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.)

S.Y.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.

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

Principles of Operating Systems (1103111)

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	Work with any type of operating system		✓				
CO2	Handle threads, processes, process synchronization		✓	✓	✓		
CO3	Implement CPU scheduling algorithms			✓	✓		
CO4	Understand the background role of memory management	✔	✔				
CO5	Design file system			✔	✔		✔

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

Theory of Computation (1103112)

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	Describe the fundamental concepts and significance of Theory of Computation in Computer Science.		✔				
CO2	Design deterministic and non-deterministic finite automata for regular languages and prove their equivalence.				✔		
CO3	Apply regular expressions and grammars to define and generate formal languages.			✔			
CO4	Construct context-free grammars and analyse their ambiguity, simplification, and normal forms.				✔		
CO5	Differentiate between complexity classes such as P, NP, NP-Complete, and NP-Hard problems				✔		
CO6	Identify and analyze undecidable problems				✔		

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

Data Structures (1103113)

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	Define and implement various data structures using Abstract Data Types (ADTs) and understand their classifications and use cases.			✔			
CO2	Apply operations on linked lists, including traversal, insertion, deletion, and use them in practical applications like polynomial manipulations.			✔			
CO3	Implement stack and queue operations with array and linked representations, and apply them in real-world scenarios like delimiter checking and scheduling.			✔			
CO4	Design and traverse tree structures including binary trees, BSTs, AVL trees, and understand their applications in encoding and searching.						✔
CO5	Implement graph structures, perform traversals using BFS and DFS, and solve shortest path and connectivity problems.				✔		
CO6	Use heaps and hashing techniques effectively for priority management, efficient searching, and collision handling in various applications.			✔			

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

Computer Science Practical – 3 (1103114)

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	Design and implement solutions using inter-process communication techniques such as shared memory and message passing.						✔
CO2	Apply multithreading, synchronization mechanisms, and scheduling algorithms to solve operating system-related problems.			✔			
CO3	Construct and manipulate linear and non-linear data structures using custom implementations						✔
CO4	Demonstrate effective use of stack, queue, trees, graphs, and hash tables in algorithm development.				✔		
CO5	Analyze and evaluate the performance of memory and disk management techniques and abstract data operations.					✔	
CO6	Apply practical programming knowledge to develop efficient, real-time, and scalable system-level applications			✔			

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

VSC - JAVA Programming (1103411)

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	Apply object-oriented programming concepts to develop efficient and maintainable Java applications.			✔			
CO2	Implement exception handling and multithreading to build robust and concurrent programs.				✔		
CO3	Use Java Collection Framework to store, manipulate, and retrieve data effectively		✔				
CO4	Design user interfaces using Swing components and handle user events in GUI applications.						✔
CO5	Connect Java applications with databases using JDBC and perform CRUD operations			✔			
CO6	Develop dynamic, session-managed web applications using Servlets and JSP.						✔

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

MINOR – Operation Research I (1083213)

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	Optimize the cost, time profit or loss through Linear Programming Problem			✔			
CO2	Make best transportation schedule with minimum cost and to maximize profit				✔		
CO3	Optimal allocation or assignment of Jobs to machines			✔			

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

MINOR – Practical based on Operation Research I (1083214)

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	Optimize the cost, time profit or loss through Linear Programming Problem			✔			
CO2	Make best transportation schedule with minimum cost and to maximize profit				✔		
CO3	Optimal allocation or assignment of Jobs to machines			✔			

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

Environmental Management & Sustainable Development -I (1573311)

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	Understand the concept of sustainable goals of development goals.		✔				
CO2	Understand the concept of environmental conservation and its practices.		✔				

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

भाषिक-कौशल्यांचे-उपयोजन-2 (कथाकथन कौशल् आषि अषभवाचन कौशल्)

(2513515)

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	विद्यार्थ्यांना कथाकथन या भाषिक कौशल्याचे स्वरूप, महत्त्व आणि घटक समजतील.		✔				
CO2	विद्यार्थ्यांना प्रभावी कथाकथनासाठी आवश्यक असलेल्या क्षमता, तंत्रे आणि अभिव्यक्ती कौशल्यांचा परिचय होईल.		✔				
CO3	विद्यार्थ्यांना अभिवाचन या भाषिक कौशल्याचे स्वरूप व वैशिष्ट्ये समजतील.		✔				
CO4	विद्यार्थ्यांना प्रभावी अभिवाचनासाठी आवश्यक असलेल्या तंत्र, स्वरभंगिमा, उच्चार आणि सादरीकरण कौशल्यांची माहिती मिळेल.		✔				
CO5	विद्यार्थ्यांमध्ये प्रत्यक्ष कथाकथन व अभिवाचन करण्यासाठी आवश्यक क्षमता आणि कौशल्ये विकसित होतील.			✔			

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

हिंदी भाषा : व्यावहारिक प्रयोग (2513511)

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	विद्यार्थियों को राजभाषा हिंदी का ज्ञान प्राप्त होगा तथा उसमें दक्षता विकसित होगी।		✔				
CO2	विद्यार्थियों को राजभाषा हिंदी के व्यावहारिक प्रयोग की जानकारी प्राप्त होगी।			✔			
CO3	विद्यार्थियों को हिंदी की संज्ञा आदि व्याकरणिक तत्वों का ज्ञान प्राप्त होगा तथा भाषा के शुद्ध एवं व्यावहारिक रूप की समझ विकसित होगी।		✔				
CO4	विद्यार्थियों को कारकों, वाक्य-रचना एवं भाषिक रूपों आदि का ज्ञान प्राप्त होगा।	✔					

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

Indian Theatre: Classical Roots and Contemporary Expressions (2523613)

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	Describe the historical and cultural development of Indian theatre across different time periods.		✔				
CO2	Interpret and apply the aesthetic principles from Natyashastra (such as Rasa and Abhinaya) in the analysis of theatrical performances			✔			
CO3	Critically evaluate classical Indian plays for their structure, themes, character development, and historical significance.					✔	
CO4	Compare and contrast different forms of modern Indian theatre and assess their audience impact and staging methods.				✔		
CO5	Demonstrate understanding of street theatre and one-act plays by creating outlines or performing excerpts reflecting real-world issues.						✔
CO6	Reflect on the role of performing arts in cultural preservation, education, and community engagement.				✔		

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

SPORTS – Introduction to Sports Training & Tests and Measurement (2523612)

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	Understand and apply the principles of sports training.			✔			
CO2	Identify and differentiate between various training methods.				✔		
CO3	Develop effective exercise plans and training schedules.						✔
CO4	Evaluate the impact of training on performance enhancement.					✔	
CO5	Identify and explain the importance of test and measurement in sports.		✔				
CO6	Apply various skill, fitness, and psychological tests.			✔			
CO7	Evaluate test results to assess fitness and performance levels.					✔	
CO8	Utilize test data to design targeted training and rehabilitation programs						✔

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

Computer Networks (1104111)

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
	OC 1. Describe network architectures, types, models, and the layered approach in data communication.		✔				
	OC 2. Analyze the working of physical and data link layers including signal transmission, media, error detection, and MAC protocols.			✔			
	OC 3. Explain the role of switching techniques and multiplexing in efficient communication.		✔				
	OC 4. Configure and evaluate IPv4/IPv6 addressing schemes and understand packet forwarding and routing algorithms.			✔			
	OC 5. Compare and contrast TCP, UDP, and SCTP protocols and apply them to real-time applications.					✔	
	OC 6. Use knowledge of application layer protocols (HTTP, FTP, Email, DNS, etc.) to understand client-server interactions.		✔				
	OC 7. Assess Quality of Service (QoS) requirements and identify modern network challenges and solutions like 5G, satellite, and secure communication.					✔	

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

Software Engineering (1104112)

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	OC 1. Explain software process models and apply suitable models to project scenarios.	✔					
CO2	OC 2. Analyze software requirements and create UML-based system models.				✔		
CO3	OC 3. Apply design principles and estimation techniques for software development.			✔			
CO4	OC 4. Plan, schedule, and manage software projects effectively using industry practices.						✔
CO5	OC 5. Demonstrate understanding of quality assurance and perform software testing using appropriate methods.			✔			

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

IoT Technologies (1104113)

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	OC 1. Understand the core concepts, design, and architecture of IoT systems.		✔				
CO2	OC 2. Identify and use various sensors, actuators, and IoT development boards like Raspberry Pi, Arduino, and NodeMCU.			✔			
CO3	OC 3. Apply appropriate protocols for communication and ensure secure data exchange.			✔			
CO4	OC 4. Design simple IoT applications involving data collection, processing, and visualization.						✔
CO5	OC 5. Analyze IoT use cases and appreciate the role of Edge, Fog, and Cloud in modern applications.				✔		

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

Computer Science Practical – 4 (1104114)

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 network diagnostic and configuration commands effectively on Windows and Linux systems.			✔			
CO2	Design and simulate wired and wireless networks using Cisco Packet Tracer with IP configurations and routing protocols.						✔
CO3	Analyze network traffic using Wireshark and identify protocol layers and data flow				✔		
CO4	Configure and test IoT hardware platforms for device communication and data acquisition.			✔			
CO5	Implement real-time IoT applications using sensors, actuators, and cloud communication.			✔			
CO6	Develop integrated solutions using web technologies, IoT protocols, and dashboarding tools.						✔

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

SEC- MEAN Stack Development (1104412)

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	Design, develop, and deploy full-stack web applications using the MEAN stack						✔
CO2	Build secure and scalable back-end APIs using Node.js and Express.js.						✔
CO3	Develop responsive and dynamic front-end interfaces using Angular.						✔
CO4	Perform CRUD operations in MongoDB using Mongoose.			✔			
CO5	Integrate the front-end and back-end for seamless data flow and user experience						✔

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

Operations Research -II (10844213)

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	Ability to Create Network Diagrams, Identification of Critical Path, and Project Scheduling Skills						✔
CO2	Ability to Formulate Game Theory Problems, Strategic Decision Making and Optimal Strategy Identification						✔
CO3	Analytical Decision-Making Skills, Optimal Decision Identification and Risk and Uncertainty Management			✔			

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

Practical based on Operations Research -II (10844213)

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	Ability to Create Network Diagrams, Identification of Critical Path, and Project Scheduling Skills						✔
CO2	Ability to Formulate Game Theory Problems, Strategic Decision Making and Optimal Strategy Identification						✔
CO3	Analytical Decision-Making Skills, Optimal Decision Identification and Risk and Uncertainty Management			✔			

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

Environmental Management & Sustainable Development -II (1574312)

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 principles of Environmental Science for explaining sustainable development and its related ethical concerns		✔				
CO2	Display scientific perspective for issues confronting our present day environment.		✔				
CO3	Analyze the national and global environmental issues relating air, water, soil, and land use, biodiversity, and pollution			✔			
CO4	Explain the Role of an individual in relation to human population and environmental pollution.		✔				
CO5	Recognize the importance of collective efforts for environmental sustainability as reflected in various treaties, conventions and laws	✔					

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

Introduction to Communication Skills in English II (2514514)

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	Demonstrate an understanding of English Usage in Communication		✔				
CO2	Exhibit the ability to Read a variety of written text using subskills such as analyzing and interpreting text				✔		
CO3	Show competence in comprehending a variety of oral texts.		✔				
CO4	Actively participate in group discussion, and research and prepare for the interview effectively			✔			
CO5	Display advanced formal (email writing, report writing) and creative writing skills.						✔

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

Integrated Theatre Production: Stage Craft, Costume, Music and Technology (2524613)

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	Describe the historical and cultural development of Indian theatre across different time periods		✔				
CO2	Interpret and apply the aesthetic principles from Natyashastra (such as Rasa and Abhinaya) in the analysis of theatrical performances			✔			
CO3	Critically evaluate classical Indian plays for their structure, themes, character development, and historical significance.					✔	
CO4	Compare and contrast different forms of modern Indian theatre and assess their audience impact and staging methods.				✔		
CO5	Demonstrate understanding of street theatre and one-act plays by creating outlines or performing excerpts reflecting real-world issues.						✔
CO6	Reflect on the role of performing arts in cultural preservation, education, and community engagement.				✔		

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

Advanced Sports Training and Performance Evaluation (2524612)

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	Gain practical knowledge of sports training principles and methods		✔				
CO2	Develop the ability to conduct, evaluate, and interpret various fitness and skill-based tests					✔	
CO3	Learn to design and implement personalized and professional training programs						✔
CO4	Acquire experience in organizing and volunteering in sports and fitness events.			✔			
CO5	Understand the role of psychological, fitness, and skill tests in enhancing performance.		✔				