DTE Code: 4151 www.tgpcet.com

TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Approved by AICTE, New Delhi and Govt. of Maharashtra | Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

AN AUTONOMOUS INSTITUTE

# DEPARTMENT OF INFORMATION TECHNOLOGY

# B. Tech in Information Technology
## As Per NEP 2020
## (Version 2)

# Scheme of Instruction
# &
# Syllabus

## Third Year (Fifth Semester)
## From AY. 2025-26

GAIKWAD-PATIL
GROUP OF INSTITUTIONS

# Vision Mission of Institution

Vision - To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission -

- To strive for rearing standard and stature of the students by practicing high standards of Professional ethics, transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- To ascertain holistic development of the students and staff members by inculcating Knowledge and profession as work practices.

# Vision Mission of Department

Vision - To emerge as a learning hub and centre of excellence in the domain of Information Technology

Mission -

- To impart quality technical education through effective teaching learning process.
- To provide a platform to address societal issues as well as challenges faced by IT industries.
- To foster a culture of research and impart innovative and entrepreneurial skills in the field of IT.
- To ensure overall development of students and staff by inculcating knowledge and professional ethics as a part of lifelong learning.

# Program Specific Outcomes

**PSO1: Develop and apply logical and programing skills to solve real-world challenges.**

**PSO2: Utilize knowledge of software engineering and network techniques to design and implement efficient solutions.**

**PSO3: Leverage computing knowledge to conduct research and adopt emerging technologies in the development of IT systems.**

# Program Educational Outcomes

**PEO 1: Demonstrate essential technical skills to identify, analyze and solve problems and design issues in IT Sector.**

**PEO 2: Apply field knowledge, research and professional practices to meet the requirements of industries.**

**PEO3:Imbibe lifelong learning practices and entrepreneurship skills in tune with emerging technologies.**

**PEO 4: Inculcate professional ethics and managerial skills to satisfy real life problems for serving the needs of society and environment.**

# Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

**(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)**

**SCHEME OF INSTRUCTION & SYLLABI**

**Programme: B. Tech. in Information Technology**

**Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)**

## Semester- V

| Sr | Sem | Type | BoS/ Dept | Sub Code | Subject | T/P | Contact Hours | | | Credits | % Weightage | | | ESE Duration | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | L | P | Hrs | | CT/IA | CA | ESE | | |
| 1 | V | PCC | IT | BIT33501 | Advanced Programming with Java | T | 3 | - | 3 | 03 | 30 | 10 | 60 | 3 Hrs | **100** |
| 2 | | PCC | IT | BIT33502 | Theory of Computation | T | 3 | - | 3 | 03 | 30 | 10 | 60 | 3 Hrs | **100** |
| 3 | | PCC | IT | BIT33503 | Design and Analysis of Algorithms | T | 3 | - | 3 | 03 | 30 | 10 | 60 | 3 Hrs | **100** |
| 4 | | PEC | IT | BIT33504-06 | Program Elective-I | T | 4 | - | 4 | 04 | 30 | 10 | 60 | 3 Hrs | **100** |
| 5 | | MDM | ECE | BEC33510 | Digital Logic and Fundamental of Microprocessor | T | 4 | - | 4 | 04 | 30 | 10 | 60 | 3 Hrs | **100** |
| 6 | | OEC | IT | BIT33514 | Open Elective-III | T | 2 | - | 2 | 02 | 14 | 6 | 30 | 2 Hrs | **50** |
| 7 | | PCC | IT | BIT33507 | Advanced Programming with Java Lab | P | - | 2 | 2 | 01 | - | 25 | 25 | - | **50** |
| 8 | | VSEC | IT | BIT33508 | Data Analytics (Lab) | P | - | 2 | 2 | 01 | - | 25 | 25 | - | **50** |
| 9 | | PCC | IT | BIT33509 | Design and Analysis of Algorithms Lab | P | - | 2 | 2 | 01 | - | 25 | 25 | - | **50** |
| **Total** | | | | | | | **19** | **6** | **25** | **22** | **164** | **131** | **405** | **17 Hrs** | **700** |

| Course Category | BSC/ ESC (Basic Science Course/ Engineering Science Course.) | PCC/PEC (Programme Core courses | VSEC (Skill Course) | Multidisciplinary Courses | | Humanities Social Science & Management | | | | Experiential Learning Courses | | | | CC (Co-Curricular Courses) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MDM (Multidisciplinary minor | OE(Open Elective) | AEC(Ability Enhancement Course) | IKS(Indian Knowledge System) | VEC(Value education Course | Management Course | Research Methodology | Field Project | Project | Internship /OJT | |
| Credits | - | 11 / 04 | 01 | 04 | 02 | - | - | - | - | - | - | - | - | - |
| Cumulative Sum | 16 / 13 | 29 / 04 | 07 | 08 | 08 | 04 | 02 | 04 | 04 | - | 2 | - | - | 04 |

PROGRESSIVE TOTAL CREDITS:83+22=105

| | | | | | | |
|---|---|---|---|---|---|---|
| Head of Dept. Information Technology, Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur | Director Academics Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur | Patel | Dr. Premanand Naktode Principal TGPCET, Nagpur | June, 2026 | 2.00 | Applicable for AY 2024-25 Onwards |
| Chairperson | Vice-Principal/ Director Academics | Director Administration | Principal | Date of Release | Version | |

# Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

**(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)**

**SCHEME OF INSTRUCTION & SYLLABI**

**Programme: B. Tech. in Information Technology**

**Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)**

## **Programme:** B. Tech In Information Technology

List of **Program Electives** offered by Information Technology Department

| Program Elective- I | Program Elective-II | Program Elective- III | Program Elective- IV | Program Elective- V |
|---|---|---|---|---|
| **Semester V** | **Semester VI** | **Semester VI** | **Semester VII** | **Semester VII** |
| **BIT33504-** Software Engineering & Project Management | **BIT33603-** Ethical Hacking | **BIT33606-** Digital Forensics | **BIT34704-** Reinforcement Learning | **BIT34707-** Generative AI |
| **BIT33505-** Data Warehousing and Mining | **BIT33604-** Social Media Analytics | **BIT33607-** Big Data Analytics | **BIT34705-** Deep Learning | **BIT34708-** Information Retrieval |
| **BIT33506-** Cloud Computing | **BIT33605-** Cyber Laws and Ethics | **BIT33608-** Natural Language Processing | **BIT34706-** Computer Vision | **BIT34709-** Multimedia Forensics |

## **Program**: B. Tech in Information Technology

List of **Open Electives** offered by Information Technology

| Open Elective-I | Open Elective-II | Open Elective-III |
|---|---|---|
| Semester-III | Semester-IV | Semester-V |
| BIT32312- Operating Systems | BIT32413- Artificial Intelligence | BIT33514- Cyber Security |

| | | | | | | |
|---|---|---|---|---|---|---|
| Head of Dept. Information Technology, Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur | Director Academics Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur | Patil | Dr. Premanand Naktode Principal TGPCET, Nagpur | June, 2026 | 2.00 | Applicable for AY 2024-25 Onwards |
| Chairperson | Vice-Principal/ Director Academics | Director Administration | Principal | Date of Release | Version | |

# Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

**(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)**

**SCHEME OF INSTRUCTION & SYLLABI**

**Programme: B. Tech. in Information Technology**

**Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)**

## HONORS SPECIALIZATION IN CYBER SECURITY

| Sr. No | Sem | Course Code | Subject | Nature of Evaluation | Credits |
|---|---|---|---|---|---|
| 1 | III | BIT32325 | Computer Networks and Internet Protocol | ESE | 03 |
| 2 | IV | BIT32425 | Foundations of Cryptography | ESE | 03 |
| 3 | V | BIT33525 | Secure Computation | ESE | 03 |
| 4 | VI | BIT33625 | Cyber Security and Privacy | ESE | 03 |
| | | BIT33626 | Online Privacy | ESE | |
| 5 | VII | BIT34725 | Block Chain and its Applications | ESE | 03 |
| 6 | VIII | BIT34825 | Internship(Cyber Security 1 month) | ESE | 03 |
| 7 | | BIT34826 | Capstone Project | ESE | |
| **Total** | | | | | 18 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Head of Dept. Information Technology, Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur | Director Academics Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur | Patil | Dr. Premanand Naktode Principal TGPCET, Nagpur | June, 2026 | 2.00 | Applicable for AY 2024-25 Onwards |
| Chairperson | Vice-Principal/ Director Academics | Director Administration | Principal | Date of Release | Version | |

# Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

**(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)**

**SCHEME OF INSTRUCTION & SYLLABI**

**Programme: B. Tech. in Information Technology**

**Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)**

## MINORS SPECIALIZATION IN INFORMATION TECHNOLOGY

| Sr. No | Sem | Course Code | Subject | Nature of Evaluation | Credits |
|---|---|---|---|---|---|
| 1 | III | BIT32321 | Introduction to Operating System | ESE | 03 |
| 2 | IV | BIT32421 | Programming Using C++ | ESE | 03 |
| 3 | V | BIT33521 | Introduction to Database Systems | ESE | 03 |
| 4 | VI | BIT33621 | Programming In Java | ESE | 03 |
| 5 | VII | BIT34721 | An Introduction to Artificial Intelligence | ESE | 03 |
| 6 | VIII | BIT34821 | Internship(8 Weeks)/ Capstone Project | ESE | 03 |
| **Total** | | | | | 18 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Head of Dept. (Information Technology) Tulsiramji Gaikwad-Patil College of Engineering & Technology Nagpur | Director Academics Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur | Patel | Dr. Premanand Naktode Principal TGPCET, Nagpur | June, 2026 | 2.00 | Applicable for AY 2024-25 Onwards |
| Chairperson | Vice-Principal/ Director Academics | Director Administration | Principal | Date of Release | Version | |

# Exit Course

**Award of UG Certificate (After First Year)**

| Sr. No | Course Name | Mode of conduction | Credits |
|---|---|---|---|
| 01 | Networking/IT support | Certification Online/Offline/NPTEL | 04 |
| 02 | Programming in C++ | Certification Online/Offline/NPTEL | 04 |
| **OR** | | | |
| 03 | Internship(16 week) | - | 08 |
| **Total** | | | **08** |

**Award of Diploma (After 2 Year)**

| Sr. No | Course Name | Mode of conduction | Credits |
|---|---|---|---|
| 01 | Artificial Intelligence | Certification Online/Offline/NPTEL | 04 |
| 02 | Cloud Computing | Certification Online/Offline/NPTEL | 04 |
| **OR** | | | |
| 03 | Internship(16 week) | - | 08 |
| **Total** | | | **08** |

# Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

**(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)**

**SCHEME OF INSTRUCTION & SYLLABI**

**Programme: B. Tech. in Information Technology**

**Scheme of Instructions: B. Tech. Information Technology (As Per NEP 2020)**

## Exit Course

**Award of Vocational Degree (After 3 Year)**

| Sr. No | Course Name | Mode of conduction | Credits |
|---|---|---|---|
| 01 | Cyber Security | Certification Online/Offline/NPTEL | 04 |
| 02 | Industry 4.0 | Certification Online/Offline/NPTEL | 04 |
| **OR** | | | |
| 03 | Internship(16 week) | - | 08 |
| **Total** | | | **08** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Head of Dept. Information Technology, Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur | Director Academics Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur | Patil | Dr. Premanand Naktode Principal TGPCET, Nagpur | June, 2026 | 2.00 | Applicable for AY 2024-25 Onwards |
| Chairperson | Vice-Principal/ Director Academics | Director Administration | Principal | Date of Release | Version | |

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**
Wardha Road, Nagpur-441 108
**NAAC Accredited (A+ Grade)**

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33501:-Advanced Programming with Java

| Teaching Scheme | |
|---|---|
| **Theory** | **3 Hrs/week** |
| **Tutorial** | **-** |
| **Total Credits** | **3** |

| Examination Scheme | |
|---|---|
| CT-I | 15 Marks |
| CT-II | 15 Marks |
| CA | 10 Marks |
| ESE | 60 Marks |
| Total | 100 Marks |
| Duration of ESE: 3Hrs | |

**Course Objectives:**

| | |
|---|---|
| 1. | To Classify Core Java Fundamentals. |
| 2. | To Analyze arrays, packages, and interfaces to develop modular and reusable Java applications. |
| 3. | To Develop and Manage Multithreaded Applications |
| 4. | To Utilize inheritance and polymorphism principles to create scalable Java applications |
| 5. | To Demonstrate Knowledge of JDBC for Database Connectivity |

### Course Contents

| | |
|---|---|
| **Unit I** | **Fundamentals of Java**<br>Java Overview and Features, JDK, JRE, JVM, Bytecode, Primitive and User Defined Data Types, Variables and Scope, Operators, Control Structures, Objects and Classes, Constructors, Access Modifiers, Collections Framework, Lambda Expressions, Method References, Introduction to Functional Programming. |
| **Unit II** | **Arrays, Packages, Interfaces, and Exception Handling**<br>**Arrays in Java:** One-Dimensional, Multidimensional and Jagged Arrays, Arrays Utility Class.<br>**Packages**: Built-in Packages, User Defined Packages, Static Import, Introduction to JPMS.<br>**Interfaces**: Defining, Extending and Implementing Interfaces, Default and Static Methods, Functional Interfaces.<br>**Exception Handling**: Checked and Unchecked Exceptions, try-catch, Multiple Catch Blocks, throw and throws, finally, Try-with-Resources, Custom Exceptions. |
| **Unit III** | **Multithreaded Programming and Concurrency**<br>Introduction to Multithreading, Thread Creation using Thread and Runnable, Thread Life Cycle, Thread Synchronization, Inter-Thread Communication, Deadlock and Race Conditions, Executor Framework, Thread Pools, Concurrency Utilities, Introduction to Virtual Threads. |
| **Unit IV** | **Object-Oriented Programming Concepts**<br>Inheritance and Types of Inheritance, Method Overriding, super and final Keywords, Abstract Classes, Polymorphism, Dynamic Method Dispatch, Encapsulation, Composition vs Inheritance, Introduction to SOLID Principles. |

| | |
|---|---|
| **Unit V** | **Strings, JDBC, and Networking**<br>**Strings in Java**: String, String Builder, String Buffer, String Manipulation Methods, Regular Expressions.<br>**Date and Time API**: Date, Calendar, Simple Date Format, Modern Date-Time API.<br>**Java Database Connectivity (JDBC):** Introduction to JDBC, JDBC Architecture, JDBC Drivers, Driver Manager, Statement, Prepared Statement, Callable Statement, ResultSet Handling, Transaction Management, Connection Pooling, Introduction to ORM and Hibernate.<br>**Java Networking:** TCP/IP, TCP and UDP Protocols, Socket Programming using Socket, ServerSocket, DatagramSocket, DatagramPacket, InetAddress, URL and URLConnection, Client-Server Applications, SSL/TLS. |
| **Text Books** | |
| T.1 | Java Programming Language Learn Java from Basic to Advance 2022 by Aamer Khan |
| **Reference Books** | |
| R.1 | Programming with Java: Beginner to Advanced, 7ed (An Indian Adaptation) by Cay S. Horstmann, Wiley Editorial Team |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc22_cs47/preview |
| 2 | https://www.programiz.com/java-programming |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| **BIT33501.1** | Classify the operators in Java for solving computational tasks. | 2 | 9 |
| **BIT33501.2** | Illustrate modular Java applications using arrays, packages, interfaces, and exception handling. | 2 | 9 |
| **BIT33501.3** | Demonstrate multithreaded and concurrent Java applications using thread management and synchronization techniques | 3 | 9 |
| **BIT33501.4** | Interpret OOP principles for scalable Java applications. | 3 | 9 |
| **BIT33501.5** | Apply JDBC and networking concepts to develop database-driven and client-server Java applications. | 3 | 9 |

Head of Dept. (Information Technology)
Tulsiramji Gaikwad-Patil College of
Engineering & Technology, Nagpur

| | | |
|---|---|---|
| | **Tulsiramji Gaikwad-Patil College of Engineering and Technology**<br>Wardha Road, Nagpur-441 108<br>**NAAC Accredited (A+ Grade)** | |

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33502:- Theory of Computation

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| **Theory** | **3 Hrs/week** | CT-I | 15 Marks |
| **Tutorial** | **-** | CT-II | 15 Marks |
| **Total Credits** | **3** | CA | 10 Marks |
| | | ESE | 60 Marks |
| | | Total | 100 Marks |
| | | Duration of ESE: 3Hrs | |

**Course Objectives:**

| | |
|---|---|
| 1. | To illustrate finite state machines to solve problems in computing |
| 2. | To classify the theoretical foundations of computer science from the perspective of formal languages |
| 3. | To familiarize Regular grammars, context frees grammar. |
| 4. | To enhance students' ability to understand and conduct mathematical proofs for computation and algorithms. |
| 5. | To explain the hierarchy of problems arising in the computer sciences |

**Course Contents**

| | |
|---|---|
| **Unit I** | Introduction: String, Alphabet, Symbols, Sets, Language, Finite Automata: Design of Finite Automata, Acceptance of strings and languages, Deterministic Finite Automation, Non-Deterministic Finite Automation, Equivalence between NFA and DFA , NFA with ε-transition, Minimization of FA, Equivalence between two FSM‟s Moore and Mealy machines. |
| **Unit II** | Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma for regular languages, closure properties of regular sets, properties of regular languages, Chomsky hierarchy of languages, Regular grammars, Right linear and left linear regular grammars, Equivalence between regular grammar and FA, Inter conversion between RE and RG. |
| **Unit III** | Context free grammar, Derivation trees (Parse tree), Syntax tree , Ambiguous Grammar, Context Free Language (CFL), Closure properties of CFL, Simplification of CFG, Normal Forms of grammar: Chomsky Normal Form (CNF), Greibach Normal Form (GNF), Push down automata, definition and model, acceptance of CFL by empty Stack and by final state, Introduction of DCFL and DPDA. |
| **Unit IV** | Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Variants of Turing machines, non-deterministic TMs and equivalence with deterministic TMs, context sensitive language (CSG), Linear bounded automata. |

| | |
|---|---|
| **Unit V** | Decidability and Undecidability of problems, Properties of recursive & recursively enumerable languages, Halting problems, Post correspondence problem, Ackerman function, and Church‟s hypothesis. Recursive function: Basis functions and operations on them. Bounded minimization, unbounded minimization, preemptive recursive function and μ recursive function. |
| **Text Books** | |
| T.1 | Introduction to Automata Theory, Languages and computation, 2nd edition,2000 by John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Education Asia. |
| T.2 | Introduction to Languages and the theory of Automata by John Martin, Third Edition(TMH) |
| **Reference Books** | |
| R.1 | Theory of Computer Science, Automata, Languages and Computation by K. L. P. Mishra and N. Chandrasekaran, Third Edition, PHI Learning. |
| R.2 | Theory of Computation, edition 2008, O.G. Kakde, USP |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc21_cs83/preview |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| **BIT33502.1** | Illustrate the properties of formal languages to construct Finite automata. | 2 | 9 |
| **BIT33502.2** | Interpret Finite Automata's for Regular Expressions and Languages. | 3 | 9 |
| **BIT33502.3** | Compare the grammar & test the equivalence of pushdown automata and CFL. | 4 | 9 |
| **BIT33502.4** | Examine a computational model using Turing machine for the given problem. | 4 | 9 |
| **BIT33502.5** | Evaluate problems of decidability and computability using principles of computational theory. | 5 | 9 |

Head of Dept. (Information Technology)
Tulsiramji Gaikwad-Patil College of
Engineering & Technology, Nagpur

.

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur-441 108

NAAC Accredited (A+ Grade)

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33503:-Design Analysis of Algorithms

| Teaching Scheme | |
|---|---|
| **Theory** | **3 Hrs/week** |
| **Tutorial** | **-** |
| **Total Credits** | **3** |

| Examination Scheme | |
|---|---|
| CT-I | 15 Marks |
| CT-II | 15 Marks |
| CA | 10 Marks |
| ESE | 60 Marks |
| Total | 100 Marks |
| Duration of ESE: 3Hrs | |

**Course Objectives:**

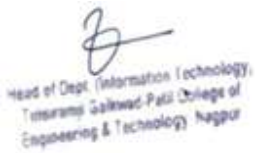
| | |
|---|---|
| 1. | To Understand the foundational concepts, characteristics, and performance analysis of algorithms. |
| 2. | To explore algorithm design paradigms using algorithms. |
| 3. | To classify classical algorithms for appropriate strategies and recurrence relations. |
| 4. | To Develop efficient solutions for complex problems through structured algorithmic techniques. |
| 5. | To examine the complexity classes, and understand non-deterministic algorithms. |

### Course Contents

| | |
|---|---|
| **Unit I** | **Analysis of Algorithm**<br>Characteristics of algorithm, Principles of designing algorithm, Asymptotic notations, Best, average and worst-case behavior, Time & Space Complexity of Algorithm, Recurrences-Substitution method, recursion method, recurrence tree method, master method, Fundamental algorithmic Strategies. |
| **Unit II** | **Divide and Conquer Strategy**<br>Basic Strategy, Analysis of Quick Sort, Quick sort Randomized Version, Analysis of Merge Sort, Strassen's Matrix Multiplication, Maximum Array Problem<br>**Greedy Method**<br>Basic Strategy, Fractional Knapsack Problem, Huffman Coding, Minimum Cost Spanning Tree: Kruskal's and Prim's Algorithm |
| **Unit III** | **Dynamic Programming**<br>Basic strategy, Floyd War shall Algorithm, Multistage graphs, Optimal Binary Search Tree, traveling salesman problem, Longest Common Subsequence problem, 0/1 Knapsack Problem, Chained Matrix Multiplication. |
| **Unit IV** | **Backtracking**<br>Basic strategy, n queen problem, Sum of Subset, Graph Coloring, Hamilton Cycle<br>**Branch and Bound Method**<br>General method, Traveling salesman problem, 0/1 knapsack problem, LC branch and bound solution, FIFO Brach and Bound solution, LIFO Brach and Bound solution. |

| | |
|---|---|
| **Unit V** | **NP Problems**<br>NP-Hard and NP Complete problems: Basic concepts, Non Deterministic algorithms, NP-Hard and NP Complete classes, NP- Hard problems, Cook's Theorem |
| **Text Books** | |
| T.1 | Design & Analysis of Computer Algorithms by Aho, Pearson education. Horowitz, Sa Rajsekharam |
| T.2 | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Cliford Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010. |
| **Reference Books** | |
| R.1 | Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, "The Design and Analysis of Computer Algorithms", First Edition, Pearson Education, 2006. |
| R.2 | Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich R. Tomassia, John Wiley and sons |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/106/101/106101060/ |
| 2 | https://nptel.ac.in/courses/106/106/106106131/ |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| **BIT33503.1** | Classify algorithm efficiency and fundamental algorithmic strategies. | 2 | 9 |
| **BIT33503.2** | Demonstrate Divide & Conquer and Greedy strategies to solve problems and analyze their efficiency | 3 | 9 |
| **BIT33503.3** | Implement Dynamic Programming techniques to solve complex optimization problems | 3 | 9 |
| **BIT33503.4** | Apply Backtracking and Branch & Bound strategies to solve combinatorial problem. | 3 | 9 |
| **BIT33503.5** | Analyze NP-Hard and NP-Complete problems by identifying problem classes | 4 | 9 |



| | | |
|---|---|---|
| | **Tulsiramji Gaikwad-Patil College of Engineering and Technology**<br>Wardha Road, Nagpur-441 108<br>**NAAC Accredited (A+ Grade)** | |

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33504:-Software Engineering & Project Management (Program Elective-I)

| Teaching Scheme | | | Examination Scheme | |
|---|---|---|---|---|
| **Theory** | **4 Hrs/week** | | CT-I | 15 Marks |
| **Tutorial** | **-** | | CT-II | 15 Marks |
| **Total Credits** | **4** | | CA | 10 Marks |
| | | | ESE | 60 Marks |
| | | | Total | 100 Marks |
| | | | Duration of ESE: 3Hrs | |

**Course Objectives:**

| | |
|---|---|
| 1. | To classify the nature and types of software, including the special characteristics of WebApps. |
| 2. | To Explore flow-oriented and behavioral modeling strategies. |
| 3. | To Understand the concept of agility and how it addresses the cost of change. |
| 4. | To Identify the factors contributing to project success or failure |
| 5. | To Explore quality models and their application in ensuring deliverable standards. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Software and Software Engineering**: The nature of Software, The unique nature of WebApps, Software Engineering, The software Process, Software Engineering Practice, Software Myths.<br>**Process Models**: A generic process model, Process assessment and improvement, Prescriptive process models: Waterfall model, Incremental process models, Evolutionary process models, Concurrent models, Specialized process models. Unified Process, Personal and Team process models |
| **Unit II** | **Understanding Requirements**: Requirements Engineering, Establishing the ground work, Eliciting Requirements, developing use cases, Building the requirements model, Negotiating Requirements, Validating Requirements.<br>**Requirements Modeling Scenarios, Information and Analysis classes**: Requirement Analysis, Scenario based modeling, UML models that supplement the Use Case, Data modeling Concepts, Class-Based Modeling.<br>**Requirement Modeling Strategies**: Flow oriented Modeling, Behavioral Modeling. |
| **Unit III** | **Agile Development**: Define Agility and its process, Agility and the cost of change. Extreme Programming (XP), Other Agile Process Models, a tool set for Agile process.<br>**Principles that guide practice**: Software Engineering Knowledge, Core principles, Principles that guide each framework activity. |

| | |
|---|---|
| **Unit IV** | **Introduction to Project Management**: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.<br>**Project Evaluation**: Evaluation of Individual projects, Cost–benefit Evaluation Techniques, Risk Evaluation |
| **Unit V** | **Software Quality**: Introduction, The place of software quality in project planning, Importance of software quality, Defining software quality, Software quality models, product versus process quality management.<br>**Software Project Estimation**: Observations on Estimation, Decomposition Techniques, Empirical Estimation Models. |
| **Text Books** | |
| T.1 | Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill |
| T.2 | Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018. |
| **Reference Books** | |
| R.1 | "Software Engineering: Principles and Practice", Hans van Vliet, Wiley India, 3rd Edition, 2010. |
| R.2 | Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India. |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc20_cs68/preview |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| BIT33504.1 | Explain the nature and fundamental principles of software engineering. | 2 | 9 |
| BIT33504.2 | Classify requirements engineering techniques to identify, analyze, and model user requirements. | 2 | 9 |
| BIT33504.3 | Demonstrate Agile methodologies and their use in dynamic project environments. | 3 | 9 |
| BIT33504.4 | Discuss project management principles to plan, execute, and control software projects. | 2 | 9 |
| BIT33504.5 | Analyze software quality and estimation techniques to improve project outcomes. | 4 | 9 |

Head of Dept. (Information Technology)
Tukaramji Gulabrao Patil College of
Engineering & Technology, Nagpur

| | | |
|---|---|---|
| | **Tulsiramji Gaikwad-Patil College of Engineering and Technology**<br>Wardha Road, Nagpur-441 108<br>**NAAC Accredited (A+ Grade)** | |

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33505:- Data Warehousing and Mining (Program Elective-I)

| Teaching Scheme | | | Examination Scheme | |
|---|---|---|---|---|
| **Theory** | **4 Hrs/week** | | CT-I | 15 Marks |
| **Tutorial** | **-** | | CT-II | 15 Marks |
| **Total Credits** | **4** | | CA | 10 Marks |
| | | | ESE | 60 Marks |
| | | | Total | 100 Marks |
| | | | Duration of ESE: 3Hrs | |

**Course Objectives:**

| | |
|---|---|
| 1. | To classify the fundamentals, need, structure, and cost of data warehousing for effective data management. |
| 2. | To classify data warehousing architecture, modeling techniques, ETL processes, and OLAP operations for efficient data analysis. |
| 3. | To explain data preprocessing techniques, and transformation, for improving data quality. |
| 4. | To provide fundamental knowledge of data mining concepts, techniques, and applications |
| 5. | To introduce classification techniques and equip students with the ability to compare and apply different classifiers effectively. |

### Course Contents

| | |
|---|---|
| **Unit I** | Introduction to Data Warehousing, The need for data warehousing, Operational & Informational Data Stores, Data Warehouse Characteristics, Data Warehouse role & Structure, The cost of warehousing data. |
| **Unit II** | Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations |
| **Unit III** | Data Preprocessing: Data Processing An overview: Data Quality, Major Task in data Prepossessing. Data Cleaning Missing Values, Noisy Data, Data cleaning as a Process. Data Integration, Data Reduction, Data Transformation Strategies Overview. |

| | |
|---|---|
| **Unit IV** | Data Mining: Fundamentals of data mining, Relationship of data warehousing and data mining, what is data mining, kind of data mined, kind of patterns mined, Technologies used for mining, kind of application targeted by mining, Major issues in data mining, Data mining applications. |
| **Unit V** | Buisness Intilligence and Big Data: BI-Defining Business Intelligence, Important factors in BI, BI Architecture, BI framework. Development of BI system, BI applications in Marketing, Logistics and Production, Retail Industry. Big Data: Understanding the challenges of Big data, Big data meets hadoop. Hadoop: Meeting Big data challenges, Hadoop Ecosystem, Core components, developing applications with Hadoop. |
| **Text Books** | |
| T.1 | Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014 |
| T.2 | Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012 |
| **Reference Books** | |
| R.1 | The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling 3rd Edition by Ralph Kimball , Margy Ross |
| **Useful Links** | |
| 1 | http://nptel.ac.in/courses/106106093/35 |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| **BIT33505.1** | Classify data warehouse concepts and their role in enabling business intelligence. | 2 | 9 |
| **BIT33505.2** | Illustrate data warehouse models, and perform OLAP operations using multidimensional data models | 2 | 9 |
| **BIT33505.3** | Apply data preprocessing strategies to handle raw data for effective analysis. | 3 | 9 |
| **BIT33505.4** | Analyze data and patterns along with suitable mining technologies. | 4 | 9 |
| **BIT33505.5** | Examine the architecture, and framework of Business Intelligence using Hadoop ecosystem. | 4 | 9 |

Head of Dept. (Information Technology)
Tulsiramji Gaikwad-Patil College of Engineering & Technology Nagpur

| | | |
|---|---|---|
| | **Tulsiramji Gaikwad-Patil College of Engineering and Technology**<br>Wardha Road, Nagpur-441 108<br>**NAAC Accredited (A+ Grade)** | |

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33506:-Cloud Computing (Program Elective-I)

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| **Theory** | **4 Hrs/week** | CT-I | 15 Marks |
| **Tutorial** | **-** | CT-II | 15 Marks |
| **Total Credits** | **4** | CA | 10 Marks |
| | | ESE | 60 Marks |
| | | Total | 100 Marks |
| | | Duration of ESE: 3Hrs | |

**Course Objectives:**

| | |
|---|---|
| 1. | To classify the fundamentals of cloud computing and virtualization |
| 2. | To gain insights into service deployment, performance, and scalability management. |
| 3. | To explore cloud-based data and resource management |
| 4. | To Evaluate security challenges and risk management strategies in cloud environments |
| 5. | To Familiarize with leading cloud platforms |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Introduction to Cloud Computing and Virtualization**: Virtualization Concepts, Cloud Computing Fundamental: Overview of Computing Paradigm, Evolution of cloud computing, Defining cloud computing, Components of a computing cloud, Essential Characteristics of Cloud Computing, Cloud Taxonomy. Infrastructure as a Service, Platform as a Service(PaaS), Software as a Service (SaaS), Hardware-as-a-service, Oriented Architecture (SOA) |
| **Unit II** | **Cloud Computing Architecture and Service Management in Cloud**: Computing Cloud architectural principles, Role of Web services, Benefits and challenges to Cloud architecture, Cloud Service Models, cloud computing vendors. Cloud Services, Management, Performance and scalability of services, tools and technologies used to manage cloud services deployment |
| **Unit III** | **Management in Cloud**: Data Management in Cloud Computing and Resource Management in Cloud, Big Data in the Cloud.<br>**Salesforce as Cloud CRM**: Overview of Salesforce platform and services, Use of Salesforce for cloud-based customer relationship management, Case studies on Salesforce integration and deployment in cloud environments |
| **Unit IV** | **Cloud Security and Risk Management**: Cloud Security: Understanding cloud based security issues and threats, Data security and Storage, Identity & Access Management, Risk Management in cloud, Governance and Enterprise Risk Management. |
| **Unit V** | **Open Source and Commercial Clouds**: Openstack, AWS, Google Cloud, Microsoft Azure, Cloud Simulator and IoT Cloud Framework, Research trend in Cloud Computing, Fog Computing. |

| Text Books | |
|---|---|
| T.1 | Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011 |
| T.2 | Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010 |
| **Reference Books** | |
| R.1 | Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010 |
| R.2 | Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India,2010 |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc21_cs14/preview |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| **BIT33506.1** | Explain the concepts of virtualization and the fundamental principles of cloud computing. | 2 | 9 |
| **BIT33506.2** | Classify cloud architecture principles and service management techniques. | 2 | 9 |
| **BIT33506.3** | Discuss concepts of data and resource management in cloud | 2 | 9 |
| **BIT33506.4** | Analyze cloud security mechanisms and risk mitigation strategies. | 4 | 9 |
| **BIT33506.5** | Compare open-source and commercial cloud platforms and examine modern cloud research trends. | 4 | 9 |

Head of Dept. Information Technology,
Tulsiramji Gaikwad-Patil College of
Engineering & Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur-441 108

**NAAC Accredited (A+ Grade)**

## Third Year (Semester-V) B. Tech. Information Technology

## BEC33510: Digital Logic and Fundamental of Microprocessor

| Teaching Scheme | |
|---|---|
| **Theory** | **4 Hrs/week** |
| **Tutorial** | **-** |
| **Total Credits** | **4** |

| Examination Scheme | |
|---|---|
| CT-I | 15 Marks |
| CT-II | 15 Marks |
| CA | 10 Marks |
| ESE | 60 Marks |
| Total | 100 Marks |
| Duration of ESE: 3Hrs | |

**Course Objectives:**

| | |
|---|---|
| 1. | To classify the working principles of various combinational circuits and their applications in different digital systems. |
| 2. | To analyze and recognize various sequential components utilized in the design of combinational circuits. |
| 3. | To develop the skills to design and validate the operation of various combinational and sequential circuits. |
| 4. | To provide knowledge on the 8085 microprocessors, covering its architecture, functionalities, addressing modes, port types, and practical applications. |
| 5. | To explore the use of Assembly language programming for the 8085 microprocessor, emphasizing its timing, control features in industrial embedded systems. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Logic Simplification:** Number system, Binary Arithmetic, Boolean algebra and De Morgan's Theorem, Logic Gates, SOP & POS forms, Logic Optimization Technique, Karnaugh maps. |
| **Unit II** | **Combinational logic Design:** Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Adder, Subtractors. Minimization of combinational circuits. |
| **Unit III** | **Sequential Logic Design**: Latches, Flip flop – S-R, J-K, D, T and Master-Slave JK FF, Counters, Shift registers. Excitation table, Conversion of one type of F/F to another. |
| **Unit IV** | **Microprocessor Introduction:** 8085 microprocessor architecture, addressing modes, instruction sets. |
| **Unit V** | **Interrupts & Programming:** Interrupts, Basic memory organization, Timing diagram, Programming in 8085. |

| Text Books | |
|---|---|
| T.1 | Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016. |
| T.2 | Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009. |
| **Reference Books** | |
| R.1 | Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016. |
| R.2 | Digital Electronic Principles, By Malvino PHI, 3 Edition. 2014 |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc21_ee10/preview |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| **BEC33510.1** | Express number systems and logic simplification techniques using Boolean algebra and Karnaugh maps. | 2 | 9 |
| **BEC33510.2** | Identify the sequential components used in combinational circuits. | 2 | 9 |
| **BEC33510.3** | Demonstrate functionality of various combinational and sequential circuits. | 3 | 9 |
| **BEC33510.4** | Apply the features, addressing modes, and port types of the 8085 microprocessor in real-time applications | 3 | 9 |
| **BEC33510.5** | Interpret assembly language program for 8085 Microprocessor, Timing and Control Panel of 8085. | 3 | 9 |

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**
Wardha Road, Nagpur-441 108
**NAAC Accredited (A+ Grade)**

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33514:- Cyber Security(Open Elective-III)

| Teaching Scheme | |
|---|---|
| Theory | 2 Hrs/week |
| Tutorial | - |
| Total Credits | 2 |

| Examination Scheme | |
|---|---|
| CT-I | 07 Marks |
| CT-II | 07 Marks |
| CA | 06 Marks |
| ESE | 30 Marks |
| Total | 50 Marks |
| Duration of ESE: 2Hrs | |

**Course Objectives:**

| | |
|---|---|
| 1. | To Understand fundamental cybersecurity concepts, and types of cybercrimes |
| 2. | To Identify security challenges wireless computing, and comprehend organizational policies to evaluate associated risks. |
| 3. | To Explore emerging trends in cybersecurity. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Fundamentals of Cybersecurity :**<br>Introduction to Cyber Security, CIA (Confidentiality, Integrity, and Availability) triad, threat, vulnerability, introduction to cybercrime ,Reasons of cybercrime, Types of cybercrime, Mobile and wireless device. |
| **Unit II** | **Mobile and Wireless Security :**<br>Credit Card Fraud in Smart Phone and Wireless Computing Era; Security challenges posed by Mobile devices; Authentication Service Security, Attacks on Mobile, Security implication for Organizations; Organizational Security polices and Measures in Mobile Computing Era, UPI Security. |
| **Unit III** | **Cyber Threats and Defense Mechanisms :**<br>Introduction to Emerging Trends in Cyber Security, Fighting cyber-Attacks-Authentication, Phishing Attacks, Password Cracking Techniques, Spyware, Viruses and Worms<br>Basic Defense Mechanisms: Authentication Methods, Cryptography, Firewalls, Secure Web Browsing Practices<br>**Emerging Trends in Cybersecurity :**<br>Internet of Things (IoT) Security, Artificial Intelligence and Machine Learning in Cybersecurity, Blockchain Technology and Cybersecurity, Careers in Cybersecurity |

**Text Books**

| | |
|---|---|
| T.1 | Cryptography and Network Security Principles and Practice, 8th Edition - Pearson - by William Stallings |
| T.2 | A. Basta, N. Basta, M. Brown, R. Kumar, Cyber Security and Cyber Laws, Cengage, 2018. |

| Reference Books | |
|---|---|
| R.1 | W. Stallings and L. Brown, Computer Security: Principles and Practice, 4th ed. Pearson, 2018. |
| R.2 | R. Meeuwisse, Cybersecurity for Beginners (2nd ed.). Cyber Simplicity Ltd., 2017. |
| **Useful Links** | |
| 1 | https://onlinecourses.swayam2.ac.in/nou19_cs08/preview |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| **BIT33514.1** | Explain key cybersecurity principles and types of cybercrimes. | 2 | 10 |
| **BIT33514.2** | Analyze security issues in mobile and wireless computing to mitigate risks through organizational policies.. | 4 | 10 |
| **BIT33514.3** | Evaluate emerging technologies in cybersecurity, and assess their implications for future security challenges. | 5 | 10 |

Head of Dept. (Information Technology)
Tulsiramji Gaikwad-Patil College of
Engineering & Technology, Nagpur

# Tulsiramji Gaikwad -Patil College of Engineering and Technology

Wardha Road, Nagpur-441108

NAAC Accredited with A+ Grade

(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

## Third Year (Semester-V) B. Tech Information Technology

## BIT33507: Advance Programming with Java Lab

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| Practical | 2 Hrs/week | CA | 25 Marks |
| Total Credits | 1 | ESE | 25 Marks |
| | | Total | 50 Marks |

| Sr. No | List of Practical | CO |
|---|---|---|
| 1 | Develop a Java program to demonstrate the use of data types, operators, and control structures. | CO1 |
| 2 | Implement a Java application using classes, objects, constructors, and basic collection classes. | CO1 |
| 3 | Develop a Java program to perform operations on one-dimensional and multidimensional arrays using Arrays utility methods. | CO2 |
| 4 | Implement a Java application demonstrating packages, interfaces, and exception handling mechanisms. | CO2 |
| 5 | Develop a multithreaded Java application using Thread class and Runnable interface. | CO3 |
| 6 | Implement thread synchronization and basic concurrency using Executor Framework. | CO3 |
| 7 | Develop a Java application demonstrating inheritance and method overriding concepts. | CO4 |
| 8 | Implement a Java program using abstraction, polymorphism, and encapsulation principles. | CO4 |
| 9 | Develop a Java application for string manipulation and date-time operations. | CO5 |
| 10 | Implement a basic Java application for JDBC database connectivity and socket-based client-server communication. | CO5 |

| Text Books | |
|---|---|
| 1 | "Competitive Programming" by Steven Halim & Felix Halim |
| 2 | Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein |
| **Reference Books** | |
| 1 | Elements of Programming Interviews in Java" by Adnan Aziz, Tsung-Hsien Lee, and Amit Prakash |
| 2 | Java Programming for Problem Solving" by P. S. Deshpande & O. G. Kakde. |
| **Useful Links** | |
| 1 | https://www.hackerrank.com/domains/tutorials/10-days-of-java |
| 2 | https://onlinecourses.nptel.ac.in/noc22_cs47/preview |

| | Course Outcomes | CL | Lab Sessions |
|---|---|---|---|
| **BIT33507.1** | Classify the operators in Java for solving computational tasks. | 2 | 4 |
| **BIT33507.2** | Illustrate modular Java applications using arrays, packages, interfaces, and exception handling. | 2 | 4 |
| **BIT33507.3** | Demonstrate multithreaded and concurrent Java applications using thread management and synchronization techniques | 3 | 4 |
| **BIT33507.4** | Interpret OOP principles for scalable Java applications. | 3 | 4 |
| **BIT33507.5** | Apply JDBC and networking concepts to develop database-driven and client-server Java applications. | 3 | 4 |

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**
Wardha Road, Nagpur-441 108
**NAAC Accredited (A+ Grade)**

## Third Year (Semester-V) B. Tech. Information Technology

## BIT33508:- Data Analytics Lab

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| Practical | 2 Hrs/week | CA | 25 Marks |
| Tutorial | - | | |
| Total Credits | 1 | ESE | 25 Marks |
| | | Total | 50 Marks |

**Course Objectives:**

| | |
|---|---|
| 1. | To understand fundamentals of data analysis, business analytics, and project workflows. |
| 2. | To analyze the statistics, sampling, and exploratory data analysis to interpret datasets. |
| 3. | To explore the concept of hypothesis testing, correlation analysis, and draw insights from sample data |
| 4. | To classify skills in R programming, data handling, visualization, and EDA for continuous and categorical variables. |
| 5. | To illustrate feature engineering, predictive modeling, and create interactive visualizations using Tableau integrated with R/Python. |

**Course Contents**

| | |
|---|---|
| **Unit I** | Introduction to data analysis: Overview, Data Science vs Data Analysis, Business Analytics classification, Data Science Project workflow, Project Roles, Introduction to R programming, R Studio, Applications of R |
| **Unit II** | Basics of Statistics: Population, Sample, Parameter, Statistic, Types of data: Qualitative & Quantitative. Sampling Methods: Simple Random Sampling, Systematic Sampling, Cluster Sampling, Stratified Sampling, Biased / Non-probability Sampling, Sampling Error. Exploratory Data Analysis (EDA)**:** Summary statistics, Handling missing values & outliers, Basic graphs: Histogram, Box plot, Bar chart. Measures of Central Tendency**:** Mean, Median, Mode, Mid-range, Measures of Dispersion**:** Range, Variance, Standard Deviation, Mean Deviation |
| **Unit III** | Introduction to Hypothesis Bayes theorem, Basics and need of hypothesis and hypothesis testing, Pearson Correlation, Sample Hypothesis testing. |
| **Unit IV** | Basic Data Analysis through RStudio, Essentials of R Programming: Data Types and Objects in R, Control Structures (Functions) in R, Useful R Packages, Exploratory Data Analysis in R : Basic Graphs, Treating Missing values, Working with Continuous and Categorical Variables |
| **Unit V** | Data Manipulation in R: Feature Engineering, Label Encoding and One Hot Encoding. Predictive Modeling using Machine Learning: Linear (Multiple) Regression, Decision Trees, Random Forest, Introduction to Modern Analytics Tools Tableau**:** Overview, worksheets, dashboards: Creating interactive visualizations, Connecting datasets and exploring data, Simple storyboards & insights Integrating R/Python with Visualization Tools**:** Export processed data from R/Python to Tableau, Visualize predictive model outputs |

**Text Books**

| | |
|---|---|
| T.1 | Hands-on Programming with R, Garrett Grolemund. |

**Reference Books**

| | |
|---|---|
| R.1 | Applied predictive modeling by Max Kuhn and Kejell Johnson |

| Useful Links | |
|---|---|
| 1 | NPTEL Course: https://nptel.ac.in/courses/110/106/110106072/ |

| Sr. No | List of Practical | CO |
|---|---|---|
| 1 | a. Installation and Configuration of R/Python Studio.<br>b. Write a R/Python program to create a list of random numbers in normal distribution and count occurrences of each value. | CO1 |
| 2 | Write an R/Python program to count vowels, consonants, digits, and spaces in given data. | CO1 |
| 3 | Write an R/Python program to calculate Mean, Median, Mode of a dataset. | CO2 |
| 4 | Analyze and visualize dataset using Excel or Power BI. | CO2 |
| 5 | Write an R/Python program to calculate Pearson correlation between two variables. | CO3 |
| 6 | Write an R/Python program to perform sample hypothesis testing (t-test). | CO3 |
| 7 | Write an R/Python program to detect and treat missing values in a dataset. | CO4 |
| 8 | Write an R/Python program to create basic visualizations (bar chart, histogram, boxplot). | CO4 |
| 9 | Build and evaluate simple Linear Regression model. | CO5 |
| 10 | Create an Open Ended Project using Backend Database. | CO5 |

| | Course Outcomes | CL | Class Sessions |
|---|---|---|---|
| BIT33508.1 | Illustrate the basics of data analysis, and statistical measures. | 02 | 4 |
| BIT33508.2 | Apply sampling techniques and perform basic probability, correlation, and hypothesis computations for data-driven decisions. | 03 | 4 |
| BIT33508.3 | Analyze R/Python data structures, controls, and functions for effective EDA and data manipulation. | 04 | 4 |
| BIT33508.4 | Demonstrate visualizations, manage missing data, and apply basic ML and feature engineering using R/Python. | 03 | 4 |
| BIT33508.5 | Implement R/Python skills, ML models, and preprocessing to solve analytical problems. | 03 | 4 |

Head of Dept. (Information Technology)
Tulsiramji Gaikwad-Patil College of
Engineering & Technology, Nagpur

**Tulsiramji Gaikwad -Patil College of Engineering and Technology**

Wardha Road, Nagpur-441108

**NAAC Accredited with A+ Grade**

**(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)**

## Third Year (Semester-V) B.Tech. Information Technology

## BIT33509: Design and Analysis of Algorithms Lab

| Teaching Scheme | | Examination Scheme | |
|---|---|---|---|
| **Practical** | **2 Hrs/week** | CA | 25 Marks |
| **Total Credits** | **1** | ESE | 25 Marks |
| | | Total | 50 Marks |

| Sr. No | List of Practical | CO |
|---|---|---|
| 1 | To classify the program to implement Recursive and iterative Linear and Binary Search | CO1 |
| 2 | Write a program to implement Masters Theorem. | CO1 |
| 3 | Classify a program to implement Quick sort and analyze its best, average and worst case | CO2 |
| 4 | Write a program to implement minimum cost spanning tree using Krushkal's Algorithm | CO2 |
| 5 | To write a program to implement Floyd's warshall algorithm. | CO3 |
| 6 | Write a program to implement 0/1 Knapsack problem using Dynamic Programming | CO3 |
| 7 | Write a program to implement N Queen Problem using Backtracking. | CO4 |
| 8 | Design and implement C/C++ Program to find a subset of a given set S = {sl,s2,…..,sn} of n positive integers whose sum is equal to a given positive integer d. | CO4 |
| 9 | Write a program to implement Traveling salesman problem using Brach and Bound method | CO4 |
| 10 | To demonstrate the concept of Cook's Theorem. | CO5 |

| Text Books | |
|---|---|
| 1 | Design & Analysis of Computer Algorithms by Aho, Pearson education. Horowitz, Sa Rajsekharam |
| 2 | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Cliford Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010. |
| **Reference Books** | |
| 1 | Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, "The Design and Analysis of Computer Algorithms", First Edition, Pearson Education, 2006. |
| 2 | Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich R. Tomassia, John Wiley and sons |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/106/101/106101060/ |
| 2 | https://nptel.ac.in/courses/106/106/106106131/ |

| | Course Outcomes | CL | Lab Sessions |
|---|---|---|---|
| **BIT33509.1** | Classify algorithm efficiency and fundamental algorithmic strategies. | 2 | 4 |
| **BIT33509.2** | Demonstrate Divide & Conquer and Greedy strategies to solve problems and analyze their efficiency | 3 | 4 |
| **BIT33509.3** | Implement Dynamic Programming techniques to solve complex optimization problems | 3 | 4 |
| **BIT33509.4** | Apply Backtracking and Branch & Bound strategies to solve combinatorial problem. | 3 | 4 |
| **BIT33509.5** | Analyze NP-Hard and NP-Complete problems by identifying problem classes | 4 | 4 |