M.Sc. (Mathematics): 1st year  
Subject: Real Analysis  
(Subject Code: MT406)  
(w.e.f. session 2015-2016)  
L T P  
3 1 0  

UNIT-1  
8  
Countability of Sets, Lebesgue measure on the real line, Length of intervals, Open and closed 
sets on real line. Outer and inner Lebesgue measure, Lebesgue measurable sets, Properties of 
measurable sets.  

UNIT-2  
8  
Sequence and Series of functions, Pointwise and uniform convergence, Cauchy criterion for 
uniform convergence, Weierstrass M test, Abel’s and Dirichlet’s test, for uniform convergence 
and differentiation, Uniform convergence and integration.  

UNIT-3  
8  
Weierstrass approximation theorem, The fundamental theorem of integral calculus, Definition 
and existence of Reimann Stieltjes integral, Properties and some important theorems on Reimann 
Stieltjes integral.  

UNIT-4  
8  
Power series, Uniqueness theorem of power series, Abel’s and Taylor’s theorem, 
Rearrangement of terms of series, Riemann’s theorem.  

UNIT-5  
8  
Functions of several variables, linear transformation, Partial derivatives, Total derivative, 
Jacobian, Chain rule, interchange of the order of differentiation, higher derivatives, inverse 
function theorem, implicit function theorem.  

Books Recommended:  
1. W. Rudin: Principle of Mathematics Analysis  
2. D. Somasundram and B. Choudhary: A First Course in Mathematical Analysis, Narosa, 
   1999.  
4. Jain, P.K. & Gupta V.P., Lebesgue measure and Integration, Willey Eastern Ltd., New Age 
   Int. Ltd., New Delhi, (1994).
Integral University, Lucknow  
Department of Mathematics  

M.Sc. (Mathematics): 1st year  

Subject: Modern Algebra  

Subject Code: MT407  

(w.e.f. session 2015-2016)  

L T P  
3 1 0  

UNIT-1  
Normal subgroups and Quotient groups, Permutation groups, Homomorphisms, Cayley’s theorem.  

UNIT-2  
Conjugate elements, Class equation, Cauchy theorem, Sylow’s theorems and its Applications.  

UNIT-3  
Quotient of rings, Maximal and prime ideals, Homomorphisms, Polynomial rings.  

UNIT-4  
Integral domain, Divisibility in integral domains, Unique factorization domains, Principal ideal domains, Euclidean domains, Polynomial rings over UFD.  

UNIT-5  
Fields, Extension of fields, Splitting fields, Algebraic extensions of fields: Irreducible and reducible polynomials.  

Text Books:  

Reference Book:  
Integral University, Lucknow  
Department of Mathematics  
M.Sc. (Mathematics):  1st year I st sem  
Subject: Ordinary Differential Equations  
Subject Code: MT408  
(w.e.f. session 2015-2016)  

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

UNIT-1  
Linear differential equations of nth order, fundamental sets of solutions, Wronskian Abel’s identity, theorem on linear dependence of solutions, adjoint, self adjoint linear operator, Green’s formula.  

UNIT-2  
Adjoint equations, the nth order non homogeneous linear equations, Variation of parameters, zeros of solutions, comparison and separation theorems.  

UNIT-3  
Power series, solution of linear differential equations, ordinary and singular points of differential equations, Classification into regular and irregular singular points, series solution about an ordinary point and regular singular point.  

UNIT-4  
Existence and uniqueness of solutions: Lipschitz Condition, Successive Approximation, Picard’s theorem for initial value problem, Homogeneous BVP, Non-Homogeneous BVP, Sturm Liouville’s problem, Green’s function, non-existence of solutions, Picard’s theorem for BVP.  

UNIT-5  

Reference Books:  
Subject: Discrete Mathematics

Unit -1

Lattices: Posets & Lattices, Hasse diagram, Lattices on Algebraic systems, Sub-lattices.

Unit -2

Unit -3
Combinatorics: Permutations & combinations, Pigeon hole principle, Recurrence relation, solution by characteristic roots, Generating function.

Unit -4
Graphs: Degree of a vertex, types of graphs, Eulerian & Hamiltonian graphs, Matrix representation of graphs, Graph colouring.

Trees: Properties, spanning tree, Kruskal’s algorithm, Binary tree, tree reversal.

Unit -5

Functions: Classification, types & composition of functions, growth of functions, Recursive function.

Text Books:

2. Discrete Mathematical Structures, Kolman, Busby & Ross, 4e, Prentice Hall of India.
3. Discrete Mathematics with Graph theory, Goodaire & Parmenter, 2e, Pearson.
Integral University, Lucknow  
Department of Mathematics  
M.Sc. (Mathematics): 1st year 1st sem

Subject: Complex Analysis  
Subject Code: MT410  
(w.e.f. session 2015-16)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>L T P</td>
<td>3 1 0</td>
</tr>
</tbody>
</table>

**UNIT-1**
Analytic functions, Cauchy Riemann equations, Necessary and Sufficient condition, Harmonic function, velocity potential, Milne’s Thomson Method, Cauchy Integral Theorem, Cauchy’s Integral Formula.

**UNIT-2**
Power series, uniform convergence of power series, Taylor’s series, zeros of analytic functions, Laurent’s series, Integration and differentiation of power series, multiplication and division of power series.

**UNIT-3**
Cauchy Residue theorem, evaluation of the real definite integral: round the unit circle, evaluation of $\int_{-\infty}^{\infty} f(z) \, dz$ when $f(z)$ has no pole on real axis & when pole lies on real axis. Evaluation of integral involving many valued function, rectangular contours.

**UNIT-4**
Introduction, Conformal transformation, bilinear transformation, Exponential transformation, trigonometric transformation, special bilinear transformations, Schwarz - Christoffel transformation.

**UNIT-5**
Weierstrass’s theorem, principle of maximum modulus, Schwarz’s lemma, Picard’s theorem, Jensen’s inequality, Jensen’s formula, order of an integral function, Hadamard’s three circles theorem, Three circles theorem as a convexity.

**Text/References:**
5. B.Chaudhary, The Elements of Complex Analysis, Wiley Eastern
M.Sc. (Mathematics): 1st year
Subject: Statistical Techniques

(w.e.f. session 2015-2016)

Ist sem
Subject Code: MT411

LTP 3 1 0

UNIT-I
8
Discrete and continuous data, Frequency and non-frequency data, primary and secondary data, diagrammatic and graphical representation of grouped data, frequency and cumulative frequency distribution and their applications, histogram, frequency polygon, ogives. Concept of central tendency and its measures, partition values, dispersion and relative dispersion, moments, Sheppard’s correction for moments (without derivation), skewness, kurtosis and their measures.

UNIT-II
7
Scatter diagram, Karl Pearson’s and spearman’s rank correlation coefficients, coefficient of determination, correlation ratio, principle of least squares, fitting of linear regression and related results, partial and multiple correlations of three variables, their measures and related results.

UNIT-III
9
Random experiment, trial, sample point, sample space, definitions of equally likely, mutually exclusive and exhaustive events, definition of probability, classical, relative frequency and axiomatic approaches to probability, conditional probability, independence of events, Bayes theorem and its applications.

UNIT-IV
7
Discrete and continuous random variable, expectation and variance of random variables, Probability mass/density function, distribution function, joint density function of two continuous variables, marginal and conditional probability density functions, uniform, binomial, Poisson, geometric, negative binomial, hyper geometric and normal distributions.

UNIT-V
9
null and alternative hypotheses, critical region, types of error, level of significance, p-value, size and power of a test, Z, t, chi-square & F tests, analysis of variance: one way and two way classifications.

Suggested readings: