

**R.P. Gogate College of Arts & Science  
and  
R.V. Jogalekar College of  
Commerce (Autonomous), Ratnagiri**



**Bachelor of Science (Computer Science)(B.Sc. CS)  
Programme  
Three Year Integrated Programme- Six Semesters**

***Course Structure***

**T. Y. B.Sc. Sem-V & VI**

**Under Choice Based Credit System  
(CBCS)**

**To be implemented from Academic Year  
2025-26 progressively**

## Preamble

This is a third year curriculum in the subject of Computer Science. The revised and restructured curriculum for the three year integrated course is systematically designed considering the National Education Policy (NEP) along with the proposed Autonomy constraints. The syllabus aims to provide students with a comprehensive understanding of computer science concepts, theories, and practical skills, enabling them to excel in the dynamic and rapidly evolving field of technology. The revised and restructured curriculum for the Three-year integrated course is systematically designed considering the current industry needs in terms of skill sets demanded in the new technological environment. It also endeavors to align the program structure and course curriculum with student aspirations and corporate expectations.

The proposed curriculum contains two semesters, each semester contains two Electives: Elective-I and II. Every elective contains three papers based on specific areas of computer science. It also include one skill enhancement paper per semester, helps the student to evaluate his/ her computer science domain specific skill and also to meet industry expectations. The proposed curriculum is contextual, industry-friendly, and suitable to cater to the needs of society and the nation in the present-day environment. The T.Y.BSc Computer Science syllabus is structured as follows: Core Modules: The syllabus comprises core modules that cover essential topics in computer science, ensuring a strong foundation that aim to develop computational thinking, analytical abilities, and problem solving skills among students. The Artificial Intelligence course provides in-depth knowledge of cutting edge AI concepts and techniques empowering them to develop intelligent systems and algorithms. With a focus on safeguarding information and systems the Cyber and Information Security course equips students with essential concepts and practices in cybersecurity. The Data Science course provides students with a solid foundation in data analysis and interpretation, enabling them to extract valuable insights and make data-driven decisions. In an era dominated by cloud-based technologies, the Cloud Computing course focuses on the principles, architectures, and applications of cloud computing. Skill Enhancement Electives: Students are required to choose skill enhancement electives to deepen their knowledge in specific areas of interest. The electives offer specialized courses such as web development, cybersecurity, data science, or software engineering.

By selecting these courses, students can tailor their learning experience according to their career aspirations and industry demands. Skill Enhancement courses such as Linux Server Administration, Software Testing and Quality Assurance, Cyber Forensics, Game Programming, Data Mining and Warehousing, Wireless and Sensor Networks, Ethical Hacking, and Information Retrieval cater to specialized areas of expertise and industry demands. Generic Electives: The syllabus also includes generic electives, which provide students with the option to explore disciplines of interest beyond their choices in Core and Discipline-Specific Elective papers. These courses broaden their horizons and allow for interdisciplinary learning.

Project Work: A significant component of the syllabus involves hands-on project work. Through practical assignments and projects, students have the opportunity to apply their theoretical knowledge to real-world scenarios. This approach fosters creativity, problem-solving skills, and innovation in designing and developing software solutions. Assessment methods for the TY Computer Science syllabus include written examinations, practical

## **Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

assignments, project evaluations, and presentations. This comprehensive approach ensures that students' understanding is evaluated through various mediums, emphasizing both theoretical knowledge and practical skills.

The newly designed TY Computer Science syllabus aims to equip students with the necessary competencies to pursue careers in software development, data analysis, research, or further studies in computer science related disciplines. It seeks to empower students with the knowledge and skills required to thrive in the ever-evolving landscape of technology and contribute to the advancement of the field. We sincerely believe that students who undertake this program will gain a strong foundation and exposure to the basics, advanced concepts, and emerging trends in the subject. We express our gratitude to all the experts who provided valuable feedback and suggestions to improve the curriculum. We have made sincere efforts to incorporate their inputs. In essence, the objective of this syllabus is to create a pool of technologically savvy, theoretically strong, innovatively skilled and ethically responsible generation of computer science professionals.

Special thanks to the Department of Computer Science, Gogate Jogalekar College(Autonomous), Ratnagiri and all honorable members of the Board of Studies of Computer Science, who volunteered or have directly or indirectly, helped design certain specialized courses and the syllabus as a whole.

## Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26

Name of Programme	<b>B.Sc. Computer Science</b>
Level	UG
No of Semesters	06
Year of Implementation	<b>2025-26</b>
Programme Specific Outcomes (PSO)	<ol style="list-style-type: none"> <li>1. To formulate, model, design solutions, procedure and to use software tools to solve real world problems.</li> <li>2. To design and develop computer programs/computer -based systems in the areas such as networking, web design, security, cloud computing, IoT, data science and other emerging technologies.</li> <li>3. To familiarize with the modern-day trends in industry and research based settings and thereby innovate novel solutions to existing problems.</li> <li>4. To apply concepts, principles, and theories relating to computer science to new situations.</li> <li>5. To use current techniques, skills, and tools necessary for computing practice</li> <li>6. To apply standard Software Engineering practices and strategies in real-time software project development</li> <li>7. To pursue higher studies of specialization and to take up technical employment.</li> <li>8. To work independently or collaboratively as an effective team member on a substantial software project.</li> <li>9. To communicate and present their work effectively and coherently.</li> <li>10. To display an ethical code of conduct in usage of Internet and Cyber systems.</li> <li>11. To engage in independent and life-long learning in the background of rapid changing IT industry</li> </ol>
Relevance of PSOs to the local, regional, national, and global developmental needs (200 words)	<p>The revised and restructured curriculum for the Three-year integrated course is systematically designed considering the National Education Policy(NEP) along with the proposed Autonomy constraints. The focus is on current industry needs in terms of skills sets demanded under the new technological environment. It also endeavors to align the programme structure and course curriculum with student aspirations and corporate expectations. The proposed curriculum is more contextual, industry friendly and suitable to cater the needs of society and nation in the present day context.</p> <p>As the world is heading towards digitalization, the syllabus is framed by concentrating on such needs. With the help of basic programming skills and designing technique, a student is able to make small workable projects which can be beneficial for local vendors. To make these projects strong, various concepts of project management, database management are involved.</p> <p>Various industries need IT support at local or across the country.</p>

## Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26

	<p>Students having the skills of computers are able to sustain in the IT industry at various locations.</p> <p>Development in thought processes can lead one in a research area to contribute to an upcoming trend. Students can become entrepreneurs since the techniques of management and entrepreneurship are taught to them.</p> <p>Due to the learning of cyber safety, ethical hacking, students can become ethical hackers where students can contribute to national security. Students can make community awareness due to learning about cyber safety.</p> <p>Continuous growth in trends requires students updated which will help them mercurial. This will help in sustaining the IT industry and become employable.</p>
--	---

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

**Bachelor of Science (B.Sc.) Programme  
Under Choice Based Credit System (CBCS)  
Course Structure (Autonomous)  
Department of Computer Science**

**(To be implemented from Academic Year 2025-26)**

Course Code	Semester V	Credits	Course Code	Semester VI	Credits
	<i>Discipline Specific Course (DSC)</i>			<i>Discipline Specific Course (DSC)</i>	
	<i>Major Mandatory</i>			<i>Major Mandatory</i>	
25_USCSM501	Artificial Intelligence	<b>02</b>	25_USCSM601	Data Science	<b>02</b>
25_USCSM502	Information and Network Security	<b>02</b>	25_USCSM602	Cyber Forensics	<b>02</b>
25_USCSM503	Software Testing and Quality Assurance	<b>02</b>	25_USCSM603	Wireless Sensor Networks	<b>02</b>
25_USCSM504	Computer Science Practical 5	<b>02</b>	25_USCSM604	Computer Science Practical 7	<b>02</b>
25_USCSM505	Computer Science Practical 6	<b>02</b>	25_USCSM605	Computer Science Practical 8	<b>02</b>
	<i>Major Electives (Any 1)</i>			<i>Major Electives (Any 1)</i>	
25_USCSE506	Web Services	<b>02</b>	25_USCSE606	Ethical Hacking	<b>02</b>
25_USCSE507	Web Services Practical	<b>02</b>	25_USCSE607	Ethical Hacking Practical	<b>02</b>
OR			OR		
25_USCSE508	Linux Server Administration	<b>02</b>	25_USCSE608	Information Retrieval	<b>02</b>
25_USCSE509	Linux Server Administration Practical	<b>02</b>	25_USCSE609	Information Retrieval Practical	<b>02</b>
	<i>Vocational Skill Course (VSC)</i>			<i>Vocational Skill Course (VSC)</i>	

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

25_USCSV510	Android Application Development	<b>02</b>	25_USCSV610	Advance Application Development	<b>02</b>
25_USCSV511	Android Application Development Practical	<b>02</b>	25_USCSV611	Advance Application Development Practical	<b>02</b>
	<i>Field Project (FP)</i>			<i>On Job Training(OJT)</i>	
25_USCSF512	Field Project	<b>04</b>	25_USCSJ612	On Job Training(OJT)	<b>04</b>
<b>Total Credits</b>		<b>22</b>	<b>Total Credits</b>		<b>22</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

**Semester V**  
**Syllabus of Courses of B.Sc. Computer Science**  
**Programme at Semester V**  
**with Effect from the Academic Year 2025-2026**  
**Discipline Specific Course (DSC)**  
**Major Course**

<b>Nomenclature of the Course</b>	<b>Artificial Intelligence</b>		
<b>Class</b>	T.Y.B.Sc.		
<b>Semester</b>	V		
<b>Course Code</b>	25_USCSM501		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major Mandatory		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> Understand the foundational concepts and contemporary advancements in artificial intelligence. Analyze the structure and nature of intelligent agents with application and evaluation of search strategies.			
<b>CO2:</b> Explore various forms of learning in machine learning, with a focus on supervised learning and different algorithms.			
<b>CO3:</b> Explore probabilistic models with reinforcement learning, generalization, policy search, and practical applications.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Subtitles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>What Is AI, Intelligent Agents, Problem Solving by searching</b>	<b>What Is AI:-</b> Foundations, History and State of the Art of AI. <b>Intelligent Agents:-</b> Agents and Environments, Nature of Environments, Structure of Agents. <b>Problem Solving by searching:-</b> Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.	<b>10</b>
2	<b>Learning from Examples</b>	<b>Learning from Examples:-</b> Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

		Models, Support Vector Machines, Ensemble Learning, Practical Machine Learning	
3	<b>Learning probabilistic models</b>	<b>Learning probabilistic models:-</b> Statistical Learning, Learning with Complete Data, Learning with Hidden Variables: The EM Algorithm. Reinforcement learning: Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, Applications of Reinforcement Learning.	<b>10</b>
<p><b>Prescribed Text/s (If any):</b></p> <p>1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2010.</p> <p><b>Other Learning Resources recommended:</b></p> <p>1. Artificial Intelligence: Foundations of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press, 2017.</p> <p>2. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017</p> <p>3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer,</p>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>What Is AI, Intelligent Agents, Problem Solving by searching</b>	Classroom Teaching and ICT	10
2	<b>Learning from Examples</b>	Classroom Teaching and ICT	10
3	<b>Learning probabilistic models</b>	Classroom Teaching and ICT	10

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2024-2025  
Department Specific Course (DSC)  
Major Course*

<b>Nomenclature of the Course</b>	<b>Information and Network Security</b>		
<b>Class</b>	T.Y.B.Sc		
<b>Semester</b>	V		
<b>Course Code</b>	25_USCSM502		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> To study the principles and practices of cryptographic techniques.			
<b>CO2:</b> To understand a variety of generic security threats and vulnerabilities.			
<b>CO3:</b> To identify & analyze particular security problems for a given application.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Sub Titles (Learning Points)</b>	<b>No. of Lectures</b>
1	<b>Introduction, Classical Encryption Techniques, Public-Key Cryptography and RSA</b>	Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms. Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, AES (round details not expected), Multiple Encryption and Triple DES, Block Cipher Modes of Operation, Stream Ciphers. Principles of Public-Key Cryptosystems, The RSA Algorithm	<b>10</b>
2	<b>Key Management, Message Authentication and Hash Functions, Digital Signatures and Authentication, Authentication Applications:</b>	Public-Key Cryptosystems, Key Management, DiffieHellman Key Exchange. Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Secure Hash Algorithm, HMAC. Digital Signatures, Authentication Protocols, Digital Signature Standard. Kerberos, X.509 Authentication, Public-Key Infrastructure	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

		Functions, Security of Hash Functions and Macs,	
3	<b>Electronic Mail Security, IP Security, Web Security, Intrusion, Intrusion, Firewalls</b>	Pretty Good Privacy, S/MIME. Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management. Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction. Intruders, Intrusion Techniques, Intrusion Detection. Viruses and Related Threats, Virus Countermeasures, DDOS. Firewall Design Principles, Types of Firewalls.	<b>10</b>
<p><b>Prescribed Text/s (If any):</b></p> <p>1. Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson,2010</p> <p><b>Other Learning Resources recommended:</b></p> <p>1. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2013. 2. Cryptography and Network, Behrouz A Fourouzan, Debdeep Mukhopadhyay, 2nd Edition, TMH,2011.</p>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>Introduction, Classical Encryption Techniques, Public-Key Cryptography and RSA</b>	Classroom Teaching and ICT	10
2	<b>Key Management, Message Authentication and Hash Functions, Digital Signatures and Authentication, Authentication Applications:</b>	Classroom Teaching and ICT	10
3	<b>Electronic Mail Security, IP Security, Web Security, Intrusion, Intrusion, Firewalls</b>	Classroom Teaching and ICT	10

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Major Course*

<b>Nomenclature of the Course</b>	<b>Software Testing and Quality Assurance</b>		
<b>Class</b>	TYBSc		
<b>Semester</b>	V		
<b>Course Code</b>	25_USCSM503		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> To understand phases of the software development life cycle.			
<b>CO2:</b> To Understand different types of defects in software development.			
<b>CO3:</b> To Understand the different types of quality costs in software development.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Sub Titles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Software Testing and Introduction to quality</b>	Introduction, Nature of errors, an example for Testing, Definition of Quality , QA, QC, QM and SQA , Software Development Life Cycle, Software Quality Factors	<b>10</b>
	<b>Verification and Validation</b>	Definition of V &V , Different types of V & V Mechanisms, Concepts of Software Reviews, Inspection and Walkthrough	
	<b>Software Testing Techniques</b>	Box Testing and its types, Black Box Testing and its types	
2	<b>Software Testing Strategies</b>	Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, System Testing	<b>10</b>
	<b>Software Metrics</b>	Concept and Developing Metrics, Different types of Metrics, Complexity metrics	
	<b>Defect Management</b>	Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.	
	<b>Software Quality Assurance</b>	Quality Concepts, Quality Movement, Background Issues, SQA activities, Software	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

3		Reviews, Formal Technical Reviews, Formal approaches to SQA, Statistical Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, SQA Plan , Six sigma, Informal Reviews	
	<b>Quality Improvement</b>	Introduction, Pareto Diagrams, Cause-effect Diagrams, Scatter Diagrams, Run charts	
	<b>Quality Costs</b>	Defining Quality Costs, Types of Quality Costs, Quality Cost Measurement, Utilizing Quality Costs for Decision-Making	
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1. Software Engineering for Students, A Programming Approach, Douglas Bell, 4<sup>th</sup> Edition,, Pearson Education, 2005</li> <li>2. Software Engineering – A Practitioners Approach, Roger S. Pressman, 5<sup>th</sup> Edition, Tata McGraw Hill, 2001</li> <li>3. Quality Management, Donna C. S. Summers, 5<sup>th</sup> Edition, Prentice-Hall, 2010.</li> <li>4. Total Quality Management, Dale H. Besterfield, 3<sup>rd</sup> Edition, Prentice Hall, 2003.</li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>1. Software engineering: An Engineering approach, J.F. Peters, W. Pedrycz , John Wiley,2004</li> <li>2. Software Testing and Quality Assurance Theory and Practice, Kshirsagar Naik, Priyadarshi Tripathy , John Wiley &amp; Sons, Inc. , Publication, 2008</li> <li>3. Software Engineering and Testing, B. B. Agarwal, S. P. Tayal, M. Gupta, Jones and Bartlett Publishers, 2010</li> </ol>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>Software Testing and Introduction to quality</b>	Classroom Teaching and ICT	10
	<b>Verification and Validation</b>		
	<b>Software Testing Techniques</b>		
2	<b>Software Testing Strategies</b>	Classroom Teaching and ICT	10
	<b>Software Metrics</b>		
	<b>Defect Management</b>		
3	<b>Software Quality Assurance</b>	Classroom Teaching and ICT	10
	<b>Quality Improvement</b>		
	<b>Quality Costs</b>		

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Major Practical*

<b>Nomenclature of the Course</b>	<b>Computer Science Practical 5</b>
<b>Class</b>	T.Y.B.Sc
<b>Semester</b>	V
<b>Course Code</b>	25_USCSM504
<b>No. of Credits</b>	2
<b>Nature</b>	Practical
<b>Type</b>	Major- Practical
<b>Course Outcomes:</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> To Implement various search algorithms to solve the Romanian map problem.	
<b>CO2:</b> To Implement Neural Networks, AdaBoost ensemble learning, and Naive Bayes algorithms to address the restaurant waiting problem.	
<b>CO3:</b> To Develop programs to implement various substitution and transposition cipher techniques.	
<b>CO4:</b> To Implement programs to encrypt and decrypt strings using algorithms like DES and RSA and apply the Diffie-Hellman Key Agreement algorithm to generate symmetric keys.	
<b>CO5:</b> To Implement message digest computation algorithms and to develop programs for substitution cipher techniques.	
<b>CO6:</b> To Understand and implement web testing using Selenium IDE	
<b>CO7:</b> To Execute test suites on different websites and verify their functionality.	
<b>The following practical's will be implemented using Python, NetBeans and Selenium Minimum 20 practical's to be completed as a journal work.</b>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1.	Implement Breadth First Search algorithm for Romanian map problem.
2.	Implement Iterative Deep Depth First Search for Romanian map problem.
3.	Implement A* Search algorithm for Romanian map problem.
4.	Implement a Recursive Best-First Search algorithm for Romanian map problem.
5.	Implement a Decision Tree learning algorithm for the restaurant waiting problem.
6.	Implement Feed Forward Back Propagation neural network learning algorithm for the restaurant waiting problem.
7.	Implement Adaboost ensemble learning algorithm for the restaurant waiting problem.
8.	Implement Naive Bayes' learning algorithm for the restaurant waiting problem.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

9.	Write a program to implement the following Substitution Cipher Technique:- Caesar Cipher.
10.	Write a program to implement the following Substitution Cipher Technique:- Monoalphabetic Cipher.
11.	Write a program to implement the following Substitution Cipher Technique:- Playfair Cipher.
12.	Write a program to implement the following Transposition Cipher Technique:- Rail Fence Cipher.
13.	Write a program to implement the following Transposition Cipher Technique:- Simple Columnar Technique.
14.	Write a program to implement an RSA algorithm to perform encryption / decryption of a given string.
15.	Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys.
16.	Write a program to implement the MD5 algorithm. Compute the message digest.
17.	Write programs to implement the following Substitution Cipher Techniques:- Caesar Cipher- Monoalphabetic Cipher.
18.	Install Selenium IDE; Write a test suite containing minimum 4 test cases for different formats. Conduct a test suite for any two web sites.
19.	Write and test a program to login to a specific web page.
20.	Write and test a program to update 10 student records into table into Excel file
21.	Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects).
22.	Write and test a program to provide a total number of objects present / available on the page.
23.	Write and test a program to get the number of items in a list / combo box.
24.	Write and test a program to count the number of check boxes on the page checked and unchecked count.

**Other Learning Resources recommended:**

**Textbooks:**

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2010
2. Artificial Intelligence: Foundations of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press, 2017.
3. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017
4. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2013
5. Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson, 2010
6. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2013.
7. Cryptography and Network, Behrouz A Fourouzan, Debdeep Mukhopadhyay, 2<sup>nd</sup> Edition, TMH, 2011
8. Software engineering: An Engineering approach, J.F. Peters, W. Pedrycz, John Wiley, 2004

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

9. Software Testing and Quality Assurance Theory and Practice,			
<b>Teaching Plan:</b>			
<b>Practicals</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
<b>All</b>	<b>All Practical's</b>	<b>Lab Session with ICT</b>	<b>60</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Skill Enhancement Course*

<b>Nomenclature of the Course</b>	<b>Computer Science Practical 6 (Game Programming)</b>	
<b>Class</b>	T.Y.B.Sc	
<b>Semester</b>	V	
<b>Course Code</b>	25_USCSM505	
<b>No. of Credits</b>	2	
<b>Nature</b>	Practical	
<b>Type</b>	Major- Practical	
<b>Course Outcomes</b>		
<i>The learner will be able to</i>		
<b>CO1:</b> Understand familiarity with the Unity interface and learn to manipulate game objects through movement, rotation, and scaling using C# scripts.		
<b>CO2:</b> Write scripts for object movement, including continuous movement and jump mechanics, while dynamically transforming game object properties.		
<b>CO3:</b> Implement collision detection and in-game events like item collection, health systems, and enemy interactions in both 2D and 3D games.		
<b>CO4:</b> Design and build simple games like 2D platformers, 3D maze games, and shooting games, incorporating player-controlled movement, jumping, and shooting.		
<b>CO5:</b> Create menus, score tracking, and feedback systems, including timers, game over screens, and animations.		
<b>CO6:</b> Script basic AI for enemies and optimize game performance through techniques like object pooling and Level of Detail.		
<b>CO7:</b> Develop local multiplayer features, add sound and particle effects, and integrate all mechanics into a complete game project.		
<b>The following practical's will be implemented using Unity and visual studio C# Script Minimum 20 practical's to be completed as a journal work.</b>		
<b>Syllabus:</b>		
<b>Sr. No.</b>	<b>Aim of the Practical</b>	<b>Literature</b>
1	<b>Unity Interface Exploration</b> Familiarize with IDLE of Unity, Unity Editor, scene hierarchy, and game objects.	Game object manipulation, hierarchy, inspector, creating and modifying 2D/3D objects.
2	<b>Introduction to C# Scripting in Unity</b> Using keyboard inputs, create a simple script to move a 3D object.	Basics of C# scripting, input handling, and using Unity's Transform component.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

3	<b>Game Object Manipulation</b> Create and script basic game objects (cubes, spheres) to move, rotate, and scale.	Understand C# scripting for object manipulation, understanding vectors, and physics.
4	<b>Implementation of Simple Object Movement and Jump Mechanic</b> Implement continuous movement and jumping for a 3D player object.	Implementing Rigidbody physics, input handling, applying force and gravity.
5	<b>Understanding Collision Detection and Triggers</b> Detect collisions and trigger events (e.g., collect items).	Develop Unity Collider, Rigidbody, OnCollisionEnter, OnTriggerEnter.
6	<b>Building a Simple Maze Game</b> Create a 2D/3D maze with a player-controlled object that navigates through it.	Understanding Collision detection, camera setup, UI elements (for scoring and timer).
7	<b>Building a 2D Platformer</b> Create a simple 2D platformer where the player jumps between platforms.	Implement Rigidbody 2D, player movement, sprite rendering, physics, camera follow.
8	<b>Implementing 2D Collision and Health System</b> Add enemies and obstacles that affect the player's health.	Implement 2D collision detection, health management, health bar UI.
9	<b>Implementing Animation in 2D Games</b> Implement player animations (walking, jumping) in the platformer game.	Configure Animator, animation transitions, sprite sheets
10	<b>Creating a Main Menu and Pause Screen</b> Add a main menu, pause screen, and UI navigation between scenes.	Implement Unity UI, button interactions, scene management.
11	<b>Maintaining Score System and Game Over Screen</b> Implement score tracking and a game over screen.	Apply UI elements (score text), condition-based scene switching.
12	<b>Adding Timer or Countdown System</b> Add a timer to a game with a countdown for gameplay.	Implement C# scripting for timers, UI updates, game-over conditions.
13	<b>Setting playfield for Basic 3D Shooting Game</b> Create a 3D game where the player shoots at targets.	Understand Input handling for shooting, Raycasting, collision detection, target destruction.
14	<b>Implementing Basic Enemy AI and Patrolling</b> Implement basic enemy AI that patrols between points and chases the player.	Implement NavMesh for AI movement, simple state machines.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

15	<b>Add Weapon and Ammo System</b> Add a weapon system with limited ammo, and allow ammo pickups.	Apply C# scripting for weapon management, UI updates for ammo count.
16	<b>Object Pooling for Performance Optimization</b> Implement object pooling for bullets or enemy spawning.	Implement Object pooling, improving performance by reusing game objects.
17	<b>Setting Power-ups and Boosts</b> Add power-ups like health packs, speed boosts, and shields.	Understand Collision detection, UI updates, timers for temporary boosts.
18	<b>Developing Enemy Wave Spawning System</b> Develop a wave-based spawning system for enemies.	Develop Randomization, timer-based spawning, increasing difficulty.
19	<b>Introduction to multiplayer and networking</b> Implement a local multiplayer game where two players can control different.	Understand Input handling for multiple players, UI updates for player stats.
20	<b>Introduction to Unity Networking multiplayer tools</b> practical approach/ demo session.	Basic networking concepts, syncing players and objects across clients.
21	<b>Adding Background Music and Sound Effects</b> Add background music and sound effects to different events (like jumping or shooting).	Apply Unity Audio Source, audio event triggers.
22	<b>Adding Particle Systems and Visual Effects</b> Implement visual effects such as explosions, trails, and particle effects.	Unity Particle System, configuring visual effects.
23	<b>Game Optimization Techniques</b> Apply techniques to optimize game performance (reducing draw calls, using LOD).	Performance profiling, light mapping, object pooling, optimizing assets.
24	<b>Testing and Debugging Your Game</b> Learn how to test and debug a Unity game for errors and performance issues.	Using Unity's Profiler, debugging scripts, identifying bottlenecks.
25	<b>Developing a Complete Game</b> Build a complete small game combining mechanics learned in the course (e.g., platformer, shooter, puzzle).	Game design, level design, project management, and iteration.

## Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26

### Prescribed Text/s (If any):

1. Learn Unity for 2D Game Development By Alan Thorn .
2. Unity Game Development in 24 Hours, Sams Teach Yourself by Mike Geig
3. Multiplatform Game Development in C# with unity 5 by Joe Hocking and Jesse Schell /second edition
4. Learning C# from Developing Games with unity 5.x first edition by Greg Lukosek.
5. <https://docs.unity3d.com/Manual/class-AnimatorController.html>

### Teaching Plan:

Practicals	Unit Title	Teaching Methods	No. of Lectures
All	All Practical's	Lab Session with ICT	60

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Department Specific Courses (DSC)  
Major Elective Course*

<b>Nomenclature of the Course</b>	<b>Web Services</b>		
<b>Class</b>	T.Y.B.Sc		
<b>Semester</b>	V		
<b>Course Code</b>	25_USCSE506		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major Elective		
<b>Course Outcomes:</b>			
<i>The learner will be able to:</i>			
<b>CO1:</b> To study SOAP based web services and associated standards such as WSDL.			
<b>CO2:</b> To design SOAP based / RESTful / WCF services.			
<b>CO3:</b> To study web services which deal with Security and QoS issues.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Subtitles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Web services basics</b>	What Are Web Services? Types of Web Services Distributed computing infrastructure, overview of XML, SOAP, Building Web Services with JAX-WS, Registering and Discovering Web Services, Service Oriented Architecture, Web Services Development Life Cycle, Developing and consuming simple Web Services across platform	<b>10</b>
2	<b>The REST Architectural style</b>	Introducing HTTP, The core architectural elements of a RESTful system, Description and discovery of RESTful web services, Java tools and frameworks for building RESTful web services, JSON message format and tools and frameworks around JSON, Build RESTful web services with JAX-RS APIs, The Description and Discovery of RESTful Web Services, Design guidelines for building RESTful web services, Secure RESTful web services	<b>10</b>
	<b>Developing Service Oriented</b>	What Is Windows Communication Foundation, Fundamental Windows Communication Foundation Concepts, Windows Communication Foundation	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

3	<b>Applications with WCF</b>	Architecture, WCF and .NET Framework Client Profile, Basic WCF Programming, WCF Feature Details. Web Service QoS	
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1. Web Services: Principles and Technology, Michael P. Papazoglou, Pearson Education Limited, 2008</li> <li>2. RESTful Java Web Services, Jobinesh Purushothaman, PACKT Publishing, 2nd Edition, 2015</li> <li>3. Developing Service-Oriented Applications with WCF, Microsoft, 2017 <a href="https://docs.microsoft.com/en-us/dotnet/framework/wcf/index">https://docs.microsoft.com/en-us/dotnet/framework/wcf/index</a></li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>1. Leonard Richardson and Sam Ruby, RESTful Web Services, O'Reilly, 2007</li> <li>2. The Java EE 6 Tutorial, Oracle, 2013</li> </ol>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>Web services basics</b>	Classroom Teaching and ICT	10
2	<b>The REST Architectural style</b>	Classroom Teaching and ICT	10
3	<b>Web services Basics</b>	Classroom Teaching and ICT	10

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Major Elective Practical*

<b>Nomenclature of the Course</b>	<b>Web Services Practical</b>
<b>Class</b>	TYBSc
<b>Semester</b>	V
<b>Course Code</b>	25_USCSE507
<b>No. of Credits</b>	02
<b>Nature</b>	Practical
<b>Type</b>	Major Elective Practical
<b>Course Outcomes:</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> Analyze and compare different types of operations (one-way vs. request-response).	
<b>CO2:</b> Evaluate the functionality and discoverability of the service by creating a UDDI registry entry	
<b>CO3:</b> Design, implement, and consume cross-platform web services; evaluate SOA principles, and analyze XML's role in SOAP-based interoperability	
<b>CO4:</b> Implement JAX-WS and RESTful services; analyze REST architecture for efficiency.	
<b>CO5:</b> Implement secure RESTful services and WCF applications; analyze architecture Principles.	
<b>CO6:</b> Implement WCF services with AJAX; analyze architecture and concepts.	
<b>Practical shall be performed using Netbeans, Visual Studio Minimum 20 practical's to be implemented as a journal work.</b>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1	Write a program to implement to create a simple web service that converts the temperature from Fahrenheit to Celsius and vice versa.
2	Write a program to implement the operation and can receive request and will return a response in two ways 1. One - Way operation 2. Request –Response
3	Illustrate the implementation of business UDDI Registry entry.
4	Discuss web services and their types
5	Illustrate Web Services Development Life Cycle.
6	Describe the Service Oriented Architecture.
7	Elaborate role of XML in distributed computing and SOAP-based web services.
8	Develop a client which consumes web services developed in different platform.
9	Write a JAX-WS web service to perform the following operations. Define a Servlet / JSP that consumes the web service.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

10	Define a web service method that returns the contents of a database in a JSON string. The contents should be displayed in a tabular format.		
11	Define a RESTful web service that accepts the details to be stored in a database and performs CRUD operation		
12	Describe the Core Architectural Elements of a RESTful System?		
13	Define HTTP, and how does it serve as the foundation for RESTful web services?		
14	Elaborate Key Design Guidelines for Building Secure RESTful Web Services?		
15	Explain Windows Communication Foundation (WCF) and its key features.		
16	Implement a typical service and a typical client using WCF.		
17	Use WCF to create a basic ASP.NET Asynchronous JavaScript and XML (AJAX) service.		
18	Demonstrates using the binding attribute of an endpoint element in WCF		
19	Discuss the Fundamental Concepts of Windows Communication Foundation (WCF)?		
20	Describe the Architecture of Windows Communication Foundation (WCF).		
21	Illustrate the Role of WCF in the .NET Framework Client Profile		
22	Discuss QoS in Web Service.		
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1) Web Services: Principles and Technology, Michael P. Papazoglou, Pearson Education Limited, 2008</li> <li>2) RESTful Java Web Services, Jobinesh Purushothaman, PACKT Publishing, 2nd Edition, 2015</li> <li>3) Developing Service-Oriented Applications with WCF, Microsoft, 2017  <a href="https://docs.microsoft.com/en-us/dotnet/framework/wcf/index">https://docs.microsoft.com/en-us/dotnet/framework/wcf/index</a></li> </ol>			
<b>Teaching Plan:</b>			
<b>Practical's</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	All Practical's	Lab Session with ICT	60

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Department Specific Course (DSC)  
Elective Course*

<b>Nomenclature of the Course</b>	<b>Linux Server Administration</b>		
<b>Class</b>	TY.B.Sc		
<b>Semester</b>	V		
<b>Course Code</b>	25_USCSE508		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Elective		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> To provide a comprehensive understanding of the responsibilities involved in managing and securing individual hosts in a networked environment, preparing students for roles such as system administrators, network administrators.			
<b>CO2:</b> To gain a comprehensive understanding of common internet services and its relevant Protocol.			
<b>CO3:</b> To acquire skills and knowledge to design, deploy, manage, and secure intranet services using Linux-based systems within an organizational network.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Sub Titles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Introduction, Single-Host Administration, Networking and Security</b>	Technical Summary of Linux Distributions, Managing Software. Managing Users and Groups, Booting and shutting down processes, File Systems, Core System Services, Process of configuring, compiling, Linux Kernel. TCP/IP for System Administrators, basic network Configuration, Linux Firewall (Netfilter), System and network security.	<b>10</b>
2	<b>Internet Services:</b>	Domain Name System (DNS), File Transfer Protocol (FTP), Apache web server, Simple Mail Transfer Protocol (SMTP), Post Office Protocol and Internet Mail Access Protocol (POP and IMAP), Secure Shell (SSH), Network Authentication, OpenLDAP Server, Samba and LDAP, Network authentication system (Kerberos), Domain Name Service (DNS), Security	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

3	<b>Intranet Services</b>	Network File System (NFS), Samba, Distributed FileSystems (DFS), Network Information Service (NIS),Lightweight Directory Access Protocol (LDAP), DynamicHost Configuration Protocol (DHCP), MySQL, LAMP Applications File Servers, Email Services, Chat Applications, Virtual Private Networking	<b>10</b>
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>Linux Administration: A Beginner’s Guide, Wale Soyinka, Seventh Edition, McGraw-Hill Education, 2016.</li> <li>Ubuntu Server Guide, Ubuntu Documentation Team, 2016</li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>Mastering Ubuntu Server, Jay LaCroix, PACKT Publisher, 2016.</li> </ol>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>Introduction, Single-Host Administration, Networking and Security</b>	Classroom Teaching and ICT	10
2	<b>Internet Services</b>	Classroom Teaching and ICT	10
3	<b>Intranet Services</b>	Classroom Teaching and ICT	10

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science*

*Programme at Semester V*

*With Effect from the Academic Year 2025-2026*

*Department Specific Course (DSC)*

*Elective Course*

<b>Nomenclature of the Course</b>	<b>Linux Server Administration Practical</b>
<b>Class</b>	T.Y.B.Sc
<b>Semester</b>	V
<b>Course Code</b>	25_USCSE509
<b>No. of Credits</b>	2
<b>Nature</b>	Practical
<b>Type</b>	Elective
<b>Course Outcomes</b>	
<p><b>CO1:</b> To develop Linux based systems and maintain.</p> <p><b>CO2:</b> To install appropriate service on Linux server as per requirement.</p> <p><b>CO3:</b> To become proficient in Linux server administration.</p> <p><b>CO4:</b> To handle troubleshoot challenging technical problems typically encountered when operating and administering Linux systems.</p> <p><b>CO5:</b> Understand the architecture and configuration of NFS for sharing files across a Network, enabling seamless access to remote file systems.</p> <p><b>CO6:</b> Acquire knowledge of NIS for centralized management of network information, including user accounts and hostnames, to simplify administration.</p>	
<p align="center"><b>The following practical's will be implemented using ubuntu 22.02</b>  <b>Minimum 20 practical's to be completed as a journal work.</b></p>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
<b>1</b>	Discuss the Popular Linux distributions and Managing Software on Linux in detail.
<b>2</b>	Explain:--Managing users and groups, as well as handling processes like booting and shutting down, are essential aspects of Linux system administration.
<b>3</b>	Discuss the process of configuring and compiling Linux Kernel.
<b>4</b>	Explain the role of TCP/IP for System Administrators.
<b>5</b>	Discuss on:-Firewall (Netfilter), System and network security.
<b>6</b>	Write note on Domain Name System (DNS) and File Transfer Protocol (FTP)
<b>7</b>	Simple Mail Transfer Protocol (SMTP), Post Office Protocol and Internet Mail Access Protocol (POP and IMAP)
<b>8</b>	Install DHCP Server in Ubuntu 22.02
<b>9</b>	Initial settings: Add a User, Network Settings, Change to static IP address, Disable IPv6 if not needed, Configure Services, display the list of services which are running, Stop and turn OFF auto-start setting for a service if you don't need it, Sudo Settings

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

<b>10</b>	Configure NTP Server (NTPd), Install and Configure NTPd, Configure NTP Client (Ubuntu and Windows)		
<b>11</b>	SSH Server : Password Authentication Configure SSH Server to manage a server from the remote computer, SSH Client : (Ubuntu and Windows)		
<b>12</b>	Install DNS Server BIND, Configure DNS server which resolves domain name or IP address, Install BIND 9, Configure BIND, Limit ranges you allow to access if needed.		
<b>13</b>	Configure DHCP Server, Configure DHCP (Dynamic Host Configuration Protocol) Server, Configure NFS Server to share directories on your Network, Configure NFS Client. (Ubuntu and Windows Client OS)		
<b>14</b>	Configure LDAP Server, Configure LDAP Server in order to share users' accounts in your local networks, Add LDAP User Accounts in the OpenLDAP Server, Configure LDAP Client in order to share users' accounts in your local networks. Install phpLDAPadmin to operate LDAP server via Web browser.		
<b>15</b>	Configure NIS Server in order to share users' accounts in your local networks, Configure NIS Client to bind NIS Server		
<b>16</b>	Install MySQL to configure database server, Install phpMyAdmin to operate MySQL on web browser from Clients.		
<b>17</b>	Install Samba to share folders or files between Windows and Linux.		
<b>18</b>	Elaborate the use of tools like netstat, ss, and tcpdump to monitor TCP/IP network connections and troubleshoot issues.		
<b>19</b>	Mention the steps to configure SSH access on a Linux server.		
<b>20</b>	Demonstrate the steps to create virtual hosts in Apache for hosting multiple websites on a single server.		
<b>21</b>	Describe the steps involved in setting up an NIS server and client in a Linux environment.		
<b>22</b>	List and explain the steps involved in setting up an NFS server on a Linux machine.		
<b>Teaching Plan:</b>			
<b>Practical's</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	All Practical's	Lab Session with ICT	60

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Vocational Skill Course (VSC)*

<b>Nomenclature of the Course</b>	<b>Android Application Development</b>		
<b>Class</b>	TYBSc		
<b>Semester</b>	V		
<b>Course Code</b>	25_USCSV510		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	VSC		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> To understand Kotlin Programming Language for application development			
<b>CO2:</b> To store data using SQLite Databases.			
<b>CO3:</b> To create simple Animation in Android Studio.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Sub Titles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Introduction to Kotlin</b>	Basics of Kotlin, type conversions, comments, Kotlin operators, variables in Kotlin, packages, visibility modifiers, control flow statements, Concept of OOPS in Kotlin, classes in Kotlin, delegation and extension functions, the companion object	<b>10</b>
	<b>Advanced Concepts in Kotlin</b>	Declaring and calling functions, parameters, and arguments in Kotlin, default argument, variable number of arguments, unit-returning function, explicit return type, lambda expression, coroutines, Collections in Kotlin, Mutable and Immutable Collections, Ranges, type Checks, casting concept, this expression, Null safety, exception handling, annotations	
	<b>App Development with Android Studio</b>	Android Architecture, Android Application Framework, Android Virtual Device, Creating and running First Android Application, working with Physical Android Device, Adding Kotlin Files in Android Studio	

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

	<b>Basics Of Android</b>	Application Components: Activities, Intent, and Broadcast Receiver, Services, Fragment, Activity Life Cycle, Content Provider, Widgets, and Notifications	
2	<b>Designing Android UI</b>	User Interface (UI), Layout and Its Types, Layout Attribute, working with Views, Android UI Controls, Styles and Themes, Event Handler, setting up themes in Manifest and from the application, dialog in activity, using intents, fragments	<b>10</b>
	<b>Handle Images, Listview And Menu</b>	ImageView, ImageSwitcher, ListView, Menu, and its types, Designing menu in XML, Option menu, Context menu, popup menu, Screen Navigation, RecyclerView, Interaction of Views	
	<b>Data binding in Android</b>	AdapterView, Spinner, Gallery view, AutotextCompleteView, screen orientation, Designtheviewdynamically	
	<b>Implementing Data Persistence</b>	Data Storage-Shared Preference, Internal And External Storage Storing Data Using SQLite Databases, Content Provider, Firebase Real-Time Data	
3	<b>Graphics, Animations, and Integrating Media in Android</b>	Drawable Class, Animation in Android, MediaPlayer API and in Android, Mediaplayer and AudioManager Class,	<b>10</b>
	<b>Interacting With Camera</b>	Android Camera, Input gestures-multiple touch, swipe, drag, scroll, zoom, Recording	
	<b>Managing Background Tasks</b>	Broadcast Receivers, Services, Threads and Process, AsyncTask, JobScheduler, Manage device Awake State	
	<b>Deploying Android applications on Google Play</b>	Publishing/Deploy the application, Versioning, signing Application	

**Prescribed Text/s (If any):**

1. How to Build Android Apps with Kotlin: A hands-on guide to developing, testing, and publishing your first apps with Android, Alex Forrester, Packt Publishing, 2021
2. Android Programming: Crafting UI/UX using Kotlin, SYBGEN Learning, 2020

**Other Learning Resources recommended:**

1. Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin Dawn Griffiths, 3rd Edition, O'Reilly Media, 2021
2. Android Studio 4.2 Development Essentials - Kotlin Edition: Developing Android Apps Using Android Studio 4.2, Kotlin and Android Jetpack, Neil Smyth, Payload Media, 2021
3. Android Programming with Kotlin for Beginners, John Horton, Packt Publishing,

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

2019			
4. Android Development with Kotlin: Enhance your skills for Android development using Kotlin, Marcin Moskala, Packt Publishing Introduction to Automata Theory, Languages and Computation, John E. Hopcroft, Pearson Education, 2014			
<b>Teaching Plan:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
1	<b>Introduction to Kotlin:</b>	Classroom Teaching and ICT	10
	<b>Advanced Concepts in Kotlin</b>		
	<b>App Development with Android Studio</b>		
	<b>Basics Of Android</b>		
2	<b>Designing Android UI</b>	Classroom Teaching and ICT	10
	<b>Handle Images, Listview And Menu</b>		
	<b>Data binding in Android</b>		
	<b>Implementing Data Persistence</b>		
3	<b>Graphics, Animations, and Integrating Media in Android</b>	Classroom Teaching and ICT	10
	<b>Interacting With Camera</b>		
	<b>Managing Background Tasks</b>		
	<b>Deploying Android applications on Google Play</b>		

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester V  
with Effect from the Academic Year 2025-2026  
Vocational Skill Course (VSC)*

<b>Nomenclature of the Course</b>	<b>Android Application Development Practical</b>
<b>Class</b>	TYBSC
<b>Semester</b>	V
<b>Course Code</b>	25_USCSV511
<b>No. of Credits</b>	2
<b>Nature</b>	Practical
<b>Type</b>	VSC
<b>Course Outcomes:</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> To understand Controls, Menus and Layouts in Android Studio.	
<b>CO2:</b> To play audio and video using android studio.	
<b>CO3:</b> To create different types of Menus.	
<p align="center"><b>The following practical's will be implemented using Android Studio Minimum 20 practical's to be completed as a journal work.</b></p>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1	Write a program using Kotlin to implement control structures and loops.
2	Write a program to implement object-oriented concepts in Kotlin.
3	Create "Hello World" application. That will display "Hello World" in the middle of the screen in the red color with white background.
4	Create an Android application to design screens using different layouts and UI including Button, Edittext, Textview, Radio Button etc.
5	Create an application that will Demonstrate Button onClick() Event and change the TextView Color based on button Clicked.
6	Write an android application demonstrating response to event/user interaction for <ul style="list-style-type: none"> <li>● Radio button</li> <li>● Checkbox</li> </ul>
7	Write an android application demonstrating response to event/user interaction for <ul style="list-style-type: none"> <li>● Button</li> <li>● Spinner</li> </ul>
8	Create an application that will demonstrate AutotextCompleteView Control
9	Create sample application with login module. (Check username and password) On successful login, go to next screen. And on failing login, alert user using Toast.
10	Create a calculator app that performs addition, subtraction, division and multiplication operation on numbers.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

11	Create an Android application to demonstrate implicit and explicit intents.		
12	Create an application to demonstrate different types of Layouts <ul style="list-style-type: none"> <li>● Linear Layout,</li> <li>● Table Layout,</li> </ul>		
13	Create an application to demonstrate different types of Layouts. <ul style="list-style-type: none"> <li>● Grid Layout,</li> <li>● Constrain Layout.</li> </ul>		
14	Create an Android application to demonstrate the ImageSwitcher.		
15	Create an Android application to demonstrate the use of Broadcast Receiver.		
16	Create an Android application to demonstrate XML based animation.		
17	Create an Android application to Screen Orientation of mobile screen.		
18	Create a media player application in android that plays audio. Implement play, pause, and loop features.		
19	Create an Android application to use a camera and capture image/video and display them on the screen.		
20	Create an Android application to demonstrate the different types of menus. <ul style="list-style-type: none"> <li>● Pop-up Menu</li> <li>● Context Menu</li> <li>● Option Menu</li> </ul>		
21	Create an Android application to record the current location. Based on the current location allow the user to use some useful services/applications		
22	Create a suitable Android application to store and retrieve data in the SQLite database.		
23	Create a suitable Android application to work with Firebase for storing and manipulating data.		
<b>Prescribed Text/s (If any):</b>			
<b>Teaching Plan:</b>			
<b>Practical's</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	All Practical's	Lab Session with ICT	60

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

**Semester VI**  
**Syllabus of Courses of B.Sc. Computer Science**  
**Programme at Semester VI**  
**with Effect from the Academic Year 2025-2026**  
**Discipline Specific Course (DSC)**  
**Major Course**

<b>Nomenclature of the Course</b>	<b>Data Science</b>		
<b>Class</b>	T.Y.B.Sc		
<b>Semester</b>	VI		
<b>Course Code</b>	25_USCSM601		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major Mandatory		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> Understand data types and sources, utilize high-level programming and IDEs for exploratory data analysis and visualization, and apply data management techniques including collection, cleaning, and modeling.			
<b>CO2:</b> Utilize query languages for data transformation, semi-structured and unstructured data systems with large-scale data systems and AWS tools.			
<b>CO3:</b> Explore model selection techniques, data transformations, supervised learning methods and unsupervised learning approaches.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Subtitles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Introduction to Data Science, Data Management</b>	<b>Introduction to Data Science:-</b> What is Data? Different kinds of data, Introduction to high level programming language, Integrated Development Environment (IDE), Exploratory Data Analysis (EDA), Data Visualization, Different types of data sources <b>Data Management:-</b> Data Collection, Data cleaning/extraction, Data analysis and Modeling	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

2	<b>Data Curation</b>	<b>Data Curation:-</b> Query languages and Operations to specify and transform data, Structured/schema based systems as users and acquirers of data Semi-structured systems as users and acquirers of data, Unstructured systems in the acquisition and structuring of data, Security and ethical considerations in relation to authenticating and authorizing access to data on remote systems, Software development tools, Large scale data systems, Amazon Web Services (AWS)	<b>10</b>
3	<b>Statistical Modelling and Machine Learning</b>	<b>Statistical Modelling and Machine Learning:-</b> Introduction to model selection: Regularization, bias/variance tradeoff e.g. parsimony, AIC, BIC, Cross validation, Ridge regressions and penalized regression e.g. LASSO <b>Data transformations:-</b> Dimension reduction, Feature extraction, Smoothing and aggregating <b>Supervised Learning:-</b> Regression, linear models, Regression trees, Time Series Analysis, Forecasting, Classification: classification trees, Logistic regression, separating hyperplanes, k-NN <b>Unsupervised Learning:-</b> Principal Components Analysis (PCA), k-means clustering, Hierarchical clustering, Ensemble methods	<b>10</b>
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1. Doing Data Science, Rachel Schutt and Cathy O’Neil, O’Reilly,2013</li> <li>2. Mastering Machine Learning with R, Cory Lesmeister, PACKT Publication,2015</li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>1. Hands-On Programming with R, Garrett Golemund,1st Edition, 2014</li> </ol> <p>An Introduction to Statistical Learning, James, G., Witten, D., Hastie, T., Tibshirani, R.,Springer,2015</p>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>Introduction to Data Science, Data Management</b>	Classroom Teaching and ICT	10
2	<b>Data Curation</b>	Classroom Teaching and ICT	10
3	<b>Statistical Modelling and Machine Learning</b>	Classroom Teaching and ICT	10

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Department Specific Courses (DSC)  
Major Course*

<b>Nomenclature of the Course</b>	<b>Cyber Forensics</b>		
<b>Class</b>	T.Y.B.Sc		
<b>Semester</b>	VI		
<b>Course Code</b>	25_USCSM602		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major		
<b>Course Outcomes:</b>			
<i>The learner will be able to:</i>			
<b>CO1:</b> The student will be able to plan and prepare for all stages of an investigation			
<b>CO2:</b> The Learner will able to do the detection, initial response and management interaction related cyber problems			
<b>CO3:</b> Also investigate various media to collect evidence, report them in a way that would be acceptable in the court of law.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Subtitles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Computer Forensics, Network Forensic, Cell Phone and Mobile Device Forensics</b>	Introduction to Computer Forensics and standard procedure, Incident Verification and System Identification, Recovery of Erased and Damaged data, Disk Imaging and Preservation, Data Encryption and Compression, Automated Search Techniques, Forensics Software. Introduction to Network Forensics and tracking network traffic, Reviewing Network Logs, Network Forensics Tools, Performing Live Acquisitions, Order of Volatility, Standard Procedure. Overview, Acquisition Procedures for Cell Phones and Mobile Devices	<b>10</b>
2	<b>Internet Forensic, E-mail Forensics, Social Media Forensics,</b>	Introduction to Internet Forensics, World Wide Web Threats, Hacking and Illegal access, Obscene and Incident transmission, Domain Name Ownership Investigation, Reconstructing past internet activities and events	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

	<b>Browser Forensics</b>	E-mail analysis, E-mail headers and spoofing, Laws against E-mail Crime, Messenger Forensics: Yahoo Messenger Social Media Investigations Cookie Storage and Analysis, Analyzing Cache and temporary internet files, Web browsing activity reconstruction	
3	<b>Investigation, Evidence presentation and Legal aspects of Digital Forensics, Introduction to Legal aspects of Digital Forensics</b>	Authorization to collect the evidence, Acquisition of Evidence, Authentication of the evidence, Analysis of the evidence, Reporting on the findings, Testimony. Laws & regulations, Information Technology Act, Giving Evidence in court, Case Study – Cyber Crime cases, Case Study – Cyber Crime cases	<b>10</b>
<p><b>Prescribed Text/s (If any):</b></p> <p>1. Guide to computer forensics and investigations, Bill Nelson, Amelia Philips and Christopher Steuart, course technology, 5th Edition, 2015</p> <p><b>Other Learning Resources recommended:</b></p> <p>1. Incident Response and computer forensics, Kevin Mandia, Chris Prorise, Tata McGrawHill, 2<sup>nd</sup> Edition, 2003</p>			
<b>Teaching Plan:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
1	<b>Computer Forensics, Network Forensic, Cell Phone and Mobile Device Forensics</b>	Classroom Teaching and ICT	10
2	<b>Internet Forensic, E-mail Forensics, Social Media Forensics, Browser Forensics</b>	Classroom Teaching and ICT	10
3	<b>Investigation, Evidence presentation and Legal aspects of Digital Forensics,</b>	Classroom Teaching and ICT	10

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

	<b>Introduction to Legal aspects of Digital Forensics</b>		
--	---	--	--

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Major Mandatory*

<b>Nomenclature of the Course</b>	<b>Wireless Sensor Network</b>		
<b>Class</b>	TYBSc		
<b>Semester</b>	VI		
<b>Course Code</b>	25_USCSM603		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major Mandatory		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> To understand the fundamentals, applications, and architecture of sensor networks, including design principles and enabling technologies.			
<b>CO2:</b> To explore medium access control, routing, and transport protocols in wireless sensor networks, focusing on design challenges and performance evaluations.			
<b>CO3:</b> To understand wireless transmission principles and telecommunication systems, including GSM, DECT, and satellite systems, focusing on architecture, protocols, and signal propagation.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Sub Titles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Introduction</b>	Introduction to Sensor Networks, unique constraints and challenges. Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETWORKS (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks.	<b>10</b>
	<b>Sensor Node Hardware and Network Architecture:</b>	Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC. Network architecture, Design principles for WSNs, Service interfaces of WSNs.	
2	<b>Medium Access Control Protocols:</b>	Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study.	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

	<b>Routing Protocols:</b>	Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless	
	<b>Transport Control Protocols :</b>	Routing Strategies in Wireless Sensor Networks. Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols.	
3	<b>Wireless Transmission:</b>	Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems.	10
	<b>Telecommunication, Satellite and Broadcast Systems: GSM:</b>	Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, security, New data services; DECT: System architecture, Protocol architecture; ETRA, UMTS and IMT- 2000. Satellite Systems: History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover.	
<p><b>Prescribed Text/s (If any):</b>  <b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Protocols and Architectures for Wireless Sensor Network, Holger Kerl, Andreas Willig, John Wiley and Sons, 2005</li> <li>2. Wireless Sensor Networks Technology, Protocols, and Applications ,Kazem Sohraby, Daniel Minoli and TaiebZnati, John Wiley &amp; Sons, 2007</li> <li>3. Mobile communications, Jochen Schiller, 2<sup>nd</sup> Edition, Addison wisely , Pearson Education, 2012</li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>1. Fundamentals of Wireless Sensor Networks, Theory and Practice, Waltenequs Dargie, Christian Poellabauer , Wiley Series on wireless Communication and Mobile Computing, 2011 Networking Wireless Sensors, Bhaskar Krishnamachari , Cambridge University Press, 2005</li> </ol>			
<b>Teaching Plan:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
1	<b>Introduction</b>	Classroom Teaching and ICT	10
	<b>Sensor Node Hardware and Network Architecture:</b>		
2	<b>Medium Access Control Protocols:</b>	Classroom Teaching and ICT	10
	<b>Routing Protocols :</b>		
	<b>Transport Control Protocols :</b>		
3	<b>Wireless Transmission:</b>		

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

	<b>Telecommunication, Satellite and Broadcast Systems: GSM:</b>	Classroom Teaching and ICT	10
--	---	----------------------------	----

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Major Practical*

<b>Nomenclature of the Course</b>	<b>Computer Science Practical 7</b>
<b>Class</b>	T.Y.B.Sc
<b>Semester</b>	VI
<b>Course Code</b>	25_USCSM604
<b>No. of Credits</b>	2
<b>Nature</b>	Practical
<b>Type</b>	Major- Practical
<b>Course Outcomes:</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> To Understand the architecture and use cases of NoSQL databases.	
<b>CO2:</b> To Learn to design and implement efficient data models.	
<b>CO3:</b> To Gain knowledge of time-series data characteristics.	
<b>CO4:</b> To Understand dashboards in PowerBI.	
<b>CO5:</b> To Create, customizing, and formatting Pie Chart and Donut Chart.	
<b>CO6:</b> To Insert and format tables, objects, images, text, shapes, and cards in your reports.	
<b>The following practical's will be implemented using Python, Mongo DB and PowerBI Minimum 20 practical's to be completed as a journal work.</b>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1	Practical of Data collection, Data curation and management for Unstructured data (NoSQL).
2	Practical of Data collection, Data curation and management for Large-scale Data system (such as MongoDB).
3	Practical of Principal Component Analysis.
4	Practical of Clustering.
5	Practical of Time-series forecasting.
6	Practical of Simple/Multiple Linear Regression.
7	Practical of Logistics Regression.
8	Practical of Hypothesis testing.
9	Practical of Analysis of Variance.
10	Practical of Decision Tree.
11	Installation and Introduction To PowerBI.
12	Overview and Creating Dashboards in PowerBI.
13	Designing and Creating Pie Chart, Donut chart in PowerBI.
14	Designing and Creating Funnel Chart, Ribbon Chart in PowerBI.
15	Designing and Creating Line Chart, Area Chart in PowerBI.
16	Designing and Creating Scatter, Waterfall, Treemap in PowerBI.
17	Inserting Table and data formatting in PowerBI.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

18	Designing Gauge Chart in PowerBI..		
19	Inserting Object, Image, Text, Shapes in PowerBI.		
20	Inserting Cards Text, Number in PowerBI.		
21	Creating Maps and adding information PowerBI.		
22	Inserting Buttons for performing action in PowerBI.		
<b>Prescribed Text/s (If any):</b>			
<ol style="list-style-type: none"> <li>1. Book: <i>MongoDB: The Definitive Guide</i> by Shannon Bradshaw, Eoin Brazil, Kristina Chodorow</li> <li>2. Book: <i>Python Data Science Handbook</i> by Jake VanderPlas</li> <li>3. <i>Pattern Recognition and Machine Learning</i> by Christopher M. Bishop</li> <li>4. "Microsoft Power BI Complete Reference" by Devin Knight, Brian Knight, Mitchell Pearson, and Manuel Quintana</li> <li>5. "Pro Microsoft Power BI Administration" by Adam Aspin</li> <li>6. "Introducing Microsoft Power BI" by Alberto Ferrari and Marco Russo</li> </ol>			
<b>Other Learning Resources recommended</b>			
<ol style="list-style-type: none"> <li>1. <i>The Elements of Statistical Learning</i> by Trevor Hastie, Robert Tibshirani, Jerome Friedman</li> <li>2. <a href="https://www.mongodb.com/docs/">https://www.mongodb.com/docs/</a></li> <li>3. <a href="https://www.microsoft.com/en-us/power-platform/products/power-bi/">https://www.microsoft.com/en-us/power-platform/products/power-bi/</a></li> <li>4. "Mastering Microsoft Power BI" by Brett Powell</li> <li>5. <a href="https://www.youtube.com/watch?v=A5TghJtKqYs&amp;list=PLsR_0x6BuM-HpLMzgYqsBlz68RnHfBqVr">https://www.youtube.com/watch?v=A5TghJtKqYs&amp;list=PLsR_0x6BuM-HpLMzgYqsBlz68RnHfBqVr</a></li> </ol>			
<b>Teaching Plan:</b>			
<b>Practical's</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	All Practical's	Lab Session with ICT	60

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science*

*Programme at Semester V*

*with Effect from the Academic Year 2025-2026*

*Discipline Specific Course (DSC)*

*Major Practical*

<b>Nomenclature of the Course</b>	<b>Computer Science Practical 8</b>
<b>Class</b>	T.Y.B.Sc
<b>Semester</b>	V
<b>Course Code</b>	25_USCSM605
<b>No. of Credits</b>	2
<b>Nature</b>	Practical
<b>Type</b>	Major
<b>Course Outcomes</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> Master forensic imaging, packet analysis, and data recovery techniques.	
<b>CO2:</b> Analyze network traffic, email headers, and web browser artifacts.	
<b>CO3:</b> Understand legal frameworks and conduct cybercrime case studies effectively.	
<b>CO4:</b> Understanding of WSN architecture and components.	
<b>CO5:</b> Designing and Implementing Sensor Networks.	
<b>CO6:</b> Understanding and Implementing Communication Protocols.	
<b>The following practical's will be implemented using FTK imager, Autopsy, FTK, Sysinternal tools, wireshark, RAM Capturer, Browser History Examiner, Minimum 20 practical's to be completed as a journal work.</b>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1	Creating a Forensic Image using FTK Imager/Encase Imager : -Creating Forensic Image - Check Integrity of Data - Analyze Forensic Image
2	Data Acquisition: - Perform data acquisition using: - USB Write Blocker in Services
3	Forensics Case Study: - Solve the Case study (image file) provide in lab using Encase Investigator or Autopsy
4	Capturing and analyzing network packets using Wireshark (Fundamentals) : - Identification the live network - Capture Packets - Analyze the captured packets
5	Analyze the packets provided in lab and solve the questions using Wireshark : - What web server software is used by www.snopes.com?

## Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26

	<ul style="list-style-type: none"> <li>- About what cell phone problem is the client concerned?</li> <li>- According to Zillow, what instrument will Ryan learn to play?</li> <li>- How many web servers are running Apache?</li> <li>- What hosts (IP addresses) think that jokes are more entertaining when they are explained?</li> </ul>
6	<p>Using Sysinternals tools for Network Tracking and Process Monitoring :</p> <ul style="list-style-type: none"> <li>- Check Sysinternals tools</li> <li>- Monitor Live Processes</li> <li>- Capture RAM</li> <li>- Capture TCP/UDP packets</li> <li>- Monitor Hard Disk</li> <li>- Monitor Virtual Memory</li> <li>- Monitor Cache Memory</li> </ul>
7	<p>Recovering and Inspecting deleted files - Check for Deleted Files</p> <ul style="list-style-type: none"> <li>- Recover the Deleted Files</li> <li>- Analyzing and Inspecting the recovered files</li> <li>- Perform this using recovery option in FTK and also Perform manually through command line</li> </ul>
8	<p>Illustrate the implementation of Acquisition of Cell phones and Mobile devices</p>
9	<p>Email Forensics</p> <ul style="list-style-type: none"> <li>- Mail Service Providers</li> <li>- Email protocols</li> <li>- Recovering emails</li> <li>- Analyzing email header</li> </ul>
10	<p>Web Browser Forensics</p> <ul style="list-style-type: none"> <li>- Web Browser working</li> <li>- Forensics activities on browser</li> <li>- Cache / Cookies analysis</li> <li>- Last Internet activity</li> </ul>
11	<p>Discuss the following</p> <ul style="list-style-type: none"> <li>- Information Technology Act</li> <li>- Case study for cyber crime.</li> </ul>
12	<p>Understanding the Sensor Node Hardware. (For Eg. Sensors, Nodes(Sensor mote), Base Station, Graphical User Interface.)</p>
13	<p>Understanding TOSSIM for</p> <ul style="list-style-type: none"> <li>- Mote-mote radio communication</li> <li>- Mote-PC serial communication</li> </ul>
14	<p>Exploring and understanding TinyOS computational concepts:</p> <ul style="list-style-type: none"> <li>- Events, Commands and Task.</li> <li>- nesC model - nesC Components</li> </ul>
15	<p>Create and simulate a simple adhoc network</p>
16	<p>Understanding, Reading and Analyzing Routing Table of a network.</p>
17	<p>Create a basic MANET implementation simulation for Packet animation and Packet Trace.</p>
18	<p>Implement a Wireless sensor network simulation.</p>
19	<p>Create MAC protocol simulation implementation for wireless sensor Network</p>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

20	Simulate Mobile Adhoc Network with Directional Antenna		
21	Create a mobile network using Cell Tower, Central Office Server, Web browser and Web Server. Simulate connection between them.		
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1. Guide to computer forensics and investigations, Bill Nelson, Amelia Philips and Christopher Steuart, course technology,5th Edition,2015</li> <li>2. Protocols and Architectures for Wireless Sensor Network, Holger Kerl, Andreas Willig, John Wiley and Sons, 2005</li> <li>3. Wireless Sensor Networks Technology, Protocols, and Applications ,Kazem Sohraby, Daniel Minoli and TaiebZnati, John Wiley &amp; Sons, 2007</li> <li>4. Mobile communications, Jochen Schiller,2<sup>nd</sup> Edition, Addison wisely , Pearson Education,2012</li> </ol> <p><b>Other Learning Resources recommended</b></p> <ol style="list-style-type: none"> <li>1. Incident Response and computer forensics, Kevin Mandia, Chris Prorise, Tata McGrawHill,2<sup>nd</sup> Edition,2003</li> <li>2. Fundamentals of Wireless Sensor Networks, Theory and Practice, Waltenequs Dargie, Christian Poellabauer , Wiley Series on wireless Communication and Mobile Computing, 2011</li> <li>3. Networking Wireless Sensors, Bhaskar Krishnamachari , Cambridge University Press, 2005</li> </ol>			
<b>Teaching Plan:</b>			
<b>Practical's</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	<b>All Practical's</b>	Lab Session with ICT	60

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Elective*

<b>Nomenclature of the Course</b>	<b>Ethical Hacking</b>		
<b>Class</b>	TYBSc		
<b>Semester</b>	VI		
<b>Course Code</b>	25_USCSE606		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major Elective		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> To Understand the different types of attacks and vulnerabilities.			
<b>CO2:</b> To Understand the differences between authenticated and unauthenticated testing.			
<b>CO3:</b> To Understand the principles of steganography.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Sub Titles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Information Security:- Attacks and Vulnerabilities Introduction to information security</b>	Asset, Access Control, CIA, Authentication, Authorization, Risk, Threat, Vulnerability, Attack, Attack Surface, Malware, Security-Functionality-Ease of Use Triangle	<b>10</b>
	<b>Types of malware</b>	Worms, viruses, Trojans, Spyware, Rootkits	
	<b>Types of vulnerabilities</b>	OWASP Top 10 : cross-site scripting (XSS), cross site request forgery (CSRF/XSRF), SQL injection, input parameter manipulation, broken authentication, sensitive information disclosure, XML External Entities, Broken access control, Security Misconfiguration, Using components with known vulnerabilities, Insufficient Logging and monitoring, OWASP Mobile Top 10, CVE Database	
	<b>Types of attacks and their common prevention mechanisms</b>	Keystroke Logging, Denial of Service (DoS /DDoS), Waterhole attack, brute force, phishing and fake WAP, Eavesdropping, Man-in-the-middle, Session Hijacking, Clickjacking, Cookie Theft, URL Obfuscation, buffer overflow, DNS	

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

		poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs and BOTNETs	
	<b>Case-studies</b>	Recent attacks – Yahoo, Adult Friend Finder, eBay, Equifax, WannaCry , Target Stores, Uber, JP Morgan Chase, Bad Rabbit	
2	<b>Ethical Hacking – I (Introduction and pre-attack)</b>	Black Hat vs. Gray Hat vs. White Hat (Ethical) hacking, Why is Ethical hacking needed?, How is Ethical hacking different from security auditing and digital forensics?, Signing NDA, Compliance and Regulatory concerns, Black box vs. White box vs. Black box, Vulnerability assessment and Penetration Testing.	<b>10</b>
	<b>Approach :- Planning</b>	Threat Modeling, set up security verification standards, Set up security testing plan – When, which systems/apps, understanding functionality, black/gray/white, authenticated vs. unauthenticated, internal vs. external PT, Information gathering, Perform Manual and automated (Tools: WebInspect/Qualys, Nessus, Proxies, Metasploit) VA and PT, How WebInspect/Qualys tools work: Crawling/Spidering, requests forging, pattern matching to known vulnerability database and Analyzing results, Preparing report, Fixing security gaps following the report	
	<b>Enterprise strategy</b>	Repeated PT, approval by security testing team, Continuous Application Security Testing, <b>Phases:</b> Reconnaissance/foot-printing/Enumeration, <b>Phases:</b> Scanning, Sniffing	
3	<b>Phases :- Gaining and Maintaining Access</b>	<b>Phases : Gaining and Maintaining Access : Systems hacking</b> – Windows and Linux – Metasploit and Kali Linux, Keylogging, Buffer Overflows, Privilege Escalation, Network hacking - ARP Poisoning, Password Cracking, WEP Vulnerabilities, MAC Spoofing, MAC Flooding, IPspoofing, SYN Flooding, Smurf attack, <b>Applications hacking</b> : SMTP/Email-based attacks, VOIP vulnerabilities, Directory traversal, Input Manipulation, Brute force attack, Unsecured login mechanisms, SQL injection, XSS, Mobile apps security, <b>Malware analysis</b> : Netcat Trojan, wrapping definition, reverse engineering <b>Phases</b> : Covering your tracks : Steganography, Event Logs alteration <b>Additional</b>	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

		<b>Security Mechanisms</b> : IDS/IPS, Honeypots and evasion techniques, Secure Code Reviews (Fortify tool, OWASP Secure Coding Guidelines)	
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1. Certified Ethical Hacker Study Guide v9, Sean-Philip Oriyano, Sybex; Study Guide Edition,2016</li> <li>2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2007</li> <li>3. Certified Ethical Hacker: Michael Gregg, Pearson Education,1<sup>st</sup> Edition, 2013</li> <li>4. Certified Ethical Hacker: Matt Walker, TMH,2011</li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>1. <a href="http://www.pentest-standard.org/index.php/PTES_Technical_Guidelines">http://www.pentest-standard.org/index.php/PTES_Technical_Guidelines</a></li> <li>2. <a href="https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project">https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project</a></li> <li>3. <a href="https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10">https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10</a></li> <li>4. <a href="https://www.owasp.org/index.php/OWASP_Testing_Guide_v4_Table_of_Contents">https://www.owasp.org/index.php/OWASP_Testing_Guide_v4_Table_of_Contents</a></li> <li>5. <a href="https://www.owasp.org/index.php/OWASP_Secure_Coding_Practices_-_Quick_Reference_Guide">https://www.owasp.org/index.php/OWASP_Secure_Coding_Practices_-_Quick_Reference_Guide</a></li> <li>6. <a href="https://cve.mitre.org/">https://cve.mitre.org/</a></li> <li>7. <a href="https://access.redhat.com/blogs/766093/posts/2914051">https://access.redhat.com/blogs/766093/posts/2914051</a></li> <li>8. <a href="http://resources.infosecinstitute.com/applications-threat-modeling/#gref">http://resources.infosecinstitute.com/applications-threat-modeling/#gref</a></li> <li>9. <a href="http://www.vulnerabilityassessment.co.uk/Penetration%20Test.html">http://www.vulnerabilityassessment.co.uk/Penetration%20Test.html</a></li> </ol>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>Information Security : Attacks and Vulnerabilities</b>	Classroom Teaching and ICT	10
	<b>Introduction to information security</b>		
	<b>Types of malware</b>		
	<b>Types of vulnerabilities</b>		
	<b>Types of attacks and their common prevention mechanisms</b>		
	<b>Case-studies</b>		
2	<b>Software Testing Strategies</b>	Classroom Teaching and ICT	10

*Syllabus of Courses of B.Sc. Computer Science*

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

	<b>Software Metrics</b>		
	<b>Defect Management</b>		
3	<b>Software Quality Assurance</b>	Classroom Teaching and ICT	10

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Skill Enhancement Course*

<b>Nomenclature of the Course</b>	<b>Ethical Hacking Practical</b>
<b>Class</b>	TYBSc
<b>Semester</b>	VI
<b>Course Code</b>	25_USCSE607
<b>No. of Credits</b>	02
<b>Nature</b>	Practical
<b>Type</b>	Major Elective
<b>Course Outcomes:</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> To understand how to encrypt and decrypt passwords.	
<b>CO2:</b> To understand different types of Port Scanning Techniques.	
<b>CO3:</b> To understand MAC spoofing in Ethical Hacking.	
<p align="center"><i>Practical tasks shall be performed using CrypTool , Ubuntu , NMap scanner , XAMP server , Wireshark , Cain and Abel , python.</i></p> <p align="center"><b>Minimum 20 practical's to be implemented as a journal work.</b></p>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1	Use Google and Whois for Reconnaissance.
2	Use CrypTool to encrypt and decrypt passwords using the RC4 algorithm.
3	Run and analyze the output of following commands in Linux – ifconfig, ping, netstat, traceroute.
4	Use NMap scanner to perform port scanning of various forms – ACK, SYN, FIN, NULL, XMAS.
5	Simulate persistent cross-site scripting attack.
6	Use Wireshark (Sniffer) to capture network traffic and analyze.
7	Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords.
8	Perform ARP Poisoning in Windows.
9	Use Nemesy to launch DoS attack.
10	Perform SQL injection attack.
11	Create a simple keylogger using python.
12	Perform Steganography to hide confidential data using OpenPuff software.
13	Demonstrate MAC spoofing attack.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

14	Demonstrate Brute force Attack using Cain and Abel		
15	Demonstrate man in the middle attack using Wireshark		
16	Perform IP spoofing using nmap and wireshark		
17	Demonstrate DNS spoofing using Ettercap		
18	Write a Case-study on cyber-attack on Yahoo Data Breach (2013-2014) and eBay Data Breach (2014)		
19	Write a Case-study on Equifax Data Breach (2017) and Target Stores Data Breach (2013)		
20	Write a Case-study on WannaCry Ransomware Attack (2017) Bad Rabbit Ransomware Attack (2017)		
21	Write a Case-study on Uber Data Breach (2016)		
22	Write a Case-study on JP Morgan Chase Data Breach (2014)		
23	Write a Case-study on Adult Friend Finder Data Breach (2016)		
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1) <a href="https://www.youtube.com/watch?v=9PftIRw3Ko8&amp;list=PLGwQaJZINbBDHjpdN5MKPWhz2MS16ijol&amp;index=27">https://www.youtube.com/watch?v=9PftIRw3Ko8&amp;list=PLGwQaJZINbBDHjpdN5MKPWhz2MS16ijol&amp;index=27</a></li> <li>2) <a href="https://www.youtube.com/watch?v=cLRY5OtcXFQ">https://www.youtube.com/watch?v=cLRY5OtcXFQ</a></li> <li>3) <a href="https://www.youtube.com/watch?v=4Fo3W4Tns0s&amp;t=15s">https://www.youtube.com/watch?v=4Fo3W4Tns0s&amp;t=15s</a></li> <li>4) <a href="https://www.youtube.com/watch?v=DsuGFMloIBU">https://www.youtube.com/watch?v=DsuGFMloIBU</a></li> <li>5) <a href="https://www.youtube.com/watch?v=h9S4mkk10Vw">https://www.youtube.com/watch?v=h9S4mkk10Vw</a></li> </ol>			
<b>Teaching Plan:</b>			
<b>Practical's</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	All Practical's	Lab Session with ICT	60

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Major Course*

<b>Nomenclature of the Course</b>	<b>Information Retrieval</b>		
<b>Class</b>	T.Y.B.Sc.		
<b>Semester</b>	VI		
<b>Course Code</b>	25_USCSE608		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	Major Elective		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> Understand the history and evolution of Information Retrieval (IR) systems and their key components.			
<b>CO2:</b> Analyze web structure and apply link analysis techniques such as Hubs and Authorities for ranking web pages.			
<b>CO3:</b> Understand and work with XML data structures for efficient information retrieval.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Subtitles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Introduction to Information Retrieval</b>	Introduction to Information Retrieval: Introduction, History of IR, Components of IR, and Issues related to IR, Boolean retrieval, Dictionaries and tolerant retrieval.	<b>10</b>
2	<b>Link Analysis and Specialized Search</b>	Link Analysis and Specialized Search: Link Analysis, hubs and authorities, Page Rank and HITS algorithms, Similarity, Hadoop & Map Reduce, Evaluation, Personalized search, Collaborative filtering and content-based recommendation of documents and products, handling “invisible” Web, Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.	<b>10</b>
	<b>Web Search Engine</b>	Web Search Engine: Web search overview, web structure, the user, paid placement, search engine optimization/spam, Web size measurement, search	<b>10</b>

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

3		engine optimization/spam, Web Search Architectures.	
	<b>XML retrieval</b>	XML retrieval: Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric versus data-centric XML retrieval.	
<p><b>Prescribed Text/s (If any):</b></p> <ol style="list-style-type: none"> <li>1. Introduction to Information Retrieval, C. Manning, P. Raghavan, and H. Schütze, Cambridge University Press, 2008</li> <li>2. Modern Information Retrieval: The Concepts and Technology behind Search, Ricardo Baeza -Yates and Berthier Ribeiro – Neto, 2 nd Edition, ACM Press Books 2011.</li> <li>3. Search Engines: Information Retrieval in Practice, Bruce Croft, Donald Metzler and Trevor Strohman, 1 st Edition, Pearson, 2009.</li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>1. Information Retrieval Implementing and Evaluating Search Engines, Stefan Büttcher, Charles L. A. Clarke and Gordon V. Cormack, The MIT Press; Reprint edition (February 12, 2016)</li> </ol>			
<b>Teaching Plan:</b>			
Unit No.	Unit Title	Teaching Methods	No. of Lectures
1	<b>Introduction to Information Retrieval</b>	Classroom Teaching and ICT	10
2	<b>Link Analysis and Specialized Search</b>	Classroom Teaching and ICT	10
3	<b>Web Search Engine</b>	Classroom Teaching and ICT	10
	<b>XML retrieval</b>		

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Major Practical*

<b>Nomenclature of the Course</b>	<b>Information Retrieval Practical</b>
<b>Class</b>	T.Y.B.Sc
<b>Semester</b>	VI
<b>Course Code</b>	25_USCSE609
<b>No. of Credits</b>	2
<b>Nature</b>	Practical
<b>Type</b>	Elective- Practical
<b>Course Outcomes:</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> To Understand the Implement and evaluate key algorithms for web search, such as the PageRank algorithm.	
<b>CO2:</b> To Learn to Pre-process text documents by removing stop words and applying other text cleaning techniques	
<b>CO3:</b> To Gain knowledge of Parse XML text, generate a web graph, and compute topic-specific PageRank for the XML dataset.	
<b>CO4:</b> To Understand HITS (Hyperlink-Induced Topic Search) algorithm and analyze the importance of hubs and authorities in web search.	
<b>CO5:</b> To Visualize web graphs using tools like Gephi and explore the relationships between pages and links.	
<b>CO6:</b> To understand Google Trends to analyze user search patterns and perform basic analysis of user query behavior.	
<b>The following practical's will be implemented using software/tools like Python / Java / Hadoop Information Retrieval Minimum 20 practical's to be completed as a journal work.</b>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1	Write a program to demonstrate bitwise operation.
2	Implement Page Rank Algorithm.
3	Implement Dynamic programming algorithm for computing the edit distance between strings s1 and s2. (Hint. Levenshtein Distance)
4	Write a program to Compute Similarity between two text documents.
5	Write a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each letter should be case-insensitive (i.e., include both upper-case and lower-case versions of the letter; Ignore non-alphabetic characters).
6	Implement a basic IR system using Lucene.
7	Write a program for Pre-processing of a Text Document: stop word removal.

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

8	Write a program for mining Twitter to identify tweets for a specific period and identify trends and named entities.		
9	Write a program to implement a simple web crawler.		
10	Write a program to parse XML text, generate Web graph and compute topic specific page rank.		
11	Write a program to text preprocessing for text Cleaning, Tokenization Removing Stop Words text mining using Python.		
12	Write a program to solve Problem: Text Contains URLs, Email Addresses, or Special Characters		
13	Write a program Tokenization: Properly splitting text into tokens.		
14	Write a program to demonstrate HITS algorithms.		
15	Write a program Link Analysis to create graph and analysis graph clustering coefficient.		
16	Create user search patterns using tools like Google Trends.Perform a basic analysis of user query behavior.		
17	Implement a simple VSM for XML retrieval (e.g., using Python or any IR tool)Rank XML documents based on query relevance using TF-IDF scores.		
18	Analyze a small web graph using tools like Gephi. Visualize and explore the relationships between pages and links.		
19	Evaluate the ranking effectiveness of PageRank and HITS using precision and recall.		
20	Set up a local search engine using open-source tools (e.g., Apache Nutch).Test the performance of different search engine architectures.		
21	Build a simple QA system that retrieves answers from a structured dataset.		
22	Implement a simple snippet generation system for document queries.		
<b>Prescribed Text/s (If any):</b>			
<ol style="list-style-type: none"> <li>1. Software Engineering for Students, A Programming Approach, Douglas Bell, 4<sup>th</sup> Edition,, Pearson Education, 2005</li> <li>2. Software Engineering – A Practitioners Approach, Roger S. Pressman, 5<sup>th</sup> Edition, Tata McGraw Hill, 2001</li> <li>3. Quality Management, Donna C. S. Summers, 5<sup>th</sup> Edition, Prentice-Hall, 2010.</li> <li>4. Total Quality Management, Dale H. Besterfield, 3<sup>rd</sup> Edition, Prentice Hall, 2003.</li> <li>5. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, “An Introduction to Information Retrieval”, 1st Edition, Cambridge University Press, 2008.</li> </ol>			
<b>Teaching Plan:</b>			
<b>Practicals</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	All Practical's	Lab Session with ICT	60

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Vocational Skill Course*

<b>Nomenclature of the Course</b>	<b>Advanced Application Development</b>		
<b>Class</b>	TYBSc		
<b>Semester</b>	VI		
<b>Course Code</b>	25_USCSV610		
<b>No. of Credits</b>	2		
<b>Nature</b>	Theory		
<b>Type</b>	VSC		
<b>Course Outcomes:</b>			
<i>The learner will be able to :</i>			
<b>CO1:</b> To Acquire skills in Node.js and MongoDB, covering setup, module creation, HTTP server development, and CRUD operations.			
<b>CO2:</b> To Develop full-stack applications using Express for server-side development and Angular for client-side management, covering templating, CRUD operations, data binding, and form validation.			
<b>CO3:</b> To Gain proficiency in Flutter and Dart by understanding framework setup, Dart programming fundamentals, and utilizing key widgets for building responsive mobile applications.			
<b>Syllabus:</b>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>Sub Titles (Learning Points)</b>	<b>No of Lectures</b>
1	<b>Node.js (N):</b>	Introduction to Node.js. Installing Node.js. The package.json File. The Node.js Event Loop. The I/O Cycle. The Anatomy of a Node.js Module. Creating Node Modules. HTTP Module. Creating an HTTP Webserver with Node.js. Responding to HTTP Requests. Routing in Node.js. Creating a Sample Node.js Application.	<b>10</b>
	<b>Mongo DB (M):</b>	Introduction to MongoDB. Installing MongoDB. Using MongoDB Compass. Using Mongo Shell Interface. Connecting to MongoDB. Creating Schemas and Models. Querying Documents Using find(). Inserting Documents Using create(). Updating Documents Using findOneAndUpdate().	

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

		Deleting Documents Using findOneAndDelete() & deleteMany()	
2	<b>Server-Side Development with Express (E)</b>	Introduction to the Express Framework. Installing and Testing Express. Creating Templates. Using Express Middleware Functions. Creating the List Page. Creating the Details Page. Creating the Edit Page. Creating the Add Page. Deleting Data.	<b>10</b>
	<b>Understanding Angular.JS(A):</b>	Getting Started with Angular. Creating an Angular Application. Angular Project File Structure. Anatomy of an Angular Component. One-way Data Binding. Two-way Data Binding. Using NgIf Directive. Using NgForOf Directive. Angular Modules. Creating NgModules Using Angular Router. Validating Form Data. Services Dependency Injection (DI). Reading Data from Database. Inserting Data into Database. Updating Data in the Database. Delete Data from Database.	
3	<b>Understanding Flutter:</b>	Importance of Flutter, Flutter Framework, Android Studio, Flutter SDK, Installing and Configuring Flutter SDK.	<b>10</b>
	<b>Dart Programming:</b>	main() function, Dart Variables, Dart Data Types, Dart Conditional Operators, Control Flow & Loops. Dart Functions - Functions, Function Structure, creating a Function, Function Returning Expression. Object-Oriented Programming (OOP) - Creating a Class, Adding Methods to Classes, Class — Getters and Setters, Class Inheritance, Abstract Class.	
	<b>Flutter Widgets Fundamentals:</b>	Scaffold Widget, Image Widget, Container Widget, Column and Row Widgets, Icon Widget, Layouts in Flutter, Card Widget, Hot Reload and Hot Restart, Stateful and Stateless Widgets	
<p><b>Prescribed Text/s (If any):</b>  <b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications by Brad Dayley, Brendan Dayley, Caleb Dayley, Pearson, 2018.</li> <li>2. Beginning Flutter: A Hands On Guide to App Development by Marco L. Napoli, Wrox, 2019</li> </ol> <p><b>Other Learning Resources recommended:</b></p> <ol style="list-style-type: none"> <li>1. Full Stack Javascript Development with Mean - MongoDB, Express, AngularJS, and Node.JS by Adam Bretz, Colin J Ihrig, Shroff/SitePoint, 2015</li> <li>2. Practical Flutter by Zammetti Frank, Apress, 2019</li> </ol>			
<b>Teaching Plan:</b>			

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

<b>Unit No.</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
1	<b>Node.js (N):</b>	Classroom Teaching and ICT	10
	<b>Mongo DB (M):</b>		
2	<b>Server-Side Development with Express (E)</b>	Classroom Teaching and ICT	10
	<b>Understanding Angular.JS(A):</b>		
3	<b>Understanding Flutter:</b>	Classroom Teaching and ICT	10
	<b>Dart Programming:</b>		
	<b>Flutter Widgets Fundamentals:</b>		

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

*Syllabus of Courses of B.Sc. Computer Science  
Programme at Semester VI  
with Effect from the Academic Year 2025-2026  
Discipline Specific Course (DSC)  
Vocational Skill Course*

<b>Nomenclature of the Course</b>	<b>Advance Application Development Practical</b>
<b>Class</b>	T.Y. B.Sc
<b>Semester</b>	VI
<b>Course Code</b>	25_USCSV611
<b>No. of Credits</b>	02
<b>Nature</b>	Practical
<b>Type</b>	Vocational Skill Course (VSC)
<b>Course Outcomes:</b>	
<i>The learner will be able to :</i>	
<b>CO1:</b> To understand the architecture and components of the MEAN stack (MongoDB, Express.js, Angular, Node.js) and how they work together to build web applications.	
<b>CO2:</b> To develop full-stack web applications using the MEAN stack, implementing RESTful APIs and integrating front-end and back-end functionalities.	
<b>CO3:</b> To understand the fundamentals of Dart programming language and its application in building Flutter mobile applications.	
<p align="center"><i>Practical tasks shall be performed using MongoDB, Express.js, Angular, Node.js, Dart SDK, Flutter SDK and Android Studio.</i></p> <p align="center"><b>Minimum 20 practical to be implemented as a journal work.</b></p>	
<b>Syllabus:</b>	
<b>Sr. No.</b>	<b>Aim of the Practical</b>
1	Set up the necessary tools and environment for the MEAN stack to enable the development of dynamic web applications, focusing on installing MongoDB, Node.js, Express.js, and Angular
2	Understand the functionality and usage of MongoDB Compass and the MongoDB shell.
3	Create and drop a MongoDB collection and perform CRUD operations on MongoDB Documents.
4	Implement various functions in MongoDB to perform sorting and limiting the data in documents.
5	Implement the concept of nested documents in MongoDB.
6	Implementing the get requests in Express JS.
7	Working with route parameters and query parameters in Express JS
8	Implementing the put and patch requests in Express JS

**Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26**

9	Implementing the post and delete requests in Express JS		
10	Implementing and understanding the middleware function in Express JS		
11	Implementing the concept of routers in Express JS		
12	Create a new angular project using Angular CLI and install bootstrap in the project.		
13	Create New Custom Component in Angular and add it into the App Module in component declarations.		
14	Working with template urls and style urls for formatting and styling Angular application.		
15	Implement data binding in the Angular. Understanding string interpolation in the HTML file.		
16	Implement property binding and event binding in Angular.		
17	Send the data from the event Binding using \$event reserved word in Angular		
18	Understand the Node JS and execute Hello World program.		
19	Understanding and working with Node JS modules.		
20	Implementing callback pattern in Node JS.		
21	Setup necessary tools for Flutter and Dart development on windows		
22	Create and run your first flutter project using the IDE.		
23	Understand and implement the Scaffold and AppBar widgets in Flutter.		
24	Understand and implement the concepts of stateless widget and hot reload.		
25	Understand and implement the concepts of containers, padding, rows and columns		
<b>Prescribed Text/s (If any):</b>			
<ol style="list-style-type: none"> <li>1) <a href="https://youtube.com/playlist?list=PL4cUxeGkcC9h77dJ-QJlwGIZITd4ecZOA&amp;si=aYUII3QPAukDmFhc">https://youtube.com/playlist?list=PL4cUxeGkcC9h77dJ-QJlwGIZITd4ecZOA&amp;si=aYUII3QPAukDmFhc</a></li> <li>2) <a href="https://youtube.com/playlist?list=PL_cUvD4qzwbkwmjy-KjbieZ8J9cGwxZpC&amp;si=mpXZIX2akS-BuBgI">https://youtube.com/playlist?list=PL_cUvD4qzwbkwmjy-KjbieZ8J9cGwxZpC&amp;si=mpXZIX2akS-BuBgI</a></li> <li>3) <a href="https://youtube.com/playlist?list=PL_euSNU_eLbeAJxvVdJn5lhPWX9IWHhxs&amp;si=d1nWbJvNxjBFIxxC">https://youtube.com/playlist?list=PL_euSNU_eLbeAJxvVdJn5lhPWX9IWHhxs&amp;si=d1nWbJvNxjBFIxxC</a></li> <li>4) <a href="https://youtube.com/playlist?list=PLC3y8-rFHvwh8shCMHFA5kWxD9PaPwxaY&amp;si=b39vmTFjilSP-24w">https://youtube.com/playlist?list=PLC3y8-rFHvwh8shCMHFA5kWxD9PaPwxaY&amp;si=b39vmTFjilSP-24w</a></li> <li>5) <a href="https://youtube.com/playlist?list=PL4cUxeGkcC9jLYyp2Aoh6hcWuxFDX6PBJ&amp;si=4A6QU7ho9b5PuheV">https://youtube.com/playlist?list=PL4cUxeGkcC9jLYyp2Aoh6hcWuxFDX6PBJ&amp;si=4A6QU7ho9b5PuheV</a></li> </ol>			
<b>Teaching Plan:</b>			
<b>Practical's</b>	<b>Unit Title</b>	<b>Teaching Methods</b>	<b>No. of Lectures</b>
All	All Practical's	Lab Session with ICT	60

## Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26

### Evaluation Scheme

#### For 2 Credit Theory Course:

The allocation of marks for the Internal Assessment and Semester End Examinations are as follows

Evaluation for the course will be of 50 marks conducted in a 30:20 pattern. 30 marks will be for semester end examination and 20 marks will be for internal evaluation.

#### Internal Evaluation: 20 Marks (40%)

Method	Marks
<b>Mid-Term Class Test</b> <ul style="list-style-type: none"> <li>● It should be conducted using any <b>learning management system</b> such as <b>Moodle</b>(Modular object-oriented dynamic learning environment)</li> <li>● The test should have <b>20 MCQ's</b> which should be solved in a time duration of <b>40 minutes</b>.</li> </ul>	10
<b>Assignment/ Case study/ Presentations</b> <ul style="list-style-type: none"> <li>● Assignment / Case Study Report / Presentation can be uploaded on any <b>learning management system</b>.</li> </ul>	05
<b>Attendance and behavior</b>	05

#### Semester End Evaluation: 30 Marks (60%)

**Duration:** 1 Hour

All questions are compulsory.				
Question	Based on	Sub-Question	Options	Marks
Q.1	Unit I	A	<i>Any 2 out of 4</i>	6
		B	<i>Any 1 out of 2</i>	4
Q.2	Unit II	A	<i>Any 2 out of 4</i>	6
		B	<i>Any 1 out of 2</i>	4
Q.3	Unit III	A	<i>Any 2 out of 4</i>	6
		B	<i>Any 1 out of 2</i>	4

## Syllabus for T.Y.B.Sc. Computer Science: Implementation Year 2025-26

### Evaluation Scheme

#### For Practical Course:

The allocation of marks for the Internal Assessment and Semester End Examinations are as follows

Evaluation for the course will be of 50 marks conducted in a 60: 40 pattern. 30 marks will be for semester end examination and 20 marks will be for internal evaluation.

#### Evaluation Pattern

##### Internal Examination: 20 Marks (40%)

Sr No	Criterion	Marks
1	Journals containing minimum 05 practical's which are timely completed with desired output	10
2	Attendance & Practical Performance	10

##### Semester End Examination: 30 Marks (60%)

Sr No	Criterion	Marks
1	One Practical Question <b>OR</b> Combination of Practical Questions <b>OR</b> Combination of Practical Question and Theory Question <b>Duration : 2 Hours</b>	25
2	Viva	05

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Standard of Passing**

The learner to pass a course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment & Semester End Examination. The learner shall obtain minimum of 40% marks (i.e. 16 out of 40) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 24 out of 60) separately, to pass the course and minimum of Letter Grade “P” in the project component, wherever applicable to pass a particular semester. A learner will be said to have passed the course if the learner passes the Internal Assessment & Semester End Examination together.

**Performance Grading:**

**Letter Grades and Grade Points**

<b>Semester GPA/ Program CGPA Semester/Program</b>	<b>% of Marks</b>	<b>Alpha-Sign / Letter Grade Result</b>
9.00-10.00	90.0 -100	0 (Outstanding)
$8.00 \leq 9.00$	$80.0 \leq 90.0$	A+ (Excellent)
$7.00 \leq 8.00$	$70.0 \leq 80.0$	A (Very Good)
$6.00 \leq 7.00$	$60.0 \leq 70.0$	B+ (Good)
$5.50 \leq 6.00$	$55.0 \leq 60.0$	B (Above Average)
$5.00 \leq 5.50$	$50.0 \leq 55.0$	C (Average)
$4.00 \leq 5.00$	$40.0 \leq 50.0$	P (Pass)
Below 4.00	Below 40	F (Fail)
Ab (Absent)	-	Absent

**Date: 20/11/2024**

**Place:-Ratnagiri**

**The Chairperson**

**BoS of Computer Science**

### **Field Project (25\_USCSF512)**

#### **Field Project Guidelines**

##### **Aim:**

Learners have to work 120 hours in a semester for a Field Project. The Field Project Work provides students with practical experience in applying their knowledge and skills to real-world projects, emphasizing hands-on experience in industry- standard project practices. It focuses on project development, implementation, and deployment using computer science principles and techniques. Students will work individually or in teams to design, develop, and present a substantial software project, gaining exposure to real-life project scenarios. It also covers project planning, requirements gathering, software design, coding, testing, debugging, documentation, and project management, following industry best practices. Through these projects, students will enhance their problem- solving abilities, gain proficiency in software development methodologies, and strengthen their practical skills in computer science.

##### **Objectives:**

- Apply interdisciplinary knowledge to effectively solve real-life problems using acquired skills and concepts.
- Gain hands-on experience in the software development life cycle, encompassing requirements analysis, design, implementation, testing, and deployment.
- Familiarize yourself with global IT industry standards, ethics, and professional practices to thrive in a professional environment.
- Develop teamwork and project management skills through structured collaboration, effective communication, and task delegation.
- Produce professional technical documentation aligning with industry practices, ensuring clarity, accuracy, and usability.
- Acquire time management, resource allocation, and personnel coordination skills for efficient project execution.

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Project Types:**

**a) Developing a solution for a real-life problem:** The project can be developed as per commercial problems or according to industry demands or outsourced modules to meet current trend and market needs. In this case, the project focuses on addressing an existing requirement for a computer-based solution that has practical applications. The project should successfully implement the different stages of the system development life cycle. Examples: Secure Online Banking System, Machine Learning-based Disease Diagnosis System, Cloud-based Document Management System.

**b) Innovative Product Development:** These projects involve exploring and developing computer-based solution with a unique and innovative utility. Examples: Cybersecurity Monitoring and Threat Detection System, Machine Learning-powered Predictive Maintenance System for Industrial Equipment, IoT-based Smart Energy Management System, Customized Database application.

**Tools & Technologies:**

In the field project work, students are granted complete freedom to select platforms, tools, and programming languages without any imposed restrictions. This approach encourages creativity, flexibility, and exploration of various technologies. By prioritizing open-source technologies, students can leverage a vast array of resources and community support. Commonly employed tools include IDEs, version control systems (e.g., Git), programming languages (e.g., Python, Java), databases (e.g., MySQL), and web frameworks (e.g., Django, Ruby on Rails). The evaluation process focuses on the project's content and implementation rather than the specific tools chosen, ensuring a fair assessment of the students' skills and problem-solving abilities.

**Project Guide:**

The field project guide is here to support and mentor you throughout your project journey. They provide expert advice, help you refine your ideas, and guide you in developing a clear and feasible project proposal. Your guide will help you to overcome challenges, and ensure you stay on track with your goals. Weekly project enhancements should be reported to guide. They also ensure that your project meets academic requirements. In short, your guide is a key resource for improving your work and helping you succeed in your project.

**Project Team Size:** 1 member

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and**  
**R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Evaluation Scheme:**

<b>Field Project Evaluation (100 marks)</b>							
<b>Internal (40 Marks)</b>			<b>External (60 Marks)</b>				
Project Proposa l	Project proposal Presentati on	Attendan ce and Behavior	Quality of the Project	Worki ng of the Projec t	Docu ment ation	Project Presentati on	Viv a
20	10	10	15	15	10	10	10

The evaluation of the project will assess the project based on the following parameters:

- **Project Proposal - 20 Marks:** Submit a detailed two to three page proposal outlining the project's objectives, timeline, resources needed, expected outcomes, and a plan for assessment.
- **Project proposal Presentation – 10 Marks:** Present a clear, concise overview of your project, including objectives, methodology, timeline, and expected outcomes, while engaging your audience with professional delivery, visual aids, and confident communication.
- **Attendance and Behavior - 10 Marks:** Students are expected to attend all scheduled sessions, and project-related activities. It is crucial to be present unless there is an unavoidable conflict (e.g., illness or emergency).
- **Quality of the Project – 15 Marks:** The overall quality of the project, including its design, implementation, and user experience, will be evaluated.
- **Working of the Project – 15 Marks:** The functionality and performance of the project will be assessed to determine how well it meets the specified requirements and objectives.
- **Documentation – 10 Marks:** The completeness, accuracy, and professionalism of the project documentation, including the project report and supporting materials, will be considered.
- **Project Presentation – 10 Marks:** The clarity, organization, and effectiveness of the project presentation will be evaluated.
- **Viva – 10 Marks:** The viva voce session will provide an opportunity for the student to demonstrate their knowledge and understanding of the project, as well as to answer questions and engage in a discussion with the evaluators.

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Project Proposal:**

The project proposal will be considered for internal evaluation. The project proposal is a mandatory document that serves as a foundation for the project. It helps students define their project idea, receive early evaluation and feedback, establish clear communication with the project guide, and take ownership of the project's successful execution. A formal proposal ensures systematic and professional project planning, fostering critical thinking, effective communication, and project management skills. The proposal provides a roadmap and increases the chances of a successful outcome. Before initiating a project, it is mandatory to submit a project proposal for approval. The original duly approved project proposal should be attached to the final project report. The project proposal for UG computer science projects should include the following contents:

- **Title:** It should be clear, concise, and reflect the core objective or theme of the project.
- **Introduction:** Introduces the project topic with general area of interest (field, industry, or problem the project addresses) and relevance or importance of the topic in the current scenario.
- **Objectives:** It should explain the goals and desired outcomes of the project.
- **Scope:** It should define the boundaries of the project, explaining what will and won't be covered.
- **Methodology:** Briefly introduces a high-level overview of the methods, techniques, or tools used to achieve the objectives of project.
- **Tools and Technologies:** The Tools and Technologies section should list and justify the specific software, hardware, programming languages, frameworks, and platforms used in the project
- **Timeline:** The Project Timeline should outline the key milestones, tasks, and deadlines, providing a clear schedule for project activities and ensuring timely completion of objectives.
- **Resources:** Mention different stakeholders, equipment, materials, and budget required to complete a project successfully.
- **Expected Outcomes:** Outline specific outcomes of a project, measurable results or benefits that the project aims to achieve upon completion.
- **References:** Mention Name of the books, journal, or websites referenced for project development throughout the development.

**Project Report:**

The Certified Copy of Hard Bound Project Report must adhere to the following guidelines:

- No of Copies: 1 Hard copy + Soft copy (College / Department)
- The project report should include the following

- **Title Page**

Mentioning the title of the report, name of the student, program, institution, and the period of Field project. (Refer Annexure B)

- **Certificate**

A **Certificate of Completion** for a field project is an official document issued to acknowledge that a participant or student has successfully completed a specific field project. It typically includes:

**Participant's Name:** The individual who completed the project.

**Project Title:** The name or description of the field project.

**Institution/Organization:** The entity overseeing the project.

**Completion Acknowledgment:** Confirmation that the project was successfully completed, often with a brief description of the work done.

**Signature and Seal:** The supervisor's signature and, if applicable, the institution's seal or stamp to authenticate the certificate.

(Refer Annexure C)

- **Table of Contents**

Providing a clear outline of the report's sections and page numbers.

(Refer Annexure D)

- **Acknowledgement**

Recognizing individuals or organizations that provided support, guidance, or resources during the training/project. (Refer Annexure E)

- **Self-attested copy of Plagiarism Report from any open-source tool.**

Use an open-source plagiarism detection tool (such as **PlagScan**, **Quetext**, or **DupliChecker**, etc) to run the field project report through the software. The tool will highlight any text that matches other sources and provide a similarity percentage.

- **Gantt chart**

It shows the start and finish dates of various elements or tasks within a project, allowing stakeholders to track progress, allocate resources, and ensure deadlines are met.

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

- **System Requirements**

**Hardware Requirements:-**List all physical equipment required for the fieldwork, such as Processor Type, RAM and Hard Disk Capacity, GPS units, survey instruments, etc.

**Software Requirements:-**Data Collection and Analysis Software, Internet Connectivity, Operating System Version, Server Type etc.

- **System Design**

**System Design** section typically outlines how the system will be structured and how various components will interact to achieve the project's objectives. It may include **UML (Unified Modeling Language) diagrams**, **screenshots** of user interfaces or system components, and **code snippets** to give a clear picture of the technical architecture, workflows, and implementation details.

- **Conclusion and Future Work**

The **Conclusion and Future Work** section in a Computer Science field project report provides a summary of the key findings and outcomes from the project, along with suggestions for further development or research. It serves to wrap up the project and point to areas that could benefit from future improvements or further investigation.

- The text of the report should be set in 12 pt, Times New Roman font, and single-spaced.
- Chapter headings should be centered, written in 20pt, Times New Roman font, bold, and in all caps.
- These guidelines ensure a standardized format for the project report, promoting clarity and readability.

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure A**

*(Proforma for the Field Project Proposal in Field Project Report)*

**R. E. Society's  
Gogate- Jogalekar College (Autonomous), Ratnagiri.  
Department of Computer Science  
Field Project Proposal**

**Academic Year: 20\_ - 20\_**

**Semester: VI**

Date of submission:-

Name of the learner:-

Academic seat number:-

- **Title of the project :**
- **Introduction project topic :**
- **Objectives :**
- **Scope :**
- **Methodology :**
- **Tools and Technology :**
- **Timeline :**
- **Resources :**
- **Expected Outcomes :**
- **References :**

**Signature of Student**

**Signature of Internal Guide**

**Roll Number:**

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure B**

*(Proforma for the Sample Title Page Format in Field Project Report)*

**A PROJECT REPORT**

on

**<PROJECT NAME>**

**In partial fulfillment of**

**B.Sc. in Computer Science**

*By*

**Mr. XYZ**

*Through*

*Gogate Jogalekar College (Autonomous),  
Ratnagiri*

**In**

**Sem VI March 202- – 202-**

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure C**  
*(Proforma for the Certificate in Field Project Report)*

*R. E. Society's*  
**R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce  
Autonomous), Ratnagiri**



**Department of Computer Science**

**CERTIFICATE**

This is to certify that Mr. /Ms. \_\_\_\_\_ of **T.Y.B.Sc. (Sem VI)** class bearing examination seat no. \_\_\_\_\_ has satisfactorily carried out Project on \_\_\_\_\_, as laid by the Board of Studies of Computer Science Major for the year 202- . His/Her bonafide work was completed under the guidance of Mr. /Mrs. \_\_\_\_\_.

**Signature of Guide**

**Examiner**

**Head**

**Department Computer Science**

**Date:**

**Place:**

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure D**

*(Proforma for the Table of Contents in Field Project Report)*

**Index**

<b>Sr. No.</b>	<b>Title</b>	<b>Page No.</b>
1	<b>Acknowledgement</b>	
2	<b>Plagiarism Report</b>	
3	<b>Preliminary Investigation</b>	
	A. Organizational Overview	
	B. Advantages of proposed system	
	C. Feasibility Study	
	D. Stake Holders	
	E. Gantt Chart	
4	<b>System Analysis</b>	
	A. Event Table	
	B. ER Diagram	
	C. Class Diagram	
	D. Use-case Diagram	
5	<b>System Design</b>	
	A. Design Class Diagram	
	B. Package Diagram	
6	<b>System Coding</b>	
	A. Screen Layout	
	B. Code	
7	<b>References</b>	

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**  
**Annexure E**

*(Proforma for the Acknowledgment in Field Project Report)*

**ACKNOWLEDGMENT**

It is my prime duty to offer my sincere gratitude to University of Mumbai to include the field project work in the syllabus of Third Year Bachelor's degree so as to develop interest about research work among the students like us.

I wish to express my sincere thanks to **[HOD's Name]**, Head of the Department of Computer Science for giving me the opportunity to complete the project work by providing facilities in the department and providing valuable guidance to complete the task.

I am greatly obliged to **[Field Project Guide Name]**, Lecturer in Department of Computer Science who provided valuable guidelines and conceptual guidance throughout the project work also helped out in clearing concepts about the project.

I am also grateful to **[Principal's Name]**, Principal of Gogate Jogalekar College, Ratnagiri and **[Vice Principal's Name]**, Vice Principal of Science Faculty for all necessary facilities of laboratory and library at Gogate Jogalekar College, Ratnagiri.

Last but not the least, my special thanks to my parents, my friends and all those people who have encouraged me, helped me to complete this course successfully in time.

**Date: 20/11/2024**

**Place: Ratnagiri**

(Chairperson BoS)

**On Job Training (25\_USCSJ512)**  
**Guidelines and Evaluation pattern for On Job Training (100 Marks)**

**Aim:**

The aim of on-job training during an internship is to provide students with practical experience in a professional setting, allowing them to apply classroom knowledge to real-world tasks. It helps students develop job-specific skills, improve their problem-solving abilities, and gain a deeper understanding of industry practices, preparing them for future career opportunities.

**Introduction:**

Inclusion of On Job Training in the course curriculum of the B.Sc. programme is one of the ambitious aspects in the programme structure. The main objective of inclusion of On Job Training and Field Project is to inculcate the ability to interpret particular aspects of the study in his/ her own words.

**Guidelines for On Job Training:**

On-the-Job Training: Students will be required to undertake a designated project or tasks in an organization or industry relevant to their field of study. The course aims to provide students with practical exposure and hands-on experience in a professional work environment related to their field of study.

**Course Objectives:**

By the end of the course, students should be able to:

1. Gain exposure to real-world insights and apply theoretical knowledge to practical situations
2. Enhance his/her skills regarding problem-solving, decision-making, and communication skills.
3. Understand organizational dynamics and work culture.
4. Build industry connections and networking opportunities.

**Course Duration:**

Minimum 1 months / 120 hours of On Job Training with an Organization/ Startup/ Charitable Organization/ Private firm/ Private Limited Company.

- The theme of the On Job Training should be based on any study area of the Major course
- Experience certificate, Evaluation report, working module and attendance report is Mandatory

**Evaluation Scheme:**

<b>OJT Evaluation (100 Marks)</b>				
<b>Internal (40 Marks)</b>		<b>External (60 Marks)</b>		
<b>Mid –Term Report</b>	<b>Presentation</b>	<b>End –Term Report</b>	<b>Working Module</b>	<b>Presentation</b>
30	10	30	20	10

**Mid-Term Report:**

Mid-Term Report will be utilized for internal evaluation. The presentation of work done so far will be presented up to 10 minutes in the form of power point presentation which will include only introduction slide and working module/work done/skills earned so far. Mid-Term report will be submitted at the time of presentation. Please find the format of Mid-Term Report in Annexure A.

**End-Term Report:**

The students will be required to submit a comprehensive report at the end of the On-the-Job Training. A project report has to be brief in content and must include the following aspects:

**a) Title Page:**

Mentioning the title of the report, name of the student, program, institution, and the period of training/project. (Refer Annexure B)

**b) Certificate of Completion:**

1. A certificate issued by the organization or supervisor confirming the successful completion of the training/project. (Refer Annexure C)
2. A certificate issued by the institution confirming the successful completion of the training/project (duly signed by internal guide and HOD). (Refer Annexure D)

**c) Professional Evaluation of intern:**

Mentioning the behavior and punctuality of learner in the organization during On Job Training. (Refer Annexure E)

**d) Declaration:**

A statement by the student declaring that the report is their original work and acknowledging any assistance or references used. (Refer Annexure F)

**e) Acknowledgments:**

Recognizing individuals or organizations that provided support, guidance, or resources during the training/project. (Refer Annexure G)

**f) Table of Contents:**

Providing a clear outline of the report's sections and page numbers. (Refer Annexure H)

**g) Introduction of the Company:**

A Concise representation of company/ organization defining its scope, products / service. (Refer Annexure I)

**h) Your Role in the Organization during the on-Job Training:**

The key aspects handled, the department under which you were deployed and brief Summary report duly acknowledged by the reporting head. (Refer Annexure J)

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure A**  
*(Proforma for Mid Term Report)*

1. Name of the Trainee: \_\_\_\_\_
2. Academic Roll No.: \_\_\_\_\_
3. Position (If Any): \_\_\_\_\_
4. Name of the Company in which OJT is performed: \_\_\_\_\_  
\_\_\_\_\_
5. Name of Guide from the Company: \_\_\_\_\_
6. No of Weeks/Hours for which mid-term Report is submitted: \_\_\_\_\_
7. Duration: From \_\_\_\_ / \_\_\_\_ / \_\_\_\_ to \_\_\_\_ / \_\_\_\_ / \_\_\_\_
8. Submission date: \_\_\_\_\_

**Signature**  
**Internal Guide**

**Signature**  
**Student**

**R.E. Society's**  
**R. P. Gogate College of Arts and Science and**  
**R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Internship Letter (If Given):**

*(Proforma for the certificate for internship in official letter head)*

This is to certify that Mr/Ms \_\_\_\_\_  
of \_\_\_\_\_ College/Institution worked as an intern  
as part of his/her M.Sc. course in Computer Science of University of Mumbai.  
The particulars of internship are given below:

Internship starting date: \_\_\_\_\_

Internship ending date: \_\_\_\_\_

Actual number of days worked: \_\_\_\_\_

Tentative number of hours worked: \_\_\_\_\_ Hours

Broad area of work: \_\_\_\_\_

A small description of work done by the intern during the period:

\_\_\_\_\_  
\_\_\_\_\_

Signature: \_\_\_\_\_ Name: \_\_\_\_\_ Designation: \_ Contact number: \_\_\_\_\_ Email:

\_\_\_\_\_

***R.E. Society's***  
**R. P. Gogate College of Arts and Science and**  
**R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

Tasks & Actions Taken (So-far)

1. Assigned Task:

---

---

---

---

---

---

---

---

2. Research work performed so far (Min 100 words):

---

---

---

---

---

---

---

---

3. Any new skills learned (Min 100 words):

---

---

---

---

---

---

---

---

4. Action taken on assigned task (Min 100 words):

Note: Mention in points. Do not mention module / working script

---

---

---

---

---

---

---

---

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure B**  
*(Proforma for the Title Page of OJT End Term Report)*

**On-the-Job Training Report (OJT Report)**

**Student Information**

Full Name:

Course/Program Name: BSc (Computer Science - Major)

Student Exam Seat Number:

Contact Information (Mobile Number):

**OJT Details**

Company Name:

Company Address:

OJT Department/Division:

OJT Supervisor Name and Position:

Duration of OJT:

**Academic Information**

Institution Name:

Department/Faculty Name:

Instructor/Advisor Name:

Course Code:

Date of Submission (Month, Year):

**R.E. Society's**  
**R. P. Gogate College of Arts and Science and**  
**R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure C**

*(Proforma for the certificate for OJT End Term Report on official letter head of  
Company)*

***Certificate***

This is to certify that Mr/Ms \_\_\_\_\_  
of \_\_\_\_\_ College/Institution worked as an intern as part of  
his/her B.Sc course in Computer Science of R. P. Gogate College of arts an Science & R. V.  
Jogalekar College of Commerce(Autonomous), Ratnagiri . The particulars of internship are  
given below:

On Job Training starting date: \_\_\_\_\_

On Job Training ending date: \_\_\_\_\_

Actual number of days worked: \_\_\_\_\_

Tentative number of hours worked: \_\_\_\_\_ Hours

Broad area of work: \_\_\_\_\_

A small description of work done by the Student during the period:

\_\_\_\_\_

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Designation: \_\_\_\_\_

Contact number: \_\_\_\_\_

Email: \_\_\_\_\_

(Seal of the organization)

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure D**  
*(Proforma for the certificate issued by institution)*

**R. E. Society's  
R. P. Gogate College of Arts and Science and R. V. Jogalekar College of Commerce  
(Autonomous), Ratnagiri**



Department of Computer Science

**CERTIFICATE**

This is to certify that Mr./Ms. \_\_\_\_\_ of T.Y.B.Sc. (Sem V) class bearing examination seat no. \_\_\_\_\_ has satisfactorily completed On Job Training in \_\_\_\_\_, as laid by the Board of Studies of Computer Science for the year 20 -- in Computer Science as Major. His/ Her bonafide work was completed under the guidance of Mr./Mrs. \_\_\_\_\_.

**Signature of Guide**

**Examiner**

**Head  
Department Computer Science**

**Date:  
Place:**

**R.E. Society's**  
**R. P. Gogate College of Arts and Science and**  
**R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure E**  
*(Proforma for Professional Evaluation of Intern)*

**Professional Evaluation of intern**

Name of intern: \_\_\_\_\_

College/institution: \_\_\_\_\_

*[Note: Give a score in the 1 to 5 scale by putting √ in the respective cells]*

No	Particular	Excellent	Very Good	Good	Moderate	Satisfactory
1	Attendance & Punctuality					
2	Ability to work in a team					
3	Written and oral communication skills					
4	Problem solving skills					
5	Ability to grasp new concepts					
6	Technical skill in terms of technology, programming etc					
7	Ability to complete the task					
8	Quality of overall work done					

Comments:

\_\_\_\_\_

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Designation: \_\_\_\_\_

Contact Number: \_\_\_\_\_

Email: \_\_\_\_\_

(Seal of the organization)

**Annexure F**  
*(Proforma for the Declaration in OJT End Term Report)*

**DECLARATION BY STUDENT**

I, **[Full Name]**, hereby declare that this On-the-Job Training (OJT) report titled "**[Title of the Report]**" is my own work and has been written and prepared in compliance with the guidelines and requirements set by **[Institution Name]**. All information and references from external sources have been properly cited and acknowledged.

This report has not been submitted for any other academic or professional purpose, and no part of it has been plagiarized or copied from other sources without appropriate citations. I understand the consequences of academic dishonesty, and I assure the authenticity of the content presented in this report.

I further declare that I have completed the OJT at **[Company Name]** during the period from **[Start Date]** to **[End Date]**, under the supervision of **[OJT Supervisor's Name]**, and the activities and experiences discussed in this report accurately reflect my involvement during the training.

---

**Signed:**

**[Full Name of Student]**

**Date:** [Month, Year]

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure G**  
*(Proforma for the acknowledgments in OJT End Term Report)*

**ACKNOWLEDGMENTS**

I would like to express my sincere gratitude to all the individuals who contributed to the successful completion of my On-the-Job Training (OJT) and this report.

First and foremost, I would like to extend my deepest thanks to **[OJT Supervisor's Name]**, **[Position]** at **[Company Name]**, for his/her invaluable guidance, mentorship, and support throughout my training. His/her expertise and encouragement significantly enhanced my learning experience.

I would also like to express my appreciation to the **Head of the Department (HOD)**, **[HOD's Name]**, for his/her continuous support and for providing me with the opportunity to undergo this OJT program. His/her leadership and direction have played a significant role in shaping my academic and professional development.

My sincere thanks go to **[Vice Principal's Name]**, Vice Principal of Science Faculty for his/her support and for facilitating the training opportunities that enriched my learning experience. I am grateful for the opportunities provided under his/her leadership.

I would also like to express my heartfelt appreciation to **[Principal's Name]**, Principal of **[Institution Name]**, for his/her encouragement, and for ensuring that the institution maintains strong ties with industry partners, allowing students like me to gain practical experience in the field.

I am equally grateful to my academic advisor, **[Instructor/Advisor's Name]**, for providing me with the academic guidance and knowledge that prepared me for the challenges and opportunities during my OJT.

Special thanks are due to the entire team at **[Department/Division Name]** at **[Company Name]**, particularly **[Names of colleagues or team members, if applicable]**, for their collaboration and support, and for creating a positive and learning-focused environment during my training.

Lastly, I would like to thank my family and friends for their unwavering support and encouragement, which motivated me to give my best during this experience.

**Sign**

**[Your Full Name]**

**Date:** [Month, Year]

*R.E. Society's*  
**R. P. Gogate College of Arts and Science and  
R. V. Jogalekar College of Commerce (Autonomous), Ratnagiri**

**Annexure H**

*(Proforma for the table of contents of OJT End Term Report)*

**TABLE OF CONTENTS**

<b>No.</b>	<b>Section Title</b>	<b>Page Number</b>
1.	<b>Introduction</b>	
2.	<b>Objectives of the OJT</b>	
3.	<b>Company Profile</b>	
4.	<b>OJT Activities and Responsibilities</b>	
5.	<b>Skills and Knowledge Gained</b>	
6.	<b>Conclusion</b>	

## **Annexure I**

*(Proforma for Company Introduction of OJT End Term Report)*

### **Company Introduction**

- **Company Name:** [Insert the full name of the company]
- **Industry:** [What industry does the company belong to? For example, manufacturing, marketing, IT, healthcare, etc.]
- **Location:** [Where is the company based? Include main offices or branches, if relevant.]
- **Year Established:** [When was the company founded?]
- **Founders:** [If applicable, mention who founded the company.]
- **Mission Statement (If Any):** [Include the company's mission or vision statement if available. This provides insight into the company's core values and objectives.]
- **Company Structure:** Explain the organizational structure of the company, particularly highlighting the departments or divisions where you worked or interacted.
- **Products/Services Offered:** [List the key products or services offered by the company. Focus on what was relevant to your training.]
- **Target Market:** [Who are the company's primary customers? For example, businesses, consumers, governments, etc.]
- **Clients:** [If relevant, mention some key clients or partners the company works with.]

## **Annexure J**

*(Proforma for role in organization during OJT of OJT End Term Report)*

### **Role in the Organization during On-the-Job Training**

#### **Position/Title:**

- Position/Title: [Your official position or title during the OJT, e.g., OJT Trainee, Marketing Assistant, IT Intern, etc.]
- Department/Division: [The department where you were assigned, e.g., Marketing, HR, IT, Production, etc.]
- Supervisor: [Name of your OJT supervisor, position, and department]

#### **Primary Responsibilities and Tasks:**

Provide a detailed description of the key tasks and responsibilities you were given during your OJT. Mention any specific projects or activities you worked on, and describe how these contributed to the organization's objectives.

- Task 1: [Description of the first key responsibility or task. Explain what you did, how you did it, and why it was important.]
- Task 2: [Description of the second responsibility, and so on.]

#### **Skills and Knowledge Applied:**

Explain the specific skills and knowledge you applied during your OJT, and how your academic background helped you in your role. This shows the connection between theory and practice.

- Skills Applied: [Mention the technical, professional, and soft skills you utilized. For example, communication skills, data analysis, project management, technical skills, etc.]
- Knowledge Applied: [Describe the theoretical knowledge you applied, such as principles from your coursework in marketing, engineering, business management, etc.]

#### **Challenges and Problem-Solving:**

Briefly mention any challenges or problems you faced in your role and how you addressed or overcame them. This demonstrates your ability to adapt and problem-solve in a professional environment.

#### **Contribution to the Organization:**

Highlight how your work and efforts contributed to the success of the organization during your OJT. This could include improvements in processes, successful projects, or other positive outcomes as a result of your involvement.

**Date:** 20/11/2024

**Place:** Ratnagiri

(Chairperson BoS)