# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 301: Analysis – I (Theory)**

**Hours: 4 /week** **Credits:4**

**Unit I:** The Real Numbers

1.1 Sets and Functions
1.2 Finite and Infinite Sets
1.3 Algebraic and Order properties of R
1.4 Absolute Value and Real Line
1.5 The completeness Property of R
1.6 The Applications of Supremum Property
Articles 1.1, 1.3, 2.1 to 2.5 of Text Book (2)

**Unit II:** Sequences

2.1 Sequences and limits
2.2 Limit Theorems
2.3 Monotonic sequences
2.4 Sequences defined inductively
2.5 Subsequences (includes lim sup and lim inf)
2.6 Cauchy Sequences
2.7 Infinite limits
Articles 2.1-2.7 of Text Book (1)

**Unit II:** Complex Numbers

3.1 Complex numbers as ordered pairs
3.2 Geometric representation of Complex numbers
3.3 Properties of Complex numbers
3.4 Roots of Complex numbers
3.5 De Moivre's theorem and application
3.6 The exponential function, Trigonometric functions, Hyperbolic functions

**Unit IV:** Functions of Complex variable

4.1 Theorems on limits, continuity, differentiation
4.2 Cauchy-Reimann equations
4.3 Sufficient condition for differentiability
4.4 Analytic functions and Harmonic functions
4.5 Linear Transformations
4.6 The transformation w=1/z
4.7 Linear fractional transformation
4.8 An implicit form

**Text Books:**


1. An Introduction to Analysis - Gerald G. Bilodeau, Paul R. Thie and G. E. Keough. Jones and Bartlett Student Edition.
2. Introduction to Real Analysis - Robert G. Bartle and Donald R. Sherbert, Wiley Student Edition, 2010.
3. Complex variables and applications - Ruel V. Churchill, Mcgraw-hill inter. 6th edition, Articles 1 to 7, 23 to 25 and 43. Chapter 2 (omit art. 13). Articles. 68, 69, 70, 71, 79, 80.

**Reference Books:**


1. A Course in Calculus & Real Analysis – S. R. Ghorpade & B. V. Limaye.
2. Elementary Analysis: the theory of calculus - K. Ross, Springer, India.
3. Numbers to Analysis - I. K. Rana, world scientific.
4. Calculus - Michael Spivak.
5. Principles of Mathematical Analysis- W. Rudin, McGraw-Hill
6. Fundamentals of mathematical analysis- G. Das & S Pattanayak, Tata Mcgraw Hill Pub. Co. Ltd.
7. A First course in Aanalysis- D. Somasundaram & B. Choudhary
8. Fundamentals of Mathematical Analysis- G. Das & S Pattanayak, Tata Mcgraw Hill Pub. Co. Ltd.
9. Analytical Geometry & Real and Complex analysis – T. Veerarajan, Mcgraw Hill.
11. Complex Analysis - V. Karunakaran, Narosa publishers.
12. Higher Engineering Mathematics – B. S. Grewal, Khanna Publishers.
13. Advance engineering Mathematics – H. K. Dass, S. Chand.
14. A First Course in Complex Analysis with Applications - Dennis G. Zill & Patrick S. Shanahan Jones & Bartlett India Pvt Ltd.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 302: Abstract Algebra-I**

**Hours: 4 /week** **Credits: 4**

**Unit I:**

Relation, Equivalence Relation,Partition of set, Binary operations. Division Algorithm for Integers, Congruence modulo Relation in Z, Definition and Examples of Groups, Elementary properties of Group, Equivalent Definitions of a Group, Finite Groups and their tables, Commutative and non-commutative groups.

**Unit II:**

Subgroups: Definition and Examples, normalizer and centralizers, order of an element, order of a group, cyclic subgroup generated by an element, Lattice diagrams of finite groups, cosets and its properties, Lagrange's theorem and its applications, Euler's theorem, Fermat's theorem**.**

**Unit III:**

Permutations: Definitions and Examples, cycle, transposition, even and odd permutations, order of a permutation, inverse of a permutation, Symmetric groups and Alternating groups. Examples, Quotient groups.

Normal subgroups: Definitions and Examples, Quotient group.

**Unit IV:**

Isomorphism of groups: Definitions and Examples, Isomorphism as an equivalence relation. Cyclic Groups: Properties of Cyclic Groups , Isomorphism of Cyclic Groups.

Homomorphism of groups: Definitions and Examples, Kernel of a Homomorphism, Fundamental Theorem of Homomorphism, Caley's Theorem, Automorphism of Groups.

**Text Book**:

Abstract Algebra - I. H. Sheth, PHI, New Delhi, Second edition-2009.

**Reference Books**:


1. Topics in Algebra - I. N. Herstein, Vikas Publishing, New Delhi.
2. A First Course in Abstract Algebra – J. B. Fraleigh, Narosa Publishing, New Delhi.
3. Basic Abstract Algebra – P.B. Bhattacharya, S.K. Jain and S. R. Nagpal, Foundation Books, New Dehli.
4. Abstract Algebra - Dipak Chatterajee, PHI Learing Pvt. Ltd, New Delhi.
5. Arup Bijganit (Gujarati) - I. H. Sheth, University Granth Nirman Board, Ahmedabad.
6. Algebra - Michael Artin, PHI.
7. A survey of Modern - G.B irkhoff & S. Maclane, Algebra Univ. Press.
8. A first course in Abstract Algebra (Rings, Groups & fields) - Marlow Anderson & Todd Fel, Chrpman & Halilereivy.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 303: Linear Algebra – II (Theory)**

**Hours: 4 /week**

**Credits: 4**

**Unit I:**

Composition of Linear Maps, The Space L(U,V), Operator Equation, Linear Functional, Dual Spaces, Dual of Dual, Dual Basis Existence Theorem, Annihilators, bilinear forms.

**Unit II:**

Inner Product Space, Norm, Cauchy-Schwarz Inequality, Orthogonalization and orthonormalization of Basis, Gram-Schmidt Orthogonalization Process. Orthogonal complement and its properties. Orthogonal transformations.

**Unit III:**

Determinants and their properties. Value of determinant, Basic results, Laplace expansion, Cramer's rule.

**Unit IV:**

Eigen values and eigen vectors of linear operators and square matrices, Caley-Hamilton's Theorem and its verification. Application to reduction of Quadrics, classification of Quadrics, Diagonalization of real and symmetric Matrices, Spectral Theorem.

**Text Book:**

An Introduction to Linear Algebra – V. Krishnamurthy and others, Affiliated East-West press, New Delhi.

**Reference Books:**


1. Linear Algebra a Geometric Approach – S. Kumaresan, PHI.
2. Linear Algebra with Applications – Otto Bretscher– 3rd ed. –Pearson Education.
3. An Introduction to Linear Algebra – I. K. Rana, Ane Books Pvt. Ltd., New Delhi.
4. Theory and Problems of Linear Algebra – R. D. Sharma, I. K. Inter. Pub. House Pvt. Ltd.
5. Matrix and Linear Algebra by – K.B.Datta, Prentice Hall, New Delhi.
6. Linear Algebra: Theory & Applications - Ward Cheney & David Kincaid Viva Books, Jones & Bartlett.
7. Vector Calculus, Linear Algebra & Differential Forms: A unified approach - Hubbard J & Hubbard B., Prentice Hall 1999.
8. Linear Algebra with Applications -Jeanne, L. Agnew & Robert C. Knapp Brooks / Col publishing Co, California.
9. A First Course in Linear Algebra – Dr. Aloknath Chakrabarti. ISBN: 9788182091306. Tata McGraw-Hill Edu. Pvt. Ltd.


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# Shri Govind GuruUniversity

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 304: Operation Research-1(Theory)**

**Hours: 4 /week** **Credits: 4**

**Unit I: Convex Set and Linear Programming Problem**

Convex set, Extreme points of a convex set, convex combination, Examples of Convex sets and Theorems on convexity. Formulation techniques of LP problems (Only Examples).

**Unit II: Problem solving techniques for LP problems**

Simplex method for solving LPP, Big-M (Penalty) method, Two-Phase method, Integer programming problem (Only Gomory's cutting plane method).

**Unit III: Duality and Dual simplex method**

Introduction, Definition of the dual problem, General rules for converting any primal problem into it's dual, How to interpret the solution of the dual from its primal and vice versa, Comparison of the solution of the primal and its dual. Find initial solution for dual simplex table, Mathematical procedure to find solution by dual simplex method.

**Unit IV: Transportation and Assignment Problems**

Introduction, Mathematical formulation, Tabular representation, Definitions, Methods for finding initial basic feasible solution (North West Corner Rule, Least Cost Method, Vogel's Approximation Method), Optimality test (MODI method), Degeneracy in Transportation Problem, Unbalanced Transportation Problem. Introduction of Assignment problem, Mathematical formulation of Assignment problem, Method for solving Assignment problem (Hungarian Method), Unbalanced Assignment problem, Examples.

**Reference books:**


1. Mathematical models in O.R. - J. K. Sharma,Tata-MacGraw Hills book-company.
2. Operations Research – Nita H Shah, Ravi Gor and Hardik Soni. PHI – Learning.
3. Optimization method in O.R. & System Analysis - K. V. Mittal, New Age inter. Publishers.
4. Operation Research - S. D. Sharma, Kedarnath Ramnath & Co.
5. Operation Research - Kanti Swaroop & Man Mohan, Sultan Chand & Co.
6. Linear Programming - L. I. Gass, Tata MacGraw Hills book-company.
7. Linear Programming - G. Hadley, Narosa Publishing house.
8. Operation Research- A. M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education.


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# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc Semester V (Mathematics)**

**MAT 305(Optional) (Any One)**

**Number Theory (Theory)**

**Hours: 4 /week** **Credits: 4**

**Unit I:**

Some Preliminary Consideration: Well-Ordering Principle, Mathematical Induction, the Binomial Theorem & binomial coefficients.

Divisibility Theory: the division algorithm, divisor, remainder, prime, relatively prime, the greatest common divisor, the Euclidean algorithm (Without proof), the least common multiple, the linear Diophantine equation & its solution.

**Unit II:**

Prime Numbers: Prime and composite number, the Fundamental Theorem of Arithmetic (without proof), canonical form of a number, the Sieve of Eratosthenes.

Theory of Congruence: Definition and basic properties of congruence, Residue class &complete system of residues, special divisibility test, linear congruence, Chinese Remainder Theorem. (without proof)

**Unit III:**

Fermat's Theorem: Fermat's Factorization method, Fermat's little theorem, Wilson theorem,

Euler's theorem: Euler's Phi-function and formula for Phi-function, Euler's theorem (without proof) and only problems on Euler's theorem.

**Unit IV:**

The Sum and Number of Divisors, The Mobius Inversion Formula, The Greatest Integer Function

**Text Book:**

Elementary Number Theory **-** David M. Burton, Sixth Edition, Universal Book stall, New Delhi.

**[(Chapter 1)**: 1.1 and 1.2 **2)** 2.1 to 2.4 **3)** 3.1 and 3.2 **4)** 4.1 to 4.3 **5)** 5.2 and 5.3 **7)** 7.2 and 7.3 **6**) 6.1 to 6.3 **]**

**Reference Books:**


1 An introduction to the Theory of numbers - Niven and Zuckerman, Wiley Eastern Ltd.
2 Number Theory - S. G. Telang, Tata Mc Graw-Hill Publishing Company Limited, New Delhi
3 Elementary Theory of Numbers - C. Y. Hsiung, Allied Publishers Ltd.-India, ISBN 81-7023-464-6.
4 Number Theory - George E. Andrews, Hindustan Publishing Corporation- Delhi.
5 Elementary Number Theory - Gareth A. Jones & J. Mary Jones, Springer Verlag, ISBN 81-8128-278-7.
6. Number Theory - J. Hunter, Oliver and Boyd-London.
7. Beginning Number Theory - Neville Robbins, Narosa Pub. House -New Delhi ISBN 978-81-7319-836
8 Introduction to the theory of Numbers - G. H. Hardy & E. M. Wright, Oxford Uni. Press
9 Higher Algebra - S. Barnard & J. M. Child, Macmillan India Ltd
10 Elements of Number Theory - I. M. Vinogradov , Dover Pub INC
11 Elementary Number Theory in Nine chapters - James J. Tattersall, Cambridge Uni Press
12 A first course in Theory of Numbers - K. C. Chowdhary, Asian Books Pvt Ltd New Delhi
13 1001 problems in Classical Number Theory - Jean Marie De Konick Armed Mercier, AMS


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# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 305: Optional (anyone)**

**Discrete Mathematics**

**Hours: 4 /week** **Credits: 4**

**Unit-I**

Sets and Propositions – Cardinality. Mathematical Induction. Principle of Inclusion and Exclusion.
Computability and Formal Languages – Ordered Sets. Languages. Phrase Structure Grammers.
Types of Grammers and Languages.
Permutations. Combinations and Discrete Probability.

**Unit-II**

Relations and Functions – Binary relations. Equivalence Relations and Partitions. Partial order relations and Lattices. Chains and Antichains. Pigeon Hole Principle.
Graphs and Planar Graphs – Basic Terminology. Multigraphs. Weighted Graphs. Paths and Circuits. Shortest Paths. Eulerian Paths and Circuits. Travelling Salesman Problem. Planar Graphs

**Unit-III**

Trees
Finite State Machines – Equivalent Machines. Finite state Machines as Language Recognizers.
Analysis of Algorithms – Time Complexity. Complexity of Problems
Discrete Numeric Functions and Generating Functions.
Recurrence Relations and Recursive Algorithms – Linear Recurrence Relations with Constant Coefficients. Homogeneous Solutions. Particular Solution. Total Solution. Solution by the Method of Generating Functions. Brief review of Groups and Rings.

**Unit-IV**

Boolean Algebras – Lattices and Algebraic Structures. Duality. Distributive and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Expressions. Propositional Calculus. Design and Implementation of Digital Networks. Switching Circuits.

**References**

C. L. Liuy, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, Computer Science Series, 1986.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 305: Optional (anyone)**

**Application of Mathematics in Finance**

**Hours: 4 /week** **Credits: 4**

**Unit-I**

Financial Management-An Overview. Nature and Scope of Financial Management. Goals of Financial Management and main decisions of Financial Management. Difference between risk, speculation and gambling. Time value of money-Interest rate and discount rate. Present value and future value-discrete case as well as compounding case. Annuities and its kind.

**Unit-II**

Meaning of return. Return as Internal Rate of Return (IRR). Numerical Methods like Newton Raphson Method to calculate IRR. Measurement of returns under uncertainty situations. Meaning of risk. Difference between risk and uncertainty. Types of risks. Measurement of risk. Calculation of security and Portfolio Risk and Return-Markowitz model. Sharpe's Single Index Model-Systematic Risk and Unsystematic Risk.

**Unit-III**

Taylor series and Bond valuation. Calculation of Duration and Convexity of bonds. Financial Derivatives-Futures. Forward Swaps and Options. Call and Put Option. Call and Put Parity Theorem. Pricing of contingent claims through Arbitrage and Arbitrage Theorem.

**References**


1. Aswath Damodaran, Corporate Finance-Theory and Practice, John Wiley & sons, Inc.
2. John C. Hull, Options, Futures, and Other Derivativs, Parentice-Hall of India Private Imited.
3. Sheldon M. Ross, An Introduction to Mathematical Finance, Cambridge University Press.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 305: Optional (Any One)**

**Programming in C**

**Hours: 4 /week Credits: 4**

**Unit-I**

Programmer's model of a computer. Algorithms. Flow charts. Data types. Arithmetic and input/output instructions.

**Unit-II**

Decisions control structures. Decision statements. Logical and conditional operators. Loop. Case control structures.

**Unit-III**

Functions. Recursions. Preprocessors. Arrays. Puppetting of strings. Strings.

**Unit-IV**

Structures. Pointers. File formatting.

**References**


1. Henry Mulish & Herbert L. Cooper, Spirit of C: An introduction to modern programming, Jaico Publishers, Bombay.
2. B. W. Kernighan and D. M. Ritchie, The C Programming Language 2nd Edition, (ANSI features) Prentice Hall, 1989.
3. Peter A. Darnel and Philip E. Margolis, C: A Software Engineering Approch, Narosa Publishing House, 1993.
4. Robert C. Hutchison and steven B. Just, Programming Using C Language, McGraw Hill, 1988.
5. V. Rajaraman, Programming in C, Prentice Hall of India, 1994.
6. Byron S. Gottfried, Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 305: Optional (Any One)**

**Probability Theory**

**Hours: 4 /week** **Credits: 4**

**Unit-I**

Notion of probability: random experiment, sample space, axiom probability, elementary properties of probability, equally likely outcomes problems.

Random variables: Concept, cumulative distribution function, discrete and continuous random variables, experiments, mean, variance, moment generating function.

**Unit-II**

Discrete random variables: Bernoulli random variable, binomial random variable, geometric random variable, Poisson random variable.

Continuous random variables: uniform random variables, exponential random variable, gamma random variable, normal random variable.

**Unit-III**

Conditional probability and conditional expectations, Bayes theorem, independence, computing expectation by conditioning: some applications-a list model, a random graph, palya's urn model.

Bivariate random variables: joint and conditional distributions, the correlation coefficient.

**Unit-IV**

Functions of random variables: sum of random variables, the law of large numbers and central limit theorem, the approximation of distributions.

Uncertainty, information and entropy, conditional entropy solution of certain logical problems by calculating information.

**References**


1. S. M. Ross, Introduction to Probability Models (Sixth edition) Academic Press, 1997.
2. I. Blake, An Introduction to Applied Probability, John Wiley & Sons, 1979.
3. J. Pitman, Probability, Narosa, 1993
4. A. M. Yagolam and I. M. Yagolam, Probability and Information, Hindustan Publishing Corporation, Delhi, 1983

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 306:Practical-1(Based on MAT301, MAT302)**

**Hours: 6 /week** **Credits: 2.5**

**List of Practicals:**

**Unit I:**

1. Countable and Uncountable Sets
2. Completeness property of R - problems related to infimum, supremum of sets,
3. Limits of sequences including inductively defined sequences, limit inferior and superior
4. Examples of Cauchy Sequences

**Unit II:**

5. Application of De-Moivere's theorem (to find the roots of an equation and simplify common statements)
6. Verification of Cauchy-Riemann equaations (Cartesian & polar form).
7. Find the harmonic conjugate of a function and hence find corresponding analytic function.
8. If f(z)= u+iv is an analytic function then find f(z) when u, v. u+v or u-v is given.
9. Problems on transformation under function $w=1/z$.

**Unit III:**

10. Examples of Equivalence Relation
11. Examples of Group (Commutative and Non-Commutative), Group Tables
12. Examples of Subgroup, Cyclic Subgroup
13. Lattice Diagrams of Finite Group

**Unit IV:**

14. Examples of even and odd permutations
15. Find the order of the permutations
16. Examples of Quotient groups

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester V (Mathematics)**

**MAT 306:Practical-2(Based on MAT303, MAT304)**

**Hours: 6 /week** **Credits: 2.5**

**List of Practicals:**

**Unit I:**

1. Examples of solving an operator equation,
2. Examples of finding dual bases for $R^2$ and $R^3$ from their given bases through the Dual-Basis-Existence Theorem.
3. Examples of inner product .
4. Examples of orthogonalization and orthonormalization of basis through Gram-Schmidt orthogonalization process.

**Unit II:**

5. Examples of finding value of determinant through the properties.
6. Examples of finding eigen values/vector of a square matrix.
7. Examples of the verification of Caley-Hamilton Theorem .
8. Examples of diagonalization of square matrices.

**Unit III:**

9. Solve Linear programming problem by graphical method for two variable problem (3 problems)
10. Solve Linear Programming Problem by simplex method-I (3 problems)
11. Solve Linear Programming Problem by big-M method (3 problems)
12. Solve Linear Programming Problem by Two-phase method (3 problems)

**Unit IV:**

13. Using duality solve Linear Programming Problem (3 problems)
14. Using Modi method to solve Transportation problem (Balanced) (3 problems)
15. Using Modi method to solve Transportation problem (Unbalanced) (3 problems)
16. Using "Hungarian method" to solve Assignment problem (Balanced and Unbalanced) (3 Problems)

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 307: Analysis-II (Theory)**

**Hours: 4 /week** **Credits: 4**

**Unit I:** Riemann Integration

1.1. Definition of the integral
1.2. Properties of the integral
1.3. Existence theory (monotone, continuous functions etc. (includes Riemann sums)
1.4. Fundamental theorem
1.5. Mean value theorems (First and Second)

Articles 5.1 to 5.5 of (I); 1.5 and 1.6 to be supplemented from reference books

**Unit II:** Infinite series

2.1 Basic Theory (covers upto comparison test)
2.2 Series with positive terms (Condensation Test, Pringsheim's Test)
2.3 Absolute convergence (includes alternating series), ratio and root tests with lim sup and lim inf

Articles 6.1, and 6.2 of (I); 2.2 to be supplemented from reference books.

**Unit III:** Infinite Series –II

3.1 Rearrangement of series, Cauchy Product of Series, Merten's theorem
3.2 Power Series
3.3 Improper integrals of the first and second kind.

**Unit IV:** Taylor Series

4.1 Taylor's Theorem with Lagrange and Cauchy form of remainders
4.2 Expansions of exponential ,logarithmic and trigonometric functions
4.3 Binomial series theorem
4.4 Power series solutions of differential equations

Articles 6.4 and 8.3 of (I); 4.2 and 4.3 to be supplemented from reference books

**Text Book:**

An Introduction to Analysis, Gerald G.Bilodeau, Paul R.Thie and G.E.Keough.
Jones and Bartlett Student edition

**Reference Books:**


1. Fundamentals of Mathematical Analysis, Das and Pattanayak, TMH.
2. Calculus Vol 1, Tom M. Apostol.
3. Principles of Mathematical Analysis, W. Rudin, McGraw-Hill
4. Mathematical Analysis by Tom M. Apostol, Narosa Publ. House India.
5. Calculus, Michael Spivak.
6. Understanding Analysis - Stephen D. Abbott.
7. A Course in Calculus & Real Analysis - S. R. Ghorpade & B. V. Limaye.
8. Elementary Analysis: the theory of calculus - K. Ross, Springer, India.
9. Numbers to Analysis - I. K. Rana, world scientific.
10. Mathematical Analysis- Andrew Browder, Springer ISBN No. 978-81-8489-520-9.
11. A First course in Aanalysis- D. Somasundaram & B. Choudhary

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 308: Analysis-III**

**Hours: 4 /week** **Credits: 4**

**Unit I:** Metric Spaces

1.1. Definition and Examples.
1.2. Open Sets.
1.3. Closed Sets
1.4. Convergence, Completeness and Baire's Theorem

Articles 9, 10, 11 and 12 of Text Book (1)

**Unit II:** Continuity, Compactness and Connectedness

2.1 Continuous mappings

**Unit III:** Uniform Convergence

3.1 Pointwise Convergence
3.2 Uniform Convergence
3.3 Uniform Convergence and Continuity
3.4 Uniform Convergence and Differentiation
3.5 Term by Term Integration of Series
3.6 Term by Term Differentiation of Series

Articles 9.1-9.5 of Text Book (2)

**Unit IV:** Applications of Uniform Convergence

4.1 Power Series (advanced)
4.2 Abel's Limit Theorem, Multiplication of Power Series
4.3 Taylor's Series
4.4 Weierstrass's Approximation Theorem
4.5 Exponential, Logarithmic and Trigonometric Functions

Articles 9.6-9.8 of Text Book (2), 4.5 from section 8.3 and 8.4 of Text Book (3)

**Text Books:**


1. Topology and Modern Analysis - G. F. Simmons.
2. Fundamentals of Mathematical Analysis - Das and Pattanayak, TMH.
3. Introduction to Real Analysis - Robert G. Bartle and Donald R. Sherbert, Wiley Student Edition, 2010.


**Reference Books:**


1. A .Course in Calculus & Real Analysis - S. R. Ghorpade & B. V. Limaye
2. Elementary Analysis: the theory of calculus - K. Ross, Springer.India.
3. Numbers to Analysis - I. K. Rana, world scientific.
4. Metric Spaces - Shirali, Springer, India.
5. Topology of Metric Spaces - S. Kumaresan, Narosa
6. An Introduction to Analysis - Arlen Brown & Carl Pearcy, Springer, India.
7. Analysis I By Herbert Amann & Joa Chim Escher, Birkhauser Verlag, Berlin.
8. Topology By B. D. Gupta, Kedarnath Ram Nath, Delhi.
9. Mathematical Analysis: Linear & Metric Structure & Continuity - Mariano Giaquinta & Giuseppe Modica Birkhauser, Boston.
10. Mathematical Analysis- Andrew Browder, Springer ISBN No. 978-81-8489-520-9.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 309: Abstract Algebra-II**

**Hours: 4 /week** **Credits: 4**

**Unit I:**

Rings: Definition and examples, commutative ring, division ring, unity and unit elements of a ring, Field, properties of a ring, Boolean ring, Finite rings.

Integral Domain: Zero divisor, Definition and examples of Integral Domain (Finite and of infinite order), Characteristic of a ring

**Unit II:**

Subrings: Definition and examples, necessary and sufficient criterion for subring, Ideals: Definition and examples, necessary and sufficient criterion for ideal, principal ideal ring, quotient ring and its operation tables

Homomorphism: Definition and some examples, Kernel of homomorphism, Isomorphism of rings, Fundamental theorem on homomorphism, homomorphism and characteristic.

**Unit III:**

Polynomial ring: Introduction and definition of polynomial, degree of polynomial, operation between polynomials, Integral domain D[x], different types of polynomials, factorization of polynomials, Division algorithm for polynomials, irreducibility of polynomial over field, Remainder and factor theorem, solution of polynomial equation, zero of polynomial, Eisenstein's criterion for irreducibility, rational zero of polynomial.

**Unit IV:**

Fields: Fields, Subfields, Extension field, The field of quotients and integral domain, Prime fields, Finite fields, Maximal ideals, Prime ideals and their characterization through quotient ring.

**Text Book:**

Abstract Algebra - I. H. Sheth, Prentice-Hall of India Pvt. Ltd. New Delhi, Second edition -2003

**Reference Books:**


1. Abstract Algebra Theory and Applications -Thomas W. Judson, Stephen F. Austin State University,2009.
2. Basic Abstract Algebra - Bhattacharya P.B., Jain S. K. and Nagpal S. R., Foundation Books, New Delhi.
3. A First Course in Abstract Algebra - Fraleigh J.B., Narosa Publishing, New Delhi.
4. Topics in Algebra – I. N. Herstein, Vikas Publishing, New Delhi.
5. Algebra - Michael Artin, PHI.
6. A survey of Modern Algebra - G.Birkhoff & S. Maclane, Uni. Press.
7. A first course in Abstract Algebra (Rings, Groups & fields) - Marlow Anderson & Todd Fel, Chrpman & Halilereivy.
8. Proofs from the Book - Aigner

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 310: Graph Theory**

**Hours: 4 /week** **Credits: 4**

**Unit I:**

Graph, Graphs as Models, More Definitions, Vertex Degrees, Subgraphs, Path and Cycles.

**Unit II:**

The Matrix Representation of Graphs, Fusion, Definition and simple properties, Bridges.

**Unit III:**

Spanning Trees, Connector problems (Omit the proofs of theorems 2.14-2.18),
Shortest path Problems, Cut vertices and Connectivity.

**Unit IV:**

Euler Tours, (Omit the proof of Theorem 3.5), Hamiltonian Graphs.

**Text Book:**

A First Look at Graph Theory - John Clark and Derek Allan Holton, Allied Publishers Limited, Chapters 1 to 3 (Omit 3.2 and 3.4).

**Reference Books:**


1. Introduction to Graph Theory - R. J. Wilson, Longman.
2. Introduction to Graph Theory - Douglas B. West, Prentice-Hall of India, Second Edition, 2006, ISBN-81-203-2142-1.
3. Invitation to Graph Theory - S. Arumugam, S. Ramchandran, Scitech Publication (India) Pvt. Ltd, Chennai.
4. A First Course in Graph Theory - S. A. Choudum, Macmillan India Limited, SBN 033392 040 6.
5. Graph Theory – G. Suresh Singh, Prentice Hall of India,.


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# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 311 Optional (Any One)**

**Operations Research -2(Theory)**

**Hours: 3 /week** **Credits: 4**

**Unit I**: Inventory Problems

Introduction, types of inventory, cost involved in inventory problems, notations, EOQ model, limitations of EOQ formula, EOQ model with finite replenishment rate, EOQ model with shortages, Order – level Lot – size model, Order – level Lot – size model with finite replenishment rate.

**Unit II**: PERT and CPM

Introduction, origin of PERT & CPM, applications of PERT & CPM, framework of PERT & CPM, construction of project network, dummy activities and events, rules for network construction, finding the critical path, concepts of float, total float and free float and its interpretations.

**Unit III**: Game Theory

Introduction, Two person zero-sum games, Maximin and Minimax Principles, Mixed strategies, expected pay-off, solution of 2×2 mixed strategy game, solution of mixed strategy game by the method of oddments, Dominance Principle, solution of mixed game by matrix method, solution of a two person zero-sum 2×n game, Algebraic method for solving a game, solution of 3×3 games with mixed strategy by the method of oddments, Iterative method for approximate solution.

**Unit IV:** Simulation Modeling

Introduction, Monte Carlo Simultion, Types of Simulation, Simulations of Network, Elements of Discrete event simulation, Generation Of random Numbers, Mechanics of Discrete Simulation.

**Text Book:**

Operations Research - Nita H. Shah, Ravi M. Gor and Hardik Soni, PHI learning.
Chapter 11 (11.1 – 11.10), Chapter 15 (15.1 – 15.9) and Chapter 18 (18.1 – 18.14).

**Reference books:**


1. Operations Research by J. K. Sharma.
2. Operations Research by S. D. Sharma.
3. Operations Research by Man Mohan, Kanti Swaroop and P. K. Gupta.


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**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 311: Optional (anyone)**

**Application of Mathematics in Insurance**

**Hours: 4 /week** **Credits: 4**

**Unit-I**

Insurance Fundamentals – Insurance defined. Meaning of loss. Chances of loss, peril, hazard, and proximate cause in insurance. Costs and benefits of insurance to the society and branches of insurance-life insurance and various types of general insurance. Insurable loss exposures-feature of a loss that is ideal for insurance.

**Unit-II**

Life insurance Mathematics – construction of mortality tables. Computation of premium of life insurance for a fixed duration and for the whole life.

**Unit-III**

Determination of claims for General Insurance – Using Poison Distribution and Negetive Binomial Distribution – the Polya Case.

**Unit-IV**

Determination of the amount of Claims in General Insurance–Compound Aggregate claim model and its properties, and claims of reinsurance. Calculation of a compound claim density function. F-recursive and approximate formulate for F.

**Referance**


1. Mark S. Dorfman, Introduction to Risk Management and Insurance, Prentice Hall, Englwood Cliffs, New Jersey.
2. C. D. Daykin, T. Pentikainen and M. Pesonen, Practical Risk Theory for Actuaries, Chapman & Hall.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 311: Optional (anyone)**

**Mechanics**

**Hours: 4 /week** **Credits: 4**

**Statics**

**Unit-I**

Analytical conditions of equilibrium of Coplanar forces. Virtual work. Catenary.

Forces in three dimensions. Poinsot's Central axis. Wrenches. Null lines and planes. Stable and Unstable Equilibrium.

**Dynamics**

**Unit-II**

Velocities and accelerations along radial and transverse directions, and along tangential and normal directions. Simple harmonic motion. Elastic strings.

**Unit-III**

Motion on smooth and rough plane curves. Motion in a resisting medium. Motion of particles of varying mass.

**Unit-IV**

Central Orbits. Kepler's laws of motion.

Motion of a particle in three dimensions. Acceleration in terms of different coordinate systems

**Reference**


1. S. L. Loney, Statics, Macmillan and Company, London.
2. R. S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. S. L. Loney, An Elementary Treatise on the Dynamics of a Particle and of Rigid bodies, Cambridge University Press, 1956.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 311: Optional (anyone)**

**Combinatorial Number Theory**

**Hours: 4 /week** **Credits: 4**

**Unit-I**

Set addition. Theorems of Mann, Davenport and Chowla

**Unit-II**

Vosper theorem. Kneser theorem. E-transform and its properties.

**Unit-III**

Theorem of Besicovitch. E-G-Z theorem.

**Unit-IV**

Erdos-Heilbronn conjecture, Freiman's theorem.

**Reference**


1. H. B. Mann, Addition theorems, Krieger, 1976.
2. Melvyn B. Nathanson, Additive Number theory: Inverse Problems and the Geometry of Sumsets, Springer, 1996.

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 312: Practical-1(Based on MAT-307, MAT-308)**

**Hours: 6 /week** **Credits: 2.5**

**List of Practicals:**

**Unit I:**

1. Definition and evaluation of Riemann integrals by various methods
2. Verifying MVTs and problems based on Fundamental Theorem of Integration
3. Convergence of infinite series of positive terms
4. Absolute convergence, root and ratio tests using limit inferior and superior

**Unit II:**

5. Power Series, radius of convergence
6. Improper integrals
7. Power series expansion of functions.
8. Power series solutions of differential equations

**Unit III:**

9. Metric spaces, examples
10. Uniform convergence of sequences
11. Uniform convergence of series, tem by term differentiation and integration
12. Multiplication of power series

**Unit IV:**

13. Properties of exponential, logarithmic and trigonometric functions
14. Compact and connected spaces
15. One article to be chosen from journals/books and presented in own words with proofs

# Shri Govind Guru University

**Choice Based Credit System (CBCS)**

**Syllabus for B. Sc. Semester VI (Mathematics)**

**MAT 312:Practical-2(Based on MAT309, MAT310)**

**Hours: 6 /week** **Credits: 2.5**

**List of Practicals:**

**Unit I:**

1. Verification of Rings, Commutative ring and ring with unity. Finite rings and their operation tables.
2. Examples of Ideals and Integral Domain.
3. Examples of finite fields and extension fields.
4. Construction of quotient ring and their operation tables.

**Unit II:**

5. Find the g.c.d. of two given polynomials and express it as a linear combination of these two polynomials.
6. Check the irreducibility of polynomial over the given field (By different methods)
7. Factorization of polynomial and the rational zeros of given polynomial.
8. Example of Maximal and prime ideal

**Unit III:**

9. Using the adjacency matrix determine whether the given graph is connected or not.
10. Determine whether the given graph is connected or not using fusion algorithm.
11. Find a minimal spanning tree of a given connected weighted graph using Kruskal's algorithm.
12. Find a minimal spanning tree of a given connected weighted graph using Prim's algorithm.

**Unit IV:**

13. Find a shortest path between two vertices of a given connected graph using the Breadth First Search algorithm.
14. Find a shortest path between two vertices of a given connected graph using the Back-tracking algorithm.
15. Find a shortest path between two vertices of a given connected weighted graph using the Dijkstra's algorithm.
16. Construct an Euler tour in a Euler graph using Fleury's algorithm.