Syllabus

(For IV, VI & VIII Sem. – Jan. – June- 2025)

of

B.Tech.

in

Mathematics and Computing

Department of Engineering Mathematics and Computing

Madhav Institute of Technology & Science

Gwalior-474005

Department of Engineering Mathematics & Computing

(B. Tech. IV Semester)

Transform and Vector Calculus(MAC – 2250401)

Objective of Course

- To perceive the transform techniques in engineering problems
- To expose the concept of Fourier series and Fourier Transform
- To understand Wavelet transform & Z-Transform
- To explore the Vector Calculus

Unit 1: Fourier series and Fourier Transform

Introduction, Periodic functions: Even & Odd functions: Properties, Euler's Formulae for Fourier Series, Fourier Series for arbitrary and periodic functions, Dirichlet's conditions, Half Range Fourier Series, Harmonic analysis. Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform.

Unit 2: Laplace Transform & Its Applications

Definition of Laplace Transform, conditions for existence of Laplace Transform. Properties of Laplace transform,
Unit step functions, Dirac delta-function. Inverse Laplace transform, convolution theorem, Solution of ordinary differential equations with the initial and boundary conditions.

Unit 3: Z- Transform & Difference Equations

Introduction to Z- transform, Properties of the Z-Transform, Inverse Z-Transform, Convolution, Partial Fraction Method, Residual Method and Solving Linear Difference Equation Using Z-Transform.

Unit 4: Wavelet Transform

Introduction to Wavelet transform, Discrete and Continuous Wavelet Transform, Orthogonal Wavelet Decomposition, MRA, Ortho Normal Wavelets and their Relationship to Filter Banks, Examples of Wavelets, Alternative Wavelet Representations, Non-Separable Multidimensional Wavelets, Embedded Tree Image Coding, Construction of Simple Wavelets.

Unit 5: Vector calculus

Introduction of Vector calculus, Vector differentiation: Gradient, Divergence, and Curl, directional derivative, Solenoidal and Irrotational vectors, Vector Integration: Line integral, Gauss divergence theorem and Stoke's theorem.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Identify the concepts of Fourier series and Fourier transform
CO2	Describe Laplace Transform.
CO3	Illustrate the problems of Z- transform & Difference Equations
CO4	Analyze the Wavelet Transform
CO5	Evaluate vector calculus

Recommended Books:

1. B. S. Grewal: Higher Engineering Mathematics, Khanna Publisher, 43rd Edition, 2015.
2. G. ShankerRao: Mathematical Methods, I. K. International Publications, 1st Edition, 2009.
3. J.C. Goswami and A.K. Chan: Fundamentals of Wavelets: Theory, Algorithms, and Applications, 2nd ed., Wiley,2011.
4. Michel Misiti, Yves Misiti, Georges Oppenheim, JeanMichel Poggi: Wavelets and their Applications, John Wiley &Sons, 2010.
5. Ian N. Sneddon: Fourier Transforms, Dover Publications, 2010.
6. Loknath Debnath: Integral Transforms and their applications, Chapman and Hall/CRC, 2nd edition, 2006.
7. Narayan Shanti and P. K. Mittal: A Text Book of Vector Analysis, S. Chand, Company, 2010 Edition.

Department of Engineering Mathematics and Computing

(B. Tech. Fourth Semester)
Database Management Systems and SQL
(MAC - 2250402)

Course Objectives

- To explain basic database concepts, applications, data models, schemas and instances.
- To demonstrate the use of constraints and relational algebra operations.
- Describe the basics of SQL and construct queries using SQL.
- To emphasize the importance of normalization in databases, design and concurrency.

Unit-1-Introduction: Advantage of DBMS approach, various view of data, data independence, schema and sub-schema, primary concepts of data models, Database languages, transaction management, Database administrator and users, data dictionary, overall system architecture.
ER model: basic concepts, design issues, mapping constraint, keys, ER diagram, weak and strong entity sets, specialization and generalization, aggregation, inheritance, design of ER schema, reduction of ER schema to tables.
Unit-2 -Domains, Relations and Keys: domains, relations, kind of relations, relational database, various types of keys, candidate, primary, alternate and foreign keys.
Relational Algebra & SQL: The structure, relational algebra with extended with extended operations, modifications of Database, idea of relational calculus, basic structure of SQL, set operations, aggregate functions, null values, nested sub queries, derived relations, views, modification of Database, join relations, DDL in SQL.
Database Integrity: general idea. Integrity rules, domain rules, attribute rules, relation rules, Database rules, assertions, triggers, integrity and SQL.
Unit-3- Functional Dependencies and Normalization: basic definitions, trivial and non-trivial dependencies, closure set of dependencies and of attributes, irreducible set of dependencies, introduction to normalization, non-loss decomposition, FD diagram, first, second, third Normal forms, dependency preservation, BCNF, multivalued dependencies and fourth normal form, Join dependency and fifth normal form.
Unit-4-Transaction, concurrency and Recovery: basic concepts, ACID properties, Transaction states, implementation of atomicity and durability, concurrent executions, basic idea of serializability, basic idea of concurrency control, basic idea of deadlock, failure classification, storage structure types, stable storage implementation, data access, recovery and atomicity- log based recovery, deferred Database modification, immediate Database modification, checkpoints.
Unit-5-Distributed Database: basic idea, distributed data storage, data replication, data fragmentation- horizontal vertical and mixed fragmentation.
Emerging Fields in DBMS: Object Oriented Databases-basic idea and the model, object structure, object class, inheritance, Data Warehousing- terminology, definitions, characteristics, data mining and it's overview, Multimedia Databases-difference with conventional DBMS, issues, similarity based retrieval.
Storage structure and file organizations: overview of physical storage media, magnetic disks-performance and optimizations, basic idea of RAID, file organizations, organization of records in files, basic concepts of indexing, ordered indices.

Course Outcomes

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Demonstrate the concepts of different type of database system.
CO2	Apply Relational algebra concepts to design database system.
CO3	Make use of queries to design and access database system.
CO4	Analyze the evaluation of transaction processing and concurrency control.
CO5	Determine the optimize database for real world applications.

Recommended Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan: Database System Concepts, McGraw-Hill 6th Edition.
2. Ramakrishnan Raghu and Gehrke Johannes: Database Management System, McGraw Hill, 3rd Edition.
3. Elmasri & Navathe: Fundamentals of Database System, Addison-Wesley Publishing, 5th Edition.
4. C.J. Date: An Introduction to Database Systems, Addison-Wesley Publishing, 8th Edition.
5. Bipin Desai: An introduction to Database System –Galgotia Publications, Revised Edition, 2010

Department of Engineering Mathematics and Computing

(B. Tech. Fourth Semester)

Theory of Computation (MAC - 2250403)

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- To understand computability, decidability, and complexity through problem solving.
- To analyse and design abstract model of computation & formal languages
- To understand and conduct mathematical proofs for computation and algorithms

Unit-1:

Introduction to Theory of Computation: Automata, Computability and Complexity, Alphabet, Symbol, String, and Formal Languages, Examples of automata machines, Finite Automata as a language acceptor and translator, Moore machines and Mealy machines, Composite Machine, Conversion from Mealy to Moore and vice versa.

Unit-2

Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, conversion of NDFA to DFA, minimization of automata machines, regular expression, Arden's theorem. Pumping lemma, applications, Closure properties of regular languages, 2 way DFA.

Unit-3

Grammars: Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, Rightmost and Leftmost derivations of Strings, ambiguity in grammar, simplification of context free grammar, killing null and unit productions, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar,. Chomsky Normal Form (CNF) and Greibach Normal Form (GNF).

Unit-4

Push down Automata: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack, Example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA.

Unit-5

Turing Machine: Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable languages, undecidable languages, Halting problem of Turing machine & the post correspondence problem (PCB).

Course Outcomes

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Explain the basic concepts of switching and finite automata theory & languages.
CO2	Relate practical problems to languages, automata, computability and complexity.
CO3	Construct abstract models of computing and check their power to recognize the languages.
CO4	Analyse the grammar, its types, simplification and normal form.
CO5	Interpret formal mathematical methods to prove properties of languages, grammars and automata.

Recommended Books:

1. Hopcroft& Ullman: Introduction to Automata Theory Language & Computation, Narosa Publication, 2009.
2. Lewis &Christors: Element of the Theory Computation, Pearson, 2011.
3. Chandrasekhar & Mishra: Theory of Computation, PHI, 2011
4. Daniel I-A Cohen: Introduction to Computing Theory, John Wiley, 2010.

Department of Engineering Mathematics and Computing

(B. Tech. Fourth Semester)

Design and Analysis of Algorithms

(MAC - 2250404)

L	T	P	C
2	1	0	3

Course Objectives

- To analyze performance of algorithms.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To understand how the choice of data structures and algorithm design methods impacts the performance of programs.

Unit-1: Review of elementary Data Structures: Stacks, Queues, Lists, Trees, Hash, Graph, Internal representation of Data Structures, Code tuning techniques: Loop Optimization, Data Transfer Optimization, Logic Optimization, etc.

Unit-2: Definitions of complexity, Time and Space Complexity; Time space tradeoff, various bounds on complexity, Asymptotic notation: O-notation, Ω-notation, Θnotation, Recurrences and Recurrences solving techniques: Recursion-tree method and Master method, Average time analysis methods: Probabilistic methods. Amortized analysis.

Unit 3: Design and analysis of algorithms using the brute-force, greedy, dynamic programming, divide-and-conquer and backtracking techniques.

Unit-4: Algorithm for sorting and searching, string matching algorithm, Numbertheoretic algorithms, linear programming, Matrix Manipulation algorithms, tree and Graph Algorithms.

Unit-5: NP-hard and NP-complete problems, Approximations Algorithms, Data Stream Algorithms, Introduction to design and complexity of Parallel Algorithms.

Course Outcomes

After completion of this course, the students would be able to:

CO's	Description of CO's
CO1	Define the basic properties of algorithm.
CO2	Analyze the complexity of an algorithm.
CO3	Apply mathematical preliminaries to analyze and design stages of different types of algorithms.
CO4	Examine algorithms for a number of important computational problems.
CO5	Compare different design techniques to develop algorithms for various computational problems.

Recommended Books

1. Leiserson Cormen, Stein Rivest: Introduction to Algorithms, 3rd Edition, PHI, 2010.
2. A.V.Aho, J. E. Hopcroft, J. Ullman: Design and Analysis of Computer Algorithms, Addison Wesley, 1998.
3. Horowitz E. and Sahani: Fundamentals of Computer Algorithms‖, 2nd Edition, Galgotia Publications, 2008.
4. D. Knuth: Fundamental algorithms: The Art of Computer programming, Volume – I, Third Edition, Pearson Education 1998.
5. D. Knuth: Sorting and Searching: The Art of Computer programming, Volume – III, Second Edition Pearson Education1998.
6. John Kleinberg, Trades E: Algorithm Design, Pearson Education 2002.
7. Papoulis, S.U. Pillai: Probability, Random Variables and Stochastic Processes‖, McGraw Hill, Fourth Edition 2006.

Department of Engineering Mathematics and Computing

B. Tech. (Fourth Semester)

Number Theory and Cryptography
(MAC - 2250405)

L	T	P	C
3	1	NIL	4

Objective of Course

- To Understand the Crypto graphical techniques to converting some secret information to not readable texts
- Explore the Crypto graphical techniques in various applications such as include military information transmission, computer passwords, electronic commerce, and others.
- Introduce the idea of encryption and public key cryptosystem in the context of algebra and elementary number theory.

Unit 1:

Number theory, Divisibility theory, Modular Arithmetic, primes and their distribution, theory of congruence and its applicationin security, Congruence: basic definitions and properties, complete and reduced residue systems.

Unit 2:

Integer representations (binary and base expansions, base conversion algorithm), Fermat's Little Theorem and Euler's Theorem, primitive roots, quadratic reciprocity, and Divisibility: basic definition, properties, prime numbers, some results on distribution of primes.

Unit 3:

Arithmetical functions: examples, with some properties and their rate of growth; Continued fractions, and their connections with Diophantine approximations, applications to linear and Pell's equations; Binary quadratic forms; Partition: basic properties and results; Diophatine equations: linear and quadratic, some general equations.

Unit 4:

Overview of cryptography, Encryption, Symmetric Encryption, Plain text, cipher text, Historical Ciphers, Shift Cipher, Substitution Cipher, Vigen'ere Cipher, Permutation Cipher, Symmetric Ciphers, Stream Cipher, Block Ciphers. Symmetric Key Distribution, key management, secret key distribution, public and private key cryptography.

Unit 5:

RSA cryptosystem, Primality Testing and Factoring, Key Exchange and Signature Schemes Diffie–Hellman Key Exchange, Digital Signature Schemes, Cryptographic hash functions, Authentication, Digital Signatures, Identification, certification, Discrete logarithm problem in general and on finite fields. Polynomials on finite fields, irreducibility and their applications to coding theory.

Course Outcomes

After completing this course, student will be able to:

CO's	Description of CO's
CO1	Acquire the knowledge of number theory and transcendental numbers
CO2	Describe the divisibility and related algorithms, factorization and quadratic sieve, efficiency of other factoring algorithms.
CO3	Evaluate arithmetical functions, Distribution of primes and Diophantine equations
CO4	Apply cryptography tools in various applications
CO5	Examine the Public key cryptosystems

Recommended Books:

1. Nigel Smart : Cryptography : An Introduction, CRC Press,3rd edition, 2013
2. Neal Koblitz : A course in number theory and cryptography, Springer-Varlag, 2nd edition, 1994.
3. W. Stein: Elementary Number Theory: Primes, Congruences and Secrets, OPAQUE, 2017
4. Burton, David M. Elementary Number Theory, 7th ed., 2011, McGraw-Hill, Inc.
5. Koshy, Thomas. Elementary Number Theory With Applications, 2nd ed., 2007. Elsevier, Inc
6. Robbins, Neville. Beginning Number Theory, 1993. Iowa: Wm. C. Brown
7. P. S. Gill, Cryptography and Network Security, 2011, Oxford Publication
8. Stein, William, Elementary Number Theory: Primes, Congruences, and Secrets: A Computational Approach, 2017,Springer Verlag

Department of Mathematics & Computing

B. Tech (Sixth Semester)
COMPUTER GRAPHICS
MAC-250601

L	T	P	C
3	1	NIL	4

COURSE OBJECTIVES

- To provide an introduction to the theory and practice of computer graphics.
- To give a good exposure related to Computer Graphics algorithms and to design various graphics primitives.
- To enhance the proficiency in programming skills related to animation and graphics object Design

Unit-I

Introduction to Computer Graphics: Interactive Computer Graphics, Application of Computer Graphics, Random and Raster Scan Displays, Storage Tube Graphics Display, Calligraphic Refresh Graphics Display, Flat Panel Display, Refreshing, Flickering, Interlacing, Resolution, Bit Depth, Aspect Ratio etc.

Unit-II

Scan Conversion Technique: Image representation, Line drawing: DDA, Bresenham's Algorithm. Circle Drawing: General Method, Mid- Point, DDA, Bresenham's Circle Generation Algorithm, And Ellipse Generation Algorithm, Curves: Parametric Function, Bezier Method, B-Spline Method.

Unit-III

2D & 3D Transformations: Translation, Rotation, Scaling, Reflection, Shearing, Inverse Transformation, Composite Transformation, World Coordinate System, Viewing Transformation, Representation of 3D object on Screen, Parallel and Perspective Projections.

Unit-IV

Clipping: Point clipping, Line Clipping, Simple Visibility Line Clipping Algorithm, Cohen Sutherland Line Clipping Algorithm etc., Polygon Clipping, Convex and Concave Polygon, Sutherland Hodgeman Polygon Clipping Algorithm etc., Area Filling, Hidden Surface Elimination: Z-Buffer algorithm and Painter's Algorithm.

Unit-V

Basic Illumination Models: Diffuse Reflection, Specular Reflection, Phong Shading, Gouraud Shading, and Color Models like RGB, YIQ, CMY, HSV etc., and Introduction to Digital Image Processing (DIP), Fundamental Steps and Components of DIP.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1. Explain interactive Computer Graphics, various display devices and explore applications of computer graphics.
CO2. Illustrate various line generations, circle generation, curve generation and shape Generation algorithms.
CO3. Apply various 2-Dimensional and 3-Dimensional transformations and projections on Images.
CO4. Classify methods of image clipping and various algorithms for Line and Polygon clipping.
CO5. Choose appropriate filling algorithms, Hidden Surface Elimination algorithm and apply on various images.
CO6. Discuss various color models, shading methods, animation and Digital Image Processing.

RECOMMENDED BOOKS

1. Computer Graphics, Donald Hearn and M.P. Becker, PHI Publication.
2. Computer Graphics principle and Practice, FoleyVandam, Feiner, Hughes.
3. Principles of Computers Graphics, Rogers, TMH.
4. Computer Graphics, Sinha and Udai, TMH. Digital Image Processing, Gonzalez.

Department of Mathematics and Computing

B. Tech. (Sixth Semester)

Complier Design

(MAC – 250602)

L	T	P	Total Credits
3	1	0	4

Objective of Course

- To learn finite state machines and context free grammar.
- To learn, various phases of complier.
- To understand process of complier implementation.

Unit 1:

Overview of Translation Process: Introduction to complier, Translator, Interpreter and Assembler, overview and use of Linker and Loader. Major Data Structures in Complier, Other-Issues in Complier Structure, BOOT Strapping and Porting, Complier Structures: Analysis-Synthesis Model of compilation, Various Phase of a Complier, Tool Based Approach to Complier Construction.

Unit 2:

Lexical Analysis: Input Buffering, Symbol Table, Token, Recognition of Tokens, Lexeme and Patterns, Difficulties in Lexical Analysis, Error Reporting and Implementation, Regular Grammer and Language Definition, Transition diagrams, Design of Typical Scanner using LEX.

Unit 3:

Syntax Analysis: Context Free Grammer (CFGs), Ambiguity, Basic Parsing Techniques: Top Down Parsing, Recursive Descent Parsing, Transformation on the Grammer, Predictive Parsing LL(1) Grammer, Bottom-UP Parsing, Operator Precedence Parsing , LR Parsing (SLR, CLR, LALR), Design of Typical Parser Using YACC.

Unit 4:

Semantic Analysis: Compilation of Expression, Control, Structures, Conditional Statements, Various Intermediate Code Forms, Syntax, Directed Translation, Memory Allocation and Symbol Table Organizations, Static and Dynamic Array Allocation, String Allocation, Structure Allocation, etc., Error Detection Indication and Recovery, Routines or Printing Various Lexical, Syntax and Semantic Errors.

Unit 5:

Code Generation and Code Optimization:Issues, Basic Blocks and Flow Graphs,RegisterAllocation,CodeGeneration,DAGRepresentationofPrograms,CodeGenerationfromDAGS,Peep-holeOptimization,CodeGeneratorGenerators,Specificationof Machine. Code Optimization:Source of Optimizations, Optimizationof Basic Blocks, Loops, Global Data Flow Analysis, Solution to Iterative Data FlowEquations,CodeImprovingTransformations,DealingwithAliases,DataFlowAnalysisofStructuredFlowGraphs.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	**Define** the concepts of finite automata and contextfreegrammar
CO2	**Build**theconceptofworkingofcompiler
CO3	**Examine**variousparsingtechniquesandtheircomparison.
CO4	**Compare**variouscodegenerationandcodeoptimizationtechniques.
CO5	**Analyse**differenttoolsandtechniquesfordesigningacompiler

Recommended Books:

1. Compilers: Principles,Techniquesand Tools,V. Aho, R. Sethi and J. D. Ullman,PearsonEducation.
2. CompilerConstruction:PrinciplesandPractice,K.C.Louden,CengageLeaming.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)
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Department of Mathematics and Computing

B. Tech. (Sixth Semester)

Artificial Intelligence & Machine Learning (AI & ML)

MAC- 250604

L	T	P	Total Credits
3	0	2	4

COURSE OBJECTIVES:

- To provide the fundamental knowledge of Artificial Intelligence, Neural Network and MachineLearning.
- To present the basic representation and reasoning paradigms used in AI &ML.
- To understand the working of techniques used in AI &ML.

Unit – I: Introducing Artificial Intelligence: Definition, Goals of AI, Task of AI, Computation, Psychology and Cognitive Science. Perception, Understanding, and Action. Artificial intelligence vs machine learning vs deep learning and other related fields. Applications of Artificial intelligence and Machine Learning in the real world.

Unit – II: Problem, Problem Space and Search: Production System, Blind Search: BFS & DFS, Heuristic Search, Hill Climbing, Best First Search

Introduction to Neural Networks: History, Biological Neuron, Artificial Neural Network, Neural Network Architectures, Classification, & Clustering

Unit – III: Introduction to Machine Learning: Traditional Programming vs Machine learning. Key Elements of Machine Learning: Representation, process (Data Collection, Data Preparation, Model selection, Model Training, Model Evaluation and Prediction), Evaluation and Optimization. Typesof Learning: Supervised, Unsupervised and reinforcement learning. Regression vs classification problems.

Unit – IV: Supervised Machine Learning: Linear regression: implementation, applications & performance parameters. Decision tree classifier, terminology, classification vs regression trees, tree creation with Gini index and information gain, IDE3 algorithms, applications and performance parameters.Random forest classifier.Case study on regression and classification for solving real world problems.

Unit –V: Unsupervised Machine Learning: Introduction, types: Partitioning, density based, DBSCAN, distribution model- based, hierarchical, Agglomerative and Divisive, Common Distance measures, K-means clustering algorithm. Case study on clustering for solving real world problems.

COURSE OUTCOMES:

After completing the course, the student will be able to:

CO1: Define basic concepts of Artificial Intelligence & Machine Learning.
CO2: Illustrate various techniques for search and processing.
CO3: Identify various types of machine learning problems and techniques.
CO4: Analysis various techniques in Artificial Intelligence, ANN & Machine Learning.
CO5: Apply AI and ML techniques to solve real world problems.
CO6: Build AI enabled intelligent systems for solving real world problems.

RECOMMENDED BOOKS:

1. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, PrenticeHall.
2. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill.
3. Introduction to AI & Expert System: Dan W. Patterson,PHI.
4. Pattern Recognition and Machine Learning, Christopher M.Bishop
5. Introduction to Machine Learning using Python: Sarah Guido
6. Machine Learning in Action: Peter Harrington

List of Courses

(NPTEL/ SWAYAM for VIII Sem.)

2021-2022

B.Tech.

in

Mathematics and Computing

Department of Engineering Mathematics and Computing

Madhav Institute of Technology & Science

Gwalior-474005

Department of Engineering Mathematics and Computing

B. Tech. (Eight Semester)

DE –V (Through NPTEL)					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1	**250801**	Reinforcement Learning	12	***Dr. Minakshi Dhaiya / Dr. A. K. Ray***	Prof. Balaraman Ravindran | IIT Madras
2		Edge Computing	12		Prof. Rajiv Misra | IIT Patna
3		Computer Aided Applied Single Objective Optimization	12		Prof. Prakash Kotecha | IIT Guwahati

OC- III (Through NPTEL)					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1		Machine Learning for Engineering and science applications	12	***Dr. Minakshi Dhaiya / Dr. A. K. Ray***	Prof. Balaji Srinivasan, Prof. Ganapathy Krishnamurthi from IIT Madras
2		Introduction to Queueing Theory	12		Prof. N. Selvaraju from IIT Guwahati
3		Computer Aided Decision Systems - Industrial practices using Big Analytics	12		Prof. Deepu Philip, Prof. Amandeep Singh from IIT Kanpur

List of Courses
(NPTEL/ SWAYAM for VI Sem.)
2021-2022

B.Tech.

in

Mathematics and Computing

Department of Engineering Mathematics and Computing
Madhav Institute of Technology & Science
Gwalior-474005

Department of Engineering Mathematics and Computing
B. Tech. (Six Semester)

DE –I (Through NPTEL)					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1	**250605**	Block chain and its application	12	***Dr. Minakshi Dhaiya / Dr. A. K. Ray***	Prof. Sandip Chakraborty, Prof. Shamik Sural from IIT Kharagpur
2	**250606**	Cloud Computing	12		Prof. Soumya Kanti Ghosh from IIT Kharagpur
3	**250607**	GPU Architectures and Programming	12		Prof. Soumya jit Dey from IIT Kharagpur
4	**250608**	Introduction to internet of things	12		Prof. Sudip Misra from IIT Kharagpur

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
Deemed to be University
(Declared under Distinct Category by Ministry of Education, Government of India)
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List of Additional Courses

(SWAYAM/NPTEL/MOOC for VIII & VI Sem.)

2021-2022& 2022-2023

B.Tech.

in

Mathematics and Computing

Department of Engineering Mathematics and Computing

Madhav Institute of Technology & Science

Gwalior-474005

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर
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Deemed to be University
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Department of Engineering Mathematics & Computing
B. Tech. (VIII- Semester)

Honors Specialization					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1		Algebraic Combinatorics	12	***Dr. Minakshi Dhaiya/ Dr. A. K. Ray***	Prof. Amritanshu Prasad, Prof. S. Viswanath from The Institute of Mathematical Sciences, Chennai.
2		Natural Language Processing	12		By Prof. Pawan Goyal from IIT Kharagpur
Minor Specialization					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1		Algebraic Number Theory	12	***Dr. Minakshi Dhaiya/ Dr. A. K. Ray***	Prof. Mahesh Kakde from IISc Bangalore
2		Optimization from Fundamentals	12		Prof. Ankur A. Kulkarni from IIT Bombay

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
Deemed to be University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ Grade
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Department of Engineering Mathematics & Computing
B. Tech. (VI- Semester)

Honors Specialization					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1		Getting Started with Competitive Programming	12	***Dr. Minakshi Dhaiya/ Dr. A. K. Ray***	Prof. Neeldhara Misra from IIT Gandhinagar
2		Advanced Graph Theory	8		Prof. Rajiv Misra from IIT Patna
Minor Specialization					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1		Advanced Linear Algebra	12	***Dr. Minakshi Dhaiya/ Dr. A. K. Ray***	Prof. Premananda Bera from IIT Roorkee
2		Advanced Probability Theory	12		Prof. Niladri Chatterjee from IIT Delhi

List of Courses

(NPTEL/ SWAYAM for VI Sem.)

2022-2023

B.Tech.

in

Mathematics and Computing

Department of Engineering Mathematics and Computing

Madhav Institute of Technology & Science

Gwalior-474005

Department of Engineering Mathematics and Computing

B. Tech. (Six Semester)

DE –I (Through NPTEL)					
S. No.	**Subject Code**	**Subject name**	**Time Duration (Weeks)**	**Faculty Coordinator**	**Mentor Name and Affiliation**
1	**250605**	Block chain and its application	12	***Dr. Minakshi Dhaiya / Dr. A. K. Ray***	Prof. Sandip Chakraborty, Prof. Shamik Sural from IIT Kharagpur
2	**250606**	Cloud Computing	12		Prof. Soumya Kanti Ghosh from IIT Kharagpur
3	**250607**	GPU Architectures and Programming	12		Prof. Soumya jit Dey from IIT Kharagpur
4	**250608**	Introduction to internet of things	12		Prof. Sudip Misra from IIT Kharagpur

List of Open Category (OC) Courses

(Traditional Mode for VI Sem.)

2022-2023

B.Tech.

in

Mathematics and Computing

Department of Engineering Mathematics and Computing

Madhav Institute of Technology & Science

Gwalior-474005

Syllabus

Of

Experiment List/ Skill based mini-project

B.Tech.

in

Mathematics and Computing

Department of Engineering Mathematics and Computing

Madhav Institute of Technology & Science

Gwalior-474005

Department of Engineering Mathematics and Computing

B. Tech. (Fourth Semester)

Database Management Systems and SQL(2250402)

List of Experiments

1. The given relational scheme is:

employee(ename, street, city)
works (ename, cname, salary)
company (cname, city)
manager (ename, mname)

Answer the following queries in SQL and relational algebra:

a) Find the names of all employees who works for xyz company.
b) Find names and cities of residence of all employees who works for XYZ company.
c) Find the name of all employees who works for companies located in Gwalior.
d) Find the name and city of all employees who works for companies located in Gwalior.
e) Find names & city of residence of all employees who works for XYZ company & earn more than Rs. 10,000 per month ?
f) Find the name of all employees who live in the same city as the company for which they work.
g) Find the name and city of residence of all managers.
h) Find the name of all managers who work for XYZ company.
i) Find the name and city of all managers who work for XYZ company.
j) Find the name of all employees who are not mangers.
k) Find the name of all employees who works for the managers living in Gwalior.
l) Find the name of all employees who live in the same city as do their manager.
m) Find the name of employee with maximum salary.

2. The given relation scheme is:

S(s#, sname, status, scity)
P(p#, pname, color)
J (j#, jname, jcity)
SPJ(s # , p# , j# , qty)

Answer the following queries in SQL and relational algebra:

a) Get s# for supplier who supply project for j1
b) Find supplier name and city for project J1.
c) Get part no and part name for parts supplied by suppliers in Gwalior.
d) Get part no for project for items by a supplier in Gwalior to a project in Gwalior
e) Get p# for parts supplies to project by a supplier in the same city as that project.
f) Get part name also in previous query.
g) Get project names for projects supplied by supplier, no. s1
h) Get colors of part supplied by supplier s1

i) Get supplier no. who is supplying maximum qty of part p1
j) Get J # for projects supplied entirely by supplier S1

3.The given relation scheme is:

person(name, city, fname)

Answer the following queries in SQL and relational algebra:

a) Find the name persons who live in Gwalior.
b) Find the name persons whose father live in Gwalior.
c) Find the name of persons and name their fathers whose fathers live in Gwalior.
d) Find the name of those persons whose grandfather live in Gwalior.

Department of Engineering Mathematics and Computing

B. Tech. (Fourth Semester)

Skill Development Projects

Database Management Systems and SQL

(MAC-2250402)

1. COLLEGE DATABASE DATA BASE PROJECT

A college contains many departments. Each department can offer any number of courses. Many instructors can work in a department, but an instructor can work only in one department. For each department, there is a head, and an instructor can be head of only one department. Each instructor can take any number of courses, and a course can be taken by only one instructor. A student can enroll for any number of courses and each course can have any number of students

2. RAILWAY SYSTEM DATABASE PROJECT

A railway system, which needs to model the following:

1. Stations
2. Tracks, connecting stations. You can assume for simplicity that only one track exists between any twostations. All the tracks put together to form a graph.
3. Trains, with an ID and a name
4. Train schedules recording what time a train passes through each station on its route.

You can assume for simplicity that each train reaches its destination on the same day and that every train runs everyday. Also for simplicity, assume that for each train, for each station on its route, you store Time in, Timeout (same as time in if it does not stop).

A sequence number so the stations in the route of a train can be ordered by sequence number. Passenger booking consisting of train, date, from-station, to station, coach, seat and passenger name.

3. HOSPITAL MANAGEMENT SYSTEM DATABASE PROJECT

A patient will have unique Patient ID. Full description about the patient about personal detail and phone number, and then Disease and what treatment is going on. The doctor will handle patients; One doctor can Treat more than 1patient. Also, each doctor will have unique ID. Doctor and Patients will be related. Patients can be admitted to hospital. So different room numbers will be there, also rooms for Operation Theaters and ICU. There are some nurses, and ward boys for the maintenance of hospital and for patient take care. Based upon the number of days andtreatment bill will be generated.

4. LIBRARY MANAGEMENT SYSTEM DATABASE PROJECT

A student and faculty can issue books. Different limits for the number of books a student and teacher can issue. Also, the number of days will be distinct in the case of students and teachers for issue any book. Each book will have different ID. Also, each book of the same name and same author (but the number of copies) will have different ID. Entry of all the book will be done, who issue that book and when and also duration. Detail of Fine(when the book is not returned at a time) is also stored.

5. HEALTH CARE ORGANIZATION DATABASE PROJECT

This organization provides following functionalities:

- Emergency Care 24x7
- Support Groups
- Support and Help Through calls

Any new Patient is first registered in their database before meeting the doctor. The Doctor can update the datarelated to the patient upon diagnosis (Including the disease diagnosed and prescription). This organization also

provides rooms facility for admitting the patient who is critical. Apart from doctors, this organization has nursesand ward boy. Each nurse and ward boy is assigned to a doctor. Also, they can be assigned to patients (to take care of them). The bill is paid by the patient with cash and E-banking. Record of each payment made is also maintained by the organization. The record of each call received to provide help and support to its existing person is also maintained.

6. RESTAURANT MANAGEMENT DATABASE PROJECT

The restaurant maintains the catalog for the list of food and beverage items that it provides. Apart from providing food facility at their own premises, the restaurant takes orders online through their site. Orders on the phone are also entertained. To deliver the orders, we have delivery boys. Each delivery boy is assigned to the specific area code. The delivery boy cannot deliver outside the area which is not assigned to the delivery boy (for every delivery boy there can be single area assigned to that delivery boy). The customer record is maintained so that premium customer can be awarded discounts.

7. HOTEL MANAGEMENT SYSTEM DATABASE PROJECT

A hotel is a hive of numerous operations such as front office, booking, and reservation, banquet, finance, HR, inventory, material management, quality management, security, energy management, housekeeping, CRM and more. The hotel has some rooms, and these rooms are of different categories. By room category, each room has the different price. A hotel has some employees to manage the services provided to customers. The customer can book the room either online or by cash payment at the hotel. The customer record is stored in hotel database which contains customer identity, his address, check in time, check out time, etc. hotel provides food and beverages to their customers and generates the bill for this at the time of their check out.

8. SALARY MANAGEMENT SYSTEM DATABASE PROJECT

1. Employee list to be maintained having id, name, designation, experience
2. Salary details having employee id, current salary
3. Salary in hand details having employee id, CTC salary, pf deduction or any other deduction and net salary to begiven and also maintain details of total savings of employee
4. Salary increment to be given by next year if any depending upon constraints
5. Deduction in monthly salary if any depending upon any discrepancy in work and amount to be deducted.

Department of Engineering Mathematics and Computing
B. Tech. (VI -SEMESTER)
Artificial Intelligence and Machine Learning (250604)

List of Experiments

1. Linear Regression:

- **Experiment 1: Home Price Dataset (No. of rooms vs. price)**
  - Implement a simple linear regression model for a univariate dataset (**Home Price Dataset (No. of rooms vs. price)**).
  - Evaluate the model's performance using metrics like Mean Squared Error (MSE) or R-squared.
  - Visualize the regression line.

2. Multi-Linear Regression:

- **Experiment 2: Home Price Dataset (No. of rooms, Plot area, Location, Age vs. price)**
  - Extend linear regression to multiple variables (multivariate regression).
  - Feature scaling and normalization for improved performance.

3. Logistic Regression:

- **Experiment 3: Breast Cancer dataset**
  - Implement a logistic regression model for binary classification (**Breast Cancer dataset**).
  - Evaluate the model using metrics like accuracy, precision, recall, and ROC-AUC.
  - Visualize decision boundaries.

3. K-Nearest Neighbors (KNN):

- **Experiment 4: Diabetes Dataset**
  - Implement a KNN classifier for a classification problem **(Diabetes Dataset)**.
  - Choose an appropriate value for 'k' using cross-validation.
  - Evaluate the model's performance and visualize decision boundaries.

4. Decision Tree Classification:

- **Experiment 5: Titanic Dataset**

- Apply Decision Tree classification to predict the survival of passengers on the Titanic.
- Preprocess the dataset by handling missing values and encoding categorical features.
- Split the dataset and evaluate the model's performance.
- Visualize the resulting Decision Tree.

- **Experiment 6: Iris Dataset**
  - Use the famous Iris dataset for a classification task.
  - Implement a Decision Tree classifier.
  - Split the dataset into training and testing sets.
  - Evaluate the model's performance using metrics like accuracy, precision, recall, and F1-score.
  - Visualize the Decision Tree.
- **Experiment 7: Boston Housing Dataset**
  - Use the Boston Housing dataset for a regression task.
  - Implement a Decision Tree regressor.
  - Split the dataset into training and testing sets.
  - Evaluate the model's performance using regression metrics (e.g., Mean Squared Error).
  - Visualize the resulting Decision Tree.

4. Random Forest:

- **Experiment 8: Wine Quality Dataset**
  - Preprocess the data by handling outliers and feature scaling.
  - Implement a Random Forest classifier for a classification problem (**Wine Quality Dataset**).
  - Evaluate the model's performance using metrics like accuracy, precision, recall, and F1-score.
  - Visualize feature importance.

- **Experiment 9: Boston Housing dataset**
  - Implement a Random Forest regressor for a regression problem (**Boston Housing dataset**).

- Evaluate the model's performance using metrics like Mean Squared Error (MSE) or R-squared.
- Visualize feature importance.

- **Experiment 10: Future Sales Prediction**
  - Implement a Random Forest regressor for a regression problem **(Sales Prediction)**.
  - Evaluate the model's performance using metrics like Mean Squared Error (MSE) or R-squared.
  - Evaluate the model's performance and visualize decision boundaries.

5. K Means Algorithms:

- **Experiment 11: Iris Dataset**
  - Use the Iris dataset, a well-known dataset in machine learning.
  - Apply K-Means clustering to group the iris flowers based on their features.
  - Experiment with different values of K (number of clusters) and choose the optimal K using methods like the elbow method.
  - Visualize the clusters and compare them to the actual class labels in the dataset.
  - Evaluate the performance of the clustering using metrics like silhouette score.

- **Experiment 12: Mall Customer Segmentation**
  - Use a Mall Customer Segmentation dataset that includes information about customers such as age, income, and spending score.
  - Apply K-Means clustering to segment customers into different groups based on their spending behavior.
  - Explore the characteristics of each cluster and analyze the customer segments.
  - Visualize the clusters in a 2D or 3D space, considering relevant features.
  - Discuss potential marketing strategies for each customer segment.

Lab Manual & Skill based Mini Projects

1. Online House Renting System

Idea: House rental portal is a web-based project where house owners, clients, customers can exchange information effectively and inexpensively. This system provides a user-friendly interface, satisfying the needs of the consumers. It also employs a new strategy that facilitates easy management of rental houses.

2.Laboratory Management System

Idea: The laboratory management system is another exciting beginner level project that is used to provide security of the data of the laboratory. Access permissions for viewing and updating the data are set for each entity. There are three entities in this system.

3. School Management System

Idea: School management system is another beginner level project idea that will help you implement your skills. This project is developed for schools to store and manage all data and records related to school. All information related to students, teachers, and staff of the school is stored in the database. System also provides the facility to calculate and manage attendance of students.

4. Water Supply Management System

Idea: Water supply is one of the most essential needs of a human being's survival. Each one who uses the water has to pay the bill monthly. Sometimes, the process of paying bills manually in a queue becomes tedious and time-consuming. The water supply management system will help to resolve this problem by helping the private companies and local government of the city to manage the water supply system in an organized and computerized manner. The payments of the water supply bills will be transacted through online mode.

5. Catering Management System

Idea: Catering is a business that provides food services in events like marriages, parties, etc. The Catering management system will help the catering companies to manage their catering business in an efficient and time-saving way. The caterers can manage their resources and orders in an organized manner without keeping the details manually on paper. All the details will be stored in the system. They can manage the resources, available employees, and timings very well for organizing the event.

6. Stadium Seat Booking System

Idea: This is another automated system that can be developed in a web-based programming language and will be useful to the people for booking their seats in the stadium through the online method. Every detail of the stadium should be mentioned properly including the number of seats, seat availability, price of the seat, category of seats.

7. Clinic Management System

Idea: It supports an efficient management system for clinics and helps doctors to manage the appointments and data of each patient in an organized manner. The patients can get the appointment without having a manual conversation; he can just find the timings of the clinic and availability of the doctor and book the appointment with the doctor. The admin will approve the appointment request according to particular criteria.

10. Hospital Management System

Idea: The Hospital management system provides a well-tuned management system that helps to automate the workflow and activities of a hospital. This system manages the administrative and financial activities of the hospital along with all the medical facilities.

11.Telephone Billing System

Idea: The Telephone Billing system is a simple mini project that can be developed to increase the efficiency of manual procedures of telephone billing systems. The bills are easily calculated and managed in the system. System provides a fast and automatic bill generation. It eliminates the use of registers and files to store information about consumers and their telephone records.

12. Electricity Billing System

Idea: Electricity Billing System is a web-based project that provides an online platform for users to pay electricity bills. The system automates billing system and calculates the amount of money to be paid according to the units consumed in a specific duration of time. The customer will just feed the meter's readings into the system and software will generate the bill.

13. Online Courier Management System

Idea: The online Courier management system is a suitable project for beginners who are looking to make their career in programming. This project is based on MySql and JSP and runs on tomcat server. This system automates the process of courier management by performing all the processes of a courier system in an automated manner.

14. Wedding Planner System

Idea: This will be one of the catchy applications that you can choose to develop. This system is used to plan and manage the wedding events in an effective way. The user has to login to the system to get its services. The user will add the details of the wedding event like venue booking, type of food to be served, number of members to attend the wedding, decoration details, and the estimated budget. Then, the admin will view all the details and process the request of user. The user will get the final quote of wedding event and can book the event planner for managing all the activities.

15. Assignments and Materials System

Idea: This system is a web-based system based on MySql, JSP, Servlets, JavaScript, HTML and CSS. It will be a very good platform for communication between faculty and students.

There are three users in this system- admin, faculty, and the students. The faculty and students have to register themselves before using the system and the admin's role is just to maintain all registered users. The faculty will upload the necessary study materials and assignments related to his/her subject and the students can read the study materials. This will reduce the paperwork and wastage of time for teachers and students.

16. Online Cab Booking System

Idea: This system provides a convenient way to users for booking the cabs from any place as per their requirements. This system allows users to book the cabs online, manage their bookings, and even cancel the booking at any point of time.

The user has to first signup/login to the system and then he has to enter details to book the cab like- date and time of journey, pick-up location, destination, and drop-off point. As soon as they book a cab, they are provided with the driver's name and his contact number so as to communicate with him. The current status of the cab is also shown on the map on the user's system so that he can easily track the cab.

17. Online Auction System

Idea: This system is an online platform for carrying out auctions. This brings the process of auction to the fingertips of the auctioneers. There are buyers and sellers in this system who can exchange their products through a fair auction. There will be an admin who will manage the details of the products and the users of the system.

18. Crime Records Management System

Idea: This is an automated system for managing and storing all the records related to the criminals over a particular area. There will be a proper criminal record for all the criminals according to their crime, date of crime, and their punishment period.

One of the most significant features is that the victims can also file their complaints through this system at a particular police station or from any place and at any time by providing the details of the incident with all the required details. When the request is lodged by the victim or the user, it will reach the server of the Police station and it will be converted to an FIR for further investigations.

19. Online Shopping System

Idea: The Online Shopping System is a kind of E-Commerce website which has become a common requirement for almost every individual. It is developed to perform commercial transactions over the web. The whole system is divided into two panels- admin panel and customer panel.

20.University Admission System

Idea: The University admission system can be developed to automate the admission process of a university. This project will really help you to gain more knowledge of web application development and strengthen your resume.

21. Venue Booking System

Idea: The venue booking system is a fascinating project that you can go with to enhance your skills. It is a web application that helps dealers and customers to book the venue according to their choice like location, availability, cost, type, and area of the venue.

22. Career Analysis System

Idea: It is helpful for the students, who have graduated from the schools, to search for colleges all over the country to make their career. They need to either manually visit the colleges and get the inquiry for the admission or have to contact the colleges through mails and calls which is again a time-consuming task.

23. Warehouse management system

Idea: A Warehouse is defined as a huge quantity of stocks and products. To manage all the products with their maintenance there is a need for a well organized system that keeps a record of all these products with their receiving, shipping, and billing details. There are 5 modules in this system which are- Admin module, Receiving Module, Shipping Module, Billing Module, and Reports Module.

Department of Engineering Mathematics & Computing

B. Tech. VI Semester (Open Course)

Advance Numerical Techniques for Engineering

Objective of Course

- To explore the knowledge of numerical techniques
- To develop an understanding of interpolation
- To familiarize with Numerical differentiation and integration
- To know about the numerical solution of ordinary and partial differential equations

Algebraic & Transcendental Equations:

Basic concept of Algebraic and Transcendental equations, Solution of algebraic and transcendental equations by Bisection, Regula-Falsi and Newton-Raphson method, Iterative method, Secant method and its convergence, Newton's Iterative Formula for obtaining inverse, square root, cube root, Generalized Newton's Raphson method for Multiple Roots

Solution of Simultaneous Liner Algebraic Equation:

Matrix Inversion Method, Simultaneous linear algebraic equations by Gauss elimination method, Gauss- Jordan method, Gauss Jacobi's method of iteration and Gauss-Seidal, Relaxation method, iteration method, Ill condition, Well condition and refinement.

Interpolation & Numerical Different ion and Integration:

Basic concept of finite differences and differences operators, Relation between Operators, Interpolation, Hermite's interpolation formula, Piecewise and Spline and Bivariate Interpolations, Approximation of derivatives using interpolation polynomials, Numerical integration using Trapezoidal, Simpson's(1/3), Romberg's method and Two & Three point Gaussian quadrature formulae.

Numerical Solution of Ordinary Differential Equations:

Single step methods as Euler's method, Modified Euler's method and Rung-Kutta method of fourth order, Higher order differential equations, Multi step methods as Milne and Adams-Bash forth predictor corrector method for solving first order equations and Stability Analysis.

Numerical Solution of Partial Differential Equations:

Basic concept of partial differential equation, Classification of partial differential equations and its applications, Finite difference method for solving second order two –point linear boundary value problems, and finite difference techniques for solution of two dimensional (Laplace & Poisson Method) on rectangular domain, one dimensional Heat flow equation by explicitly and implicitly by Crank Nicholson method and One dimensional Wave equation by explicit method.

Course Outcomes: After completing this course, the students will be able to:

CO-1: Analyze the algebraic and transcendental equations
CO-2: Apply different numerical methods in algebraic equations
CO-3: Examine the various interpolations
CO-4: Solve ordinary differential equation by numerical techniques
CO-5: Apply finite difference methods to solve Partial differential equations

Recommended Books:

1. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt. Ltd., 5th Edition, 2016.
2. M. K. Jain, R. K. Jain and S. R. K. Iyengar: Numerical Methods for Scientific & Engineering, New Age International Pvt Ltd Publisher, 6th Edition (2014).
3. S.C., Chapra: Numerical Methods for Engineers, 5th Ed Mc Graw Hill, 2006.
4. S.S. Sastry: Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 4th edition, 2007.
5. J. H. Mathews and K. D. Fink: Numerical Methods using MATLAB, PHI, 4th edition, 2007.
6. C.F. Gerald and P.O. Wheatley: Applied Numerical Analysis, Pearson Education, 6th edition, 2006.

Department of Engineering Mathematics & Computing

B. Tech. VI Semester (Open Course)

Computational Fluid Dynamics

Objective of Course

- To understand the basic concepts of computational fluid dynamics.
- To develop the model of boundary layer fluid flow problems.
- To acquire the knowledge of various types of boundary conditions and non-dimensional numbers.
- To solve problems by Explicit, Implicit and Crank-Nicolson Method.

Unit 1:

Introduction: History and Philosophy of computational fluid computational fluid dynamics and its applications in various industries, Governing equations of fluid flow: conservation of mass, conservation of linear momentum, conservation of energy, Navier-Stokes equations for viscous flow: Continuity Equation, Momentum equation, Equation, Inviscid flow, Incompressible Flows, Boussinesq approximation.

Unit 2:

Similarity Transformation, Nondimensionalization of Governing Equations, Some useful Non-Dimensional Numbers: Reynolds number, Eckert number, Prandtl number, Peclet number, Physical Boundary Conditions of viscous flow, slip boundary condition, no-slip boundary condition.

Unit 3:

Laminar Boundary Layer Equations, Velocity Boundary Layer, Thermal Boundary Layer, Blasius solution for flat- plate flow, wall shear stress. Flat plate heat transfer for constant wall temperature. Some examples of Falkner-Skan potential flows. Reynolds analogy as a function of pressure gradient.

Unit 4:

Mathematical Behavior of Partial Differential Equations: Classification of quasi-linear partial differential equations, Methods of determining the classification, Hyperbolic, Parabolic and Elliptic equations, numerical behavior of these equations. Approximate Solutions of Differential Equations: Error Minimization Principles, Variational Principles and Weighted Residual Approach.

Unit 5:

Discretization,,Finite Difference formulation, Explicit method, Implicit method, Crank–Nicolson method., Errors and analysis of stability, Grid Generation: Algebraic Grid Generation, Elliptic Grid Generation, Hyperbolic Grid Generation, and Parabolic Grid Generation., Consistency and convergence, Numerical Solution of Quasi 1D Flow equation.

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Understand the importance of computational fluid dynamics and principles of conservation
CO2	Identify various types of boundary conditions and Non-Dimensional Numbers
CO3	Acquire the knowledge of Boundary Layers
CO4	Classify the Partial differential equations and their numerical behaviour
CO5	Implement Explicit, Implicit and Crank-Nicolson Method

Recommended Books:

1. Anderson J.D. (1995) Computational Fluid Dynamics: The Basics with Applications, McGraw-Hill, Inc.
2. Patankar S.V. (1980) Numerical Heat Transfer and Fluid Flow, Hemisphere, Washington D.C., USA.
3. Chung, T.J., "Computational Fluid Dynamics", Cambridge University Press.
4. Hirsch C. (1988) Numerical Computation of Internal and External Flows, John Wiley & Sons, New York, USA.
5. Ferziger J.H. & Peric M. (1999) Computational Methods for Fluid Dynamics, Springer, Berlin, Germany.

Department of Mathematics & Computing
B. Tech. VI Semester (Open Course)
TRANSFORM CALCULUS

Course OBJECTIVES

- The course objective is to develop the skills of the students in the areas of Transforms and Differential Equations.
- This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, wave equation, communication systems, electro-optics and electromagnetic theory.
- The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT 1

Introduction to Laplace transform: Definition and properties, Laplace Transform of derivatives and integrals, Laplace Transform of some special functions, Inverse Laplace Transform, Application of Laplace Transform to Integral Equations and Solution of Partial Differential Equations.

UNIT 2 Introduction to Fourier Transforms: Definition and properties, Fourier Sine and Cosine transforms of different functions, Parseval's Identity for Fourier Sine and Cosine Transforms, Applications of Fourier Transform to Ordinary Differential Equations and Integral Equations.

UNIT 3

Application of Fourier Transform to Partial Differential Equations, Finite Fourier transform and its properties, Application of Finite Fourier transform to Boundary Valued Problems.

UNIT 4

Mellin Transform: Definition and elementary properties, Mellin transform of derivatives and integrals; Inversion theorems; Parseval's theore, Examples of Mellin Transform

UNIT 5

Introduction to Z-Transform, Properties of Z-Transform , Evaluation of Z-Transform of some functions, Inverse Z-Transform, convolution theorem Application of Z-Transform to Difference Equations

Course Outcomes

After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Understand the concept of Integral transform to evaluate engineering problems
CO2	Analyze the properties of Fourier transform
CO3	Apply Laplace transform and Fourier transform in differential equations
CO4	Illustrate the problems of Mellin Transform
CO5	Solve the difference equations by z-transform

Recommended Books:

- Loknath Debnath, Dambaru Bhatta:Integral Transforms and Their Applications, Second Edition, CRC Press.
- F. B. Hildebrand: Methods of Applied Mathematics, Prentice Hall, 1992.
- N.W. McLachlan: Laplace Transforms and Their Applications to Differential Equations, Dover Publication Inc. Mineola, New York.
- Brian Davies: Integral Transforms and Their Applications, Third Edition, Springer Publication.
- Allan Pinkns and Samy Zafrany: Fourier Series and Integral Transforms, Cambridge University Press.
- Refaat El Attar: Lecture notes on z-transform, First Edition, Alexandria University Egypt.
- Glyn James: Advanced Modern Engineering Mathematics, Third Edition Pearson Education (2007).
- Yu. A. Brychkov, O. I. Marichev , N. V. Savischenko: The Handbook of Mellin Transforms, CRC Press.
- Sudhakar Nair : Advanced Topics in Applied Mathematics for Engg. & physical Science:
- Gilbert Strang : Introduction to Applied Mathematics'

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)
NAAC Accredited with A++ Grade

Department of Engineering Mathematics and Computing

B. Tech. (Fourth Semester)

Database Management Systems and SQL(2250402)

List of Experiments

1. The given relational scheme is:

employee(ename, street, city)
works (ename, cname, salary)
company (cname, city)
manager (ename, mname)

Answer the following queries in SQL and relational algebra:

a) Find the names of all employees who works for xyz company.
b) Find names and cities of residence of all employees who works for XYZ company.
c) Find the name of all employees who works for companies located in Gwalior.
d) Find the name and city of all employees who works for companies located in Gwalior.
e) Find names & city of residence of all employees who works for XYZ company & earn more than Rs. 10,000 per month ?
f) Find the name of all employees who live in the same city as the company for which they work.
g) Find the name and city of residence of all managers.
h) Find the name of all managers who work for XYZ company.
i) Find the name and city of all managers who work for XYZ company.
j) Find the name of all employees who are not mangers.
k) Find the name of all employees who works for the managers living in Gwalior.
l) Find the name of all employees who live in the same city as do their manager.
m) Find the name of employee with maximum salary.

2. The given relation scheme is:

S(s#, sname, status, scity)
P(p#, pname, color)
J (j#, jname, jcity)
SPJ(s # , p# , j# , qty)

Answer the following queries in SQL and relational algebra:

a) Get s# for supplier who supply project for j1
b) Find supplier name and city for project J1.
c) Get part no and part name for parts supplied by suppliers in Gwalior.
d) Get part no for project for items by a supplier in Gwalior to a project in Gwalior
e) Get p# for parts supplies to project by a supplier in the same city as that project.
f) Get part name also in previous query.
g) Get project names for projects supplied by supplier, no. s1
h) Get colors of part supplied by supplier s1
i) Get supplier no. who is supplying maximum qty of part p1
j) Get J # for projects supplied entirely by supplier S1

3.The given relation scheme is:

person(name, city, fname)

Answer the following queries in SQL and relational algebra:

a) Find the name persons who live in Gwalior.
b) Find the name persons whose father live in Gwalior.
c) Find the name of persons and name their fathers whose fathers live in Gwalior.
d) Find the name of those persons whose grandfather live in Gwalior.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)
NAAC Accredited with A++ Grade

Department of Engineering Mathematics and Computing

B. Tech. (Fourth Semester)

Skill Development Projects

Database Management Systems and SQL

(MAC-2250402)

1. COLLEGE DATABASE DATA BASE PROJECT

A college contains many departments. Each department can offer any number of courses. Many instructors can work in a department, but an instructor can work only in one department. For each department, there is a head, and an instructor can be head of only one department. Each instructor can take any number of courses, and a course can be taken by only one instructor. A student can enroll for any number of courses and each course can have any number of students

2. RAILWAY SYSTEM DATABASE PROJECT

A railway system, which needs to model the following:

1. Stations
2. Tracks, connecting stations. You can assume for simplicity that only one track exists between any twostations. All the tracks put together to form a graph.
3. Trains, with an ID and a name
4. Train schedules recording what time a train passes through each station on its route.

You can assume for simplicity that each train reaches its destination on the same day and that every train runs everyday. Also for simplicity, assume that for each train, for each station on its route, you store Time in, Timeout (same as time in if it does not stop).

A sequence number so the stations in the route of a train can be ordered by sequence number. Passenger booking consisting of train, date, from-station, to station, coach, seat and passenger name.

3. HOSPITAL MANAGEMENT SYSTEM DATABASE PROJECT

A patient will have unique Patient ID. Full description about the patient about personal detail and phone number, and then Disease and what treatment is going on. The doctor will handle patients; One doctor can Treat more than 1patient. Also, each doctor will have unique ID. Doctor and Patients will be related. Patients can be admitted to hospital. So different room numbers will be there, also rooms for Operation Theaters and ICU. There are some nurses, and ward boys for the maintenance of hospital and for patient take care. Based upon the number of days andtreatment bill will be generated.

4. LIBRARY MANAGEMENT SYSTEM DATABASE PROJECT

A student and faculty can issue books. Different limits for the number of books a student and teacher can issue. Also, the number of days will be distinct in the case of students and teachers for issue any book. Each book will have different ID. Also, each book of the same name and same author (but the number of copies) will have different ID. Entry of all the book will be done, who issue that book and when and also duration. Detail of Fine(when the book is not returned at a time) is also stored.

5. HEALTH CARE ORGANIZATION DATABASE PROJECT

This organization provides following functionalities:

- Emergency Care 24x7
- Support Groups
- Support and Help Through calls

Any new Patient is first registered in their database before meeting the doctor. The Doctor can update the datarelated to the patient upon diagnosis (Including the disease diagnosed and prescription). This organization also

provides rooms facility for admitting the patient who is critical. Apart from doctors, this organization has nursesand ward boy. Each nurse and ward boy is assigned to a doctor. Also, they can be assigned to patients (to take care of them). The bill is paid by the patient with cash and E-banking. Record of each payment made is also maintained by the organization. The record of each call received to provide help and support to its existing person is also maintained.

6. RESTAURANT MANAGEMENT DATABASE PROJECT

The restaurant maintains the catalog for the list of food and beverage items that it provides. Apart from providing food facility at their own premises, the restaurant takes orders online through their site. Orders on the phone are also entertained. To deliver the orders, we have delivery boys. Each delivery boy is assigned to the specific area code. The delivery boy cannot deliver outside the area which is not assigned to the delivery boy (for every delivery boy there can be single area assigned to that delivery boy). The customer record is maintained so that premium customer can be awarded discounts.

7. HOTEL MANAGEMENT SYSTEM DATABASE PROJECT

A hotel is a hive of numerous operations such as front office, booking, and reservation, banquet, finance, HR, inventory, material management, quality management, security, energy management, housekeeping, CRM and more. The hotel has some rooms, and these rooms are of different categories. By room category, each room has the different price. A hotel has some employees to manage the services provided to customers. The customer can book the room either online or by cash payment at the hotel. The customer record is stored in hotel database which contains customer identity, his address, check in time, check out time, etc. hotel provides food and beverages to their customers and generates the bill for this at the time of their check out.

8. SALARY MANAGEMENT SYSTEM DATABASE PROJECT

1. Employee list to be maintained having id, name, designation, experience
2. Salary details having employee id, current salary
3. Salary in hand details having employee id, CTC salary, pf deduction or any other deduction and net salary to begiven and also maintain details of total savings of employee
4. Salary increment to be given by next year if any depending upon constraints
5. Deduction in monthly salary if any depending upon any discrepancy in work and amount to be deducted.