Thomas and R.L. Finney, *Calculus*
H. Anton, I. Bivens and S. Davis, *Calculus*