B.Sc. Mathematics Syllabus

Under Choice Based Credit System

w.e.f

2019-20

DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (AUTONOMOUS)
Osmania University, Hyderabad-5000 01.

B.Sc., Mathematics Syllabus

Under Choice Based Credit System

w.e.f (2019-20)

DEPARTMENT OF MATHEMATICS

NIZAM COLLEGE (AUTONOMOUS)

Osmania University, Hyderbad 500 001

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DEPARTMENT OF MATHEMATICS
NIZAM COLLEGE (A)

SEMESTER-I

Differential Equations

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.

Outcome: 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: Introduction - Equations in which Variables are Separable - Homogeneous Differential Equations - Differential Equations Reducible to Homogeneous Form - Linear Differential Equations - Differential Equations Reducible to Linear Form - Exact differential equations - Integrating Factors - Change in variables - Total Differential Equations - Simultaneous Total Differential Equations - Equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

Unit- II

Differential Equations first order but not of first degree: Equations Solvable for p - Equations Solvable for y - Equations Solvable for x - Equations that do not contain x (or y)- Equations Homogeneous in x and y - Equations of the First Degree in x and y - Clairaut's equation.

Applications of First Order Differential Equations: Growth and Decay - Dynamics of Tumour Growth - Radioactivity and Carbon Dating - Compound Interest - Orthogonal Trajectories

Unit-·III

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 $Q(x) = be^{ax}$, $b\ sin\ ax/b\ cos\ ax, bx^k, V\ e^{ax}$ Method of undetermined coefficients.

Unit- IV

Method of variation of parameters - Linear differential equations with non constant coefficients - The Cauchy - Euler Equation - Legendre's Linear Equations - Miscellaneous Differential Equations.

Partial Differential Equations: Formation and solution- Equations easily integrable - Linear equations of first order.

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Text:

- Zafar Ahsan, *Differential Equations and Their Applications*

References:

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

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SEMESTER-II

Differential and Integral Calculus

Objective: The course is aimed at exposing the students to some basic notions in differential calculus.
Outcome: By the time students complete the course they realize wide ranging applications of the subject.

Unit- I
Partial Differentiation: Introduction - Functions of two variables - Neighbourhood of a point (a, b) - Continuity of a Function of two variables, Continuity at a point - Limit of a Function of two variables - Partial Derivatives - Geometrical representation of a Function of two Variables - Homogeneous Functions.

Unit- II
Theorem on Total Differentials - Composite Functions - Differentiation of Composite Functions - Implicit Functions - Equality of $f_{xy}(a, b)$ and $f_{yz}(a, b)$ - Taylor's theorem for a function of two Variables - Maxima and Minima of functions of two variables – Lagrange's Method of undetermined multipliers.

Unit- III
Curvature and Evolutes: Introduction - Definition of Curvature - Radius of Curvature - Length of Arc as a Function, Derivative of arc - Radius of Curvature - Cartesian Equations - Newtonian Method - Centre of Curvature - Chord of Curvature.
Evolutes: Evolutes and Involutes - Properties of the evolute.
Envelopes: One Parameter Family of Curves - Consider the family of straight lines - Definition - Determination of Envelope.

Unit- IV
Lengths of Plane Curves: Introduction - Expression for the lengths of curves $y = f(x)$ – Expressions for the length of arcs $x = f(y)$; $x = f(t), y = \phi(t)$; $r = f(\theta)$
Volumes and Surfaces of Revolution: Introduction - Expression for the volume obtained by revolving about either axis - Expression for the volume obtained by revolving about any line - Area of the surface of the frustum of a cone - Expression for the surface of revolution - Pappus Theorems - Surface of revolution.

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Text:

- Shanti Narayan, P.K. Mittal *Differential Calculus, S.CHAND, NEW DELHI*
- Shanti Narayan *Integral Calculus, S.CHAND, NEW DELHI*

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*

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Nizam College (Autonomous)

Model Question Paper for Internal Examination

Marks: 15 **Time: 45 Min**

I. Fill in the blanks $(10X\ ^1/_2 = 5\ )$

1. 2.

3. 4.

5. 6.

7. 8.

9. 10.

II. Multiple Choice Questions $(10X\ ^1/_2 = 5\ )$

1. 2.

3. 4.

5. 6.

7. 8.

9. 10.

III. Short Answer Questions (5X1=5)

1.

2.

3.

4.

5.

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Model Theory Question Paper (I, II – Sem.)

Subject: **Paper:**

Duration of the Examination: 3 hrs **Maximum Marks: 80**

Section – A (4 X 6=24 Marks)
(Short Answer question)

1. Unit - I

2. Unit - II

3. Unit - III

4. Unit - IV

Section – B (4 X 14 = 56 Marks)
(Essay Questions)

5. (a) UNIT-I

(OR)

(b)

6. (a) UNIT-II

(OR)

(b)

7. (a) UNIT-III

(OR)

(b)

8. (a) UNIT-IV

(OR)

(b)

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1.4 Algebra

(w.e.f. academic year 2020-21)

DSC-1D **BS:401**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and
Tutorials: 1 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.

Unit- II

Permutation Groups: Definition and Notation -Cyclė Notation-Properties of Permutations -A Check Digit Scheme Based on D_5. Isomorphisms ; Motivation- Definition and Examples -Cayley' s Theorem Properties of Isomorphisms -Automorphisms-Cosets and Lagrange' s Theorem Properties of Cosets 138 - Lagrange' s Theorem and Consequences-An Application of Cosets to Permutation Groups -The Rotation Group of a Cube and a Soccer Ball.

Unit- III

Normal Subgroups and Factor Groups: Normal Subgroups-Factor Groups -Applications of Factor Groups -Group Homomorphisms - Definition and Examples -Properties of Homomorphisms -The First Isomorphism Theorem.

Introduction to Rings: Motivation and Definition -Examples of Rings -Properties of Rings - Subrings.

Integral Domains: Definition and Examples - Fields – Characteristics of a Ring.

Unit- IV

Ideals and Factor Rings: Ideals -Factor Rings -Prime Ideals and Maximal Ideals.

Ring Homomorphisms: Definition and Examples-Properties of Ring- Homomorphisms.

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.*

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- Herstein, I.N, *Topics in Algebra*
- Robert B. Ash, *Basic Abstract Algebra*
- I Martin Isaacs, *Finite Group Theory*
- Joseph J Rotman, *Advanced Modern Algebra*

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1.3 Real Analysis

(w.e.f. academic year 2020-21)

DSC-1C **BS:301**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1hours/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 -Subsequences-Lim sup' s and Lim inf' s-Series-Alternating Series and Integral Tests .

Unit- II
Continuity: Continuous Functions -Properties of Continuous Functions -Uniform Continuity - Limits of Functions

Unit- III
Differentiation: Basic Properties of the Derivative - The Mean Value Theorem - #L' Hospital Rule - Taylor' s Theorem.

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:

- S.C. Malik and Savita Arora, *Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International (P) Limited, New Delhi, 1994.*
- 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*

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1.10 Logic and Sets

(w.e.f. academic year 2020-21)

SEC - II

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and
Tutorials: 1 hours/week

Objective: Students learn some concepts in set theory and logic.
Outcome: After the completion of the course students appreciate its importance in the development of computer science.

Unit- I

Basic Connectives and truth tables - Logical equivalence : Laws of Logic - Logical Implication : Rules Inference : The Use of Quantifiers - Quantifiers, Definitions, and proofs of Theorems.

Unit- II

Sets and Subsets - Set Operations and the Laws of Set Theory - Counting and Venn Diagrams - A First Word on Probability - The axioms of Probability - Conditional Probability: Independence - Discrete Random variables .

Text:

- Ralph P Grimaldi, *Discrete and Combinatorial Mathematics* (5e)

References:

- P R Halmos, *Naïve Set Theory*
- E Kamke , *Theory of Sets*

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1.9 Theory of Equations

(w.e.f. academic year 2020-21)

SEC-II

Theory: 2 credits
Theory: 2 hours /week

Objective: Students learn the relation between roots and coefficients of a polynomial equation, Descartes' s rule of signs in finding the number of positive and negative roots if any of a polynomial equation bsides some other concepts.

Outcome: By using the concepts learnt the students are expected to solve some of the polynomial equations.

Unit- I

Graphic representation of a polynomial-Maxima and minima values of polynomials-Theorems relating to the real roots of equations-Existence of a root in the general equation -Imaginary roots-Theorem determining the number of roots of an equation-Equal roots-Imaginary roots enter equations in pairs-Descartes' rule of signs for positive roots- Descartes' rule of signs for negative roots.

Unit- II

Relations between the roots and coefficients-Theorem-Applications of the theorem-Depression of an equation when a relation exists between two of its roots-The cube roots of unity Symmetric functions of the roots-examples.

Text:

- W.S. Burnside and A.W. Panton, *The Theory of Equations*

References:

- C. C. Mac Duffee, *Theory of Equations*
- Hall and Knight , *Higher Algebra*

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1.11 Number Theory

(w.e.f. academic year 2020-21)

SEC-IV **Theory : 2 credits Theory : 2 hours /week**

Objective: Students will be exposed to some of the jewels like Fermat' s theorem, Euler' s theorem in the number theory.

Outcome: Student uses the knowledge acquired solving some divisor problems.

Unit- I

The Goldbach conjecture - Basic properties of congruences- Binary and Decimal Representation of Integers - Number Theoretic Functions; The Sum and Number of divisors- The Mobius Inversion Formula- The Greatest integer function.

Unit- II

Euler' s generalization of Fermat' s Theorem: Euler' s Phi function- Euler' s theorem Some Properties of the Euler' s Phi function.

Text:

- David M Burton, *Elementary Number Theory (7e)*

References:

- Thomas Koshy, *Elementary Number Theory and its Applications*
- Kenneth H Rosen, *Elementary Number Theory*

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1.12 Vector Calculus

(w.e.f. academic year 2020-21)

SEC-IV Theory:2credits
Theory:2hours/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 PipeEvaluation 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.

Text:

- P.C. Matthews, *Vector Calculus*

References:

- G.B. Thomas and R.L. Finney, *Calculus*
- H. Anton, I. Bivens and S. Davis ; *Calculus*
- Smith and Minton, *Calculus*

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Model Question Paper for Internal Examination

Marks: 15 **Time: 45 Min**

I. Fill in the blanks (10X $^1/_2 = 5$)

1. 2.

3. 4.

5. 6.

7. 8.

9. 10.

II. Multiple Choice Questions (10X $^1/_2 = 5$)

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3. 4.

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7. 8.

9. 10.

III. Short Answer Questions (5X1=5)

1.

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Model Theory Question Paper (III, IV– Sem.)

Subject: **Paper:**

Duration of the Examination: 3 hrs **Maximum Marks: 80**

Section – A (4 X 6=24 Marks)
(Short Answer question)

1. Unit - I

2. Unit - II

3. Unit - III

4. Unit - IV

Section – B (4 X 14 = 56 Marks)
(Essay Questions)

5. (a) UNIT-I

(b) (OR)

6. (a) UNIT-II

(b) (OR)

7. (a) UNIT-III

(b) (OR)

8. (a) UNIT-IV

(b) (OR)

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1.5 Linear Algebra

(w.e.f. academic year 2021-22)

DSC-E **BS:501**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 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 - Eigenvalues and Eigenvectors - The Characteristic Equation

Unit- III

Diagonalization -Eigenvectors and Linear Transformations -Complex Eigenvalues - Applications to Differential Equations.

Unit- IV

Orthogonality and Least Squares : Inner Product, Length, and Orthogonality -Orthogonal Sets -Orthogonal Projections - The Gram-Schmidt Process.

Text:

- David C Lay,*Linear Algebra and its Applications 4e*

References:

- S Lang, *Introduction to Linear Algebra*
- Gilbert Strang , *Linear Algebra and its Applications*
- Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; *Linear Algebra*
- Kuldeep Singh; *Linear Algebra*
- Sheldon Axler; *Linear Algebra Done Right*

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1.13 Basic Mathematics

Generic Elective - V(A) **BS:502(A)**

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and Tutorials: 1 hours /week

Objective: Students learn the techniques which have been applied successfully to an increasingly wide variety of complex problems in business. Also learn the scientific approach to managerial decision making.

Outcome: Student realizes how the quantitative analysis will be an aid to decision-making process. Also the quantitative analysis how it will be linked with other information in making decisions.

Unit- I

Coordinate Geometry: Fundamentals - Cartesian Coordinates system - Polar Coordinates - Distance Formula - Section Formula -Centroid of a Triangle - Area of a Triangle.(Chapter 11)

Unit- II

Straight Line: Introduction - Definitions of the Terms - Different Forms of the Equations of a Straight Line - Distance of a point from a Straight Line - Angle between two Lines and Condition of Parallelism and Perpendicularity of Lines - Point of intersection of Two Lines - Condition of Concurrency of Three Given Straight Lines - Position of a Point with respect to a given Line.(Chapter 13)

Unit- III

Matrices: Introduction - Definitions and Notations - Operations on Matrices - Determinant of a Square Matrix - Non Singular matrix and Singular Matrix - Sarrus Diagram for Expansion of Determinant of a matrix $3X3$ - Properties of Determinants.(15.1,15.2,15.3,15.5.1,15.5.2,15.5.3 of Chapter 15)

Unit- IV

Linear System of Equations: Conversion of a business problem into a Linear System of Equations - Rank of a Matrix - Application of Rank concept - Minor and Cofactor - Adjoint of a Square matrix -Inverse of a Square Matrix - Matrix Equation - Methods to Solve Linear System of Equations - Solution to the linear system of Equations - Types of Solutions - Cramer" s rule - Matrix Inversion method. (15.4,15.5.4,15.5.5,15.5.6,15.5.7,15.5.8,15.6,15.7.1,15.7.2,15.7.3,15.7.4,15.7.4 of Chapter 15).

Text:

- P. Mariappan , ***Business Mathematics***,Pearson Publication 2015, New Delhi.

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1.14 Mathematics for Economics and Finance

Generic Elective - V(B) **BS:502(B)**

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and Tutorials: 1 hours /week

Objective: Many models and problems in modern economics and finance can be expressed using the language of mathematics and analysed using mathematical techniques. The aim is to show how a range of important mathematical techniques work and how they can be used to explore and understand the structure of economic models.

Outcome: Student were chiefly interested in learning the mathematics that had applications to economics and finance. Students gain a familiarity with economics and finance principles and are confident in applying them.

Unit- I

Linear Equations: Introduction - Solution of Linear Equations - Solutions of Simultaneous Linear Equations - Graphs of Linear Equations - Budget Lines - Supply and Demand Analysis . **Quadratic Equations:** Introduction - Graphys of Quadratic Functions - Quadratic Equations - Applications to Economics.

Unit- II

Functions of a Single Variable: Introduction - Limitis - Polynomial Functions - Reciprocal Functions - Inverse Functions. **The Exponential and Logarithmic Functions:** Introduction - Exponential Functions - Logarithmic Functions - Returns to Scale of Production Functions - Compounding of Interest.

Unit- III

Matrices and Determinants: Introduction - Matrix Operations - Solutions of Linear Systems of Equations - Cramer' s Rule - More Determinants - Special Cases.

Unit-IV

Linear Difference Equations: Introduction - Difference Equations - First Order Linear Difference Equations.

Text:

- Vassilis. C. Mavron and Timothy N.Phillips, *Elements of Mathematics for Economics and Finance*; Springer Publishers.

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1.6 Numerical Analysis
(w.e.f. academic year 2021-22)

Theory: 5 credits and Tutorials: 0 credits Theory: 5 hours /week and Tutorials: 1 hours /week

DSE-1F/A

BS:601/A

Theory: 5 credits and Tutorials: 0 credits Theory: 5 hours /week and Tutorials: 1 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

Errors in Numerical Calculations - **Solutions of Equations in One Variable**: The Bisection Method - The Iteration Method - The Method of False Position-Newton's Method - Muller's Method - solution of Systems of Nonlinear Equations.

Unit- II

Interpolation and Polynomial Approximation: Interpolation - Finite Differences - Differences of Polynomials - Newton's formula for Interpolation - Gauss's central differences formulae - Stirling's and Bessel's formula - Lagrange's Interpolation Polynomial - Divided Differences - Newton's General Interpolation formula - Inverse Interpolation.

Unit- III

Curve Fitting: Least Square Curve Fitting: Fitting a Straight Line-Nonlinear Curve Fitting.

Numerical Differentiation and Integration: Numerical Differentiation - Numerical Integration: Trapezoidal Rule-Simpson's 1/3rd-Rule and Simpson's 3/8th-Rule - Boole's and Weddle's Rule - Newton's Cotes Integration Formulae.

Unit- IV

Numerical Solutions of Ordinary Differential Equations: Taylor's Series Method - Picard's Method - Euler's Methods - Runge Kutta Methods.

Text:

- S.S.Sastry,*Introductory Methods of Numerical Analysis, PHI*

References:

- Richard L. Burden and J. Douglas Faires,*Numerical Analysis* (9e)
- M K Jain, S R K Iyengar and R K Jain, *Numerical Methods for Scientific and Engineering computation*
- B.Bradie , *A Friendly introduction to Numerical Analysis*

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1.7 Integral Transforms

(w.e.f. academic year 2021-22)

DSE - 1F/B **BS:601/B**

Theory: 5 credits and Tutorials: 0 credits Theory: 5 hours /week and Tutorials: 1 hours /week

Objective: Students will be exposed to Integral Transforms. The students also learning the Applications of Laplace Transforms to Differential Equations which arises in Physics and Engineering Problems.

Outcome: Students apply their knowledge to solve some problems on special functions and Differential Equations by using the Integral Transforms.

Unit- I

Laplace Transforms-Definition-Existence theorem-Laplace transforms of derivatives and integrals

– Periodic functions and some special functions.

Unit- II

Inverse Transformations - Convolution theorem - Heaviside's expansion formula.

Unit- III

Applications to ordinary differential equations - solutions of simultaneous ordinary differential equations - Applications to Partial differential equations.

Unit- IV

Fourier Transforms- Sine and cosine transforms-Inverse Fourier Transforms.

Text:

• Vasishtha and Gupta,*Integral Transforms, Krishna Prakashan Media(P), Ltd,Meerut* (2e)

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1.8 Analytical Solid Geometry

(w.e.f. academic year 2021-22)

DSE - 1F/C **BS:601/C**

Theory: 5 credits and Tutorials: 0 credits
Theory: 5 hours /week and Tutorials: 1 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.

Unit- III

The Right Circular Cone-The Cylinder- The Right Circular Cylinder.

Unit- IV

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*

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1.15 Mathematical Modeling

Project/ Optional - VI **BS:602**

Theory: 4 credits and Tutorials: 0 credits
Theory: 4 hours /week and Tutorials: 1 hours /week

Objective: This topic is aims to provide the student with some basic modelling skills that will have application to a wide variety of problems.
Outcome: The focus is on those mathematical techniques that are applicable to models involving differential equations, and which describe rates of change. Student realizes some beautiful problems can be modeled by using differential equations. The students also learn how to use the mathematical technique in solving differential equations.

Unit- I
Introduction to Mathematical Modelling: Mathematical Models-Modelling for decision making. **Compartmental Models:**-Exponential decay and radioactivity - Case Study: Detecting art forgeries - Lake Pollution Models - First order Linear Differential Equations - Equilibrium points and stability.

Unit- II
Models of Single Populations: Exponential growth - Density-dependent growth - Limited growth with harvesting. **Interacting Population Models:** Model for an influenza outbreak - **Case Study:** Cholera - Predators and prey - Competing Species.

Unit- III
Formulating Heat and Mass Transporot Models: Some basic physical laws -Model for a hot water heater- Heat conduction and Fourier' s Law - Heat conduction through a wall - Radiative heat conoduction - Diffusion.

Unit- IV
Boundary Value Problems - Heat loss through a wall - Insulating a water pipe - **Introduction to Partial Differential Equations:** The heat conduction equation - Oscillating soil temperatures - **Case study:** Detecting Land Mines - Lake Pollution.

Text:

- 1. B.Barnes and G.R.Fulford, *Mathematical Modelling with Case Studies* 3rd Edition, 2009, CRC press.

References:

- 1. Shepley L. Ross, *"Differential Equations"*.
- 2. I. Sneddon , *Elements of Partial Differential Equations*
- 3.Zafar Ahsan, *"Differential Equations and their Applications"*

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CBCS COURSE STRUCTURE, NIZAM COLLEGE, OU, HYDERABAD, TELANGANA STATE						
	CODE	COURSE TITLE	HPW	CREDITS	EXAM HOURS	MARKS
SEMESTER-I						
1	ELS-1	English (First Language)	4	4	2 hours	80C+15-I+5A
2	SLS-1	Second Language	4	4	2 hours	80C+15-I+5A
3	AEC-1	Environmental Science /Human values and Ethics	2	2	1½ hours	40C+10-I
4	DSC-101	Differential Equations	5+2	5	3 hours	80C+15I+5A (50T+P)
5	DSC-102	Optional-2	4+3 (5)	4+1 (5)	3 hours	80C+15I+5A(50P)
6	DSC-103	Optional-3	4+3 (5)	4+1 (5)	3 hours	80C+15I+5A(50P)
	Total		28/25	25		550/700
SEMESTER-II						
7	ELS-2	English (First Language)	4	4	2 hours	80C+15-I+5A
8	SLS-2	Second Language	4	4	2 hours	80C+15-I+5A
9	AEC-2	Environmental Science/ Human values and Ethics	2	2	1½ hours	40C+10-I
10	DSC-201	Differential & Integral Calculus	5+2	5	3 hours	80C+15-I+5A (50T+P)
11	DSC-202	Optional-2	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
12	DSC-203	Optional-3	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
	TOTAL		28/25	25		550/700
SEMESTER-III						
13	ELS-3	English (First Language)	3	3	2 hours	80C+15-I+5A
14	SLS-3	Second Language	3	3	2 hours	80C+15-I+5A
15	SEC-1		2	2	1½ hour	40C+10-I
16	SEC-2	Theory of equations	2	2	1½ hour	40C+10-I
17	DSC-301	Real Analysis	5+2	5	3 hours	80C+15-I+5A (50T+P)
18	DSC-302	Optional-2	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
19	DSC-303	Optional-3	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
		Total	28/25	25		600/750
SEMESTER-IV						
20	ELS-4	English (First Language)	3	3	2 hours	80C+15-I+5A
21	SLS-4	Second Language	3	3	2 hours	80C+15-I+5A
22	SEC-3		2	2	1½ hour	40C+10-I
23	SEC-4	Vector Calculus	2	2	1½ hour	40C+10-I
24	DSC-401	Abstract Algebra	5+2	5	3 hours	80C+15-I+5A (50T+P)

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	CODE	COURSE TITLE	HPW	CREDITS	EXAM HOURS	MARKS
SEMESTER-I						
1	ELS-1	English (First Language)	4	4	2 hours	80C+15-I+5A
2	SLS-1	Second Language	4	4	2 hours	80C+15-I+5A
3	AEC-1	Environmental Science /Human values and Ethics	2	2	1½ hours	40C+10-I
4	DSC-101	Differential Equations	5+2	5	3 hours	80C+15I+5A (50T+P)
5	DSC-102	Optional-2	4+3 (5)	4+1 (5)	3 hours	80C+15I+5A(50P)
6	DSC-103	Optional-3	4+3 (5)	4+1 (5)	3 hours	80C+15I+5A(50P)
	Total		28/25	25		550/700
SEMESTER-II						
7	ELS-2	English (First Language)	4	4	2 hours	80C+15-I+5A
8	SLS-2	Second Language	4	4	2 hours	80C+15-I+5A
9	AEC-2	Environmental Science/ Human values and Ethics	2	2	1½ hours	40C+10-I
10	DSC-201	Differential & Integral Calculus	5+2	5	3 hours	80C+15-I+5A (50T+P)
11	DSC-202	Optional-2	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
12	DSC-203	Optional-3	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
	TOTAL		28/25	25		550/700
SEMESTER-III						
13	ELS-3	English (First Language)	3	3	2 hours	80C+15-I+5A
14	SLS-3	Second Language	3	3	2 hours	80C+15-I+5A
15	SEC-1		2	2	1½ hour	40C+10-I
16	SEC-2	Theory of equations	2	2	1½ hour	40C+10-I
17	DSC-301	Real Analysis	5+2	5	3 hours	80C+15-I+5A (50T+P)
18	DSC-302	Optional-2	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
19	DSC-303	Optional-3	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
		Total	28/25	25		600/750
SEMESTER-IV						
20	ELS-4	English (First Language)	3	3	2 hours	80C+15-I+5A
21	SLS-4	Second Language	3	3	2 hours	80C+15-I+5A
22	SEC-3		2	2	1½ hour	40C+10-I
23	SEC-4	Vector Calculus	2	2	1½ hour	40C+10-I
24	DSC-401	Abstract Algebra	5+2	5	3 hours	80C+15-I+5A (50T+P)

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25	DSC-402		Optional-2	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
26	DSC-403		Optional-3	4+2 (5)	4+1 (5)	3 hours	80C+15-I+5A(50P)
			TOTAL	28/25	25		600/750
SEMESTER-V							
27	ELS-5		English(First Language)	3	3	2 hours	80C+15-I+5A
28	SLS-5		Second Language	3	3	2 hours	80C+15-I+5A
29	GE		Basic Mathematics or Mathematics for Economics & Finance	4	4	3 hours	80C+15-I+5 A
30	DSE-501	A	Linear Algebra	5+2 (5)	5	3 hours	80C+15-I+5A (50T+P)
		B	Linear Algebra				
		C	Linear Algebra				
31	DSE-502	A		4+2 (5)	5	3 hours	80C+15-I+5A(50P)
		B					
		C					
32	DSE-503	A		4+2 (5)	5	3 hours	80C+15-I+5A(50P)
		B					
		C					
			Total	28/25	25		600/750
SEMESTER-VI							
33	ELS-6		English (First Language)	3	3	2 hours	80C+15-I+5A
34	SLS-6		Second Language	3	3	2 hours	80C+15-I+5A
35	PR		Project Report / Optional paper	4	4	1½ HOUR/ 3 HOURS	PR-75+15VV +10presentation 80C+15-I+5A
36	DSE-601	A	Numerical Analysis	5+2	5	3 hours	80C+15-I+5A (50T+P)
		B	Integral Transforms				
		C	Analytical Solid Geometry				
37	DSE-602	A		4+2 (5)	5	3 hours	80C+15-I+5A(50P)
		B					
		C					
38	DSE-603	A		4+2 (5)	5	3 hours	80C+15-I+5A(50P)
		B					
		C					
			TOTAL	28/25	25		600/750
			GRAND TOTAL	168/150			3,500/4,400
Credits under Non-CGPA			NSS/NCC/SPORTS/ EXTRA CURICULAR/ STUDENT CLUBS	6	UP TO 6 (2 IN EACH YEAR)		
			SUMMER INTERNSHIP	4	UP TO 4 (2 IN EACH AFTER 1&2 YEARS)		
			T+P		Tutorial Problem Solving + Presentation by student		

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ELS: English Language Skill; SLS: Second Language Skill; AEC: Ability Enhancement Compulsory Course; SEC: Skill Enhancement Course; DSC: Discipline Specific Course; DSE: Discipline Specific Elective; GE: Generic Elective; T: Theory; P: Practical; I: Internal Exam C: College Exam: PR: Project Report; VV: Viva- Voce Examination

Note: I) If a student should opt for "a" in SEC in III semester, the student has to opt for "a" only in IV semester and so is the case with "b" and "c". In the case of DSE also the rule applies.

II) Project work should be done by individual student or a group of 4 students.

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OSMANIA UNIVERSITY, HYDERABAD

B.A/B.Sc. Mathematics Course Structure

(Common Core Syllabus for All Universities of Telangana State for the Students Admitted from the Academic Year 2019-20 Batch onwards)

Paper	Semester	Subject	Hours/ per week	Hours/per week		Max. Marks	Credits
				Theory	*Tutorials		
DSC - I	I	Differential & Integral Calculus	6	5	1	100	5
DSC - II	II	Differential Equations	6	5	1	100	5
DSC - III	III	Real Analysis	6	5	1	100	5
DSC - IV	IV	Algebra	6	5	1	100	5
DSC - V	V	Linear Algebra	6	5	1	100	5
DSE – VI(A)	VI	(A) Numerical Analysis	6	5	1	100	5
DSE – VI(B)	VI	(B) Integral Transforms	6	5	1	100	5
DSE – VI(C)	VI	(C) Analytical Solid Geometry	6	5	1	100	5
SEC-I	III	**Communication Skills (OR) Professional Skills**	2	2	-	50	2
SEC-II	III	Theory of Equations (OR) Logic & Sets	2	2	-	50	2
SEC-III	IV	**Leadership & Management Skill (OR) Universal Human Values**	2	2	-	50	2
SEC-IV	IV	Number Theory (OR) Vector Calculus	2	2	-	50	2
Generic Elective	V-A or V-B	Basic Mathematics or Mathematics for Economics & Finance	4	4	-	100	4
Project/ Optional	VI**	Mathematical Modelling	4	4	-	100	4

*Tutorials: Problems solving session for each 20 student's one batch.

The students are required to opt either the optional paper **Mathematical Modeling or **Project.**

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