



*Thakur Educational Trust's (Regd.)*

**THAKUR RAMNARAYAN  
COLLEGE OF ARTS & COMMERCE**

ISO 21001:2018 Certified

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# Outcome Based Education (OBE) Document

## Programme: B.Sc. (C.S.)

## Program Educational Objectives

**PEO 1:** To prepare students for a career in Computer Science and its applications such as the design, development, implementation, testing and maintenance of computer software/hardware in a professional career.

**PEO 2:** To develop the skill sets of students to be at par with the advancements in the Computer Science domain.

**PEO 3:** To prepare the student for entry into a program of postgraduate study in Computer Science and related domains/ fields.

## Program Outcomes

On successful completion, graduates of B.Sc. (C.S.) programme will be able to:

**PO 1: Disciplinary Knowledge:** Apply the knowledge of mathematics, computer science and Information Technology fundamentals to find solutions of real time problems with different applications.

**PO 2: Effective Communication Skills:** Communicate effectively on complex activities with the end users and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO 3: Critical thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, testing out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

**PO 4: Problem Solving:** Identify, formulate, research literature, and analyse various research and real time application scenarios reaching substantiated conclusions using first principles of mathematics, computer sciences, and information technology.

**PO 5: Analytical Reasoning:** Develop ability to analyse a problem, identify and define applications that resolves the end user requirement with respect to real time problems with appropriate consideration for the societal, and environmental considerations.

**PO 6: Research Related Skills:** Use research-based knowledge and research methods to investigate the problems that cannot be solved by straightforward application of knowledge, theories and techniques; that may not have a unique solution, which need to be defined (modelled) within appropriate mathematical framework/ scientific derivation/ global technological evolutions.

**PO 7: Environment and Sustainability:** Understand the impact of the scientific applications and solutions in societal and environmental contexts, and demonstrate the knowledge of green computing and need for sustainable development.

**PO 8: Cooperation/ Teamwork:** Function effectively as an individual, and as a member or team leader in diverse cross functional groups and in multidisciplinary settings.

**PO 9: Information/Digital Literacy:** Create, select, and apply appropriate techniques, resources, and modern tools including prediction and modelling to complex activities with an understanding of the limitations.

**PO 10: Ethics:** Apply ethical principles and commit to professional ethics & responsibilities and norms of technological and sustainable development.

**PO 11: Self-directed and Life-long Learning:** Recognize the need for and have the preparation and ability to engage independent and lifelong learning in the broadest context of global technological evolution.

**PO 12: Leadership Readiness/Qualities:** Demonstrate knowledge and understanding of the Computer Science, Information Technology and Management principles and apply these to one's own work, as a member and leader in a team, to manage research and application projects and in multidisciplinary environments.

## **Program Specific Outcomes**

On successful completion, graduates of B.Sc. (C.S.) programme will be able to:

**PSO 1:** Demonstrate technical knowledge and illustrate the required skills for software development with the help of basic hardware components. Apply standard software engineering practices and strategies in the development using open-source programming environment.

**PSO 2:** Develop the skills of logical thinking, analytical thinking & acquire essential skills of both verbal as well as non-verbal communication.

**PSO 3:** Apply concepts of wired, wireless, embedded and IoT systems for demonstrating innovative solutions with consideration to real-time applications. Develop knowledge of basic concepts of computer network, security and software testing.

**PSO 4:** Acquaint with contemporary issues, latest trends in technological evolution and thereby develop new ideas and design new solutions to existing problems.

# Digital Systems & Architecture (USCS101)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	Use the basic logic gates and various reduction techniques of digital logic circuits in detail and <b>Recognize</b> the design of the various functional units and components of computers..			✓			
CO2	<b>Identify</b> the elements of modern instruction sets and their impact on processor design and <b>Design</b> Combinational and sequential circuits. .			✓			
CO3	<b>Design</b> synchronous circuits using FSM and analyze Asynchronous circuits and timing Analysis also <b>Recognize</b> the architecture and use of microcontrollers for the basic operations and simulate using simulation software..			✓			

# Introduction to Programming with Python (USCS102)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Describe</b> the Python syntax and semantics and be fluent in the <b>use</b> of Python statements		✓				
CO2	<b>Memorize</b> Python operators, <b>Categorize</b> functions and passing arguments, <b>Solve</b> problems based on compound data types, functions and arrays.			✓			
CO3	<b>Determine</b> the method to create and manipulate Python programs by utilizing the strings, lists, dictionaries, tuples.			✓			

# LINUX Operating System (USCS103)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> the history, philosophy and community of Linux. <b>Describe</b> Linux architecture and Explain packaging methods of Linux.		✓				
CO2	<b>Explain</b> session management, network management & various text editors. <b>Describe</b> various networking protocols, IP address and DNS.		✓				
CO3	<b>Describe</b> basic commands & general-purpose utilities. <b>Demonstrate</b> running of scripts			✓			

# Open Source Technologies (USCS104)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define</b> open source technology and express the concept of licensing in open source technology and <b>implement</b> the methodologies of open source technology, Distinguish between open source and free software.				✓		
CO2	<b>Memorize</b> open source ethics and social and financial impacts, identify and contribute to open source projects.		✓				
CO3	<b>Differentiate</b> between open source and closed source, <b>Implement</b> different open source projects.			✓			

# Discrete Mathematics (USCS105)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define, describe</b> the mathematical structures (relations, functions) and <b>use</b> them to model real life situations. <b>Define</b> Recurrence Relation, <b>understand</b> the relationship between a sequence & recurrence relation & <b>solve</b> linear homogeneous recurrence relations.			✓			
CO2	<b>Recall</b> and <b>illustrate</b> practical applications of basic counting principles, permutations, combinations. <b>Recognize</b> Languages & Grammars and <b>illustrate</b> models of automata theory			✓			
CO3	<b>Define</b> basic terminologies and <b>develop</b> an attitude to solve problems based on graphs, which are widely used in Computer Science. <b>Describe</b> basic terminologies & types of trees, <b>perform</b> various algorithms on binary trees			✓			



## Descriptive Statistics (USCS106)

### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Present</b> Statistical data in various Tabular forms and graphical methods. <b>Relate</b> Statistical Data using Basics techniques of R.			✓			
CO2	<b>Correlate</b> Statistical Data using measures of Central tendency and Dispersion along with Skewness and Kurtosis measures.			✓			
CO3	<b>Interpret</b> various relationships between variables using the Technique of correlation and regression.		✓				

## Soft Skills (USCS107)

### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> various aspects of soft skills and learn ways to develop personality. <b>Discuss</b> the concept of soft skills and describe emotional intelligence		✓				
CO2	<b>Discuss</b> the importance of communication today. <b>Explain</b> the importance and type of communication in personal and professional environments. <b>Apply</b> the academic skills and differentiate types of job interviews & group discussions.			✓			
CO3	<b>Explain</b> the importance of leadership, team building, decision making and stress management.		✓				

## F.Y.B.Sc. (C.S.) (Semester - II)

### Design & Analysis of Algorithms (USCS201)

#### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define</b> algorithm, <b>Compare</b> Algorithms and <b>Examine</b> various Algorithms, and implement basic data structures like array, list and stack.			✓			
CO2	<b>Determine</b> applications of the data structures like solving linear equations, Categorize operations like searching, sorting, selection, pattern matching and recursion.		✓				
CO3	<b>Explain</b> various algorithmic strategies like greedy, divide-n-conquer, dynamic programming, backtracking .		✓				

# Advanced Python Programming (USCS202)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> the concepts of reading, writing and implementing other operations on files Python. <b>Summarize</b> the regular expression and handling exceptions for writing robust python programs.			✓			
CO2	<b>Classify</b> basic concepts of SQL, Implement threading concept and multithreading in Python. <b>Construct</b> GUI design Programs and implement database interaction using Python.			✓			
CO3	<b>Identify</b> and <b>apply</b> the concept of inheritance and OOPs			✓			

# Introduction to OOPs using C++ (USCS203)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall</b> programming concepts, DataTypes, Data Input, Output and Operators. <b>Illustrate</b> Decision Making and Loops. Describe Arrays and Strings. <b>Explain</b> Unified Modeling Language <b>Explain</b> concept of Classes, Abstraction & Encapsulation			✓			
CO2	<b>Differentiate</b> Constructors and Destructors with examples. <b>Demonstrate</b> various methods of working with objects. <b>Explain</b> the concept of Polymorphism. Modelling of Class Diagram				✓		
CO3	<b>Demonstrate</b> the concept of Inheritance with examples. <b>Construct</b> Modelling Relationship in Class Diagram. <b>Explain</b> Runtime Polymorphism. <b>Describe</b> the concepts of Pointers. <b>Explain</b> File Handling in C++. <b>Apply</b> OOP concept to solve real life applications.			✓			

# Database Systems (USCS204)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define</b> Database Management System and <b>Describe</b> the features of data model. <b>Explain</b> and <b>apply</b> ER diagram concepts to the database. Execute various DDL, DML statements.			✓			
CO2	<b>Illustrate</b> various relational data models, relational algebra and <b>implement</b> various functions, different types of joins and subqueries to the database.			✓			
CO3	<b>Apply</b> normalization techniques of the database. <b>Describe</b> the various security mechanisms of the database. Explain views.			✓			

## Calculus (USCS205)

### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall</b> function, limits of functions, Continuity and differentiability of functions. <b>Define</b> and <b>calculate</b> Increasing, Decreasing and Extrema of functions.			✓			
CO2	<b>Solve</b> the Problems on Area between two curves, Length of Plane Curve. <b>Find</b> the difference between Linear differential and Homogeneous differential equations.			✓			
CO3	<b>Describe</b> and discuss the function of two or more variables, limits and continuity and partial derivatives. <b>Evaluate</b> Directional derivatives and Gradients.			✓			

## Statistical Methods (USCS206)

### Course Outcomes

After completing this course, students will be able to:

CO	Course OutcomesApply	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall</b> the definition of sample space and events in probability. <b>Explain</b> the rules of probability and how it applies to mutually different types of events. <b>Differentiate</b> between a discrete random variable and a continuous random variable. <b>Calculate</b> the probability mass function or probability density function of a given random variable.			✓			
CO2	<b>Define</b> the mathematical expectation & Variance for both the type of random variables and compute the same for concrete examples. <b>Explain</b> the fundamental concepts and properties of standard probability distributions. <b>Apply</b> different standard probability distributions, to solve problems in various fields.			✓			
CO3	<b>Define</b> the concept of hypothesis testing and its role in statistical inference. <b>Apply</b> different statistical tests. <b>Interpret</b> statistical output and draw conclusions based on hypothesis tests. <b>Use</b> statistical software tools, such as R, and analyze the data to interpret the results.				✓		



# E-Commerce & Digital Marketing (USCS207)

## Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Interpret</b> the concept of overall e-commerce and e-business and <b>evaluate</b> the study of electronic payment systems, digital marketing and planning in detail.					✓	
CO2	<b>Analyze</b> and <b>Evaluate</b> the concepts of social media marketing, email marketing, mobile marketing and content marketing as a whole.					✓	
CO3	<b>Analyze &amp; evaluate</b> the focus on search engine optimization, search engine marketing, web analytics and google analytics in detail and <b>explain</b> the study of overall report in e-commerce.					✓	

## S.Y.B.Sc. (C.S.) (Semester - III)

### Principles of Operating Systems (USCS301)

#### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> the main components of the Operating System, its structure and its functionality. <b>Explain</b> process management policies and <b>identify</b> the requirements for process synchronization and coordination handled by the OS.		✓				
CO2	<b>Explain</b> and <b>apply</b> process scheduling algorithms. <b>Describe</b> deadlock prevention and recovery techniques.			✓			
CO3	<b>Describe</b> memory management and its allocation policies. <b>Describe</b> , use and evaluate the storage management policies with respect to storage management techniques.			✓			

## S.Y.B.Sc. (C.S.) (Semester - III)

### Linear Algebra (USCS302)

#### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> algebraic & geometric representation of vectors in and their operations including addition, scalar multiplication & dot product. <b>Describe</b> properties of linear systems using vectors.		✓				
CO2	<b>Recall</b> the concept & properties of matrices. <b>Perform &amp; Interpret</b> matrix operations. <b>Interpret &amp; compute</b> the determinants of matrices & implement it in the concept of linear dependence & basis.			✓			
CO3	<b>Identify</b> the properties of inner product space in comparison with a Euclidean n-space, <b>interpret</b> basic concepts of norm, orthogonality of vectors in an inner product space. <b>State</b> the eigenvalues & eigenvectors of a matrix & <b>Compute</b> the eigenvalues along with its corresponding eigenvectors.			✓			

S.Y.B.Sc. (C.S.) (Semester - III)

Data Structures (USCS303)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Apply</b> different types of data structures such as array, linked list, stack, queue, tree, graph, hash table.			✓			
CO2	<b>Differentiate</b> between which data structures to be used based on the type of the problem.		✓				
CO3	<b>Apply</b> combined knowledge of algorithms and data structures to write highly effective programs in various domains.			✓			

S.Y.B.Sc. (C.S.) (Semester - III)

Advanced Database Concepts (USCS304)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Describe</b> PL/SQL and <b>use</b> their different control structures for data management. <b>Define</b> sequences, procedures and <b>use</b> this concept for manipulating data in databases with methods to create, execute, alter and view..			✓			
CO2	<b>Identify</b> various collections and records in the database. <b>Describe</b> cursor, static and dynamic SQL techniques for data management. <b>Describe</b> and <b>classify</b> exception handling in PL/SQL data management		✓				
CO3	<b>Describe</b> the concepts of triggers <b>Define</b> the concept of triggers and <b>use</b> this concept for manipulating data in databases with methods to create, insert, delete, update and view.. <b>Explain</b> the concept of Transaction Management and Crash recovery.			✓			

S.Y.B.Sc. (C.S.) (Semester - III)

Java based Application Development (USCS305)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Describe</b> the concept of Java, Java Virtual Machine, Application Programming Interface, Object Oriented Concepts <b>Demonstrate</b> basic concepts of Packages,, Exception Handling with User-defined Exceptions, Multithreading		✓				
CO2	<b>Define</b> the concept of Collection Framework, JFC Swing API Components along with Printing 2D API and Java Print Service API <b>Define</b> and <b>demonstrate</b> the concept of Event Handling using Delegation Event Model, JDBC Architecture, Driver			✓			
CO3	<b>Demonstrate</b> the concepts of Servlet, Servlet Life Cycle, Types of Servlet, Types of Servlet Events, Servlet Configuration with deployment development descriptor and Session Management, the concepts of JSP, JSP Architecture,		✓				

S.Y.B.Sc. (C.S.) (Semester - III)

Web Technologies (USCS306)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define</b> HTML5 & CSS, <b>identify</b> different tags, properties, attributes etc. and <b>explain</b> the implementation of HTML5 & CSS in designing the websites or web applications.		✓				
CO2	<b>Memorize</b> javascript concepts like popup boxes, methods, operators, properties, Document object model, browser object model and <b>apply</b> these concepts for making a dynamic website. <b>Describe</b> XML document structure, advantages and disadvantages of XML and <b>summarize</b> DTD documents along with its types and other terms.			✓			
CO3	<b>Describe</b> and <b>use</b> ajax methods for asynchronous handling requests. <b>Explain</b> server-side scripting language i.e. PHP and use the concepts along with MySQL for database connectivity and interactions with data. <b>Demonstrate</b> the multiple jQuery concepts like selectors, manipulators and events			✓			

**S.Y.B.Sc. (C.S.) (Semester - III)**

**Green Technologies (USCS307)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define</b> the concept of Green Computing and Green IT infrastructure for making computing and information system environments sustainable.	✓					
CO2	<b>Describe</b> the importance of green organization. Recite green IT strategies, metrics and measurements.		✓				
CO3	<b>Explain</b> the need for a Green Information System and staying green.		✓				



S.Y.B.Sc. (C.S.) (Semester - IV)

Theory of Computation (USCS401)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall</b> the theoretical foundations of computer science from the perspective of formal languages. <b>Illustrate</b> finite state machines to solve problems in computing			✓			
CO2	<b>Explain</b> the hierarchy of problems arising in the computer sciences. <b>Recognize</b> the concepts of Pushdown Automata.		✓				
CO3	<b>Describe</b> Turing Machines and <b>Summarize</b> Unsolvability Problems		✓				

**S.Y.B.Sc. (C.S.) (Semester - IV)**

**Computer Networks (USCS402)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Memorize</b> the concepts of networking, Define TCP/IP and OSI models	✓					
CO2	<b>Summarise</b> Network Layer and and relate IP address		✓				
CO3	<b>Determine</b> Routing protocols and Client Server Protocols			✓			

S.Y.B.Sc. (C.S.) (Semester - IV)

Software Engineering (USCS403)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> the concept of software engineering and <b>describe</b> different stages of the software development life cycle. <b>Describe</b> different software process models. <b>Draw</b> different UML diagrams.			✓			
CO2	<b>Define</b> architectural and user interface design. <b>Use</b> this concept for measurement and metrics. <b>Explain</b> software project management. <b>Use</b> this concept for software cost estimation.			✓			
CO3	<b>Describe</b> risk management and software quality assurance. <b>Explain</b> verification and validation, levels of testing, white-box, black-box techniques for software testing.		✓				

**S.Y.B.Sc. (C.S.) (Semester - IV)**

**IoT Technologies (USCS404)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall</b> the concept of SoC and IOT and various types of IOT platforms.		✓				
CO2	<b>Discuss</b> the interfacing of various types of devices using different protocols with IOT.		✓				
CO3	<b>Recognize</b> the concept of edge, fog and cloud computing along with practical application of IOT in the real life world.		✓				

S.Y.B.Sc. (C.S.) (Semester - IV)

Android Application Development (USCS405)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Identify</b> the components of Android and demonstrate the concept of Kotlin, packages and data types and illustrate the programming concepts		✓				
CO2	<b>Identify</b> and build various layouts in Android seamless user interface for Android platform and illustrate various Android programming concepts						✓
CO3	<b>Build</b> and <b>deploy</b> mobile applications using android services and components						✓

S.Y.B.Sc. (C.S.) (Semester - IV)

Advance Application Development (USCS406)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recognize and Illustrate</b> all the necessary and important technologies such as MongoDB, Express.js, AngularJS, and Node.js.			✓			
CO2	<b>Demonstrate</b> the concept of Express, RestAPI and Angular.js			✓			
CO3	<b>Apply</b> modern app development using Flutter and Dart Programming			✓			

## S.Y.B.Sc. (C.S.) (Semester - IV)

### Management and Entrepreneurship (USCS407)

#### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Interpret</b> the concept of overall management and their functions. and evaluate the study of planning, organizing and staffing in detail.					✓	
CO2	<b>Analyze</b> entrepreneurship in different types, levels & classifications, interpret the concept of entrepreneurs and evaluate the study of directing and controlling in detail.					✓	
CO3	<b>Analyze &amp; evaluate</b> the focus on small scale industry in detail and apply or study of project report and preparations of project feasibility study as a whole.					✓	

**T.Y.B.Sc. (C.S.) (Semester - V)**  
**Artificial Intelligence (USCS501)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall and Define</b> the concept of artificial intelligence, its history and state of the art application		✓				
CO2	<b>Apply</b> the different search algorithms for solving problems in AI			✓			
CO3	<b>Build</b> machine learning algorithms for classification using supervised learning techniques			✓			
CO4	<b>Apply</b> the concept of probabilistic learning to machine learning			✓			



**T.Y.B.Sc. (C.S.) (Semester - V)**

**Software Testing and Quality Assurance(USCS5032)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> the concept of software Testing Techniques. <b>Define</b> terms related to Software Testing and Quality Assurance. <b>Describe</b> different verification and validation types. <b>Explain</b> the concept of software review, walkthrough and inspection		✓				
CO2	<b>Define</b> software metrics. <b>Use</b> this concept for measurement and development of software metrics. <b>Describe</b> defect management process. <b>Explain</b> levels of testing. <b>Design</b> and <b>Execute</b> test cases to verify the functionality and performance of software systems.			✓			
CO3	<b>Identify</b> the effective tools in providing Quality assurance with respect to software. <b>Utilize</b> software testing tools and frameworks to automate testing processes and improve efficiency. <b>Design</b> quality improvement tools: Pareto Diagrams, Cause-effect Diagrams, Scatter Diagrams, Run charts			✓			

**T.Y.B.Sc. (C.S.) (Semester - V)**

**Information and Network Security (USCS504)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Explain</b> Network Security, OSI Security Architecture, Security Services and Mechanism, Describe various Encryption Techniques like Substitution, Transposition, Steganography, DES and AES Algorithm, Public Key Cryptography and RSA Algorithm.		✓				
CO2	<b>Define</b> various Key Management Techniques like Public Key Cryptosystem, Diffie-Hellman Algorithm, MAC, Hash Function and Secure Hash Algorithm, and Explain Digital Signature, Digital Signature Standards, Authentication Protocols		✓				
CO3	<b>Demonstrate</b> Electronic Mail Security Protocols like PGP and S/MIME, IP Security, Authentication Header, Encapsulating Security Payload and Combining Security Associations. <b>Apply</b> Web Security like Secure Socket Layer and Transport Layer, Secure Electronic Transaction, Intrusion, Intrusion Technique and Detection,			✓			

**T.Y.B.Sc. (C.S.) (SEMESTER - V)**

**Cyber Forensics (USCS5041)**

**Asst. Prof. Smriti.M.Dubey**

**COURSE OUTCOMES:**

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

CO No.	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
1	<b>Explain</b> the concept of Cyber Forensics. <b>Describe</b> procedure for conducting Computer Investigation. <b>Explain</b> process of acquiring and preserving digital evidence.		<input type="checkbox"/>				
2	<b>Explain</b> guidelines for seizing digital evidence as well as ways to work with graphics files. <b>Use</b> various forensics tools for conducting forensic analysis.			<input type="checkbox"/>			
3	<b>Identify</b> and <b>analyze</b> the steps to conduct network forensics and live acquisition,acquire data from mobile devices as well as how to write a report. <b>Use</b> various forensics tools for conducting network forensics and mobile forensics.		<input type="checkbox"/>	<input type="checkbox"/>			



T.Y.B.Sc. (C.S.) (Semester - V)

Web Services (USCS506)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define</b> the concept of Web Services, Types of Web Services Distributed computing, infrastructure, Build SOAP web service using XML .						✓
CO2	<b>Define</b> and <b>summarize</b> the concept of HTTP, The core architectural elements of a RESTful system, Build RESTful web services with JAX-RS APIs , relate description and discovery of RESTful web services.						✓
CO3	<b>Explain</b> WCF and its features and Build the WCF and .NET Framework Client Profile, Basic WCF Programming, WCF Feature Details. Web Service QoS.						✓

T.Y.B.Sc. (C.S.) (Semester - V)

Game Programming(USCS507)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recognize</b> various mathematical concepts required for computer graphics		✓				
CO2	<b>Apply</b> DirectX pipeline programming and understand about interpolation and character animation using various mathematical techniques			✓			
CO3	<b>Build</b> games using rendering engines such as UNITY Engine and know about various scripting tools & XR technologies						✓

**T.Y.B.Sc. (C.S.) (Semester - VI)**

**Wireless Sensor Network and Mobile Communication (USCS601)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall</b> and <b>Describe</b> various applications of wireless sensor networks, concepts, protocols, design.		✓				
CO2	<b>Illustrate</b> and <b>Apply</b> various concepts to design the Network			✓			
CO3	<b>Implement</b> and <b>Evaluate</b> new ideas for solving wireless sensor network design issues.				✓		

## T.Y.B.Sc. (C.S.) (Semester - VI)

### Cloud Computing (USCS603)

#### Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Define</b> Cloud Computing. <b>Explain</b> basic concepts of Distributed computing, Parallel computing		✓				
CO2	<b>Describe</b> virtualization and its characteristics. <b>Explain</b> various taxonomy of Virtualization techniques, virtualization using KVM, open challenges of cloud computing.		✓				
CO3	<b>Describe</b> Open Stack and its basic operations. <b>Explain</b> tenant model operations, deploying and utilizing OpenStack in production environments, Building a production environment		✓				



**T.Y.B.Sc. (C.S.) (Semester - VI)**  
**Information Retrieval (USCS604)**

**Course Outcomes**

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Recall</b> the concept of information retrieval along with its issues and dictionary and various retrieval techniques.		✓				
CO2	<b>Discuss</b> the various techniques of link analysis search algorithms and specialized search.		✓				
CO3	<b>Know</b> about the concept of web search engine and XML retrieval.		✓				

T.Y.B.Sc. (C.S.) (Semester - VI)

Data Science (USCS605)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	Outline the Introduction to Data Science; <b>Explain</b> Integrated Development Environment; <b>Describe</b> Exploratory Data Analysis; Summarize Data Management		✓				
CO2	<b>Recall</b> Query languages and operations; Distinguish Structured, Unstructured and Semi-Structured data; <b>Identify</b> Security and Ethical considerations; Explain AWS				✓		
CO3	<b>Explain</b> Statistical Modelling and Machine Learning; <b>Illustrate</b> Data transformations; Demonstrate Supervised Learning and Unsupervised Learning			✓			

T.Y.B.Sc. (C.S.) (Semester - VI)

Ethical Hacking (USCS607)

Course Outcomes

After completing this course, students will be able to:

CO	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
CO1	<b>Identify</b> the security vulnerabilities/attacks and weaknesses in the system and classify between types of malware		✓				
CO2	<b>Distinguish</b> between penetration testing and vulnerability assessment as well as identify and implement the use of various tools and techniques to test the security techniques.				✓		
CO3	<b>Identify</b> and <b>analyze</b> the stages an ethical hacker requires to take in order to compromise a target system as well as implement preventive, corrective and protective measures to safeguard the system				✓		

**T.Y.B.Sc. (C.S.) (SEMESTER - V)**

**Project Management (USCS5051)**

**COURSE OUTCOMES:**

After completing this course, students will be able to:

CO No.	Course Outcomes	Revised Bloom's Taxonomy Learning Levels					
		R	U	A	N	E	C
1	Applying project management principles, processes, and best practices to plan, execute, and control projects effectively.  Developing project charters, defining project scopes, and creating work breakdown structures (WBS) to establish project objectives and deliverables.		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>
2	Creating project schedules, estimating resource requirements, and monitoring project progress using appropriate project management techniques.			<input type="checkbox"/>		<input type="checkbox"/>	
3	Employ quality assurance and control measures to ensure project deliverables meet stakeholder expectations and industry standards.  Demonstrating effective leadership and teamwork skills, as well as the ability to manage stakeholders, resolving conflicts, and making ethical decisions in project management settings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			

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