**Nagindas Khandwala College (Autonomous)**

**Name of the Programme: Bachelor of Science Computer Science (BSC CS)**
**Programme Code: USCS**

## PROGRAMME OBJECTIVES

**PO-1:** Learners will be able to demonstrate a fundamental and systematic or coherent understanding of the academic field of Information Technology and its linkages with related disciplinary areas/subjects;

**PO-2:** Learners will be able to apply procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Information Technology including software development and testing;

**PO-3**: Learners will be able to enrich skills in areas related to one's specialization within the disciplinary/subject area of Information Technology and current and emerging developments in the field.

**PO-4**: Learners will be able to demonstrate the ability to use the knowledge in formulating and tackling IT related problems and suggest software solution to them.

**PO-5:** Learners will be able to analyse and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and special-purpose packages, and report accurately the findings of the experiment/field investigations while relating the conclusions/findings to relevant theories.

**PO-6:** Learners will be able to demonstrate relevant global competencies such as problem solving skills that are required to solve different types of problems with well-defined solutions;

**PO-7**: Learners will be able to develop communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences;

**PO-8:** Learners will be able to develop (i) ICT skills such as presentation skills, documentation, etc; (ii) ⌞SEP⌟ personal skills such as the ability to work both independently and in a group (iii) skills to manage IT infrastructure.

**PO-9:** Learners will be able to demonstrate professional behaviour such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical behavior such as fabricating, falsifying or misrepresenting data or to committing plagiarism; (ii) the ability to identify the potential ethical issues in work-related situations;

**PO-10:** Learners will be able to inculcate the mentality for (i) the appreciation of intellectual property, environmental and sustainability issues; and (ii) promoting safe learning and working environment.

**PROGRAMME OUTCOMES**

After completion of three years Bachelor of Science Computer Science (BSC CS) Programme, the learner will:

**PO-1:** Demonstrate a fundamental and systematic or coherent understanding of the academic field of Information Technology and its linkages with related disciplinary areas/subjects;

**PO-2:** Procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Information Technology including software development and testing;

**PO-3**: Skills in areas related to one's specialization within the disciplinary/subject area of Information Technology and current and emerging developments in the field.

**PO-4**: Demonstrate the ability to use the knowledge in formulating and tackling IT related problems and suggest software solution to them.

**PO-5:** Analyse and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and special-purpose packages, and report accurately the findings of the experiment/field investigations while relating the conclusions/findings to relevant theories.

**PO-6:** Demonstrate relevant global competencies such as problem solving skills that are required to solve different types of problems with well-defined solutions;

**PO-7**: Develop communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences;

**PO-8:** Develop (i) ICT skills such as presentation skills, documentation, etc; (ii) personal skills such as the ability to work both independently and in a group (iii) skills to manage IT infrastructure.

**PO-9:** Demonstrate professional behaviour such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical behavior such as fabricating, falsifying or misrepresenting data or to committing plagiarism; (ii) the ability to identify the potential ethical issues in work-related situations;

**PO-10:** Inculcate the mentality for (i) the appreciation of intellectual property, environmental and sustainability issues; and (ii) promoting safe learning and working environment.

**Nagindas Khandwala College (Autonomous)**

**Semester I**

**1. COMMUNICATION SKILLS**
**2016UISCS**

<u>**Course Objectives:**</u>

By the end of the course, learners will be able :

1. To develop effective listening skills in learner so as to enable them to comprehend instructions and become a critical listener
2. To develop effective oral skills so as to enable learner to speak confidently interpersonally as well as in large groups
3. To develop effective writing skills so as to enable learner to write in clear, concise, persuasive and audience centred manner
4. To demonstrate effective use of communication technology

<u>**Course Outcome:**</u>

After completing this course, learners will be able to:

CO1: Understand the concept, channels, objectives, methods and modes of communication. (Understand)

CO2: Differentiate obstacles to communication in the business world. (Evaluate)

CO3: Sharpen the business correspondence, language and writing skills of the learner.(Remember)

CO4:  Effectively use communication technology.(Apply)

CO5: Demonstrate effective presentation, visual communication and impress stage.(Analyse)

## 2. DISCRETE MATHEMATICS I

### 2015UISDM

**Course Objectives:**

By the end of the course, learners will be able to:

1. Construct truth table and test the validity of statements.

2. Determine the domain and range of a discrete or non-discrete function, graph functions, identify one-to-one functions, perform the composition of functions, find and/or graph the inverse of a function, and apply the properties of functions to application problems.

3. List the terms in a sequence, write a sequence in closed form, compute the sum of a finite

   sequence, compute the product of a finite sequence, and express sequences in terms of recursive or non-recursive forms.

4. Use elementary number theory including the divisibility properties of numbers to determine prime numbers and composites, the greatest common divisor, and the least common multiple; perform modulo arithmetic and computer arithmetic.

5. Recall sequences and mathematical induction.

**Course Outcome:**

After completing this course, learners will be able to:

**CO1:** Remember theory of discrete objects, starting with relations and partially ordered sets. (Remember)

**CO2:** Understand  recurrence relations, generating function and their applications. (Understand)

**CO3:** Apply well-ordering principle for integers and check correctness of algorithm.(Apply)

**CO4:** Recall types of functions and find their applications.(Analyse)

**CO5:** Locate maximum and minimum elements for Lattices.(Evaluate)

## 3. INTRODUCTION TO PROGRAMMING
## 2011UISPR

**Course Objectives:**

On completing this course learners will be able to:

1. To enhance the logical thinking
2. To develop problem solving skills
3. To introduce the basic programming concepts
4. write programs in Python and Scratch

**Course Outcome:**

After successful completion of this course, learners will be able to:

CO1: Demonstrate the need of problem solving skills and demonstrate the solution to the standard problems (understand)

CO2: Analyse whether the given strategy is suitable for a given problem (evaluate)

CO3: Explain the basic programming structures in Python (understand)

CO4: Compare and suggest the suitable statements in Python for a given problem (analyze and apply)

CO5: Create animations in Scratch for a selected problem. (Create)

CO6: Write and demonstrate the working of basic programmes in Python (Apply)

## 5. FUNDAMENTALS OF COMPUTERS AND ELECTRONICS
## 2012UISPR

**Course objectives:**

By the end of the course, learners will be able to:

- Explain the concept of computer systems and get acquainted with number systems.
- Understand Boolean Algebra and Minimization concepts.
- Understand different types of logic gates.
- Explain different types of digital circuits.
- Code in 8085 Assembly Language.

**Course Outcome:**

After completing this course learner will be able to:

CO1: Understand and perform conversion between different number systems. (Understand, Apply)

CO2: Understand and analyse different Boolean theorems and laws and implement it in reduction of logic expression. (Apply)

CO3: Analyse different logic gates, minimize the given logical expression and create circuits from it. (Analyse)

CO4: Understand the Combinational and Sequential circuits and its application in designing circuits. (Evaluate)

CO5: Learners will also be able to create code using 8085 Assembly language. (create)

## 6. OPERATING SYSTEMS
### 2013UISPR

**Course Objective:**

By the end of the course learners will be able to:

1. Understand the services provided by and the design of an operating system.
2. Recognise what a process is and how processes are synchronized and scheduled.
3. Differentiate between different approaches to memory management.
4. Learn virtual memory and secondary memory management.
5. Learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system

**Course Outcome:**

After completing this course, learners will be able to:

CO1: Understand the structure of OS and basic architectural components involved in OS design. (Understand)

CO2: Analyze and design the applications to run in parallel either using process or thread models of different OS (Apply)

CO3: Differentiate various device and resource management techniques for time sharing and distributed systems. (Evaluate)

CO4: Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system (Understand)

CO5: Conceptualize the components involved in designing a contemporary OS (Create)

## 6. WEB PROGRAMMING I
## 2014UISWP

**Course Objectives:**

By the end of the course, learners will be able to:

1. Identify and learn the Internet World with working of a website using HTML.

2. Identify the creation of dynamic websites using different components of HTML.

3. Define and describe the javascript usage.

4. State and Explain the different document object models.

5. Explain jQuery and bootstrap components.

**Course Outcome:**

After completing this course learners will be able to:

CO1: Apply a structured approach to identifying needs, interests, and functionality of a website. (Apply)

CO2: Design dynamic websites that meet specified needs and interests.(Create)

CO3: Design appropriate HTML, CSS, and JavaScript code from public repositories of open-source and free scripts that enhances the experience of site visitors.(Create)

CO4: Analyze the existing HTML, CSS, and JavaScript code to extend and alter its functionality, and to correct errors and cases of poor practice. (Analyse)

CO5: Create a website which is functional with all the basics and advanced HTML,CSS, Javascript alongwith jQuery and Bootstrap.(Apply)

**Semester II**

## 1. PROGRAMMING AND APPLICATION DEVELOPMENT IN PYTHON
### 2021UISPP

**Course Objectives :**
By the end of the course, learners will be able to:

- Design UI and program python UI applications.
- Connect database in a python program.
- Read and write files and file operations.
- Write a program on regular expressions.
- Program web applications and implement web scraping in python .
- Learn network connectivity.


**Course Outcome:**
After completing this course, learner will be able to:

CO1: Implement UI Applications using Python Tkinter. (Apply)

CO2: Apply the Knowledge of Database Connection in Python Application. (Apply)

CO3: Understand the working of different File Operations. (Understand)

CO4: Analyse the data obtained using Web Scraping and Develop Network Connectivity Applications. (Analyse)

CO5: Create a small application showing the implementation of topics learned. (create)

## 2. OBJECT ORIENTED PROGRAMMING
### 2022UISOO

**Course Objectives :**

By the end of the course, learners will be able to:

1. Study the principles of object-oriented paradigms.
2. Understand how real-world objects can become part of fundamental elements in the code.
3. Understand the difference between classes, prototypes, and instances.
4. Learn to organize data in the blueprints and create a hierarchy of blueprints that generate objects.
5. Develop basic object-oriented code using object-oriented languages.
6. Implement all concepts of OOP in Program development.

**Course Outcome:**

After completing this course, learners will be able to:

CO1: Define various concepts of Object Oriented Programming. (Remember)

CO2: Identify real-world objects and design Class diagram to organize data.(Understand)

CO3: Generate blueprints to create objects. (Create)

CO4: Apply standards and principles to write truly readable code. (Apply)

CO5: Develop and test basic programs.(Understand)

CO6: Demonstrate the concepts of object-oriented design, polymorphism, information hiding, and inheritance.(Apply)

### 3. DATABASE MANAGEMENT SYSTEMS I
### 2023UISDS

**Course Objective:**

By the end of the course, learners will be able to:

- Understand the basic concepts and the applications of database systems.
- Master the basics of SQL and construct queries using SQL.
- Familiar with the basic issues of transaction processing and concurrency control.
- Understand the concept of Normalization, Transaction and Concurrency Control.
- Understand the concept of PL/SQL procedures and construct.

**Course Outcome:**

After completing this course, learners will be able to:

CO1: Explain the basic elements of a relational database management system(Understand)

CO2: Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data. (Analyze, Create)

CO3: Apply various Normalization techniques (Apply)

CO4:Perform PL/SQL programming using concept of Cursor Management, Error Handling, Package and Triggers (Create)

CO5: Understand the principles of Transaction Processing & Locking using the concept of Concurrency control. (Understand)

## 4. WEB PROGRAMMING II
## 2024UISWP

**<u>Course Objectives:</u>**

By the end of the course, learners will be able to:

1. Analyze and evaluate the working of XML.

2. Apply how server-side programming works on the web.

3. Understand the working of web application with php as a server side scripting language.

4. Develop web applications using MySQL database

5. Apply the maintenance of MySQL database.

**Course Outcome:**

After completing this course learners will be able to:

CO1: Design a structured approach to identify needs, interests, and functionality of a website. (Apply)

CO2: Describe POST and GET in form submission using PHP(Understand)

CO3: Design website with php sessions and cookies. (Create)

CO4: Design and develop a full-fledged website using php with MySQL database. (Create)

CO5: Apply and Analyze the working of website with Php and MySql. (Analyse)

## 5. DISCRETE MATHEMATICS II
### 2025UISDM

**Course Objective:**

By the end of the course, learners will be able to:

1. To build a mathematical foundation for the computing applications

2. To build a foundation for data structures

3. Recall matrices, properties, rank and understand its linear transformation.

4. Understand application of counting principle.

5. Define graphs and trees and their traversing.

## Course Outcome:

After completing this course, learners will be able to:

**CO1:** Find a mathematical solution to the problems.(Apply)

**CO2:** Link the mathematical concepts with application in the computing    domain.(Analyse)

**CO3:** Find Normal form of matrix, similarity and its applications.(Evaluate)

**CO4:** Solve problems on counting principle. (Remember)

**CO5:** Identify graphs and trees, their traversing and operations on binary search tree.(Understand)

### 6. IT platforms, Tools and Practices
### 2026UISTP

## Course Objectives:

By the end of the course, learners will be able to:

● To prepare students according to the industry standards.

● To give an awareness on industry practices and ethics.

● To encourage the use of IT Tools so as to enable students to improve their skills and knowledge.

● To impart skills that can enable students to approach business problems analytically.

● To understand what Green IT is and How it can help improve environmental   Sustainability.

**Course Outcome:**

 After completing this course, learners will be able to:

CO1: Follow the industry standards and practices in coding.(Apply)

CO2:  Illustrate various green IT services and its roles.(Understand)

CO3: Describe the importance of IT enabled services and challenges.(Understand)

CO4: Evaluate various IT tools and services for betterment of knowledge.(Evaluate)

CO5: Use and Examine different computing services.(Analyze)

**Semester III**

**1.  CORE JAVA**

**2031UISCJ**

**Course Objectives:**

By the end of the course, learners will be able to:

1.  Understand the importance of Object Oriented paradigm in Application development.

2. Study Java language Basics.
3. Implement Object oriented concepts using Java.
4. Understand concepts of packages and Multithreading in Java.
5. Explore the importance of Exception handling in program design.
6. To develop GUI Applications using AWT.

**Course Outcome**:

After successful completion of this course, learners will be able to:

CO1: Acquire knowledge about Java language.(Understand)
CO2: Apply Object Oriented paradigm in Application development.(Apply)
CO3: Develop user defined packages.(Understand)
CO4: Implement Single threaded and Multithreaded programs in Java language.( Apply)
CO5: Create programs using Exception Handling.(Understand)
CO6: Integrate important concepts of OOP to develop GUI applications.(Create)

## 2. DATA STRUCTURES
### 2032UISDS

**Course Objectives:**

By the end of the course, learners will be able to:

1. To introduce the fundamental concept of data structures.

2. To emphasize the importance of data structures in developing and implementing efficient algorithms.

3. To understand the implementation of different data structures

4. To gain knowledge with respect to complexities of different algorithms

5. To understand concept of Hashing

## Course Outcomes:

After successful completion of this course, learners will be able to:

CO1: Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms (Understand)

CO2: Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs. (Apply)

CO3: Demonstrate different methods for traversing trees. (Apply)

CO4: Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.(Understand)

CO5: Compare and contrast the benefits of dynamic and static data structures implementations. (Analyse)

### 3. COMPUTER NETWORKS
### 2033UISCN

## Course Objectives:

By the end of the course, learners will be able to:

1. Understand Networking Basics.

2. Explore Hardware and Software requirements for Communication Network.

3. Understand the framework of communication networks.

4. Do layer wise study of OSI Model and TCP/IP Model.

5. Compare OSI and TCP/IP Model.

6. Implement various protocols in communication.

## Course Outcome:

After successful completion of this course, learners will be able to:

CO1**:** Define Data communication and Networking concepts.(Remember)

CO2: Acquire knowledge about common equipment, standard hardware and software requirements and communication protocols.(Understand)

CO3: Study functions of all layers in OSI Model and their requirements.(Analyze)

CO4: Understand the importance of TCP/IP Model in Communication Networks.    (Understand)

CO5:  Compare various protocols and their requirements in communication. (Analyze)

CO6: Simulate Communications systems using various protocols and understands its real life applications. (Apply)

### 4.  DATABASE MANAGEMENT SYSTEM – II
### 2034UISDB

## Course Objectives:

By the end of the course, learners will be able to:

- Develop efficient PL/SQL programming skills

- Understanding Oracle database.

- Designing modular applications using packages.

- Creating triggers to solve business challenges and enforce business rules.

- Stepping stone for RDBMS and PL/SQL structures.

## Course Outcomes:

After successful completion of this course, learners will be able to:

CO1: Explain the fundamental concepts of PL/SQL. (Understand)

CO2: Develop PL/SQL queries in real-time applications. (Create)

CO3: Design modular applications using packages. (Create)

CO4: Apply advanced SQL features like views, indexes, synonyms, etc. for database management. (Apply)

CO5: Analyze PL/SQL structures like functions, procedures, cursors and triggers for database applications. (Analyze)

## 5. DESCRIPTIVE STATISTICS
## 2035UISST

## Course Objective:

By the end of this course, learners will be able to:

- understand the basic terminologies

- differentiate the types of data

- use visualization tools and to analyze the underlying pattern in the data

- model the data using the suitable polynomials

- demonstrate the association between the variables

- work independently on a given data set.

**Course Outcome:**

After completing this course the learner will be able to:

CO1: define the terms population, sample, univariate and multivariate data, correlation, regression and odds ratio.

CO2: differentiate the data into different categories

CO3: analyze a given dataset using statistical techniques.

CO4: use suitable visualization tools to get a better insight into the underlying dataset.

CO5: device a strategy to identify the associations between the variable

CO6: fitting lined and polynomials to model the given data.

CO7: analyze and develop a statistical model of the data collected.

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**Discipline Specific Elective (DSE) (Any *one* of group A)**

**6A. ADVANCED WEB PROGRAMMING – I**

**2036UISAW**

### Course Objective:

By the end of the course, learners will be able to:

1. Recall the JavaScript, bootstrap, jquery and learn the advanced technologies.
2. Define and describe Ajax working with partial refreshes.
3. Study the concept of json to store data.
4. Learn designing with bootstrap and jQuery
5. Develop website with latest ajax,bootstrap and jQuery and store data in json.

### Course Outcome:

After completing this course learners will be able to:

CO1: Discuss the concepts of object oriented concepts with JavaScript.(Understand)

CO2: Develop websites with bootstrap, Ajax technologies and jquery.(create)

CO3: Discuss json in web applications.(Understand)

CO4: Define and discuss major concepts, tools, techniques, and methods of web application development.(Create)

CO5: Apply the technologies learned in creation of websites.(Apply)

## 7A. HYBRID MOBILE APPLICATION DEVELOPMENT – I

### 2036UISMD

**Course Objective:**

1. Focus in this course is on the basic understanding of web frameworks.
2. Develop API's for user interface design by Angular JS and Ionic Framework for Mobile Application Development.
3. On the completion of the course, students will be able to develop Hybrid mobile applications.

**Course Outcome:**

On completion of the course, learners will be able to:

CO1: Create a fully functional HTML5 app for any of the three OSes. (Create)

CO2: Use PhoneGap to package HTML5 apps into native apps. (Apply)

CO3: Understand mobile application development and deployment process. (Understand)

CO4: Understand jQuery and jQuery Mobile architecture.(Understand)

CO5: Learn how to build apps with the Ionic framework. (Analyse)

**Discipline Specific Elective (DSE) (Any *one* of group B)**

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## 8B. COMPUTER GRAPHICS AND ANIMATION

### 2037UISCG

**Course Objectives:**

By the end of the course, learners will be able to:

- Introduce the different graphics systems and become familiar with the working of graphics system components.

- Understand the working of different scan conversion algorithms.

- Learn the basic principles of 2- dimensional and 3- dimensional computer graphics.

- Transform the object using various transformation techniques.

- Provide an understanding of mapping from world coordinates to device coordinates, clipping, and projections.

- Have a basic understanding of Animation and its principles.

**Course Outcome:**

After completing this course learner will be able to:

CO1: Understand different scan conversion algorithms, apply it using programming language and define their applications. (Apply)

CO2: Discuss 2D and 3D transformations and different transformation matrix used. (Understand)

CO3: Apply various 2D transformations on a 2D object. (Apply)

CO4: Discuss different shading models and Visible-Surface Determination techniques. (Understand)

CO5: Define Animations and apply the basic principles of animation. (Remember, Apply)

CO6: Create basic 2D animation using programming language. (Create)

## 9B. EMBEDDED SYSTEMS

### 2037UISES

**Course Objectives:**

By the end of the course, learners will be able to:

1. To understand the meaning, components of a basic embedded systems
2. To understand the characteristics and quality attribute of an embedded systems
3. To understand the memory structure of embedded systems and its peripheral devices
4. To understand the different aspects of programming for developing embedded systems
5. To understand the EDLC

**Course Outcome:**

After successfully completing this course, learners will be able to:

CO1: Describe the components of an embedded system (Understand)

CO2: Explain the memory structure and peripherals required for embedded systems (Understand)

CO3: Illustrate the pin diagram of 8051 Microcontroller with its structure (Analyse)

CO4: Write programs for embedded systems (Apply)

CO5: Create basic Embedded Products for the market (Create)

## 10B. THEORY OF COMPUTATION I

### 2037UCSTC

**Course Objective:**

The theoretical foundations of computer science have expanded substantially in recent years. The objective of this course is to:

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing
3. To explain the hierarchy of problems arising in the computer sciences.
4. To construct automata for any given pattern and find its equivalent regular expressions

**Course Outcome:**

After completing this course the learner will be able to:

CO1: Express computer science problems as mathematical statements and to formulate proofs. (Understand)

CO2: Develop a machine model for the computing problem (Create)

CO3: Use basic concepts of finite automata techniques (Apply)

CO4: Represent a pattern as regular expression (Understand)

CO5: Design Finite Automata for different Regular Expressions and Languages(Create)

**Semester IV**

**1.  DESIGN PATTERNS**

**2041UISDP**

## Course Objectives:

By the end of the course, learners will be able to:

1.  Understand  design patterns.
2.  Acquire basic understanding of commonly used to design patterns to solve problems.
3.  Compare the object-oriented programming model with the standard structured programming.
4.  Uses the basic design principles in solving real life problems.
5.  Understand the necessity of dealing with change.
6.  Learn to apply the pattern based analysis and design to the software to be developed.

## Course Outcome:

After completing this course, learners will be able to:

CO1: Learn the role of design patterns in software development.(Understand)

CO2: Understands the pattern based design principle.(Understand)

CO3: Apply a fundamental set of design patterns utilizing object-oriented principles to solve real-world software design problems.(Apply)

CO4: Able to work individually as well as in teams to create reusable and cohesive software components.(Apply)

CO5: Create Design Patterns to solve real world problems.(Create)

## 2. DESIGN AND ANALYSIS OF ALGORITHMS

### 2042UISDA

**Course Objective:**

By the end of the course, learner will be able to:

1. understand algorithms

2. design efficient solutions for real-world problems.

3. analyze and compare various algorithms

4. understand and analyse the problems solvable in polynomial time and non-deterministic polynomial time.

**Course Outcome:**

After the completion of the course the learner will be able to:

CO1: Analyze the asymptotic performance of algorithms (analyze)

CO2: Write rigorous correctness proofs for algorithms. (apply)

CO3: Demonstrate familiarity with major algorithms and data structures and explain the NP completeness. (understand)

CO4: Apply important algorithmic design paradigms and methods of analysis. (apply)

CO5: Synthesize efficient algorithms in common design situations. (analyze)

CO6: develop suitable algorithm for a given problem. (create)

## 3. SYSTEM PROGRAMMING
## 2043UISSP

**Course Objectives:**

By the end of the course, learners will be able to:

1. Understand the basics of OS concepts efficient scripts and utilities are to be used.
2. Learn the concept of files and directories.
3. Describe the working of process and signals.
4. Describe the concept of IPC, semaphores, memory and sockets.
5. Design and implement code generators using C and gdb

**Course Outcome:**

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

CO1: Understand and make effective use of Linux utilities and Shell scripting language (bash) to solve problems.(Apply)

CO2: Develop the skills necessary for systems programming including file system programming, process and signal management and inter-process communication.(Analyse)

CO3: Develop the basic skills required to write network programs using sockets.(Apply)

CO4: Design and implement system utility programs.(Create)

CO5: Describe UNIX file systems and process control.(Understand)

## 4. SOFTWARE ENGINEERING

### 2044UISSE

**Course Objective:**

By the end of the course, learners will be able to:

- Understand the basic theory of software engineering,
- Understand the software development life cycle
- Understand and apply the basic project management practices in real life projects.
- Understanding of approaches to verification and validation including static analysis, and reviews.
- Describe software measurement and software risks.

**Course Outcome:**

After completing this course, learners will be able to:

CO1:  Decompose the given project in various phases of a lifecycle. (Analyse)

CO2:  Choose appropriate process model depending on the user requirements. (Evaluate)

CO3: Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.(Apply)

CO4: Know various processes used in all the phases of the product. (Understand)

CO5: Apply the knowledge, techniques, and skills in the development of a software product. (Apply)

# 5. PROBABILITY THEORY

## 2045UISPT

**Course Objective:**

On completing this course, learners will be able to:

1. understand the fundamentals of probability theory
2. explain the random variable and the underlying distribution
3. to apply the chebychev's inequality and central limit theorem

**Course Outcome:**

After the completion of the course the learners will be able to:

CO1: Analyze a given dataset using statistical techniques. (analyse)

CO2: Demonstrate the probability distributions (understand)

CO3: Model the given data using a suitable distribution (apply)

CO4: Demonstrate the properties of the data in terms of the distribution. (analyse)

CO5: Apply chebychev's inequality and central limit theorem (apply)

CO6: work on a real data set and make a statistical model for analysis and prediction (create)

**DISCIPLINE SPECIFIC ELECTIVE (Any ONE from GROUP A)**

**6A. ADVANCED WEB PROGRAMMING - II**

**2046UISAW**

**Course Objectives:**

By the end of the course, learners will be able to:

1. Understand and learn Angular JS concepts and develop web applications with its components.
2. Understand and learn Node JS environment and develop web applications with MongoDB database.
3. Explain and implement the components of AngularJS.
4. Develop web applications with Node JS
5. Implement MongoDB with Node JS

**Course Outcome:**

After completing this course learners will be able to:

CO1: Understand the concept of Angular JS (Understand)

CO2: Describe the working of Angular JS with its components. (Understand)

CO3: Recognize the concept of Node JS usage in web application. (Analyse)

CO4: Ability to develop web application with Angular JS and Node JS.(Apply)

CO5: Create and develop node JS applications with MongoDB. (Create)

## 7A. HYBRID MOBILE APPLICATION DEVELOPMENT - II

### 2046UISMD

**Course Objective:**

By the end of the course learner will be able to:

1. Focus in this course is on the basic understanding of web frameworks and API's for user interface design by Angular JS and Ionic Framework for Mobile Application Development.
2. On the completion of the course, students will be able to develop Hybrid mobile applications.

**Course Outcome:**

On completion of the course learner will be able to:

CO1: Learn how to build single page applications with React JS (Understand)

CO2: Use and Install React-Native dependencies for MAC and Windows Run Android and IOS simulator (Apply)

CO3: Understand and Learn the key concepts of the NodeJS (Understand)

CO4: Understand Nodejs, learn rapidy growing web server technology, Nodejs & understand how NodeJS works with Node course! (Understand)

CO5: Learn how to Style with React-Native and flex-box rules (Analyse)

## 7A. ADVANCED JAVA

### 2046UISAJ

**Course Objectives:**

By the end of the course, learners will be able to:

- Learn to perform socket programming in java.
- Get an understanding on Enterprise Java and the servlet technology.
- Explain the database connection using JDBC.
- Understand the concept of cookies and session tracking in java.
- Work with JSP, EJB and implement it.

**Course Outcome:**

After completing this course learner will be able to:

CO1: Develop networking concept using Socket Programming. (Create)

CO2: Understand Enterprise Application and Java EE architecture. (Understand)

CO3: Explain the concept of servlet, JDBC and apply it through coding. (Understand, Apply)

CO4: Learn and analyse the concept of cookies and session tracking in Java. (Analyse)

CO5: Create applications using servlet, JSP, EJB along with implementation of database. (Create)

CO6: Basic understanding of JavaBean, Web services and their applications. (Understand)

## DISCIPLINE SPECIFIC ELECTIVE (Any ONE from GROUP B)

## 8B. MULTIMEDIA SYSTEMS

## 2047UISMM

### Course Objectives:

By the end of the course, learners will be able to:

- Become multimedia/graphics designers and engineers in their areas of expertise.
- Understand the basic components of multimedia and different compression techniques used.
- Get an understanding of Animation and Virtual Reality.
- Implement different techniques for creating animated videos and edit different images using softwares.
- Apply different effects and color coding on various objects.

**Course Outcome:**

After completing this course learner will be able to:

CO1: Use different compression techniques of text, audio, video and apply basics of animation. (Apply)

CO2: Understand different file formats used for text, image, audio and video and compare between them. (Understand, Analyze)

CO3: Apply different animation on character, object, etc. Apply text effects, color variations on objects. (Apply)

CO4: Use different software for animation purposes and create a small animation clip and enhance graphics images using different software's. (Create)

CO5: Create different logos, cards and websites using multimedia software. (Create)

CO6: Discuss the concept of Virtual reality and its applications. (Understand)

## 9B. INTERNET OF THINGS

## 2047UISIT

**Course Objective:**

1. To assess the vision and introduction of IoT.
2. To Understand IoT Market perspective.
3. To Implement Data and Knowledge Management and use of Devices in IoT Technology.
4. To Understand State of the Art - IoT Architecture.

5. To classify Real World IoT Design Constraints, Industrial Automation in IoT

**Course Outcome:**

After the successful completion of this course, learners will be able to:

CO1: Describe the meaning and different components of Internet of Things, also the principles of Internet (Understand)

CO2: Explain and prototype an embedded product. (Analyse)

CO3: Illustrate the physical design of the system and work with online components API for security, polling, etc. (Apply)

CO4: Describe the the memory management of an embedded system and write the codes for embedded product (Understand)

CO5: To create a small model representing the automation in IoT. (Create)

## 10B. THEORY OF COMPUTATION II

### 2047UCSTC

**Course Objectives:**

By the end of the course learner will be able to:

1. To familiarize Regular grammars, context frees grammar
2. To design a context free grammar for any given language
3. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
4. To understand Turing machines and their capability
5. To understand undecidable problems and NP class problems
6. participate in GATE, PGECET and other competitive examinations

## Course Outcome:

On completion of the course learner will be able to:

CO1: Design Finite Automata's for different Regular Expressions and Languages (apply)

CO2: Construct context free grammar for various languages (create)

CO3: Solve various problems of applying normal form techniques, push down automata and Turing Machines (apply)

CO4: Apply this basic knowledge of Theory of Computation in the computer field to solve computational problems and in the field of compiler also. (apply)

CO5: Demonstrate the working of Turing machines and their capability (understand)

CO6: To explain undecidable problems and NP class problems (understand)

### Semester V

### Discipline Specific Elective (DSE) (Any TWO of group A)

### A. ARTIFICIAL INTELLIGENCE

### 1851UCSAI

## Course Objective:

To create appreciation and understanding of both the achievements of AI Students will able to:

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents and the theory underlying those achievements.

- To introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems
- To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
- To create an understanding of the basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.

**Course Outcomes:**

On completion of the course students will be able to:

CO1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques. (Understand)

CO2. Apply these techniques in applications which involve perception, reasoning and learning. (Apply)

CO3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals. (Analyse)

CO4. Acquire the knowledge of real world Knowledge representation. (Understand)

CO5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system. (Analyse)

CO6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.(Apply)

## A. LINUX SERVER ADMINISTRATION

### 1852UCSLA

**Course Objective:**

By the end of the course, learners will be able to:

1. Understand the services provided by and the design of an operating system.

2. Recognise what a process is and how processes are synchronized and scheduled.

3. Differentiate between different approaches to memory management.

4. Learn virtual memory and secondary memory management.

5. Learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system

**Course Outcome:**

After completing this course, learners will be able to:

CO1: Understand the structure of OS and basic architectural components involved in OS design. (Understand)

CO2: Analyze and design the applications to run in parallel either using process or thread models of different OS (Apply)

CO3: Differentiate various device and resource management techniques for time sharing and distributed systems. (Evaluate)

CO4: Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system (Understand)

CO5: Conceptualize the components involved in designing a contemporary OS (Create)

## A. SOFTWARE TESTING AND QUALITY ASSURANCE

### 1853UCSST

**Course Objectives:**

By the end of the course, learners will be able to:
1. To explore the effective testing techniques (both black-box and white box) for ensuring high quality software.
2. To learn metrics for managing quality assurance and understand capabilities of test tools .

3. To learn how to plan a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report .
4. To understand software test automation problems and solutions .
5. To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.

**Course Outcomes:**
**After successful completion of this course, learners will be able to:**
CO1: Apply software testing knowledge and engineering methods. (Apply)
CO2: Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods. (Understand, Remember)
CO3: Analyze and understand the use of software testing methods and modern software testing tools for their testing projects (Analyze, Understand)
CO4: Evaluate defects and manage those defects for improvement in quality for given Software. (Evaluate)
CO5: Design SQA activities, SQA strategy, formal technical review report for software quality control and assurance (Create)

**Discipline Specific Elective (DSE) (Any *TWO* of group B)**

**B. INFORMATION AND NETWORK SECURITY**

**1854UCSNS**

**Course Objective:**

The objectives of this course can be illustrated as:

- To provide conceptual understanding of network security issues, challenges and mechanisms.

- To develop basic skills of secure network architecture and explain the theory behind the security of different cryptographic algorithms.
- To describe common network vulnerabilities and attacks, defense mechanisms against network attacks, and cryptographic protection mechanisms.

## Course Outcome:

After completion of this Course, students will be able to:

CO1 : List and briefly describe security risks and mitigation strategies for an organization that is about to connect its network to the Internet and communicate with other companies via email.(Understand)

CO2: Explain the differences between the three major goals of information security: confidentiality, integrity and availability, and can list and explain one technique for ensuring each. (Analyse)

CO3: Explain how public key cryptography can be used to ensure the identity of the sender of an encrypted message. (Analyse)

CO4: Describe network security services and mechanisms. (Understand)

CO5: Understand the Symmetrical and Asymmetrical cryptography. (Understand)

CO6: Apply on various concepts to Data integrity, Authentication, Digital Signatures. (Apply)

CO7: Apply Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc. (Apply)

## B. WIRELESS SENSOR NETWORKS AND MOBILE COMMUNICATIONS

### 1855UCSWN

## Course Objectives:

By the end of the course, learners will be able to:

1. Understand the basic features of Wireless Sensor networks
2. Understand and apply the features of different Wireless sensor Architectures for real world scenarios.
3. Understand and apply the protocols of MAC and Network layer for real world Wireless sensor networks
4. Sensor Network Programming approaches.·
5. Design Wireless sensor network for Real time Applications

## Course Outcome:

Upon completion of this course, the students will be able to:

CO1**:** Compare MANET and WSN(Analyze)

CO2:  Understand the fundamentals of wireless networks.(Understand)

CO3: Implement MAC and Network layer protocols for Sensor networks.(Apply)

CO4:  Categorize wireless sensor networks.(Analyze)

CO5:  Simulate Wireless sensor network to understand real life applications.(Apply)

## B. WEB SERVICES

### 1856UCSWS

## Course Objectives:

By the end of the course, learners will be able to:
1. Understand and learn Web Services
2. Describe XML concepts
3. Analyze the RESTful web service.
4. Describe Service Oriented Architecture
5. Understand paradigms needed for testing Web Services with REST and WCF

## Course Outcome:

After completing this course learners will be able to:
CO1: Create and consume web services to efficiently use market leading environment tools.(Create)
CO2: Develop web services to identify and select the appropriate framework components.(Create)
CO3: Discuss and Develop RESTFul web services and WCF web services(Understand)
CO4: Understand the principles of SOA.(Understand)
CO5: Apply and Analyze RESTFul web services.(Apply)

## 5. GAME PROGRAMMING

### 1857UCSPR

## Course Objectives:

1. To understand the basic mathematics required for computer graphics.

2. To understand and implement different 2D and 3D transformations

3. To understand the concept and stages of directx implementation

4. To perform programs for directx using its library

5. To understand XR and unity engine for developing games

**Course Outcomes:**

After successful completion of this course, learners will be able to:

CO1: Explain the mathematics concepts required for Computer Graphics. (Understand)

CO2: Describe and write the programs for different 2D and 3D transformations. (Apply)

CO3: Illustrate the different stages of DirectX Pipelining. (Understand)

CO4: Generate different textures using DirectX programming.(Create)

CO5: Create 2D and 3D Games in Unity Programming. (Create)

**Semester VI**

**Discipline Specific Elective (DSE) (Any TWO of group A)**

## A. ARCHITECTING OF IOT

### 1861UCSIT

**Course Objective:**

- To assess the vision and introduction of IoT.
- To Understand IoT Market perspective.
- To Implement Data and Knowledge Management and use of Devices in IoT Technology.
- To Understand State of the Art - IoT Architecture.
- To classify Real World IoT Design Constraints, Industrial Automation in IoT

**Course Outcome:**

CO1: Describe the meaning and different components of Internet of Things, also the principles of Internet (Understand)

CO2: Explain and prototype an embedded product. (Understand)

CO3: Illustrate the physical design of the system and work with online components API for security, polling, etc. (Analyse and Apply)

CO4: Describe the memory management of an embedded system and write the codes for embedded product (Understand)

CO5: To create a small model representing the automation in IoT. (Create)

## A. CLOUD COMPUTING

# Nagindas Khandwala College (Autonomous)

## 1862UCSCC

### Course Objective:

- The learner will learn about the cloud environment, building software systems

- The learner will be able to build components that scale to millions of users in modern internet, cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas,

- The learner will be able to develop cloud-based software applications on top of cloud platforms.

- The learner will be able to assess employer's needs and initialise and install cloud based applications.

### Course Outcome:

On completion of the course learner will be able to:

CO1: Understand the key dimensions of the challenge of Cloud Computing(Understand)

CO2: Perform assessment of the economics , financial, and technological implications for selecting cloud computing for own organization (Apply)

CO3: Assess the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.(Evaluate)

CO4: Perform assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas. (Apply)

## A. CYBER FORENSICS

## 1863UCSCF

**Course Objectives:**

- To provide an understanding Computer forensics fundamentals
- To analyze various computer forensics technologies
- To provide computer forensics systems
- To identify methods for data recovery.
- To apply the methods for preservation of digital evidence.

**Course Outcome:**

Upon successful completion of the programme, learner will be familiar with cyber security landscapes and able to

CO1: Understand the definition of computer forensics fundamentals. (Level:Understand)

CO2: Describe the types of computer forensics technology.(Level:Analyze)

CO3: Analyze and evaluate the cyber security needs of an organization.(Level:Analyze)

CO4: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation. (Level:Apply)

CO5: Measure the performance and troubleshoot cyber security systems.(Level:Apply)

**Discipline Specific Elective (DSE) (Any *TWO* of group B)**

**B. INFORMATION RETRIEVAL**

**1864UCSPR**

**Course Objective:**

By the end of the course, learner will be able to:

- To understand how to retrieve information from the web
- Apply the knowledge in information processing

**Course Outcome:**

On completion of the course, learner will be able to:

CO1: Understand how to retrieve information from the web.(Understand)

CO2: Apply the knowledge in information processing. (Apply)

CO3: Understand XML retrieval.(Understand)

# B. DIGITAL IMAGE PROCESSING

## 1865UCSDP

### Course Objective:

By the end of the course learner will be able to:

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

### Course Outcome:

On completion of the course learner will be able to:

CO1: Review the fundamental concepts of a digital image processing system. (Remember)

CO2: Analyze images in the frequency domain using various transforms. (Analyse)

CO3: Evaluate the techniques for image enhancement and image restoration. (Evaluate)

CO4: Categorize various compression techniques.(Understand)

CO5: Interpret Image compression standards.(Apply)

CO6: Interpret image segmentation and representation techniques. (Apply)

## B. DATA SCIENCE

### 1866UCSDS

**Course Objectives:**

1. The main goal of this course is to help students learn, understand, and practice different techniques used in data science.
2. Develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.
3. Practice problem analysis and decision-making.
4. Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences.

**Course Outcome:**

After successful completion of course, Learner will be able to understand and apply diverse data representations, visualization and analysis tools.

CO1: Apply principles of Data Science to the analysis of business problems. (Apply)

CO2: Use data mining software to solve real-world problems. (Apply)

CO3: Employ cutting edge tools and technologies to analyze Big Data. (Apply)

CO4: Apply algorithms to build machine intelligence. (Apply)

**Nagindas Khandwala College (Autonomous)**

CO5: Demonstrate use of team work, leadership skills, decision making and

organization theory. (Apply)

**5. ETHICAL HACKING**

**1867UCSPR**

<u>**Course Objective:**</u>

By the end of the course, learners will be able to:

1. To understand the security of the system
2. To ethically try to find out the security issues in the system
3. To understand the security measures to be adopted in the organization
4. Ethical Hacking ethically penetrates into network systems using various tools to test the strength of a network.
5. Ethical Hacking course shows how to test, scan, hack and secure networks and systems.

<u>**Course Outcome:**</u>

After completing this course learners will be able to:

CO1:  Understand the security of the system (Understand)

CO2: Ethically try to find out the security issues in the system. (Apply)

CO3: Propose the security measures to be adopted in the organization (Evaluate)

CO4: Describes various types of securities and vulnerabilities (Remember)

CO5: Summarizing the legal and professional responsibilities of ethical hacking (Understand)

## PO CO Mapping Matrix

| Semester | Subject | Course Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|----------|---------|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| **Sem 1** | Communication Skills | 2016UISCS | * | | | * | | | * | * | * | * |
| | Web Programming I | 2014UISWP | * | | * | * | * | | * | * | | * |
| | Introduction to Programming | 2011UISIP | * | * | | * | * | * | | | * | * |
| | Fundamentals of Computers and Electronics | 2012UISFC | * | * | * | * | | * | | | | |
| | Operating Systems | 2013UISOS | * | * | * | * | | | * | * | | * |
| | Discrete Mathematics-I | 2015UISDM | * | * | | | | * | | | | |

| Sem | Course | Code | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Web Programming I Practical | 2014UISPR | * | | * | * | * | | * | * | | * |
| | Introduction to Programming Practical | 2011UISPR | * | * | | * | * | * | | | * | * |
| | Fundamentals of Computers and Electronics  Practical | 2012UISPR | * | * | * | * | | * | | | | |
| | Operating Systems Practical | 2013UISPR | * | * | * | * | | | * | * | | * |
| | | | | | | | | | | | | |
| **Sem 2** | IT platforms, Tools and Practices | 2026UISTP | * | * | | * | * | | * | * | * | * |
| | Web Programming II | 2024UISWP | * | | | | * | | | * | * | * |
| | Programming and Application Development in Python | 2021UISPP | * | * | * | | * | | * | * | | * |
| | Object Oriented Programming | 2022UISOO | * | * | | * | | | * | * | * | * |
| | Database Management Systems I | 2023UISDS | * | | * | * | | | * | * | | * |
| | Discrete  Mathematics II | 2025UISDM | * | * | | | | * | | * | | |

| Course | Code | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Web Programming II Practical | 2024UISPR | * | | | | * | | | | * | * | * |
| Programming and Application Development in Python Practical | 2021UISPR | * | * | * | | * | | | * | * | | * |
| Object Oriented Programming Practical | 2022UISPR | * | * | | * | | | | * | * | * | * |
| Database Management Systems I Practical | 2023UISPR | * | | * | * | | | | * | * | | * |
| | | | | | | | | | | | | |
| Core Java | 2031UISCJ | * | * | * | | | | | | * | * | * |
| Data Structures | 2032UISDS | * | * | * | | * | | | | * | | * |
| Computer Networks | 2033UISCN | * | * | * | | | | | * | * | | * |
| Database Management Systems- II | 2034UISDB | * | * | * | | | | | | * | * | * |
| Descriptive Statistics | 2035UISST | * | * | * | * | * | * | | | | | |
| Advanced Web Programming - I | 2036UISAW | * | * | * | | | | | | * | | * |

| | Course | Code | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sem 3** | Hybrid Mobile Application Development 1 | 2036UISMD | * | * | * | * | | | | | * | * | * |
| | Computer Graphics and Animation | 2037UISCG | * | * | * | * | * | * | | | * | | * |
| | Embedded Systems | 2037UISES | * | * | * | | | | | | * | | * |
| | Theory of Computation I | 2037UCSTC | * | * | | * | * | * | * | | * | * | * |
| | Core Java Practical | 2031UISPR | * | * | * | | | | | | * | * | * |
| | Data Structures Practical | 2032UISPR | * | * | * | | * | | | | * | | * |
| | Computer Networks Practical | 2033UISPR | * | * | * | | | | | * | * | | * |
| | Database Management Systems- II Practical | 2034UISPR | * | * | * | | | | | | * | * | * |
| | Advanced Web Programming - I Practical | 2036UISPR | * | * | * | | | | | | * | | * |
| | Hybrid Mobile Application Development 1 Practical | 2036UISPR | * | * | * | * | | | | | * | | * |
| | Computer Graphics and Animation | 2037UISPR | * | * | * | * | * | * | | | * | | * |

| Sem | Course | Code | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Practical | | | | | | | | | | | |
| | Embedded Systems Practical | 2037UISPR | * | * | * | | | | | * | | * |
| | Theory of Computation I Practical | 2037UCSPR | * | * | | * | * | * | * | * | | * |
| | | | | | | | | | | | | |
| | Design Patterns | 2041UISDP | * | * | * | * | | * | | * | | |
| | Design and Analysis of Algorithms | 2042UISDA | * | * | * | * | * | * | | * | * | * |
| | System Programming | 2043UISSP | * | * | * | * | | | | * | | * |
| | Software Engineering | 2044UISSE | * | * | * | * | * | | | * | | * |
| | Probability Theory | 2045UISPT | * | * | * | * | * | * | | * | | * |
| | Advanced Web Programming - II | 2046UISAW | * | * | * | * | | | | | | * |
| | Hybrid Mobile Application Development II | 2046UISMD | * | * | * | * | | | | * | * | * |
| **Sem 4** | Advanced Java | 2046UISAJ | * | * | * | | | | | * | | * |
| | Multimedia Systems | 2047UISMM | * | * | * | * | | | * | * | | * |

| Internet of Things | 2047UISIT | * | * | * | * | | | | * | | * |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Theory of Computation II | 2047UCSTC | * | * | * | | * | * | * | * | | * |
| Design Patterns Practical | 2041UISPR | * | * | * | * | | * | | * | | |
| Design and Analysis of Algorithms Practical | 2042UISPR | * | * | * | * | * | * | | * | * | * |
| System Programming Practical | 2043UISPR | * | * | * | * | | | | * | | * |
| Software Engineering Practical | 2044UISPR | * | * | * | * | * | | | * | | * |
| Advanced Web Programming - II Practical | 2046UISPR | * | * | * | * | | | | | | * |
| Hybrid Mobile Application Development II Practical | 2046UISPR | * | * | * | * | | | | * | * | * |
| Advanced Java Practical | 2046UISPR | * | * | * | | | | | * | | * |
| Multimedia Systems Practical | 2047UISPR | * | * | * | * | | | * | * | | * |
| Internet of Things Practical | 2047UISPR | * | * | * | * | | | | * | | * |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Theory of Computation II Practical | 2047UISPR | * | * | * | | | * | * | * | * | | | * |
| | | | | | | | | | | | | | |
| **Sem 5** | Game Programming | 1857UCSGP | * | * | * | * | * | * | | * | | | | * |
| | Artificial Intelligence | 1851UCSAI | * | * | * | * | * | * | * | * | | | | * |
| | Linux Server Administration | 1852UCSLA | * | * | * | | | | * | * | | | | |
| | Software Testing and Quality Assurance | 1853UCSST | * | * | * | * | * | * | * | * | | | | * |
| | Information and Network Security | 1854UCSNS | * | * | * | * | | | | | * | * | | * |
| | Wireless Sensor Networks and Mobile Communication | 1855UCSWN | * | * | * | | | | | * | | | | * |
| | Web Services | 1856UCSWS | * | * | * | * | | | * | * | * | | | * |
| | Game Programming Practical | 1857UCSPR | * | * | * | * | * | * | | * | | | | * |
| | Project Implementation | 1858UCSPR | * | * | * | * | * | * | * | * | * | | | * |
| | Artificial Intelligence Practical | 1851UCSPR | * | * | * | * | * | * | * | * | | | | * |
| | Linux Server Administration | 1852UCSPR | * | * | * | | | | * | * | | | | |

| Sem | Subject | Code | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Practical | | | | | | | | | | | |
| | Software Testing and Quality Assurance Practical | 1853UCSPR | * | * | * | * | * | * | * | * | | * |
| | Information and Network Security Practical | 1854UCSPR | * | * | * | * | | | | * | * | * |
| | Wireless Sensor Networks and Mobile Communication Practical | 1855UCSPR | * | * | * | | | | | * | | * |
| | Web Services Practical | 1856UCSPR | * | * | * | * | | | * | * | * | * |
| Sem 6 | Ethical Hacking | 1867UCSEH | * | * | * | * | | | * | * | * | * |
| | Architecting of IoT | 1861UCSIT | * | * | * | * | | | * | * | | * |
| | Cloud Computing | 1862UCSCC | * | * | * | * | | | * | * | * | * |
| | Cyber Forensics | 1863UCSCF | * | * | * | * | * | * | * | * | * | * |
| | Information Retrieval | 1864UCSIR | * | * | * | | | | * | * | | * |
| | Digital Image Processing | 1865UCSDP | * | * | * | * | * | * | * | * | | * |

| Subject | Code | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Data Science | 1866UCSDS | * | * | * | * | * | * | * | * | * | * |
| Ethical Hacking Practical | 1867UCSPR | * | * | * | * | | | * | * | * | * |
| Project Implementation | 1868UCSPR | * | * | * | * | * | * | * | * | * | * |
| Architecting of IoT Practical | 1861UCSPR | * | * | * | * | | | * | * | | * |
| Cloud Computing Practical | 1862UCSPR | * | * | * | * | | | * | * | * | * |
| Cyber Forensics Practical | 1863UCSPR | * | * | * | * | * | * | * | * | * | * |
| Information Retrieval Practical | 1864UCSPR | * | * | * | | | | * | * | | * |
| Digital Image Processing Practical | 1865UCSPR | * | * | * | * | * | * | * | * | | * |
| Data Science Practical | 1866UCSPR | * | * | * | * | * | * | * | * | * | * |