

**U.G. 3<sup>rd</sup> SEMESTER SYLLABUS**  
**DEPARTMENT OF MATHEMATICS**  
**COTTON UNIVERSITY**

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**PAPER : MTH301C**

**ANALYSIS - II**

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

**(64 lectures)**

**Unit-I**

Limits of functions ( $\varepsilon - \delta$  approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. (14 lectures)

**Unit-II**

Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, nonuniform continuity criteria, uniform continuity theorem, monotone and inverse functions (14 lectures)

**Unit-III**

Review of differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. (10 lectures)

**Unit-IV**

Rolle's theorem, Mean value theorems, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorems to inequalities and approximation of polynomials, (12 lectures)

**Unit-V**

Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions and to inequality, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions. (14 lectures)

(14 lectures)

**Books Recommended**

1. R. Bartle and D.R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, 2003
2. . K.A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2004.

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**Books for Reference**

1. G. Das and S. Pattanayak, Fundamentals of Mathematics Analysis, McGraw Hill Education; 1<sup>st</sup> Edition, 2007.
2. A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.
3. S.R. Ghorpade and B.V. Limaye, A Course in Calculus and Real Analysis, Springer, 2006
4. F. Ayres, Elliott Mendelson, Schaum's Outline of Calculus, Mcgraw Higher Ed, 6<sup>th</sup> Edition, 2012.

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**PAPER : MTH301C**

**ABSTRACT ALGEBRA - I**

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

**(64 lectures)**

**Unit-I**

Symmetries of a square, dihedral groups, definition and examples of groups including quaternion groups (illustration through matrices), elementary properties of groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. Cyclic group and its properties.

(24 lectures)

**Unit-II**

Permutation: Cycle notation for permutations, properties of permutations, even and odd permutations, symmetric group, alternating group, coset and its properties, Lagrange's theorem and consequences, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

(24 lectures)

**Unit-III**

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems. Automorphism, inner automorphism, automorphism groups, class equation.

(16 lectures)

**Books Recommended:**

1. J. A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999.(IX Edition 2010)

**Books for Reference:**

1. I. N. Herstein, Topics in Algebra , New Age Publications, 2006
2. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra, McGraw-Hill, 1997

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3. J. B. Fraleigh, A first course in Abstract Algebra, 7th Edition, Pearson Education India, 2004.
4. P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, Basic Abstract Algebra, Cambridge University Press, 2<sup>nd</sup> Edition, 1994.

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**PAPER : MTH301C**

**MULTIVARIATE CALCULUS**

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

**(64 lectures)**

**Unit-I**

Functions of several variables, limit and continuity of functions of two variables. Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters. (14 lectures)

**Unit-II**

Triple product, introduction of vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, vector field, directional derivatives, gradient, maximal and normal property of the gradient, divergence and curl. Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems. (20 lectures)

**Unit-III**

Double integration over rectangular and nonrectangular regions. Triple integral over a parallelepiped and solid regions. Volume by triple integrals in cylindrical and spherical co-ordinates. Change of variables in double and triple integrals. (14 lectures)

**Unit-IV**

Line integrals, Applications of line integrals: Mass and work. Fundamental theorem for line integrals, conservative vector fields, independence of path. Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stokes' theorem, divergence theorem. (16 lectures)

**Books Recommended:**

1. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.

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**Books for Reference:**

1. E. Marsden, A. J. Tromba and A. Weinstein, Basic multivariable calculus, Springer (SIE), Indian reprint, 2005
2. D. Spellman, M. Spiegel and S. Lipschutz, Vector analysis - Schaum's outline 2<sup>nd</sup> Edition, 2009.
3. G.B. Thomas and R.L. Finney, Calculus, 9<sup>th</sup> Ed., Pearson Education, Delhi, 2005.
4. J. Stewart, Multivariable Calculus: Concepts and Contexts, 2<sup>nd</sup> Ed., Brooks /Cole, Thomson Learning, USA, 2001.

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