Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Second Year B. Tech. (Information Technology)

With effect from Year 2025-26

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

## Second Year B.Tech Information Technology Semester-IV (w.e.f. 2025-26)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Continuous Assessment (CA)				ESE	Total	Credits	
				L	T	P	TA [A]	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of(TT1 & TT2) [B]	[C]	[A+B+C]		
1	PC	RCP23IPC251	Applied Mathematics	3			25	15	15	15	60	100	3	4
	PC	RCP23IPC251L	Applied Mathematics Tutorial		1		25					25	1	
2	PC	RCP23IPC252	Design and Analysis of Algorithm	3			25	15	15	15	60	100	3	4
	PC	RCP23IPC252L	Design and Analysis of Algorithms Laboratory			2	25				25	50	1	
3	PC	RCP23IPC253L	Python Laboratory			2	25				25	50	1	1
4	PC	RCP23IPC254L	Object Oriented Design Laboratory			2	25				25	50	1	1
5	MD	RCP23IMD251	Formal Languages and Automata Theory	3			25	15	15	15	60	100	3	4
	MD	RCP23IMD251T	Formal Languages and Automata Theory Tutorial		1		25					25	1	
6	SC	RCP23XSC251P	Semester Project-II			2	25				25	50	1	
7	HS	RCP23XHS281T	Professional and Business Communication Tutorial		2		25					25	2	
8	HS	RCP23XHS282	Economics and Financial Management	2			25	15	15	15	60	100	2	
9#	OE	RCP23XOE261	Project Management	3			25	15	15	15	60	100	3	3
		RCP23XOE262	Cyber Security, Policies and Laws	3			25	15	15	15	60	100	3	
		RCP23XOE263	Advanced Operations Research	3			25	15	15	15	60	100	3	
		RCP23XOE264	Corporate Finance Management	3			25	15	15	15	60	100	3	
		RCP23XOE265	Corporate Social Responsibility	3			25	15	15	15	60	100	3	
		RCP23XOE266	Bioinformatics	3			25	15	15	15	60	100	3	
		RCP23XOE267	Human Resource Management	3			25	15	15	15	60	100	3	
		RCP23XOE268	Digital Marketing Management	3			25	15	15	15	60	100	3	
		RCP23XOE269	Logistics and Supply Chain Management	3			25	15	15	15	60	100	3	
			Total	14	4	8	300			75	400	775	22	

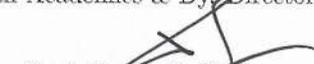# Any 1 Open Elective Course

Prepared by: Prof. N. R. Chaudhari

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BOS Chairman
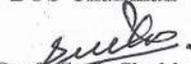
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Director

Semester - IV

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Applied Mathematics (RCP23IPC251)		
Applied Mathematics Tutorial (RCP23IPC251L)		

Prerequisite: Engineering Mathematics – I and Engineering Mathematics – II .

Course Objectives: The objective of this course is to inculcate an ability to relate engineering problems to mathematical contexts. To introduce students to the concepts of Number Theory by using different theorems. To cover the basic principles of matrices, probability and random variables. The course also familiarizes students with different methods of solving Linear Programming problems.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Reduce the matrices using various techniques.	L3	Apply
CO2	Relate the role of number theory in the domain of information technology.	L2	Understand
CO3	Model various processes using appropriate probability distribution.	L3	Apply
CO4	Use the appropriate simplex method to solve linear programming models.	L3	Apply

Applied Mathematics (RCP23IPC251)
Course Contents

Unit-I
08 Hrs.

Matrices: Eigenvalues, Eigenvectors, Algebraic and Geometric multiplicity of an eigenvalue, Similar matrices, diagonalizable matrix, Cayley-Hamilton theorem (without proof), Functions of square matrix, Singular Value Decomposition (SVD).

Unit-II
05 Hrs.

Divisibility and primes: Divisibility, Euclid's algorithm, greatest common divisors, linear Diophantine equation, primes, testing of primes, Sieve of Eratosthenes. prime number theorem

Unit-III
05 Hrs.

Congruences: Congruences, Fermat's little theorem, Euler's theorem, linear congruence, computing inverse in congruence, Chinese remainder theorem, quadratic congruences, Legendre symbol.

Unit-IV
08 Hrs.

Probability: Bayes' theorem, random variables, discrete and continuous, expectation and variance of random variable, probability mass function, probability density function and cumulative distribution function, moments, moment generating function, standard probability distribution: Binomial, Poisson and Normal (for detail study).

Unit-V
08 Hrs.

Operations on One and Multiple Random Variable: Functions of a random variable and their distribution and density functions. Pairs of random variables, Joint CDF, Joint PDF, Independence, Conditional CDF and PDF, Conditional Expectation. One function of two random variables, two functions of two random variables: joint moments, joint characteristic function, covariance and correlation-independent, uncorrelated and orthogonal random variables. .

Unit-VI
08 Hrs.

Mathematical programming: Types of solution, standard and canonical form of Linear programming problem (LPP), basic and feasible solutions, simplex method, artificial variables, Big M-method (method of penalty), duality, dual simplex method

Applied Mathematics Tutorial (RCP23IPC251L)

List of Tutorials

1. Eigenvalues and eigenvectors.

2. Function of square matrix.

3. Primes and linear congruences.

4. Quadratic congruences.

5. Bayes' theorem and Random variables.

6. Standard distributions.

7. Joint Distribution.

8. Function of Random Variable.

9. Simplex and Big-M.

10. Duality and Dual Simplex.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Tutorials:

A minimum of eight tutorials based on syllabus will be conducted. Mini projects relevant to the subject may be included, which would help the learner to apply the concept learnt.

Text Books:

1. Seymour Lipschutz and Marc Lipson, "Linear Algebra", 4th Edition, Schaum's outlines, 2008.

2. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 10th Edition, Sultan Chand and Sons, 2020.

3. David M. Burton, "Elementary Number Theory", 7th Edition, Mc Graw Hill, 2017.

Reference Books:

1. Gilbert Strang. "Linear Algebra and its Applications", 4th Edition, Cengage, 2005

2. Ward Cheney and David Kincaid, "Linear Algebra Theory and Applications", 2nd Edition, Jones & Bartlett Learning, 2011.

3. Seymour Lipschutz and John Schiller, "Introduction to Probability and Statistics", Indian Edition, Schaum's outlines, 2017.

4. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, "An Introduction to the Theory of Numbers", 5th Edition, Wiley, 2008.

5. Er. Prem Kumar Gupta, Dr. D. S. Hira, "Operations Research", 7th Edition, S. Chand and Company, 2014.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Design and Analysis of Algorithms (RCP23IPC252)		
Design and Analysis of Algorithms Laboratory (RCP23IPC252L)		

Prerequisite: Computer Programming, Data structures.

Course Objectives: The objective of the course is to introduce important algorithmic design paradigms and approaches for effective problem solving. To analyze the algorithm for its efficiency to show its effectiveness over the others. In addition, the concepts of tractable and intractable problems and the classes P, NP and NP complete problems will be introduced. .

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the performance of algorithms asymptotically.	L4	Analyze
CO2	Solve the problem using appropriate algorithmic design techniques.	L3	Apply
CO3	Prove that certain problems are NP-Complete.	L5	Evaluate

Design and Analysis of Algorithms (RCP23IPC252)
Course Contents

Unit-I
08 Hrs.

Introduction: Introduction to Asymptotic Analysis, Analysis of control statements and loops, solving recurrence relations using tree, substitution, master method, analysis of quick sort and merge sort. Problem Solving using divide and conquer algorithm - Max-Min problem, Strassen's Matrix Multiplication.

Unit-II
08 Hrs.

Greedy Method: Introduction, control abstraction, Problem solving using - fractional knapsack problem, job sequencing with deadline, find and union, Graph: Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Single source shortest path (Dijkstra's algorithm), coin change problem, Analysis of all Algorithms.

Unit-III
10 Hrs.

Dynamic Programming: Introduction, principle of optimality, Components of dynamic programming, characteristics of dynamic programming, Fibonacci problem, Coin Changing problem, 0/1 knapsack, Matrix Chain Multiplication, Longest Common Subsequence (LCS), all pairs shortest paths (Floyd Warshall Algorithm), Single source shortest path (Bellman-Ford Algorithm), Travelling salesperson problem, Multistage graphs, Optimal binary search tree (OBST-successful and unsuccessful search), Analysis of all Algorithms

Unit-IV
08 Hrs.

Backtracking: Introduction, Basics of backtracking, N-queen problem, Sum of subsets, Graph coloring, Hamiltonian cycles, Analysis of all Algorithms.

Branch-and-Bound: Introduction, Control abstraction-LC BB, FIFO BB, LIFO BB, Properties FIFO BB, LIFO BB, LC BB, Fifteen Puzzle problem, 0/1 Knapsack problem, Travelling Salesman problem, Job Sequencing with Deadline

Unit-V
04 Hrs.

String Matching Algorithms: Introduction, The naive string-matching algorithm, The Rabin Karp algorithm, The Knuth Morris Pratt algorithm, Analysis of all Algorithms

Unit-VI
04 Hrs.

Basics of Computational Complexit: Complexity classes: The class P and NP, Reduction, NP

Hard and NP Complete, Proving certain set of problems as NP Complete.

Design and Analysis of Algorithms Laboratory (RCP23IPC252L)

List of Laboratory Experiments

Suggested Experiments:(Any 10 to 12)

1. Implementation of Min Max algorithm.

2. Implementation of Strassen's Matrix Multiplication.

3. Implementation of Karatsuba algorithm for long integer multiplication.

4. Fractional Knapsack implementation using greedy approach.

5. Implementation of Activity selection using greedy approach.

6. Implementation of Kruskal's/ Prim's algorithm using greedy approach.

7. Implementation of job sequencing with deadline using greedy approach.

8. Implementation of other greedy algorithms eg: tree vertex split, subset cover, container loading. coin changing, optimal; merge patterns (Huffman tree).

9. Implementation of Single source shortest path (Dijkstra's algorithm).

10. Implementation of Bellman Ford algorithm using Dynamic programming.

11. Implementation of Longest Common Subsequence algorithm using Dynamic programming.

12. Implementation of Travelling Salesperson problem using Dynamic programming.

13. Implementation of multistage graphs/ all pair shortest path using dynamic programming.

14. Implementation of N-queen problem using Backtracking.

15. Implementation of 15 Puzzle problem using Backtracking.

16. Implementation of Knuth Morris Pratt string matching algorithm.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books:

1. S. Sridhar, Design and Analysis of Algorithms, 1st Edition, Oxford Education, 2018.

2. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction to Algorithms", 3rd Edition, The MIT Press, 2009.

2. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition.

3. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication.

4. John Kleinberg, Eva Tardos, "Algorithm Design", Pearson.

5. Lynn Beighley, S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Python Laboratory (RCP23IPC253L)		

Prerequisite: 1. Structured Programming Approach

2. Java Programming.

Course Objective(s): The objective of the course is to expose students to a new programming language "Python3", thereby making them familiarized with the sequence data types and their interoperability, various control structures and object-oriented programming in Python. To enable students, to develop GUI Applications and Web Applications with database connectivity. To lay the foundation of Machine Learning and Data Science Techniques with visualizations.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop python programs to solve real-world problems.	L6	Create
CO2	Apply different visualizations on a given dataset.	L3	Apply
CO3	Create GUI applications using Flask.	L6	Create
CO4	Work effectively as a member of a team.	L3	Apply

Python Laboratory (RCP23IPC253L)
Course Contents

Unit-I   04 Hrs.

Basics of Python: Numbers in Python, Basic Built-in Math functions, Number Formats, Strings, Quotes, print () Function, range() function, Assigning Values to Names Changing Data Through Names, Copying Data, Tuples, Lists, Dictionaries, Sets, Numpy Arrays, Strings.

Unit-II   04 Hrs.

Control Statements and Functions: If statement, if-elif-else, Repetition using while loop, for loop, Defining a Function, Checking Setting Your Parameters, Default arguments, Variable length arguments, Defining and calling functions within a function, Layers of Functions, Lambda and Filter, Zip(), Map(), Reduce() function, recursion, Function Decorators.

Unit-III   06 Hrs.

Object Oriented Programming: Creating a Class, Self-Variables, Constructors, Types of Methods. Constructors in Inheritance, Polymorphism, the super () Method, Method Resolution Order (MRO), Operator Overloading, Method Overloading Overriding, Interfaces in Python.

Exceptions Handling: Exceptions, Exception Handling, Types of Exceptions, The Except Block, The assert Statement, User Defined Exceptions

Unit-IV   06 Hrs.

Introduction To Data Science Packages: Creating Modules and Packages, Documenting Viewing Module, Basics of Testing Your Modules and Packages, Importing exporting Modules, Random, Matplotlib, Pandas, SciPy, scikit learn Modules.

Unit-V   02 Hrs.

Files Handling: Types of Files in Python, opening a File, closing a File, Writing Text Files, File content manipulation, working with Binary Files, Appending Text to a File, Reading Text Files, File Exceptions, The with Statement Pickle in Python, Zip File Module.

Unit-VI   06 Hrs.

GUI Programming with Database Connectivity: GUI Programming Toolkits, Creating GUI Widgets with Tkinter, Creating Layouts, Form Components, Dialog Boxes. Types of Database Used with Python, MySQL database Connectivity with Python, Performing DML operations on database.

Web Development Framework: Flask -Templates, Flask Template Engine: Jinga, Flask- Sma, Template creation, Rendering a web-based application.

Python Laboratory (RCP23IPC253L)
List of Laboratory Experiments

Suggested Experiments:

1. Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.

2. Write a Python program to implement Basic String Operations String Methods.

3. Write a Python program to implement functions of List, Tuples, Dictionaries.

4. Write a Python program to implement Arrays / Numpy Array (1D, 2D) applications.

5. Write python programs to demonstrate applications of different decision making statements.

6. Write a Python program to implement Functions and Recursion.

7. Write a Python program to implement Programs based on Lambda, Map, Reduce Functions.

8. Write a Python program to implement program to implement concept of Function decorators.

9. Write python programs to implement Classes objects. Constructors.

10. Write python programs to implement Inheritance Polymorphism.

11. Write a Python program to implement data analysis using pandas.

12. Write a Python program to implement basic scientific operations using scipy.

13. Write a Python program to implement data visualizations using matplotlib.

14. Write python programs to implement Exception handling.

15. Write python programs to understand different File handling operations with exception handling.

16. Write python programs to understand GUI designing and database operations (Programs based on GUI designing using Tkinter, Mysql database creation Database connectivity with DML).

17. Write a Python program to implement Web based application with Flask Framework.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Books Recommended: Text Books:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, Wiley Publication.

2. M. T. Savaliya, R. K. Maurya, "Programming through Python", StarEdu Solutions.

3. E Balagurusamy, "Introduction to computing and problem-solving using python", McGraw Hill Publication.

Reference Books:

1. Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series. C. Brown, "Python: The Complete Reference", McGraw-Hill Publication.

2. Paul Barry, "Head first Python", 2nd Edition, O'Reilly Media, Inc.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Object Oriented Design Laboratory (RCP23IPC254L)		

Prerequisite: Java Programming

Course Objective(s): The course intends to introduce the students with practical skills in applying object-oriented design principles to software development. Through hands-on projects, they learn key concepts like classes, objects, inheritance, and polymorphism, alongside advanced topics such as design patterns, UML modeling, and SOLID principles.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze real-world problems using object-oriented design principles.	L4	Analyze
CO2	Design UML diagrams for a real-world systems.	L6	Create

Object Oriented Design Laboratory (RCP23IPC254L) Course Contents

Unit-I   02 Hrs.

Introduction to Object-Oriented Design: Understanding the principles of object-oriented design. Exploring the benefits and applications of object-oriented design. Understanding the fundamentals of Object-Oriented Development, Reviewing basic object-oriented concepts (classes, objects, inheritance, polymorphism). Implementing basic object-oriented principles in a chosen programming language (e.g., Java, C++)

Exercises on encapsulation, abstraction, inheritance, and polymorphism.

Unit-II   02 Hrs.

Fundamentals of Unified Modeling Language: Introduction to Design phase of Software Development Life Cycle. Introduction to Design Specifications in software design process. Introduction to Unified Modelling Language (UML). Understanding the Classification of UML diagrams. Identifying the Problem Statement to exercise UML diagrams. Introduction to online design tools / portals viz. LucidChart, Draw.io, Creatly, Smartdraw etc.

Unit-III   10 Hrs.

Structured UML Diagrams: Detailed study of Class diagrams: Class structure, associations, attributes, and methods.

Object diagrams: Representing instances of classes and their relationships.

Package diagrams: Organizing and managing large-scale software systems.

Component diagrams: Representing the components of a system and their dependencies.

Deployment diagrams: Illustrating the physical deployment of software components on hardware nodes.

Practical exercises and case studies to create and interpret structured UML diagrams.

Unit-IV   08 Hrs.

Behavioral UML Diagrams: Introduction to behavioral diagrams: Use case diagrams: Identifying system actors, use cases, and their relationships.

Activity diagrams: Modeling workflow and business processes, representing sequential and parallel activities using activity diagrams. Visualizing complex scenarios like decision making processes or system workflows.

Sequence diagrams: Modelling the flow of interactions between objects in a system. Illustrating the sequence of method calls and messages exchanged between objects.

State Diagram: Modelling the lifecycle of an object or system states. Defining states, transitions, and events triggering state changes. Illustrating state transitions based on user actions or system events.

Practical exercises and case studies to apply behavioral UML diagrams.

Unit-V

04 Hrs.

Design Principles: Overview of design principles: SOLID principles (Single Responsibility, Open/Closed, Liskov Substitution, Interface Segregation, Dependency Inversion) Understanding the importance of design principles in object-oriented design.

Practical examples and discussions on applying design principles to software design.

Unit-VI

02 Hrs.

Design Patterns: Introduction to design patterns: Creational, Structural, Behavioral patterns Exploring common design patterns such as Singleton, Factory, Observer, Strategy. When and how to use design patterns effectively.

Practical exercises and case studies to apply design patterns in software design

Object Oriented Design Laboratory (RCP23IPC254L)
List of Laboratory Experiments

Suggested Experiments:

1. Implement a simple object-oriented program using classes, objects, and inheritance.

2. Identify a real-world problem statement and apply SOLID principles (Single Responsibility, Open/Closed, Liskov Substitution, Interface Segregation, Dependency Inversion).

3. Develop a use case diagram for a software system, identifying system actors, use cases, and their relationships.

4. Create a class diagram for a given problem domain, including class structure, associations, and attributes.

5. Develop an object diagram based on the class diagram, representing instances of classes and their relationships.

6. Create an activity diagram to model a workflow or business process in a software system.

7. Design a sequence diagram to represent interactions between objects in a specific scenario.

8. Create a package diagram to organize and manage the components of a software system.

9. Design a component diagram for a software system, identifying the components and their dependencies.

10. Construct a deployment diagram illustrating the physical deployment of software components on hardware nodes.

11. Identify and apply design patterns (e.g., Singleton, Factory, Observer, Strategy) in a given software problem.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Books Recommended: Text Books:

1. Grady Booch, James Rambaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", 2nd Edition, Pearson, 2005.

2. Martin Fowler, "Distilled – A Brief Guide to The Standard Object Modelling Language",3rd Edition, Addison Wesley Professional, 2018.

3. Russ Miles, Kim Hamilton, "Learning UML 2.0", O'Reilly Media, Inc., 2006.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Formal Languages and Automata Theory (RCP23IMD251)		
Formal Languages and Automata Theory Tutorial (RCP23IMD251T)		

Prerequisite: Knowledge of Basic Mathematical Fundamentals: Sets, Logic, Relations, Functions.

Course Objectives: The objective of the course is to introduce students to the mathematical foundations of computability theory including automata theory its applications; the theory of formal languages and grammars; the notions of decidability and computability. The course also enables students to develop the ability to design formal grammar abstract computing models for formal languages and appreciate the power and limitations of these models.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Design formal grammar.	L6	Create
CO2	Design computational model.	L6	Create
CO3	Apply rigorously formal mathematical methods to prove properties of formal languages.	L5	Evaluate
CO4	Prove that the certain languages are undecidable.	L5	Evaluate

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Formal Languages and Automata Theory (RCP23IMD251)
Course Contents

Unit-I   07 Hrs.

Formal Languages: Introduction, Chomsky Hierarchy.

Regular Language: Basic Definition, alphabets and strings.

Regular Expression (RE): Definition, RE operators, operation on regular language such as concatenation, closure, union, interaction, etc. Construction of RE for Regular Language, Pumping lemma for regular language, closure properties of regular language.

Regular Grammar: Definition, notations, grammar constituents, Left and Right Linear grammar, construction of LL RL grammar, equivalence of regular grammar and finite automata.

Unit-II   08 Hrs.

Finite Automata (FA): Basic definition, representation, FA as a language acceptor and verifier, different models such as Deterministic FA (DFA) and Non-deterministic FA (NFA).

DFA: Formal definition, construction of DFA.

NFA: Formal definition, construction of NFA. Equivalence of DFA's and NFA's.

NFA with -moves: Formal definition, -CLOSURE of a state, construction of NFA with - moves. Equivalence of NFA's with and without -moves, Equivalence of NFA's with - moves and DFA, Construction of NFA with -moves for RE and Construction of RE from FA.

Minimal State Finite Automata: Necessity and advantages of minimization, minimization algorithm.

Finite Automata with output: Basic concept, advantages, different models such as Moore and Mealy machines.

Moore m/c: Formal definition, construction of different Moore m/c models.

Mealy m/c: Formal definition, construction of Mealy m/c models (examples). Equivalence of Moore and Mealy m/c. Applications of finite automata: lexical analyzer, text editor.

Unit-III   08 Hrs.

Context Free Language (CFL) & Context Free Grammar (CFG): Definition, notations, construction of CFG for CFL.

Derivation: Left most derivation, right most derivation, derivation tree, ambiguous context free grammar, and removal of ambiguity from CFG.

Simplification of CFG: Live variable, reachable variable, useful variable, useful and useless production, removal of useless variables and useless productions, Nullable variable, - production, removal of -productions, unit production, removal of unit productions.

Normal Forms: Chomsky normal form, Greibach normal forms.

Unit-IV   07 Hrs.

Push Down Automata (PDA): Formal definition, instantaneous description, accepted languages, PDA acceptance by Final State and by Empty Stack, deterministic and non deterministic PDA, construction of PDA for CFG and CFL, construction of CFG for PDA.

Unit-V   06 Hrs.

Turing Machine (TM): Formal definition, instantaneous description, construction of TM. Variations of Turing machine: Two-way infinite tapes, Multi-tape, Multiple tracks, non deterministic, multidimensional, Multi-head, Church-Turing thesis.

Unit-VI   06 Hrs.

Undecidability: Decidable and undecidable problem. Recursive and recursively enumerable language: definition, properties. Universal Turing Machine (UTM) and an undecidable problem. A non-recursive enumerable language, halting problems, other unsolvable problems about TM. Post's correspondence problems: An instance of PCP, modified version of PCP, Undecidability of PCP, applications of PCP.

Formal Languages and Automata Theory Tutorial (RCP23IMD251)

List of Laboratory Experiments

Suggested Experiments:

1. Designing RE, RG, RLG and LLG for given Regular Language.

2. Converting RE to NFA, NFA to DFA to Reduced DFA, FA to RE.

3. Designing Moore and Mealy machines.

4. Designing CFG and getting Leftmost and Rightmost derivations from it.

5. Simplification of CFG.

6. Converting CFG to CNF & GNF

7. Designing Push Down Automata for CFL and CFG.

8. Getting CFG from PDA.

9. IDesigning Turing Machine.

10. Demonstration of JFLAP tool.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books:

1. . John C. Martin, "Introduction to Languages and Theory of Computation", 4th Edition, Tata McGraw Hill,2011.

2. Kavi Mahesh, "Theory of Computation A Problem Solving Approach", 1st Edition, Wiley India, 2011.

Reference Books:

1. S John E. Hopcroft, Jeffrey D. Ullman, Motwani, "Introduction to Automata Theory, Languages and Computation",3rd Edition, Pearson, 2007.

2. S Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Jones and Bartlett Learning, 2001.

3. Harry R. Lewis, Christos H. Papadimitriou, "Elements of the Theory of Computation", 2nd Edition, PHI, 1998.

4. Michael Sipser, "Introduction to the Theory of Computation",2nd Edition, Thomson Learning, 2006.

5. Bernard M. Moret, "The Theory of Computation", 1st Edition, Pearson Education, 2002.

6. Daniel I. A. Cohen, "Introduction to Computer Theory", 2nd Edition, Wiley, 2014.

7. J. Richard Buchi, "Finite Automata, Their Algebras and Grammars: Towards a Theory of Formal Expressions", 1st Edition, Springer-Verlag, 1989.

8. McNaughton R, "Elementary Computability, Formal Languages and Automata", Prentice-Hall, 1982.

9. K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science", 3rd Edition, PHI, 2008.
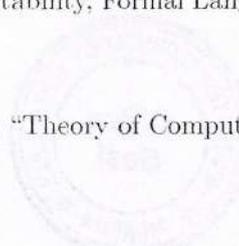
Program: Information Technology		S.Y. B.Tech.	Semester: IV
Semester Project-II (RCP23XSC251P)			

Course Objectives:

Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the departmental committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(Log Book Format will be as per Table 4).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation Details

- Project Outcomes

- Conclusion

- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 5.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 6.

Table 4: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 5: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintenance	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 6: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	Hardware/ Programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Professional and Business Communication Tutorial (RCP23XHS281T)		

Course Objectives:

1. To inculcate professional and ethical attitude at the workplace.

2. To enhance communication and interpersonal skills.

3. To develop effective employability skills.

4. To hone written skills for technical documentation.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply group discussion techniques in professional situations.	L3	Apply
CO2	Use employability skills to optimize career opportunities.	L3	Apply
CO3	Employ storytelling techniques for effective presentation.	L3	Apply
CO4	Prepare technical documents using appropriate style, format, and language	L6	Create
CO5	Analyze the concept of professional ethics.	L4	Analyze
CO6	Demonstrate interpersonal skills in professional and personal situations.	L3	Apply

The course is designed to equip students with essential skills, crucial for navigating the contemporary job market successfully and fostering a positive work environment through effective communication and collaboration. The assignments comprise of a combination of interactive activities, discussions, case studies and real-world simulations, to help students, not only to ace job interviews and professional interactions, but also to contribute positively to the ethical and productive functioning of any organization. For the project work, students must prepare and present a well-researched and persuasive business proposal, in groups, integrating the skills and knowledge acquired throughout the course.

Description of Activities

Unit-I
No. of Assignments:01

Group Discussion:

Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD

Activity: The students will be divided into groups of 8-12 and each group will be given a topic/case to discuss within a given time frame. Each student will submit a write-up on their observations of the GD.

Unit-II
No. of Assignments:02

Employment Skills

Resume Writing:

Types of resumes, structure, content, and formatting of resume Activity: The students will prepare and submit their individual resume according to the professional requirements.

Interview Skills:

Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview

Activity: The students will submit a write-up on the FAQs and participate in mock interviews

Unit-III
No. of Assignments:01

Corporate Story Telling:

Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOPs and interviews, storytelling to manage conflict or to motivate.

Activity: The students will be divided into groups of 8-12 and asked to give a team presentation using storytelling technique and submit the hardcopy of the ppt.

Unit-IV

No. of Assignments:01

Technical Writing and Documentation

Business Proposal Writing:

Types of business proposals, format of proposal, language and style, presentation of proposal

Meeting Documentation:

Planning layout of meetings, observing meeting decorum, drafting notice, agenda, and minutes of meeting Activity: The students will be divided into groups of 8-12 and each group will conduct a mock meeting based on an agenda and submit a writeup of the meeting documentation.

Unit-V

No. of Assignments:01

Professional Ethics:

Effective work habits, accountability, integrity, and excellence

Activity: The students will be divided into groups of 8-12 and each group will analyse a case involving an ethical issue and submit the writeup.

Unit-VI

No. of Assignments:02

Interpersonal Skills

Team Building:

Difference between group and team, importance of teamwork, strategies to be a good team player

Activity: The students will be divided into groups of 8-12 and each group will be assigned a task to be accomplished as a team, for which they will submit the writeup.

Leadership:

Types of leadership, leadership styles, case studies

Activity: Each student will submit a writeup involving a leader they admire, analysing various aspects of his leadership style.

Time Management:

Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals

Activity: Each student will submit a writeup about a case involving time management.

Term work of minimum eight assignments from the above suggested list or any other assignments based on the syllabus will be included, which would help the learner to apply the concepts learnt.

Reference Books:

1. Fred Luthans, "Organizational Behavior", McGraw Hill, edition.

2. Lesiker and Petit, "Report Writing for Business", McGraw Hill, edition.

3. Huckin and Olsen, "Technical Writing and Professional Communication", McGraw Hill.

4. Wallace and Masters, "Personal Development for Life and Work", 12th Edition, Thomson Learning.

5. Heta Murphy, "Effective Business Communication", Mc Graw Hill, edition.

6. Sharma R.C. and Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw-Hill Education.

7. Ghosh, B. N., "Managing Soft Skills for Personality Development", Tata McGraw Hill.

8. Bell, Smith, "Management Communication" Wiley India Edition, 3rd Edition.

9. Dr. Alex, K., "Soft Skills", S Chand and Company.

10. Subramaniam, R., "Professional Ethics" Oxford University Press.

11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact", Penguin Random House India Pvt. Ltd.

Program: Information Technology		S.Y. B.Tech.	Semester: IV
Economics and Financial Management (RCP23XHS282)			

Prerequisite: Knowledge of Economics and Finance domain current affairs.

Course Objectives:

1. To describe the relationships among variables to analyse economic issues.

2. To Explain the function of the market and prices as an allocative mechanism.

3. To identify key macroeconomic indicators and measures of economic change, growth, and development.

4. To understand basic concepts of financial management and their application in investment and financing decisions.

5. To explore the relationship between Financial Management and Financial Statements.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyse individual decision making, how prices and quantities are determined inproduct and factor markets, microeconomic and macroeconomic outcomes.	L4	Analyze
CO2	Analyse the performance and functioning of government, RBI, markets, and institutions in the context of social and economic problems.	L4	Analyze
CO3	Analyse the current economic status of India at global levels and provision in budget to address economic issues at national level.	L4	Analyze
CO4	Describe an understanding of the overall role and importance of the finance function.	L2	Understand
CO5	Analyse financial performance and make appropriate inferences.	L4	Analyze

Economics and Financial Management (RCP23XHS282)
Course Contents

Unit-I Introduction to Economics   08 Hrs.

Fundamentals of Economics, Definition and scope of economics, the nature of the economic problem, finite resources and unlimited wants, definitions of the factors of production and their rewards, definition of opportunity cost, the influence of opportunity cost on decision making.

Microeconomics and Macroeconomics The role of markets in allocating resources, the market system, introduction to the price mechanism, Demand, Supply and Pricedetermination, Price elasticity of demand and supply (PED)

Unit-II Role of Government and RBI   04 Hrs.

Money, Banking, Households, Firms, economies and diseconomies of scale, Market Structure, Fiscal Policy, Monetary Policy, Economic Growth, causes and consequences of recession, causes of economic growth, measurement of economic growth inflation and deflation, living standards, indicators of living standards.

Unit-III Government Policies   04 Hrs.

Last 20 years Journey of Indian Economy, Measures taken to grow Indian Economy, Meaning of India is the world's fifth-largesteconomy by nominal GDP and the third-largest by purchasing power parity (PPP), On a per capita income basis, India ranked 139th by GDP (nominal) and 127th by GDP (PPP) (Data reference year 2023), Comparison of top 5 largest economies in world, Discuss key points of India latest union budget and its impact on Indian economy and citizens, Meaning of Initiatives like Make in India, Digital India, Skill India etc. and expected impact on Indian Economy.

Unit-IV Overview of Financial Management   04 Hrs.

Fundamentals of financial management, principles and functions of the financial management, Strategy, methods and techniques of the financial management. Overview of financial instruments, financial markets, financial Institutions.

Unit-V Overview of Financial Statements   08 Hrs.

Balance Sheet, Profit and Loss Account, and Cash Flow Statement:Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios;

Text Books:

1. Datt Sundharam, "Indian Economy by Gaurav Datt Biswajit Nag", 73rd Edition, S. Chand Publications, 2024.

2. Prasanna Chandra, "Fundamentals of Financial Management". McGraw Hill Publications,,7th Edition, 2020.

Reference Books:

1. Public Economics: The Macroeconomic Perspective by Burkhard Heer, Springer International Publications, 2019

2. Indian Economy: Economic Ideas, Development, and Financial Reforms by Raj Kumar Sen, Deep & Deep Publications, 2008.

3. Indian Economy: Performance and Policies by Dr. V. C. Sinha, SBPD Publications, 2021.

4. Financial Management by C. Paramasivan, T. Subramanian, New Age Publications, 2009.

5. Financial Management Practices in India by Sandeep Goel, Taylor Francis Publications, 2016.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Project Management (RCP23XOE261)		

Prerequisite: Basic concepts of Management.

Course Objectives:

1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.

2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain project management life cycle and the various project phases as well as the role of project manager.	L2	Understand
CO2	Apply selection criteria and select an appropriate project from different options.	L3	Apply
CO3	Create a work break down structure for a project and develop a schedule based on it. Manage project risk strategically.	L6	Create
CO4	Use Earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference.	L6	Create
CO5	Differentiate between traditional waterfall approach and agile scrum methodology for software development projects	L4	Analyze

Project Management (RCP23XOE261)
Course Contents

Unit-I

10 Hrs.

Project Management Foundation: Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical). Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).

Unit-II

08 Hrs.

Initiating Projects: How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development & growth (forming, storming, norming &performing). team dynamics.

Unit-III

08 Hrs.

Project Planning: Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM. Crashing project time & Resource loading and levelling (Only Theory), Project Stakeholders and Communication plan.

Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability, and impact matrix. Risk response strategies for positive and negative risks.

Unit-IV

08 Hrs.

Monitoring and Controlling Projects: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit, Project Contracting: Project procurement management, contracting and outsourcing.

Closing the Project: Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.

Unit-V

08 Hrs.

Agile project management:: Agile principle, Agile Manifesto, Agile process framework, Charac-

teristics of Agile Approaches and Scrum, Benefits of Agile project management, Implementing Agile project management.

Agile Project Planning: Comparison of Agile Project Management with Traditional Waterfall Approach, Project Planning with Scrum, Scrum Artifacts Supporting Project Planning , Scrum Events for Project Planning. Scheduling with scrum, Techniques for scrum scheduling- Poker estimation.

Agile Tools for Tracking Project Progress: Task Boards, Burnup and Burndown Charts.

Text Books:

1. Jack Meredith & Samuel Mantel, "Project Management: A managerial approach", 11th Edition, Wiley India.

2. Erik Larson, Clifford Gray, "Project Management: The Managerial Process", 8th Edition, McGraw Hill Education.

3. Jim Highsmith, Pearson Education, "Agile Project Management", Low Price Edition, India.

Reference Books:

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7th Edition, Project Management Institute PA, USA.

2. Gido Clements, "Project Management", Cengage Learning.

3. Gopalan, "Project Management", Wiley India.

4. Dennis Lock, "Project Management", 9th Edition, Gower Publishing England.

5. Kalpesh Ashar, "Agile Essentials You Always Wanted to Know", Vibrant Publishers U.S.A.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Cyber Security, Policies and Laws (RCP23XOE262)		

Prerequisite: Fundamentals of Computers.

Course Objectives:

1. Familiarize with the provisions and implications of the Digital Personal and Data Protection Act, the obligations of data fiduciaries, the rights and duties of data principals, and mechanisms for resolving breaches.

2. Equip individuals and organizations with the knowledge and tools to create secure cyber ecosystems, strengthen regulatory frameworks, and develop incident response plans.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and describe the major types of cybercrime and navigate legal frameworks and regulations concerning digital personal and data protection.	L2	Understand
CO2	Implement strategies for cybersecurity outlined in the National Cyber Security Policy.	L3	Apply
CO3	Apply appropriate law enforcement strategies to both, prevent and control cybercrime.	L3	Apply
CO4	Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.	L2	Understand

Cyber Security, Policies and Laws (RCP23XOE262)
Course Contents

Unit-I   08 Hrs.

Cyber Crime: Definition and Origin of the Word, Cyber Crime and Information Security, who are Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet Time Theft, Salami Attack, Salami technique Data Diddling, Forgery, Newsgroup Spam, Online Frauds, Pornographic Offenders, Email Bombing, Password Sniffing, Credit Card Frauds.

Unit-II   08 Hrs.

Cyber Offenses: How Criminals plan them, Categories of Cyber Crimes, How Criminal Plans the Attack: Active Attacks, Passive Attacks, Social Engineering, Classification of Social Engineering, Cyber Stalking: types of Stalkers, Cyber Cafe and Cyber Crimes, Botnets, Attack Vectors, Cyber Crime and Cloud Computing.

Unit-III   08 Hrs.

Indian IT Act: Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in Cyber-Law, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, Security Standards: SOX, GLBA, HIPAA, NIST Cyber Security Framework (CSF).

Unit-IV   10 Hrs.

India's Digital Personal and Data Protection Act (2023): Preliminary, Obligations of Data Fiduciary, Rights and Duties of Data Principal, Special Provisions, Data Protection Board of India, Powers, Functions and Procedure to Be Followed by Board, Appeal and Alternate Dispute Resolution, Penalties and Adjudication.

Unit-V   08 Hrs.

India's AI Regulation and Strategy: Privacy, Security and Artificial Intelligence, Differential Privacy, Security in AI. National Artificial Intelligence Strategy, Principles for Responsible AI, Information Technology (Intermediary Guidelines and Digital Media Ethics Code-2021), Draft National Data Governance Framework Policy (NDGFP), Rules against Deepfakes, Due diligence advisory for AI, AI regulations framework (June 2024).

Text Books:

1. Nina Godbole, Sunit Belapur, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley-2011.

2. Gurdip Kaur, "Understanding Cybersecurity Management in Decentralized Finance: Challenges, Strategies, and Trends", Springer-2023.

Reference Books:

1. "The Information Technology Act, 2000", Bare Act- Professional Book Publishers, New Delhi.

2. Izzat Alsmadi, "The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics", Springer-2023.

References (Web Resources):

1. Digital Personal Data Protection Act 2023.pdf (meity.gov.in)

2. National Cyber Security Policy (draft v1 (meity.gov.in)

3. CISO_Roles_Responsibilities.pdf

4. Standards(bis.gov.in)

5. AI, Machine Learning & Big Data Laws & Regulations | India (globallegalinsights.com)

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Advanced Operations Research (RCP23XOE263)		

Prerequisite: Operation Research. Mathematics (Calculus).

Course Objectives:

1. To develop an ability to analyse the structure and mathematical model of various complex system occurring in manufacturing system, service system, and business applications.

2. To develop knowledge of the mathematical structure of linear and nonlinear optimization models.

3. To develop an understanding of the techniques used to solve linear and nonlinear optimization models using their mathematical structure.

4. To develop an understanding of the use of modelling languages for expressing and solving optimization models.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply Duality theory to solve linear programming problem and analyse optimum solution.	L3	Apply
CO2	Construct linear integer programming models and apply the O.R. algorithms and techniques to solve linear integer programming problems.	L3	Apply
CO3	Determine best satisfying solution under a varying quantity of resources and priorities of the goals.	L5	Evaluate
CO4	Set up decision models and solve nonlinear programming- unconstrained optimization problems.	L3	Apply
CO5	Set up decision models and solve nonlinear programming- constrained optimization problems.	L3	Apply

Advanced Operations Research (RCP23XOE263)
Course Contents

Unit-I   06 Hrs.

Dual Linear Programs: Primal, dual, and duality theory - The dual simplex method -The primal-dual algorithm-Duality applications. Post optimization problems: Sensitivity analysis.

Unit-II   06 Hrs.

Integer Programming: Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

Unit-III   08 Hrs.

Goal Programming : Concept of Goal Programming, GP model formulations, Graphical method of GP, The simplex method of GP, Application areas of GP.

Unit-IV   11 Hrs.

Nonlinear Programming- Unconstrained optimization : Minimization and maximization of convex functions- Local & Global optimum- Convergence-Speed of convergence. one-dimensional unconstrained optimization – Newton's method – Golden-section search method , multidimensional unconstrained optimization –Gradient method — steepest ascent (descent) method – Newton's method.

Unit-V   11 Hrs.

Nonlinear Programming- Constrained optimization : Constrained optimization with equality and inequality constraints. Constrained optimization: Lagrangian method - Sufficiency conditions - Kuhn-Tucker optimality conditions Rate of convergence - Engineering Applications Quadratic programming problems-convex programming problems.

Text Books:

1. Gupta, P. K. and Hira, D. S., "Operations Research", S. Chand Publications, 2014.

2. Srinivasan, G., "Operations research: Principles and applications", Prentice Hall of India, 2007.

3. Nita H. Shah, Poonam Prakash Mishra, "Non-Linear Programming-A Basic Introduction", CRC Press, 2020.

Reference Books:

1. Frederick S. Hillier & Gerald J. Lieberman, "Introduction to Operations Research", 8th (International) Edition, McGraw-Hill: Boston MA. 2005.

2. Ravindran, Philips and Soleberg, "Operations Research – Principle and Practice", 2nd Edition, John Wiley and Sons, 2007.

3. Taha, H. A., "Operations Research - An Introduction", Pearson Education, 2022.

4. Paul A. Jensen, Jonathan F. Bard, "Operations Research: models and methods", Wiley Publications, 2003.

5. C. B Gupta, I.K., "Optimization Techniques in Operation Research", International Publishing House Pvt. Limited, 2008.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Corporate Finance Management (RCP23XOE264)		

Course Objectives:

1. Overview of Indian financial system, instruments and market.

2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management.

3. Knowledge about sources of finance, capital structure, dividend policy.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand Indian finance system	L2	Understand
CO2	Apply concepts of time value money and risk returns to product, services and business.	L3	Apply
CO3	Understand corporate finance and working capital management.	L2	Understand
CO4	Take Investment and finance decisions.	L3	Apply
CO5	Take dividend decisions.	L3	Apply

Corporate Finance Management
(RCP23XOE264)
Course Contents

Unit-I   08 Hrs.

Overview of Indian Financial System: Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market. Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges.

Unit-II   08 Hrs.

Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio: Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.

Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due: Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due: Continuous Compounding and Continuous Discounting.

Unit-III   10 Hrs.

Overview of Corporate Finance: Objectives of Corporate Finance; Functions of Corporate Finance-investment Decision, Financing Decision, and Dividend Decision.

Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories: Management of Receivables; and Management of Cash and Marketable Securities.

Unit-IV   08 Hrs.

Capital Budgeting: Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return. Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR). and Modified Internal Rate of Return (MIRR).

Unit-V   08 Hrs.

Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure

Theories and Approaches — Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure.

Dividend Policy: Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches — Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach

Text Books:

1. Prasanna Chandra, "Financial Management, Theory & Practice", 8th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.

2. M. Y. Khan, "Indian Financial System", 9th Edition, McGraw Hill Education, New Delhi, 2015.

3. I. M. Pandey, "Financial Management", 11th Edition, S. Chand (G/L) & Company Limited, New Delhi, 2015.

Reference Books:

1. Eugene F. Brigham and Joel F. Houston, "Fundamentals of Financial Management", 13th Edition, Cengage Publications, New Delhi, 2015.

2. Robert C. Higgins, "Analysis for Financial Management", 10th Edition, McGraw Hill Education, New Delhi, 2013.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Corporate Social Responsibility (RCP23XOE265)		

Prerequisite: Nil.

Course Objectives:

1. To make students understand the concept, theories and application of CSR for the Development of the Society.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To analyse and critique the ethical dimensions of Corporate Social Responsibility initiatives, demonstrating a comprehensive understanding of CSR principles and their ethical underpinnings	L4	Analyze
CO2	To understand the legislative frameworks shaping Corporate Social Responsibility both in India and globally, alongside recognizing the key drivers fostering CSR practices within the Indian context.	L2	Understand
CO3	To identify and discuss the significance of social responsibility and community engagement initiatives, demonstrating an understanding of their impact on both businesses and society.	L2	Understand

Corporate Social Responsibility (RCP23XOE265)
Course Contents

Unit-I   10 Hrs.

Introduction to Corporate Social Responsibility (CSR): Understanding the concept of CSR ,Historical evolution and development of CSR,Importance and benefits of CSR for businesses and society ,Stakeholder theory and its relevance to CSR .

Unit-II   08 Hrs.

Ethical Foundations of CSR: Ethical theories relevant to CSR (Utilitarianism, Deontology, Virtue Ethics), Ethical decision-making frameworks in business, Corporate governance and ethics, Ethical issues in supply chain management.

Unit-III   08 Hrs.

CSR-Legislation in India and the World: Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India.

Unit-IV   08 Hrs.

The Drivers of CSR in India: Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives Corporate Social Responsibility and Public-Private Partnership (PPP).

Unit-V   08 Hrs.

Social Responsibility and Community Engagement: Social issues and challenges in contemporary society, Corporate philanthropy and community development initiatives, Stakeholder engagement strategies, Corporate volunteering and employee engagement programs, CSR as a strategic business tool vital for sustainable development.

Text Books:

1. Andrew Crane, Dirk Matten, "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments", Oxford University Press.

2. O. C. Ferrell, John Fraedrich, Linda Ferrell, "Business Ethics: Ethical Decision Making & Cases", Cengage Learning.

3. Sanjay K. Agarwal, "Corporate Social Responsibility in India", Sage Publications, 2008.

4. Bidyut Chakrabarty, "Corporate Social Responsibility in India", Routledge, New Delhi, 2015.

Reference Books:

1. Mark S. Schwartz, "Corporate Social Responsibility: An Ethical Approach", Broadview Press, 2011.

2. George Pohle and Jeff Hittner, "Attaining Sustainable Growth through Corporate Social Responsibility", IBA Global Business Services, 2008.

3. William B. Werther Jr. and David Chandler, "Strategic Corporate Social Responsibility: Stakeholders in a Global Environment", 2nd Edition, Sage Publications, 2011.

Program: Information Technology		S.Y. B.Tech.	Semester: IV
Bioinformatics (RCP23XOE266)			

Course Objectives:

1. To provide an overview of bioinformatics and its significance in modern biological research.

2. To enable students to apply bioinformatics methods in practical scenarios for biological data analysis and interpretation.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the structure and function of cells, organelles, and biomolecules	L2	Understand
CO2	Understand the types of data stored in bioinformatics databases and their relevance to biological research.	L2	Understand
CO3	Explore genomic databases and understand the structure and content of protein databases.	L2	Understand
CO4	Understand system biology concepts and molecular evolution	L2	Understand
CO5	Apply knowledge of cellular and molecular biology concepts to analyze a biological problem.	L3	Apply

Bioinformatics (RCP23XOE266)
Course Contents

Unit-I   08 Hrs.

Foundations of Molecular and Cellular Biology:

Introduction to molecular biology: DNA, RNA, proteins, and their roles in cellular processes

Cell structure and function: Organelles, membrane structure, and cellular transport

Cell cycle regulation: phases of the cell cycle, checkpoints, and cell cycle control mechanisms

Unit-II   08 Hrs.

Genetics and Genomics:

Mendelian genetics: Inheritance patterns, Punnett squares, and genetic crosses

Chromosome structure and organization: karyotyping, gene mapping, and genetic linkage

Introduction to genomics: genome structure, organization, and variation

Techniques in molecular genetics: PCR, DNA sequencing, and gene cloning

Unit-III   08 Hrs.

Genomic and Protein Databases:

Types of genomic databases such as GenBank, Ensemble, and UCSC Genome Browser, Understand the structure and content of protein databases such as UniProt and Protein Data Bank (PDB), Searching, Retrieving, and Analysing Genomic and Protein data from online databases.

Unit-IV   08 Hrs.

Systems Biology:

Introduction to Systems Biology: Modeling biological systems and network analysis, Bioinformatics tools for systems biology and modeling complex biological processes.

Principles of molecular evolution: Mutation, Selection, and genetic drift.

Phylogenetic analysis: Tree construction, sequence alignment, and molecular clock.

Unit-V   10 Hrs.

Applications and Case Studies: Applications of Bioinformatics in Medicine, Agriculture, and Biotechnology, Case Studies (Integrating Cellular and Molecular Biology with Bioinformatics) and Research Examples, Ethical and Legal Issues in Bioinformatics, Future Trends and Emerging Technologies in Bioinformatics.

Text Books:

1. Jean-Michel Claverie and Cedric Notredame, "Bioinformatics For Dummies", 2019.

2. Phillip Compeau and Pavel Pevzner, "Bioinformatics Algorithms: An Active Learning Approach", Active Learning Publishers, 2019.

Reference Books:

1. Arthur Lesk, "Introduction to Bioinformatics", Biologist & Bioinformatics Expert, 2019.

2. Robert Hoyt, "Introduction to Biomedical Data Science", Informatics Education, 2019.

3. Martin Jones, "Python for Biologists: A Complete Programming Course for Beginners", Oxford University Press, 2013.

4. Neil C. Jones, and Pavel A. Pevzne, "An Introduction to Bioinformatics Algorithms", MIT Press, 2004.

5. Caroline St. Clair, and Jonathan E. Visick, "Exploring Bioinformatics: A Project-Based Approach", Jones & Bartlett Learning, 2014.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Human Resource Management (RCP23XOE267)		

Course Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource managements.

2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.

3. To familiarize the students about the importance of the labour relations in the organization.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and distinguish the changing environment of the HRM and the role of the HR managers.	L2	Understand
CO2	Understand and analyse the recruitment process and the application of the IT.	L3	Apply
CO3	Understand and examine the importance of the training and development.	L4	Analyze
CO4	Understand and determine the pay plans, performance appraisal and compensation.	L4	Analyze
CO5	Understand and explain the importance of the labour relation, the employee'security and collective bargaining.	L2	Understand

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Human Resource Management
(RCP23XOE267)
Course Contents

Unit-I

08 Hrs.

Human Resource Function: Human Resource Philosophy – Changing environments of HRM – Strategic human resource management – Using HRM to attain competitive advantage – Trends in HRM – Organisation of HR departments – Line and staff functions – Role of HR Managers.

Unit-II

10 Hrs.

Recruitment & Placement: Job analysis: Methods - IT and computerised skill inventory - Writing job specification - HR and the responsive organisation.

Recruitment and selection process: Employment planning and forecasting - Building employee commitment: Promotion from within - Sources, Developing and Using application forms - IT and recruiting on the internet.

Employee Testing & selection: Selection process, basic testing concepts, types of test, work samples & simulation, selection techniques, interview, common interviewing mistakes, Designing & conducting the effective interview, small business applications, computer aided interview.

Unit-III

08 Hrs.

Training & Development: Orientation & Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet.

Developing Managers: Management Development - The responsive managers - On-the-job and off the-job Development techniques using HR to build a responsive organisation.

Performance appraisal: Methods - Problem and solutions - MBO approach - The appraisal interviews - Performance appraisal in practice.

Managing careers: Career planning and development - Managing promotions and transfers.

Unit-IV

08 Hrs.

Compensation & Managing Quality: Establishing Pay plans: Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation - pricing managerial and professional jobs - Computerised job evaluation.

Pay for performance and Financial incentives: Money and motivation - incentives for operations employees and executives - Organisation wide incentive plans - Practices in Indian organisations.

Benefits and services : Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits -retirement benefits and other welfare measures to build employee commitment.

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Labour relations and employee security: Industrial relation and collective bargaining: Trade unions - Collective bargaining - future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation.

Labour Welfare: Importance & Implications of labour legislations - Employee health - Auditing HR functions, Future of HRM function.

Text Books:

1. Pattanayak, Biswajeet, "Human Resource Management", 6th Edition, PHI Learning Pvt. Ltd., 1 Jul 2020.

2. Gary Dessler, "Human Resource Management", 16th Edition, Pearson Publications, 2020.

Reference Books:

1. Stephen Robbins, "Organizational Behavior", 16th Edition, 2013.

2. Aswathapa. "Human resource management: Text & cases", 6th Edition, 2011.

3. C. B. Mamoria and S V Gankar, "Dynamics of Industrial Relations in India", 15th Edition, Himalaya Publishing, 2015.

4. P. Subba Rao, "Essentials of Human Resource management and Industrial relations", 5th Edition, Himalaya Publishing, 2013.

5. Laurie Mullins. "Management & Organizational Behavior", Latest Ed, Pearson Publications, 2016.

6. Raymond J. Stone, Anne Cox. Mihajla Gavin, "Human Resource Management", 10th Edition, John Wiley & Sons, 14 Dec 2020.

7. V S P Rao, "Human Resource Management", 3rd Edition. Excel publishing, 2010.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Digital Marketing Management (RCP23XOE268)		

Course Objectives:

1. Explain the evolution and technology of digital marketing, including underlying frameworks.

2. Understand digital business strategy and emerging business structures.

3. Cover digital marketing planning, operations setup, and implementation of search campaigns, alongside emerging concepts like Big Data, IoT, SMB, B2B marketing, and SoLoMo.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the digital marketing framework & model and consumer behaviour.	L2	Understand
CO2	Develop digital marketing strategy roadmap.	L6	Create
CO3	Explain the terminology and concepts for developing web-specific media plans.	L2	Understand
CO4	Understand concepts related to digital campaign management and revenue generation models.	L2	Understand
CO5	Get a perspective on global digital marketing technology/tools and future trends	L3	Apply

Digital Marketing Management (RCP23XOE268)
Course Contents

Unit-I   06 Hrs.

Introduction to Digital Marketing: Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing.

Digital Marketing Framework: Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework.

Digital Marketing Models Creation: Factors impacting digital marketplace, value chain digitization, business models.

The Consumer for Digital Marketing: Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC).

Unit-II   12 Hrs.

Digital marketing Strategy Development: Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis.

Digital Marketing Internal Assessment and Objectives Planning: Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review.

Digital Marketing Strategy Definition: Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance.

Digital marketing Strategy Roadmap: Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.

Unit-III   08 Hrs.

Digital Marketing Planning and Setup: Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing.

Digital Marketing Operations Setup: Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.

Unit-IV   08 Hrs.

Digital marketing Execution: Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing.

Digital marketing Execution Elements: Digital revenue generation models, managing service

delivery and payments, managing digital implementation challenges like ecommerce, internal & external and consumer specific challenges.

Unit-V   08 Hrs.

Digital Business – Present and Future: Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape.

Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.

Text Books:

1. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson Education Limited, 2017.

2. Seema Gupta, "Digital Marketing", McGraw Hill Education, 2022.

Reference Books:

1. Dave Chaffey and P. R. Smith, "Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing", 5th Edition, Taylor & Francis, 2017.

2. Dave Chaffey Fiona Ellis-Chadwick, "Digital Marketing: Strategy, Implementation and Practice", 6th Edition, Pearson Education Limited, 2019.

3. Vandana Ahuja, "Digital marketing", Oxford University Press, 2015.

4. Ian Dodson, "The Art of Digital Marketing", John Wiley & Sons, 2016.

Program: Information Technology	S.Y. B.Tech.	Semester: IV
Logistics and Supply Chain Management (RCP23XOE269)		

Prerequisite: Latest trend of information technology in retail industry and logistic applications.

Course Objectives:

1. To develop advanced strategic thinking skills in supply chain management and logistics to effectively analyse and optimize supply networks.

2. To attain proficiency in leveraging cutting-edge tools and technologies to enhance supply chain efficiency and supply chain transformation.

3. Design and implement collaborative supply chain and sourcing strategies to promote information sharing and optimise coordination.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop a sound understanding of the important role of supply chain management in today's business environment.	L2	Understand
CO2	Develop criteria and standards to achieve improved business performance by integrating and optimizing the total logistics and supply-chain process.	L6	Create
CO3	Summarize the value of focusing on information business logistics systems which drives improved accuracy and decision-making at all levels of management.	L2	Understand
CO4	Become familiar with current supply chain information technology management trends.	L2	Understand
CO5	Use available technologies to enhance work performance and support supply chain functions, processes, transactions, and communications.	L3	Apply

Logistics and Supply Chain Management (RCP23XOE269)
Course Contents

Unit-I   06 Hrs.

Introduction: What Is Supply Chain Management? The Development Chain, Global Optimization, Managing Uncertainty and Risk, The Complexity in Supply Chain Management, Key Issues in Supply Chain Management.

Unit-II   06 Hrs.

Network Planning: Introduction, Network Design- Data Collection, Data Aggregation, Transportation Rates, Mileage Estimation, Warehouse Costs, Warehouse Capacities, Potential Warehouse Locations, Service Level Requirements, Future Demand, Model and Data Validation, Solution Techniques, Key Features of a Network Configuration Supply Chain Planning; Inventory Positioning and Logistics Coordination -Strategic Safety Stock.

Unit-III   08 Hrs.

The Value of Information: Introduction, The Bullwhip Effect-Quantifying the Bullwhip Effect, The Impact of Centralized Information on the Bullwhip Effect, Methods for Coping with the Bullwhip Effect, Information Sharing and Incentives, Effective Forecasts, Information for the Coordination of Systems, Locating Desired Products, Lead-Time Reduction, Information and Supply Chain Trade-offs-Conflicting Objectives in the Supply Chain, Designing the Supply Chain for Conflicting Goals ,Decreasing Marginal Value of Information.

Unit-IV   08 Hrs.

Supply Chain Integration : Introduction, Push, Pull, and Push-Pull Systems-Push-Based Supply Chain, Pull-Based Supply Chain, Push-Pull Supply Chain ,Identifying the Appropriate Supply Chain Strategy, Implementing a Push-Pull Strategy The Impact of Lead Time.Demand-Driven Strategies The Impact of the Internet on Supply Chain Strategies-what is E-Business, the Grocery Industry , the Book Industry , the Retail Industry and Impact on Transportation and Fulfillment.

Unit-V   06 Hrs.

Information Technology and Business Process Introduction, The Importance of Business Processes. Goals of Supply Chain IT, Supply Chain Management System Components. Decision-Support Systems, IT for Supply Chain Excellence, Sales and Operations Planning Integrating Supply Chain Information Technology. Implementation of ERP and Decision-Support System.

Unit-VI   08 Hrs.

Technology Standards: Introduction, IT Standards, Information Technology Infrastructure-Interface Devices, System Architecture and Electronic Commerce. Service-Oriented Architecture (SOA)-Technology Base: IBM and Microsoft and ERP Vendor Platform: SAP and Oracle. Radio Frequency Identification (RFID)- applications, point of sale data, business benefits and supply chain efficiency.

Text Books:

1. Sunil Chopra, Peter Meindl, "Supply Chain Management-Strategy, Planning, and Operation", Pearson Publications, 2016.

2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain-Concepts, Strategies, and Case Studies", McGraw-Hill/Irwin, 2008.

Reference Books:

1. Ian Sadler, "Logistics and Supply Chain Integration", SAGE Publications, 2007.

2. Donald Waters, "Supply Chain Management - An Introduction to Logistics", Bloomsbury Publishing, 2019.

3. Dimitris Folinas, "E-Logistics and E-Supply Chain Management-Applications for Evolving Business , IGI Global publications, 2013.

4. Martin Christopher, "Logistics & Supply Chain Management", Pearson Education publications, 2016.