

SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Science & Humanities



**Structure, Teaching Scheme and Syllabus of
B. Sc. (Mathematics) Honours with Research
Sem-5 as per NEP-2020
Program Code: SC104
With effect from: 2023-24**

Semester-5

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Ring & Field Theory
Course Code:	15-MAM301-3C
Pre-requisite Course:	Basic Concept of Group Theory

Course Objectives:

- To understand the basic concept of Ring Theory.
- To understand the concept of Polynomials and Integral Domain.
- To be able to understand the concept of Quotient and Homomorphism of rings.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	-	2	4	50	25	-	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Definition of a Ring and illustrations, Properties of a Ring, Zero divisors and Integral domain, Characteristic of an Integral Ring, Solution of the equation $ax = b$ in a ring R, Sub rings, Ideals.	15	34
2	Introduction of Polynomials, Integral Domain $D[x]$, Familiar form of Integral domain $D[x]$, Unique factorization of Polynomials, Solutions of a Polynomial Equation, Eisenstein Criterion for irreducibility.	15	33
3	Quotient ring, Homomorphism of rings, Maximal Ideal, Prime Ideal.	15	33

Reference Books:

1. I N Herstein, *Topics in Algebra*, Wiley Eastern Ltd
2. N. Jacobson, *Basic Algebra Vol I & II*, Hindustan Publishing company.
3. Shanti Narayan, *A text book of Modern Algebra*, S.Chand & Co.
4. P.B.Bhattacharya, S.K.Jain, S R Nagpal, *Basics Abstract Algebra, (second Edition)*, Cambridge University Press.

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=ReTzwwEN_Do&list=PL8D5taFfp6CxkdMqjByPnj1qCf6yCwYwR
2. <https://www.youtube.com/watch?v=kSuQBSLvYe0>
3. <https://www.youtube.com/watch?v=SF2AMl6S6N0>

Practical

1. Application of Ring and Subring.
2. Application of Zero divisors and Characteristic of an Integral Ring.
3. Application of the equation $ax = b$ in a ring R.
4. Application of Polynomials.
5. Application of Unique factorization of Polynomials.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Use Concept of Ring and solve its applications.	3 Applying
CLO2	Discuss Polynomials, Integral Domain and using it Explain the theorem on its.	2 Understanding, 4 Analysing
CLO3	Define Quotient ring.	1 Remembering
CLO4	Create an example of Sub rings and Homomorphism of rings	6 Creating
CLO5	Define Subspaces, Maximal Ideal, Prime Ideal and Solve examples depend on it.	1 Remembering 3 Applying
CLO6	Know the Polynomials to Justify the Solutions of a Polynomial equation.	5 Evaluating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1	1	1	2		1												1	2		1
CLO2	1	1	1		2				1								3	2		
CLO3		2			1				1								2			
CLO4	1	3	3		2	1			1								1	1		1
CLO5	2	2	1		1												2			
CLO6	2	1	1		2	1			1								2	1		

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Mathematical Analysis-I
Course Code:	15-MAM302-3C
Pre-requisite Course:	

Course Objectives:

- To understand concept of Number System.
- To understand the basic concept of Topology.
- To know about Sequences and Series.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	--	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Number System: The real field to be developed by ordered set approach, Equivalence of this approach and Dedekind's approach, Extended real number system, The complex number system, Euclidean spaces.	15	34
2	Basic Topology: Finite, Countable and Uncountable sets, Metric space, Neighborhoods in metric spaces, Limit point of a set, Open, Closed, Bounded, Compact, Perfect, Connected and Convex subsets of metric spaces.	15	33
3	Sequences and Series: Convergence sequence, Sub sequences, Cauchy sequences, Upper and lower limits, Special sequences and Series, Series of non negative terms, Roots and Ratio Test. Power Series with Real (Complex) terms, Interval (circle) of convergence and radius of convergence of a power series, Summation by parts, absolute convergence, addition and multiplication of series.	15	33

Reference Books:

1. Mathematical Analysis-1, The Perfect Book.
2. "Principles of Mathematical Analysis" by Walter Rudin, McGraw Hill (International Student Edition), 3rd Edition.
3. "A First Course in Mathematical Analysis" by D. Somasundaram & B. Choudhary, Narosa Publishing House
4. "Fundamentals of Mathematical Analysis" by G. Das & S. Pattnayak Tata Mcgraw Hill Pub. Co.

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=VQWs8XBuL2A>
2. <https://www.youtube.com/watch?v=kYQQcybuRjQ&list=PLjReJAzc4wUhPJ2TNNHBGOhjUYEoE25sG>
3. <https://www.youtube.com/watch?v=ZtDNtrohSyM&list=PLU6SqDYcYsfIAbLwyyWUiWJPV6qFbPC13>

Practical

1. Application of the Number system.
2. Application of Metric space.
3. Application of Neighborhoods in metric spaces.
4. Application of Roots and Ratio Test.
5. Application of Interval (circle) of convergence and radius of convergence of a power series.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain Number System.	4 Analysing
CLO2	Discuss Basic Topology and Explain theorems on its.	2 Understanding, 4 Analysing
CLO3	Justify Convergence sequence and absolute convergence.	5 Evaluating
CLO4	Describe Sequences and Series and Solve the example of its.	1 Remembering, 3 Applying
CLO5	Solve the example depends on Roots and Ratio Test.	3 Applying
CLO6	Create an example of Neighborhoods in metric spaces, Limit point of a set, Open and Closed.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1		1	1		1												2		1	
CLO2	2	2			2	1			1								3	1		
CLO3	2	1	1		2												2	2		
CLO4	2	2			2												2			
CLO5	2	1			1												2	2	1	
CLO6	1	1	2		2	1			1								3	2		

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	General Topology-I
Course Code:	15-MAM303-3C
Pre-requisite Course:	

Course Objectives:

- To understand concept of Neighbourhoods, Hausdorff space in topological space.
- To understand the basic concept of interior, boundary, continuity in topological space.
- To know about subspace and connectedness of a topological space.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	--	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Topology and topological spaces, Neighbourhoods, Hausdorff space, Closure of a subset of a topological space.	15	34
2	Interior of a subset of topological space, Boundary of a subset of a topological space, Continuity of a function from topological space to topological space, Homeomorphism between two topological spaces.	15	33
3	Subspace of a topological space, Connectedness of a topological spaces, Some applications of connectedness, Components of a point of connected topological space.	15	33

Reference Books:

1. Topology by James R. Munkres, Prentice Hall of India Private Limited, New Delhi
2. Introduction to Topology and Modern Analysis, by. "G F Symmons", New York McGrawHill
3. General Topology by Kelly J L, New York, Van Nostrand.
4. Elementary Topology by Beckett D W., New York Academic press.

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=8xxi3ILFLBk&list=PLU6SqDYcYsfKQpxRo13Q-7qLx-gQpC-sn>
2. <https://www.youtube.com/watch?v=gXHrPi-6H4I>
3. <https://www.youtube.com/watch?v=9l7EBc3rF5Y>

Practical

1. Application of Topological space.
2. Application of Neighbourhoods in topological space.
3. Application of Interior of a subset of topological space.
4. Application of Boundary of a subset of a topological space.
5. Application of Connectedness of topological spaces.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Define Topological Space and Solve example of its.	1 Remembering 3 Applying
CLO2	Explain Neighbourhoods, Hausdorff space, Closure of a subset of a topological space.	2 Understanding
CLO3	Categorize Interior, Boundary, Continuity and Homeomorphism in a topological space.	4 Analysing
CLO4	Justify Connectedness and disconnectedness of topological spaces.	5 Evaluating
CLO5	Create an example of Subspace of a topological space	6 Creating
CLO6	Explain subspace, connectedness and components in topological space.	2 Understanding

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1	1	1			1												1			1
CLO2	1	1	1		2	2			1								2	1		
CLO3		1			3	1											2	2		
CLO4	1	2	1		2												2	1		1
CLO5	1	2	2		2	2			1								3	2		
CLO6		2	1		2				1								2	1		

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Operations Research-I
Course Code:	15-MAE301-3C
Pre-requisite Course:	

Course Objectives:

- To understand the basic concept of LPP and Graphical Method.
- To know about simplex method, Big-M method and Two-phase method.
- To understand the basic concept of primal-dual problem.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	--	25	100

Subject contents:

Sr. No.	Content	Lectures	Weightage
1	Introduction: Nature and scope of Operations Research. Linear programming: (a) LP Model and method of solution- Graphical method, Slack-Surplus and unrestricted variables, Simplex Algorithm, Simplex Method.	15	33%
2	Artificial Slack variables, Two phase method, Big-M / Penalty method, Variation in simplex method solution- unbounded, infeasible solutions and concept of degeneracy.	15	33%
3	(a) Duality Theory-The essence of duality theory, primal-dual relationships, Duality theorems, Dual simplex method. (b) Integer Programming- The need of integer solutions, The concept of the Cutting – Plane, Gomory’s Cutting Plane Algorithm,	15	34%

Reference book:

1. Operational Research, Kumar Prakashan, Ahmedabad
2. Operations Research, by. J.K.Sharma. Macmillan Publishers India Ltd.
3. Operations Research by Nita Shah, Ravi Gor and Hardik Soni, Prentice Hall of India.
4. Operations Research (Principles and Practice) by Pradeep Prabhakar Pai, Oxford University Press.

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=M8POtpPtQZc>
2. https://www.youtube.com/watch?v=iBK_XOOQ-C4
3. <https://www.youtube.com/watch?v=SN67IGIID7M>

Practical

1. Application of Graphical method in LPP.
2. Application of Simplex method in LPP.
3. Applications of Two phase method in LPP.
4. Application of Big-M / Penalty method in LPP.
5. Application of primal-dual relationships.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the knowledge on LPP and solve the example of Simplex Method.	1 Remembering 3 Applying
CLO2	Discuss Graphical method and solve the example of its.	2 Understanding 3 Applying
CLO3	Describe Slack-Surplus variable, unrestricted variables, artificial variable and create an example of its.	1 Remembering 6 creating
CLO4	Explain Big-M method , Two- phase method and solve the example of its.	4 analyzing 3 Applying
CLO5	Justify primal-dual problem.	5 evaluating
CLO6	Explain dual simplex method and Gomory's Cutting Plane method and its example.	4 analyzing

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1	1	1			2	1			1			1					1	2	1	1
CLO2	2	1	2		2	1											1	2		2
CLO3		1			1	1											1	1	1	1
CLO4	2	2	1		2	2			1			2					2	2	2	2
CLO5	2	2			2				2								2			1
CLO6	2	2	1		3	2			1								2	1	1	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Machine Learning Concept
Course Code:	15-MAE301-30
Pre-requisite Course:	

Course Objectives:

- To understand concept of Probability and Statistical Decision Theory-Regression.
- To understand the basic concept of Neural Networks- Early Models, Decision Trees.
- To know about Undirected Graphical Models.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	--	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Probability Theory, Linear Algebra, Convex Optimization - (Recap), Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance, Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares, Linear Classification, Logistic Regression, Linear Discriminant Analysis, Perceptron, Support Vector Machines.	15	34
2	Neural Networks - Introduction, Early Models, Perceptron Learning, Back propagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation, Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multi way Splits, Missing Values, Decision Trees - Instability Evaluation Measures, Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting, Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks.	15	33
3	Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation, Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering, Gaussian Mixture Models, Expectation Maximization, Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications).	15	33

Reference Books:

1. Tom M Mitchell, “Machine Learning”, McGraw Hill
2. Anuradha Srinivasaraghavan, Vincy Joseph, “Machine Learning”, Wiley India
3. Peter Harrington, “Machine Learning in Action”, DreamTech
4. Henrik Brink, Joseph Richards, Mark Fetherolf, “Real-World Machine Learning”, DreamTech
5. Christopher Bishop, “Pattern Recognition and Machine Learning”
6. Jiawei Han and Michelline Kamber, “Data Mining: Tools and Techniques”, 3rd Edition.

List of Open Source Software/learning website:

1. <https://archive.nptel.ac.in/courses/106/106/106106139/>

Practical

1. Application based on Probability and types of Regression.
2. Application based on Network and Models.
3. Application of Birch Algorithm, CURE Algorithm and Gaussian Mixture Models.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom’s Taxonomy Level
CLO1	Explain concept of of Probability and Statistical Decision Theory and types of Regression.	4 Analysing
CLO2	Discuss Neural Networks.	2 Understanding
CLO3	Justify RL framework and TD learning.	4 Analysing
CLO4	Describe Convex Optimization.	1 Remembering
CLO5	Solve example depend on Birch Algorithm.	3 Applying
CLO6	Create an example of CURE Algorithm and Gaussian Mixture Models.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1		2	1		1	1						1					1	1	2	1
CLO2		2	1		2	1			1	2		1					1		1	1
CLO3		2			2	2				1		1	1					1	1	
CLO4		1	1			1							1				1			1
CLO5	2	2	2		2	1			1	2		1					2	1	1	1
CLO6	2	3	2		2	2			1	2		1	1				1	1	2	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Mathematical Modelling-I
Course Code:	15-MAE302-3C
Pre-requisite Course:	

Course Objectives:

- To understand Types of Models, scopes and limitations.
- To understand Simple population growth model Logistic population.
- To know about Geometric interpretation and stability of Prey-Predator model.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	--	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction to the subject, its scope and limitation, classification of models. Dimensional Homogeneity, Technique of dimensional analysis, an arithmetic model of Gravity, Mathematical modeling through Algebra.	15	34%
2	Simple population growth model, Logistic population growth model ,Geometric interpretation of logistic growth function.	15	33%
3	Two Species Population Models: Prey–Predator models for population dynamics, Geometric interpretation and stability of Prey-Predator model, competition model, Compartment model.	15	33%

Reference Books:

1. J.N. Kapur ,*Mathematical Modeling*, Wiley Eastern Ltd., 1988.
2. J.N.Kapur,*Mathematical Models in Biology and Medicine*, East–West press Pvt.Ltd., 1992.
3. Braum,Coleman&Drew,*Differential Equation Models*, Springer–Verlag,1983
4. Martin Braun,*Differential Equation and their applications*, Springer-Verlag,1977

List of Open Source Software/learning website:

1. <https://youtu.be/JqAL4el3pLM?si=7dMNevkVJXuy154H>
2. https://youtu.be/mosAZwVCaxI?si=OlcrSneqkd-S_1D6
3. <https://youtu.be/XWwEsXiG3VI?si=OCRoQ9QgUTcrHL4F>

Practical

1. Application of Simple population growth model.
2. Application of Logistic population.
3. Application of Geometric interpretation of logistic growth function.
4. Application of Two Species Population Models.
5. Application of competition model.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain types of models, scope and limitations.	4 Analysing
CLO2	Discuss Technique of dimensional analysis, an arithmetic model of Gravity, Mathematical modeling through Algebra.	2 Understanding
CLO3	Justify Prey–Predator models for population dynamics, Geometric interpretation and stability of Prey-Predator model.	4 Analysing
CLO4	Describe Geometric interpretation of logistic growth function.	1 Remembering
CLO5	Solve example depend Simple population growth model Logistic population and Growth model.	3 Applying
CLO6	Create an example of competition model and compartment model.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1		1	2		2	1				1							2		1	1
CLO2		2	2		2	1			2	1		1					2	1	2	2
CLO3		2	1		2	1						1					2	1	2	1
CLO4		1	1		1				1								1		2	
CLO5	2	3			1												1	2	1	
CLO6	2	3	2		1	1			2			1					2	2	2	

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Cryptography & Network Security
Course Code:	15-MAE302-30
Pre-requisite Course:	

Course Objectives:

- To understand basic concept of cryptography and network security.
- To understand Advanced Encryption Standard (AES) and Diffie-Hellman Key Exchange.
- To know about Secure Hash Algorithm (SHA) and Digital Signature Standard (DSS).

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	--	2	4	50	25	-	25	100

Subject Contents:

Sr. No.	Topic	Total Hours	Weightage
1	Introduction to cryptography, Classical Cryptosystem, Block Cipher, Data Encryption Standard (DES), Triple DES, Modes of Operation, Stream Cipher, LFSR based Stream Cipher, Mathematical background, Abstract algebra, Number Theory, Modular Inverse, Extended Euclid Algorithm, Fermats Little Theorem, Euler Phi-Function, Eulers theorem.	15	34%
2	Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Primarily Testing, ElGamal Cryptosystem, Elliptic Curve over the Reals, Elliptic curve Modulo a Prime, Generalized ElGamal Public Key Cryptosystem, Rabin Cryptosystem, Message Authentication, Digital Signature, Key Management, Key Exchange, Hash Function.	15	33%
3	Cryptographic Hash Function, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS), Cryptanalysis, Time-Memory Trade-off Attack, Differential and Linear Cryptanalysis, Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Shamirs secret sharing and BE, Identity-based Encryption (IBE), Attribute-based Encryption (ABE), Side-channel attack, The Secure Sockets Layer (SSL), Pretty Good Privacy (PGP), Introduction to Quantum Cryptography, Blockchain, Bitcoin and Cryptocurrency.	15	33%

Reference Books:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

List of Open Source Software/learning website:

1. <https://archive.nptel.ac.in/courses/106/105/106105162/>

Practical

1. Implementation of Modular Inverse Using Extended Euclidean Algorithm.
2. Verification of Fermat's Little Theorem.
3. Implementation of Diffie-Hellman Key Exchange.
4. Implementation of RSA Digital Signature.
5. Implementation of Cryptographic Hash Function (SHA-256).
6. Implementation of Shamir's Secret Sharing Scheme.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe cryptography and network security	1 Remembering
CLO2	Discuss Encryption Standard (DES), Triple DES and LFSR based Stream Cipher.	2 Understanding
CLO3	Use system for Rabin Cryptosystem and Message Authentication.	3 Applying
CLO4	Explain Cryptographic Hash Function and Secure Hash Algorithm (SHA).	4 Analyzing
CLO5	Justify Side-channel attack, The Secure Sockets Layer (SSL) and Pretty Good Privacy (PGP),	5 Evaluating
CLO6	Design various Bitcoin and Cryptocurrency.	6 creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1		1			1	1				1			2				1			1
CLO2		1	1		2	1			1	2							1	2	2	2
CLO3		2	2		2	2				2		3	3				2	2	2	
CLO4	1	2	2		1	2			2	2		2					2	2	2	1
CLO5		2	1		2	1												1	1	1
CLO6	1	3	3		3	2			2	3		2	2				1	2	1	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Business Mathematics-V
Course Code:	15-SEC303-3C
Pre-requisite Course:	

Course Objectives:

- To understand the concept of elements of decision theory.
- To understand the basic concept of business application of derivatives.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	--	--	2	25	25	--	--	50

Subject Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Elements of Decision Theory: Basic structure of decisions, classical basis of pay-off matrix models. Pay-off matrix under conditions of risk, expected value with minimum-maximum and maximum-minimum, Horwich and Laplace criteria, Expected Monetary Value (EMV)	15	50
2	Business Application of Derivatives: Mathematical functions of demand and supply, price elasticity of demand and supply, Cost functions-average, marginal cost, marginal revenue and average revenue and their relationship with elasticity of demand. Market equilibrium, Monopoly problems.	15	50

Text Books:

1. Business Statistics-1, Sudhir Prakashan, Ahmedabad.

Reference Books:

1. Hooda R.P.: Statistics for Business and Economics, Macmillan, New Delhi.
2. Levin and Rubin: Statistics of Management, Prentice-Hall of India, New Delhi.

List of Open Source Software/learning website:

1. <https://youtu.be/0E3OZBhHxMk>
2. <https://www.youtube.com/watch?v=tbv9E9D2BRQ>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Explain Basic structure of decisions.	2 Understanding
CLO2	Discuss basis of pay-off matrix models. Pay-off matrix under conditions of risk.	2 Understanding
CLO3	Using Horwich and Laplace criteria Find examples	3 Applying, 1 Remembering
CLO4	Discuss the various Mathematical functions of demand and supply, price elasticity of demand and supply	2 Understanding
CLO5	Describe the revenue and average revenue and their relationship with elasticity of demand	1 Remembering
CLO6	Evaluate many Monopoly problems	5 Evaluating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1	1	1	1			1			1								1			1
CLO2	1	2	1		2	1		1	1			1					2			
CLO3	2	1			1			2		1			1				2	2	1	1
CLO4	1	2			2							1					2			1
CLO5						1		2	1								1	1		
CLO6	2	2			2	1		2		1			1				2	2	1	1

3: High, 2: Medium, 1: Low

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Business Mathematics- VI
Course Code:	15-SEC304-3C
Pre-requisite Course:	

Course Objectives:

- To understand the basic concept of Equivalence Relation.
- To understand the concept of Binary operations
- To understand the concept of Homomorphism and Isomorphism of Boolean Algebras.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	--	--	2	25	25	--	--	50

Subject Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Relations, Equivalence Relation, Equivalence classes or sets, Partial order Relations, Hasse Diagram, Upper and Lower Bounds, Minimal and Maximal elements, Binary operations, closure operations, Partially Ordered Set, Totally Ordered Set, Lattices as Posets, Dual Lattice, Meet and Join, Lattice as an algebraic structure, Direct Product Of two Lattices, Lattice Homomorphism, Lattice Isomorphism.	15	50
2	Sub-Lattice, Completed Lattice, Bounded Lattice, Distributive Lattice, Square Free Lattice, Complemented Lattice, Modular Lattice, De Morgan's Law, Boolean Algebra, Boolean Algebra of Switching Circuits, Sub Boolean Algebra, Homomorphism and Isomorphism of Boolean Algebras, Atoms, Unique representation Theorem, Properties Of Set of Atoms, Stone's representation Theorem.	15	50

Reference Books:

1. An Introduction To Discrete Mathematics -Udayan M.Prajapati, Dr.Ajay S. Gor, Nirav Prakashan
2. Discrete Mathematical Structures with Applications to Computer Science by Trembley I.P.And Mahonar R.
3. Discrete Mathematical Structures With applications to Computer Science by R. Hamming and E.A. Feigenbaum
4. Discrete Mathematical Structures for Computer Science by B. Kolman and R.C.Busy
5. The Essence of Discrete Mathematics by Neville Dean
6. Discrete Mathematics and its Applications with Combinatorics and Graph theory, by – Kenneth H. Rosen, McGraw Hill -2007 7th Edition.

List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=h5Lv5ZeNl0g>
2. <https://www.youtube.com/watch?v=W0aOoC6rag8>
3. https://www.youtube.com/watch?v=KeOo4JcsE_0

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe Equivalence classes or sets.	1 Remembering
CLO2	Discuss the knowledge on Lattice Homomorphism and Lattice Isomorphism.	2 Understanding
CLO3	Use De Morgan's Law and using it solve the example of its.	3 Applying
CLO4	Explain Unique representation Theorem.	4 Analysing,
CLO5	Know the Stone's representation Theorem to Justify the application of its.	5 Evaluating
CLO6	Create an example of Equivalence Relation.	6 creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1		1	1		1												1			
CLO2	1	2	1		2	1			1								2			
CLO3	1	1				1											1	2		
CLO4		2	1		2				1								2	1		
CLO5	1	2			2	1			1			1					2	2		
CLO6	2	2	2		1							1					2	1		

3: High, 2: Medium, 1: Low