

## U.G. 1<sup>st</sup> Semester

### Paper: MTH101C (Core) Calculus and Analytical Geometry

Credits: 5 = 4+1+0 (64 Lectures)

#### Unit-I (20 lectures)

Higher order derivatives, Leibniz rule and its applications in  $e^{ax+b}\sin x$ ,  $e^{ax+b}\cos x$ ,  $(ax+b)^n\sin x$ ,  $(ax+b)^n\cos x$ , concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates and polar coordinates of standard curves. L'Hospital's rule, applications in business, economics and life sciences.

#### Unit-II (07 lectures)

Reduction formulae, derivations and illustrations of reduction formulae of the type

$$\int \sin^n x dx, \quad \int \cos^n x dx, \quad \int \tan^n x dx, \quad \int \sec^n x dx, \quad \int (\log x)^n dx, \quad \int \sin^m x \cos^n x dx.$$

#### Unit-III (22 lectures)

Transformation of axes, classification of general second degree equations in two dimensions representing lines, parabola, ellipse and hyperbola, reflection properties of parabola, ellipse and hyperbola. Polar equations of conics. Spheres, cylindrical and conical surfaces.

#### Unit-IV (15 lectures)

Volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

#### Books Recommended

1. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) P. Ltd.(Pearson Education), Delhi, 2007.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.

#### Books for Reference

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
3. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London, 2016.
4. R.J.T. Bell, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.

**Paper: MTH102C (Core)**

**Algebra**

**Credits: 5=4+1+0 (64 Lectures)**

**Unit-I (18 lectures)**

De Moivre's theorem for rational indices and its applications, expansion of  $\cos x$ ,  $\sin x$  in positive integral powers of  $x$ , logarithm of a complex number, exponential and trigonometric functions of a complex variable, Euler's expansion of cosine & sine, hyperbolic functions, inverse functions, Gregory's series.

**Unit-II (08 lectures)**

Equivalence class, partitions, one to one correspondence, cardinality of a set: properties and examples.

**Unit-III (10 lectures)**

General properties of polynomials, graphical representation of a polynomial, maximum and minimum values of a polynomial.

**Unit-IV (14 lectures)**

Relation between the roots and the coefficients of equations. Symmetric functions, applications of symmetric function of the roots, transformation of equations. Descartes's rule of signs. Solutions of reciprocal and binomial equations, solutions of the cubic equations by Cardon's method and biquadratic equations by Euler's method.

**Unit-V (14 lectures)**

Systems of linear equations, row reduction and echelon forms, rank of a matrix, the matrix equation  $Ax=b$ , solution sets of linear systems, applications of linear systems, linear independence. Subspaces of  $R^n$ , dimension of subspaces of  $R^n$ .

**Books Recommended:**

1. T. Andreescu and D. Andrica, *Complex Numbers from A to Z*, Birkhauser, 2006:
2. D. C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.
4. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

**Books for Reference**

1. S. K. Mappa, *Higher Algebra (Classical)*, Ashoke Prakasam, Calcutta, 2014.
2. F. Ayers, *Theory and Problems of Matrices*, Schaum Outline Series, 1962.
3. S. Lipschutz, M. Lipson, *Linear Algebra* 4th Edition, Schaum's Outlines, 2008.

**Paper: MTH103M (Modular General Elective)  
Algebra**

**Credits: 4 = 3+1+0 (48 Lectures)**

**Unit– I** (06 lectures)

Inequalities: Inequalities involving A. M., G. M., H. M., Cauchy Schwarz Inequality

**Unit– II** (14 lectures)

De Moivre's theorem for rational indices and its applications, logarithm of a complex number, exponential and trigonometric functions of a complex variable, Euler's expansion of cosine & sine, hyperbolic functions, inverse functions, Gregory's series.

**Unit– III** (10 lectures)

Relation between roots and coefficients: Symmetric functions of roots, Relation between roots and coefficients of a general polynomial equation in one variable, transformation of equations, solution of cubic equation by Cardon's method.

**Unit– IV** (12 lectures)

Well-ordering property of positive integers, Principles of Mathematical Induction, Division algorithm, Divisibility and Euclidean algorithm, GCD, Linear Diophantine equation, Congruence relation between integers.

**Unit-V** (06 lectures)

Echelon forms and normal forms of matrix, rank of matrix, solution of system of linear homogeneous and non-homogeneous equations.

**Books Recommended:**

1. T. Andreescu and Dorin Andrica, Complex Numbers from A to .... Z, Birkhauser, 2006.
2. D. M. Burton, Elementary Number Theory (6th Edition), Tata McGraw-Hill Edition, Indian reprint, 2007.
3. D. C. Lay, Linear Algebra and its Applications (3rd Edition), Pearson Education Asia, Indian Reprint, 2007.

**Books for Reference:**

1. S. K. Mappa, Higher Algebra (Classical), Ashoke Prakasam, Calcutta, 2014
2. B. C. Das & B. N. Mukherjee, Higher Trigonometry –U N Dhur & Sons, 1932
3. S. Lipschutz, M. Lipson, Linear Algebra 3rd Edition, Mcgraw Higher Ed, 2005