KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

DEPARTMENT OF MATHEMATICS

Curriculum and Syllabus for Second Year Mathematics Courses & Open Elective Courses offered by Mathematics Department

List of Mathematics Courses (III sem to VII sem)

COURSE CODE	COURSE TITLE	DEPT.	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
LIST OF OPEN ELECTIVE PAPERS		**OFFERED TO**						
OMA151	Discrete and Algebraic Structure	CSE, AD	BS	3	0	0	3	3
OMA152	Fuzzy set and its Applications	ECE, MECH, EEE, IT	BS	3	0	0	3	3
OMA153	Lattices and Boolean Algebra	EEE	BS	3	0	0	3	3
OMA154	Number Theory and Numerical Methods	BT, ECE, CSE, AD	BS	3	0	0	3	3
OMA155	Queueing Theory and Networks	MTRE	BS	3	0	0	3	3
OMA156	Statistics	CSE, AD, EEE, EIE, MECH, MTRE	BS	3	0	0	3	3
OMA157	Theory of Equations and Numerical Methods	BT	BS	3	0	0	3	3
OMA171	Graph Theory and its applications	CSE, AD	BS	3	0	0	3	3
OMA172	Operations Research	MTRE, EIE, PT, EEE	BS	3	0	0	3	3

OMA151 DISCRETE AND ALGEBRAIC STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make them understand the concepts of logical connectives and basics of propositional calculus.
- To explain the basic concepts of sets and functions.
- To make them understand the basics of combinatorics: enumeration, recurrence relations.
- To familiarize the applications of coding theory.

UNIT I LOGIC **9**

Propositions – Connectives – Conditional and Biconditional – Tautology and Contradiction – Equivalence of Propositions – Duality Law – Algebra of Propositions – Tautological implications – PDNF – PCNF – Truth table techniques.

UNIT II SET THEORY **9**

Basic concepts – Subset – Algebra of sets – The power set – Ordered pairs and Cartesian product – Relations on sets – Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations.

UNIT III FUNCTIONS **9**

Definitions of functions – Classification of functions –Type of functions – Examples – Composition of functions – Inverse functions – Binary and n-ary operations – Characteristic function of a set – Permutation functions.

UNIT IV COMBINATORICS **9**

The basics of counting – The pigeonhole principle – Permutations and Combinations – Recurrence relations – Solving linear recurrence relations – Inclusion and exclusion principle.

UNIT V GROUPS AND CODING THEORY **9**

Groups – Subgroups – Homomorphism – Cosets – Lagrange‘s theorem – Coding theory – Encoders and Decoders – Group code – Hamming codes – Error correction in Group code.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students will be able to

CO1: Construct mathematical arguments using logical connectives.
CO2: Apply the set concepts in engineering field.
CO3: Identify the types of functions.
CO4: Apply the concepts of recurrence relations to solve combinatorial problems.
CO5: Apply the concepts of group and coding theory to solve problems in engineering.

TEXTBOOKS:

1. Rosen, K H, 2011 *"Discrete Mathematics and its Applications"*, 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition.
2. Veerarajan T, 2017 "Discrete *Mathematics with Graph Theory and Combinatorics",* Tata McGraw-Hill Education.

REFERENCES:

1. Grimaldi, R P, 2007, *"Discrete and Combinatorial Mathematics: An Applied Introduction"*, 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Koshy, T, 2006 *"Discrete Mathematics with Applications",* Elsevier Publications.
3. Lipschutz, S and Mark Lipson., 2010 *"Discrete Mathematics", Schaum's Outlines,* Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition.
4. Tremblay, J P and Manohar R, 2011*, "Discrete Mathematical Structures with Applications to Computer Science",* Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint.
5. Liu, C and Mohapatra, D P, 2017, *"Elements of Discrete Mathematics: A Computer Oriented Approach*", McGraw Hill Publications, 4th Edition.

WEB REFERENCES:

1. https://old.amu.ac.in/emp/studym/99998830..pdf
2. https://old.amu.ac.in/emp/studym/99998829.pdf
3. https://studylectureblog.files.wordpress.com/2016/08/discrete_and_combinatorial_mathematics_5th_ed_-_r-_grimaldi.pdf

OMA152 FUZZY SET AND ITS APPLICATIONS

LT P C
3 0 0 3

OBJECTIVES:

- To explain the basics of fuzzy Sets.
- To describe fuzzy Numbers and operations on fuzzy numbers.
- To make the students to use the techniques of fuzzification and defuzzification in sets.
- To define various relations in fuzzy sets.
- To solve problems using Fuzzy Decision Making.

UNIT I BASICS OFFUZZY SET THEORY 9

Representations of fuzzy sets – Extension principle for fuzzy sets – Operations of fuzzy sets – Types of operations – Fuzzy complements.

UNIT II FUZZY NUMBERS AND OPERATIONS 9

Fuzzy arithmetic – Fuzzy numbers – Linguistic variables – Arithmetic operations on intervals – Arithmetic operations on fuzzy numbers – Fuzzy equations.

UNIT III FUZZIFICATION AND DEFUZZIFICATION 9

Features of the membership function – Various forms – Fuzzification – Defuzzification to crisp sets – α-cut for fuzzy sets – Defuzzification to scalars.

UNIT IV FUZZY RELATIONS 9

Fuzzy relations – Crisp versus fuzzy relations – Binary fuzzy relations – Binary relations on a single set – Fuzzy equivalence relations – Fuzzy compatibility relations.

UNIT V FUZZY DECISION MAKING 9

Fuzzy decision making – Individual decision making – Multi-person decision Making – Multi criteria decision making – Fuzzy ranking methods – Fuzzy linear programming.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students will be able to

CO1: Apply the fuzzy set concepts in engineering field.
CO2: Use Arithmetic operations on fuzzy numbers.
CO3: Apply defuzzification techniques in optimization problems.
CO4: Identify the types of fuzzy relations.
CO5: Obtain the solutions for various problems using fuzzy theory.

TEXT BOOK:

1. George J Klir & B O, Yuan, 2012, F*uzzy sets and Fuzzy Logic Theory and Applications,* Prentice Hall of India.

REFERENCES:

1. Ganesh M*,* 2006, *Introduction to Fuzzy sets and Fuzzy logic*, Prentice Hall of India.
2. Timothy J Ross, 2010, *Fuzzy Logic with Engineering Applications*, 3rd Edition, Wiley Student Edition.
3. Zimmermann H J, 2013, *Fuzzy Set Theory and its Applications*, Springer.
4. Guanrong Chen, Trung Tat Pharm, 2000, Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems, CRC Press, 1st edition.
5. Timothy J, Ross, 2010, Fuzzy Logic with Engineering Applications, John Wiley & Sons, Ltd., 3rd edition.

WEB REFERENCES:

1. http://www.b-farhadinia.ir/bfarhadiadmin/file/stdfile/Klir.pdf
2. fuzzy logic with engineering application-3rdEdition.pdf (iauctb.ac.ir)
3. ZimmermannFuzzySetTheory2001.pdf (etsmtl.ca)

OMA153 LATTICES AND BOOLEAN ALGEBRA

L T P C
3 0 0 3

OBJECTIVES:

- To explain the basic concept of Sets.
- To explain the basic concept of various kinds of lattices and its properties.
- To classify some special lattices.
- To introduce the basics of homomorphism between lattices.
- To understand the knowledge of the concepts of Boolean algebra and sub algebra.

UNIT I SET THEORY 9

Basics of sets – Universal set – Venn diagram – Cartesian products – Relations – Equivalent relations – Partitions of sets.

UNIT II BASICS OF LATTICES 9

Lattices as partially ordered sets – Chain – Definitions of lattices – Hasse diagrams and their properties – Lattices as algebraic systems – Sub lattices.

UNIT III SOME SPECIAL LATTICES 9

Complete lattice – Bounded lattice – Complemented lattice – Distributive – Modular and non modular lattices with example and properties – Ideal lattice.

UNIT IV CONGRUENCE LATTICE 9

Congruence relations – Congruence lattices – Homomorphism theorem and product of lattices – Congruence of direct product of lattices.

UNIT V BOOLEAN ALGEBRA 9

Introduction Axioms and Theorems of Boolean algebra – Boolean functions – Simplification of Boolean functions – Karnaugh maps – Logic gates.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students will be able to

CO 1: Apply the concepts of set in real life problems.
CO 2: Apply the concepts of lattices to the problems of data mining.
CO 3: Solve problems in computer networks using special lattices.
CO 4: Perform homomorphic encryption.
CO 5: Infer Boolean algebra for the development of logic circuits.

TEXT BOOKS:

1. George Gratzer, 2011, "*Lattice Theory: Foundations*", 1st Edition, Birkhäuser Basel.
2. George Gratzer, 2007, "*General Lattice Theory*", 2nd Edition, Birkhäuser Basel.

REFERENCES:

1. Davey B A and Priestley H A., 2002 "*Introduction to Lattices and Order*", 2nd Edition, Cambridge University Press.
2. George Grätzer, 2009 "*Lattice Theory: First Concepts and Distributive Lattices (Dover Books on Mathematics)*", Dover Publication.
3. Grimaldi R P, 2004 "*Discrete and Combinatorial Mathematics*", Pearson Education Pvt. Ltd., Fifth Edition, Singapore.
4. Trembly, J P. and Manohar, R. 1997, "*Discrete Mathematical structures in the application to computer science"*, Third Edition, Tata McGraw Hill, New Delhi (for Logic, Groups and Boolean Algebra).
5. Vijay K. Garg, 2015 "*Introduction to Lattice Theory with Computer Science Applications*", 1st Edition, Wiley.

WEB REFERENCES:

1. http://library.lol/main/556D37E71B2DD02AE5624D8EED15CE5B
2. http://library.lol/main/89DEC79D73E669252F891F002BA24CF1
3. http://library.lol/main/983CA106F97DA5E04A6034138BC0B877

OMA154 NUMBER THEORY AND NUMERICAL METHODS

L T P C
3 0 0 3

OBJECTIVES:

- To make them understand the fundamental concepts of elementary number theory which helps to improve the ability of mathematical thinking.
- To explain the techniques for solving the system of equations and eigen value problems.
- To solve the ordinary differential equation with initial conditions.

UNIT I DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS 9

Division algorithm (proof excluded) – Prime and composite numbers – GCD – Euclidean algorithm (proof excluded) – Fundamental theorem of arithmetic (proof excluded) – LCM.

UNIT II DIOPHANTINE EQUATIONS AND CONGRUENCES 9

Linear Diophantine equations – Congruence‘s – Linear Congruence‘s – Chinese remainder theorem (proof excluded).

UNIT III CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS 9

Fermat‘s little theorem (proof excluded) – Euler‘s theorem (proof excluded) – Euler‘s Phi functions – Tau and Sigma functions.

UNIT IV SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Solution of linear system of equations: Gauss elimination and Gauss Jordan methods - Iterative methods: Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods: Euler’s method, Modified Euler’s method and Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne’s predictor and corrector method for solving first order equations.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students will be able to

CO1: Apply the techniques of Euclidean algorithm for calculating GCD and LCM.
CO2: Solve the system of linear congruence.
CO3: Apply Euler-Fermat's Theorem to prove relations involving prime numbers.
CO4: Apply the techniques for solving the transcendental equations, system of Equations and eigen value problems.
CO5: Solve the ordinary differential equations with initial conditions by various Methods.

TEXT BOOKS:

1. Koshy, T, 2002, *Elementary Number Theory with Applications*, Elsevier Publications, New Delhi.
2. Grewal, B S, & Grewal, J S, 2016, *Numerical Methods in Engineering and Science,* 10th Edition Reprint, Khanna Publishers, New Delhi, India.

REFERENCES:

1. Niven, I, Zuckerman, H S, and Montgomery, H L, 2004 - *An Introduction to Theory of Numbers*, John Wiley and Sons, Singapore.
2. David M. Burton, 2017, Elementary *Number Theory*, 7th Edition, McGraw Hill Education.
3. Gerald, C F, & Wheatley, P O, 2007, *Applied Numerical Analysis,* 7th Edition, Pearson Education, Asia, New Delhi.
4. Sankar Rao, K, 2018, *Numerical Methods for Scientists and Engineers*, 4th Edition, Prentice Hall of India Private.
5. Kandasamy, P, Thilagavathy, K, & Gunavathy, K ,2014, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi.

WEB REFERENCES:

1. sample_7394.pdf (kopykitab.com)
2. Applied Numerical Analysis.pdf (iitm.ac.in)
3. Rosen - Elementary number theory and its applications.pdf (uni-lj.si)

OMA155 QUEUEING THEORY AND NETWORKS

L T P C
3 0 0 3

OBJECTIVES:

- To make them understand the basic concepts of Markov process.
- To make them understand the significance of queueing models and queueing networks.

UNIT I PROBABILITY AND RANDOMVARIABLES 9

Probability – The axioms of probability – Conditional probability – Discrete and continuous random variables – Moments – Moment generating functions – Distributions: Poisson and Exponential.

UNIT II MARKOV PROCESS 9

Random process – Poisson process – Markov process – Markov chain –Transition probability matrix – Chapman Kolomogrov equations – Limiting probability.

UNIT III MARKOVIAN QUEUE WITH INFINITE CAPACITY 9

Kendall's notation – Transient and steady state – Steady state solution of Birth and death processes – Single server infinite capacity queue – Little's formula – Multi server infinite capacity queue (excluding derivation).

UNIT IV MARKOVIAN QUEUE WITH FINITE CAPACITY 9

Queues with impatient customers: Balking, reneging and jockeying – Single server finite capacity queue – Little's formula – Multi server finite capacity queue (excluding derivation).

UNIT V NONMARKOVIAN QUEUES AND NETWORKS 9

(M/G/1) queue – Pollaczek Khinchine formula – (M/D/1) queue – ($M/E_k/1$) queue as special cases – Open Jackson networks (excluding derivation).

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students should be able to:

CO1: Apply the concepts of Markov process in engineering field.
CO2: Acquire skills in analyzing queueing models with infinite capacity.
CO3: Illustrate the concepts of Markovian queue with finite capacity.
CO4: Apply the concept of Non-Markovian queue in real life situations.
CO5: Demonstrate the basic characteristic features of a queueing network.

TEXT BOOKS:

1. Gross, D, Shortle, J F, Thompson, J M and Harris C M, 2014, "*Fundamentals of Queueing Theory*", Wiley Student 4th Edition.
2. Medhi, J, 2003, "*Stochastic Models in Queueing Theory*", second edition, Academic Press, an imprint of Elsevier.

REFERENCES:

1. Trivedi, K S, 2002, "*Probability and Statistics with Reliability, Queueing and Computer Science Applications*", 2nd Edition, John Wiley and Sons.
2. Allen, A O, 2014, "*Probability, Statistics and Queueing theory with Computer Applications*", 2nd Edition, Elsevier.
3. Kanthi Swarup, P K, Gupta and Man Mohan, 2020, "*Operation Research*", Sultan Chand and Sons.
4. Stark, H, Woods, J W 2012, *Probability and Random Processes with Applications to Signal Processing*, 4th Edition, Pearson Education, Asia**.**
5. Yates, R, D, Goodman, D, J, 2012, *"Probability and Stochastic Processes",* 2nd Edition, Wiley India Pvt. Ltd., Bangalore.

WEB REFERENCES:

1. http://www.utstat.toronto.edu/mikevans/jeffrosenthal/book.pdf
2. http://www.sasurieengg.com/e-course-material/CSE/II-Year%20Sem%204/MA6453%20- %20PQT.pdf
3. https://irh.inf.unideb.hu/~jsztrik/education/16/SOR_Main_Angol.pdf

OMA156 **STATISTICS** **L T P C**

3 0 0 3

OBJECTIVES:

- To make them understand the basic concepts of statistical techniques.
- To compute various coefficients to measure the extent of skewness in a distribution.
- To make them understand the concepts of curve fitting and aware of the basic terminologies and ideas to solve equations.
- To deal with qualitative types of characteristics that are calculated by using quantitative measurements.

UNIT I MEASURES OF CENTRAL TENDENCY 9

Raw data – Arithmetic mean- combined AM – Arithmetic mean for grouped data – Median – Mode – Geometric Mean – Harmonic Mean – Relation between Arithmetic, Geometric and Harmonic Mean.

UNIT II MEASURES OF DISPERSION 9

Range – Standard deviation – Variance – Quartile deviation – Mean deviation – Standard deviation – Combined Standard deviation – Coefficient of variation.

UNIT III SKEWNESS, KURTOSIS & MOMENTS 9

Skewness – Measures of Skewness – Karl Pearson coefficient of Skewness – Bowley's coefficient of Skewness – Kelly's coefficient of Skewness – Kurtosis – Moments

UNIT IV CURVE FITTING 9

Curve fitting – Fitting of a straight line – Fitting of parabola – Fitting of a polynomial of k^{th} degree.

UNIT V THEORY OF ATTRIBUTES 9

Introduction – Dichotomy – Classes and class frequencies – Relation between class – frequencies – Class symbols as operators – Consistency of Data – Independence of attributes – Criterion of attributes – Symbols $(AB)_0$ – Association of Attributes – Yule's Coefficient of association – Coefficient of colligation.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students will be able to

CO1: Calculate the basic concepts of statistical techniques.
CO2: Find the different numerical measures.
CO3: Compute various coefficients to measure the extent of skewness in a distribution.
CO4: Apply the techniques of Least square for fitting a curve.
CO5: Know the theory of complete independence of a series of Attributes.

TEXT BOOKS:

1. Pillai R S N, Bagavathi, 2000, "Statistics", 11th edition, S chand & Company Ltd.
2. Gupta S C, and Kapur V K, 2015, "*Fundamentals of Mathematical Statistics",* 11th Edition Sultan Chand,

REFERENCES:

1. Walpole R E, Myers, R H, Myers R S L and Ye. K, 2013. "*Probability and Statistics for Engineers and Scientists*", 9th Edition, Pearsons Education.
2. Lipschutz S and Schiller J, 2011, "Schaum's outlines - *Introduction to Probability and Statistics",* 1st edition, McGraw-Hil.,
3. Johnson R A, "Miller & Freund's *Probability and Statistics for Engineers*", 7th Edition, Pearson Education, 2007.
4. Milton, J S & Arnold, J C 2008, *Introduction to Probability and Statistics*, Tata McGraw Hill, 4thEdition, New Delhi.
5. Kandasamy, P, Thilagavathy, K, & Gunavathy, K, 2014, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi.

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1. https://fac.ksu.edu.sa/sites/default/files/probability_and_statistics_for_engineering_and_the_sciences.pdf
2. https://www.dcpehvpm.org/E-Content/Stat/FUNDAMENTAL%20OF%20MATHEMATICAL%20STATISTICS-S%20C%20GUPTA%20&%20V%20K%20KAPOOR.pdf
3. http://www.elcom-hu.com/Mshtrk/Statstics/9th%20txt%20book.pdf

OMA157 THEORY OF EQUATIONS AND NUMERICAL METHODS

L T P C
3 0 0 3

OBJECTIVES:

- To make them understand the concepts of curve fitting and aware of the basic terminologies and ideas to solve equations.
- To explain the techniques for solving the system of equations and eigen value problems.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To impart the knowledge of various techniques of differentiation and integration.

UNIT I CURVE FITTING 9

Curve fitting by the method of least squares: Fitting curves of the form $y = ax + b$, $y = ax^2 + bx + c$, $y = ax^b$ and $y = ab^x$.

.UNIT II THEORY OF EQUATION 9

Fundamental theorem of algebra (proof excluded) – Symmetric function of the roots – Formation of equations – Multiple roots – Reciprocal equation – Descarte's rule of sign.

UNIT III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Solution of linear system of equations: Gauss elimination and Gauss Jordan methods – Iterative methods: Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method.

UNIT IV INTERPOLATION AND APPROXIMATION 9

Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference interpolation – Difference operators and relations – Interpolation with equal intervals: Newton's forward and backward difference formulae.

UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials – Numerical integration: Trapezoidal rule – Simpson's 1/3 rule– Simpson's 3/8 rule – Romberg's Method – Two point and three point Gaussian quadrature formulae.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students will be able to

CO1: Apply the techniques of Least square for fitting a curve.
CO2: Solve algebraic equations by various techniques in theory of equations.
CO3: Compute numerical solutions to system of linear equations and Eigen value problems.
CO4: Construct approximate polynomial to represent the data and find the intermediate values of unknown function using interpolation.
CO5: Apply numerical methods to find the values of differentiation and integration.

TEXT BOOKS:

1. Grewal, B S, & Grewal, J S 2016, *Numerical Methods in Engineering and Science,* 10th Edition Reprint, Khanna Publishers, New Delhi, India.
2. Burden, R L and Faires, J D 2016, *Numerical Analysis*, 9th Edition, Cengage Learning.

REFERENCES:

1. Gerald, C F & Wheatley, P O, 2007, *Applied Numerical Analysis,* 7th Edition, Pearson Education, Asia, New Delhi.
2. Sankar Rao, K, 2018, *Numerical Methods for Scientists and Engineers*, 4th Edition, Prentice Hall of India Private.
3. Kandasamy, P, Thilagavathy, K, & Gunavathy, K, 2014, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi.
4. Gupta, S C, & Kapoor, V K, 2020, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, 12th Edition Reprint.
5. Mathews, J H, 1992, *Numerical Methods for Mathematics, Science and Engineering*, 2nd Edition, Prentice Hall.

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1. https://content.kopykitab.com/ebooks/2016/06/7394/sample/sample_7394.pdf
2. https://www.dcpehvpm.org/E-Content/Stat/FUNDAMENTAL%20OF%20MATHEMATICAL%20STATISTICS-S%20C%20GUPTA%20&%20V%20K%20KAPOOR.pdf
3. Applied Numerical Analysis.pdf (iitm.ac.in)\

OMA171 GRAPH THEORY AND ITS APPLICATIONS

L T P C
3 0 0 3

OBJECTIVES:

- To introduce most of the basic terminologies of graph theory used in computer science courses and application of ideas to solve practical problems.
- To make the students understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of trees.
- To make the students understand the concepts and significance of network flows.

UNIT I GRAPHS 9

Graph terminology – Finite and Infinite graphs – Incidence and degree – Vertices – Types of graphs – Matrix representation of graphs – Graph isomorphism – Subgraphs – Connected graphs.

UNIT II EULERIAN AND HAMILTONIAN GRAPHS 9

Operations on graphs – Euler graphs -– Hamiltonian graphs – The Travelling Salesman Problem.

UNIT III TREES 9

Trees – Some properties of trees – Pendant Vertices in a tree – Distance and centres in a tree – Rooted and Binary tree – Spanning trees – Spanning trees in a weighted graph.

UNIT IV APPLICATIONS ON TREES 9

Minimum Spanning Tree – Kruskal's algorithm – Prim's algorithm – Shortest path algorithm – Dijkstra 's algorithm.

UNIT V NETWORK FLOWS AND CHROMATIC POLYNOMIAL 9

Network flow:1-isomorphism – 2-isomorphism – Ford and Fulkerson Algorithm – Chromatic number – Chromatic partitioning – Chromatic polynomial.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the basic concepts of graphs, and different types of graphs.
CO2: Apply the concepts of Eulerian and Hamiltonian graphs in computer networks and other network related problems.
CO 3: Understand the concept of Trees and decomposition of graphs.
CO 4: Apply the concept of trees in networks related problems.
CO 5: Apply the max-flow min-cut concept in computer networks.

TEXT BOOKS:

1. Narsingh Deo, 2003, "*Graph Theory with Application to Engineering and Computer Science*", Prentice-Hall of India Pvt. Ltd.
2. Foulds, L R, 2016, "*Graph Theory Applications*", Springer.

REFERENCES:

1. Bondy, J A and Murty, U S R, 2008, "*Graph Theory with Applications*", North Holland Publication.
2. West, D B, 2011, "*Introduction to Graph Theory*", Pearson Education.
3. John Clark, Derek Allan Holton, 1991, "*A First Look at Graph Theory*", World Scientific Publishing Company.
4. Diestel, R, 2006, "*Graph Theory*", Springer, 3rd Edition.
5. Kenneth H. Rosen, 2003, "*Discrete Mathematics and Its Applications*", Tata McGraw Hill Pub. Co. Ltd., New Delhi.

WEB REFERENCES:

1. https://www.zib.de/groetschel/teaching/WS1314/BondyMurtyGTWA.pdf
2. https://inoerofik.files.wordpress.com/2014/11/firstlook_graphtheory.pdf
3. http://docshare01.docshare.tips/files/26167/261678089.pdf

OMA172 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

OBJECTIVES:

- To formulate Mathematical models of real-life Problem / Opportunities.
- To impart the skills in the applications of Operations Research techniques to solve the linear programming problems.
- Identify the objectives and constraints and make the given problem as a suitable model.
- Acquire knowledge to solve the decision-making problem.

UNIT I LINEAR PROGRAMMING PROBLEM 9

Introduction – Linear Programming Problem – Mathematical Formulation of the Problem – Graphical Solution Method – Some Exceptional cases – General Linear Programming Problem – Canonical and Standard Forms of LPP – Demo using Excel.

UNIT II SOLUTIONS OF LINEAR PROGRAMMING USING SIMPLEX METHOD 9

Introduction – The Simplex Algorithm – Use of artificial Variables – The Two-Phase simplex method and Big- M method (Penalty Method) – Demo using Excel.

UNIT III TRANSPORTATION PROBLEM 9

Solution of Transportation Problem – Initial Basic feasible Solution: North – West corner Method – Least Cost Method – Row minima method – Column Minima method – Vogel's Approximation Method – Optimal Solution Using MODI Method (Degeneracy excluded) – Demo using Excel.

UNIT IV ASSIGNMENT PROBLEM 9

Mathematical Formulation – Hungarian Method – Special Cases: Unbalanced – Maximization case – The Travelling Salesman Problem – Demo using Excel.

UNIT V GAME THEORY 9

Introduction – Two-Person Zero-Sum game – The Maxmin – Minimax Principle – Games without Saddle Point – Mixed Strategies – Graphic Solution of 2 by n and m by 2 games – Dominance Property – Arithmetic method of n by n Games.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, students will be able to

CO1: Formulate and solve Linear Programming problem using graphical Method.
CO2: Solve Linear Programming problem using Simplex and artificial variable techniques.
CO3: Solve Transportation problem by Modi Method.
CO4: Solve Assignment problem by Hungarian algorithm.
CO5: Solve n person zero sum games by game theory.

TEXT BOOK:

1. Kanti Swarup, P K Gupta, Man Mohan, 2019, *Operations Research*, Sultan Chand and Sons Educational Publishers New Delhi.
2. Frederick, Mark Hillier, 2015, "Introduction to Operations Research", Tata Mcgraw Hill, India.

REFERENCES:

1. Sharma, J K, 2013, *Operations Research Theory and Applications*, Macmillan, 5th Edition.
2. Taha H A, *Operations Research: An Introduction*, Pearson Education, 9th Edition.
3. Prem Kumar Gupta, D S, Hira, 2013, *Operations Research*, S. Chand & Company Ltd, New Delhi, 6th edition.
4. Wayne L. Winston, 2009, "Operations Research", Cengage Learning, 4th Edition.
5. Pannerselvam R, Operations Research, PHI Learning Private Limited, 2nd Edition.

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1. http://home.ustc.edu.cn/~liweiyu/documents/Operations%20Research.%20An%20Introduction-%20H.A.%20Taha-%20Pearson%202007.pdf
2. https://thalis.math.upatras.gr/~tsantas/DownLoadFiles/Taha%20-%20Operation%20Research%208Ed.pdf
3. https://www.bbau.ac.in/dept/UIET/EME-601%20Operation%20Research.pdf