

Resolution No: AC/II(22-23).3.RUS6

**S. P. Mandali's**  
**Ramnarin Ruia Autonomous College**  
*(Affiliated to University of Mumbai)*



**Syllabus for TY**

**Program: B.Sc (Computer Science)**

**Program Code: Computer Science (RUSCS)**

**(Choice Based Credit System for the academic  
year 2023-24)**



## GRADUATE ATTRIBUTE

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Post graduate Program in Science also encourages students to reflect on the broader purpose of their education.

<b>GA</b>	<b>GA Description</b>
	<b>A student completing Bachelor's Degree in Computer Science program will be able to:</b>
<b>GA1</b>	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
<b>GA2</b>	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
<b>GA3</b>	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
<b>GA4</b>	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
<b>GA5</b>	Take complex challenges; work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
<b>GA6</b>	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
<b>GA7</b>	Follow ethical practices at workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
<b>GA8</b>	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner



## PROGRAM OUTCOMES

<b>PO</b>	<b>Description</b>
	<p align="center"><b>A student completing Bachelor’s Degree in Science program in the subject of Computer Science will be able to:</b></p>
<b>PO 1</b>	Apply knowledge of computational mathematics ,statistics and programming acquired in the field of Computer Science.
<b>PO 2</b>	Identify , analyze complex problems in the real world and formulate innovative solutions to those problems.
<b>PO 3</b>	Compare and apply hardware and software technologies for implementing reliable optimized solutions catering to need and available resources.
<b>PO 4</b>	Apply domain expertise to pursue higher education and Research in computer science discipline.
<b>PO 5</b>	Apply software development, managerial, Professional and soft skills in industry
<b>PO 6</b>	Understand the global needs and prepare themselves for the changing needs worldwide adapting an ability to engage in life- long learning..
<b>PO 7</b>	Become a responsible ,ethical citizen and explore environmental issues to develop sustainable solutions for it.
<b>PO 8</b>	Use the techniques, skills and modern computing tools to emerge as a freelancer and entrepreneur in the field.



<b>T.Y.B.Sc (Computer Science)</b>							
<b>SEMESTER – V (THEORY)</b>					<b>SEMESTER – V (PRACTICALS)</b>		
<b>YEAR</b>	<b>SEM</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDITS</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDITS</b>
<b>T.Y.Bsc</b>	<b>V</b>	<b>RUSCS501</b>	Artificial Intelligence	3	<b>RUSCSP501</b>	Practical of Artificial Intelligence	1
<b>T.Y.Bsc</b>	<b>V</b>	<b>RUSCS502</b>	Software Testing and Quality Assurance	3	<b>RUSCSP502</b>	Practical of Software Testing and Quality Assurance	1
<b>T.Y.Bsc</b>	<b>V</b>	<b>RUSCS503</b>	Information and Network Security	3	<b>RUSCSP503</b>	Practical of Information and Network Security	1
<b>T.Y.Bsc</b>	<b>V</b>	<b>RUSCS504</b>	Web Services	3	<b>RUSCSP504</b>	Practical of Web Services	1
<b>T.Y.Bsc</b>	<b>V</b>	<b>RUSCS505</b>	Skill Enhancement : Ethical Hacking	2	<b>RUSCSP505</b>	Practical of Skill Enhancement :Ethical Hacking	1
<b>T.Y.Bsc</b>	<b>V</b>	----	----	----	<b>RUSCSP506</b>	Practical of Advanced Web Programming	1



<b>T.Y.B.Sc (Computer Science)</b>							
<b>SEMESTER – VI (THEORY)</b>					<b>SEMESTER – VI (PRACTICALS)</b>		
<b>YEAR</b>	<b>SEM</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDITS</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CREDITS</b>
T.Y.Bsc	VI	RUSCS601	Cloud Computing	3	RUSCSP601	Practical of Cloud Computing	1
T.Y.Bsc	VI	RUSCS602	Cyber Forensics	3	RUSCSP602	Practical of Cyber Forensics	1
T.Y.Bsc	VI	RUSCS603	Information Retrieval	3	RUSCSP603	Practical of Information Retrieval	1
T.Y.Bsc	VI	RUSCS604	Data Science	3	RUSCSP604	Practical of Data Science	1
T.Y.Bsc	VI	RUSCS605	Skill Enhancement: Optimization Techniques	2	RUSCSP605	Project Implementation	2



**Course Code: RUSCS501**  
**Course Title: ARTIFICIAL INTELLIGENCE**  
**Academic year 2023-24**

**COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Define Artificial Intelligence.
CO 2	Implement various algorithms to solve the real world problems.
CO 3	Use various tools and techniques for automation.
CO 4	Identify different areas for AI implementation.
CO 5	Design customized algorithms.

**DETAILED SYLLABUS**

Course Code	Unit	ARTIFICIAL INTELLIGENCE	Credits 3 / 45 Hours
<b>RUSCS501</b>	<b>I</b>	<b>What Is AI:</b> Foundations, History and State of the Art of AI. Intelligent Agents: Agents and Environments, Nature of Environments, Structure of Agents. Problem Solving by searching: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.	15 Hrs
	<b>II</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 Models, Support Vector Machines, Ensemble Learning, Practical Machine Learning	15 Hrs
	<b>III</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.	15 Hrs



**Course Code RUSCSP501**  
**PRACTICAL OF ARTIFICIAL INTELLIGENCE**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Identify various algorithms to be applied in real world
CO 2	Create an algorithm for the given problem
CO 3	Select appropriate algorithm and implement for any given scenario
CO 4	Choose various libraries for developing AI applications

Course Code	PRACTICAL OF ARTIFICIAL INTELLIGENCE	Credits 1 / 15 Hours
<b>RUSCSP501</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 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. 9. Implement passive reinforcement learning algorithm based on adaptive dynamic programming (ADP) for the 3 by 4 world problem 10. Implement passive reinforcement learning algorithm based on temporal differences (TD) for 3 by 4 world problems.	

**Reference:**

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2010.

**Additional Reference(s):**

- 1) Artificial Intelligence: Foundations of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press, 2017.
- 2) Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017
- 3) The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2013



**Course Code: RUSCS502**

**Course Title: SOFTWARE TESTING AND QUALITY ASSURANCE**

**Academic year 2023-24**

**COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Design test case plan for testing software
CO 2	Understand various software testing methods and strategies
CO 3	Understand a variety of software metrics, and identify defects and managing those defects
CO 4	Design SQA activities, SQA strategy, formal technical review report for software Quality control and assurance.

**DETAILED SYLLABUS**

Course Code	Unit	SOFTWARE TESTING AND QUALITY ASSURANCE	Credits 3 / 45 Hours
RUSCS502	I	<p><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</p> <p><b>Software Testing Techniques:</b> Testing Fundamentals, Test Case Design, White Box Testing and its types, Black Box Testing and its types.</p> <p><b>Software Testing Strategies:</b> Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, System Testing</p>	15 Hrs
	II	<p><b>Software Metrics:</b> Concept and Developing Metrics, Different types of Metrics, Complexity metrics.</p> <p><b>Verification and Validation:</b> Definition of V&amp;V , Different types of V &amp; V Mechanisms, Concepts of Software Reviews, Inspection and Walkthrough</p> <p><b>Defect Management:</b> Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.</p>	15 Hrs
	III	<p><b>Test Techniques:</b> Equivalence Partitioning, Boundary Value Analysis, Decision Tables, State-Based Testing and State Transition Diagrams, State Transition Tables, Control-Flow Testing, Statement Coverage, Decision Coverage, Loop Coverage, Path Testing, Cyclomatic Complexity, Data Flow Testing Structure-Based Testing</p>	15 Hrs





	<p><b>Quality Improvement:</b> Introduction, Pareto Diagrams, Cause-effect Diagrams, Scatter Diagrams, Run charts</p> <p><b>Quality Costs :</b> Defining Quality Costs, Types of Quality Costs, Quality Cost Measurement, Utilizing Quality Costs for Decision-Making</p>	
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**Course Code RUSCSP502**

**PRACTICAL OF SOFTWARE TESTING AND QUALITY ASSURANCE**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	<b>Apply Skills to design test case plan for testing software.</b>
CO 2	<b>Demonstrate various software testing methods and strategies</b>
CO 3	<b>Illustrate a variety of software metrics, and identify defects and managing those defects</b>
CO 4	<b>Examine SQA activities, SQA strategy, formal technical review report for software Quality control and assurance.</b>

Course Code	PRACTICAL OF SOFTWARE TESTING AND QUALITY ASSURANCE	Credits 1 / 15 Hours
<b>RUSCSP502</b>	<ol style="list-style-type: none"> <li>1. Install Selenium IDE; Write a test suite containing minimum 4 test cases for different formats.</li> <li>2. Conduct a test suite for any two web sites.</li> <li>3. Install Selenium server (Selenium RC) and demonstrate it using a script in Java/PHP.</li> <li>4. Write and test a program to login a specific web page.</li> <li>5. Write and test a program to update 10 student records into table into Excel file</li> <li>6. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects).</li> <li>7. Write and test a program to provide the total number of objects present / available on the page.</li> <li>8. Write and test a program to get the number of items in a list / combo box.</li> <li>9. Write and test a program to count the number of checkboxes on the page checked and unchecked count.</li> <li>10. Load Testing using JMeter, Android Application testing using Appium Tools, Bugzilla Bug tracking tools.</li> </ol>	

**References:**

1. Software Engineering for Students, A Programming Approach, Douglas Bell, 4<sup>th</sup> Edition,, Pearson Education, 2005
2. Software Engineering - A Practitioner's Approach, Roger S. Pressman, 5<sup>th</sup> Edition, Tata McGraw Hill, 2001



3. Quality Management, Donna C. S. Summers, 5<sup>th</sup> Edition, Prentice-Hall, 2010.
4. Total Quality Management, Dale H. Besterfield, 3<sup>rd</sup> Edition, Prentice Hall, 2003.
5. Advanced Software Testing—Vol. 3 by Rex Black and Jamie L. Mitchell, Rocky Nook Publication

**Additional Reference(s):**

- Software engineering: An Engineering approach, J.F. Peters, W. Pedrycz , John Wiley,2004
- Software Testing and Quality Assurance Theory and Practice, Kshirsagar Naik, Priyadarshi Tripathy , John Wiley & Sons, Inc. , Publication, 2008
- Software Engineering and Testing, B. B. Agarwal, S. P. Tayal, M. Gupta, Jones and Bartlett Publishers, 2010

**Course Code: RUSCS503**

**Course Title: INFORMATION AND NETWORK SECURITY**

**Academic year 2023-24**

**COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Analyze Particular information and network security Problems
CO 2	Identify generic security threats and Vulnerabilities
CO 3	Assess and Apply various cryptographic techniques
CO 4	Enumerate security Protocols at Network ,Transport and Application Layers of TCP/IP model
CO 5	Implement security solutions for confidentiality, Authentication and privacy.

**DETAILED SYLLABUS**

Course Code	Unit	INFORMATION AND NETWORK SECURITY	Credits 3 / 45 Hours
RUSCS503	I	<b>Introduction to Network Security:</b> Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms <b>Classical Encryption Techniques:</b> Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, 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 <b>Public-Key Cryptography and RSA:</b> Principles of Public-Key Cryptosystems, The RSA Algorithm	15 Hrs
	II	<b>Key Management:</b> Public-Key Cryptosystems, Key Management, Diffie-Hellman Key Exchange	15 Hrs



		<p><b>Message Authentication and Hash Functions:</b> Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and Macs, Secure Hash Algorithm, HMAC</p> <p><b>Digital Signatures and Authentication:</b> Digital Signatures, Authentication Protocols, Digital Signature Standard, Digital Envelope.</p> <p><b>Authentication Applications:</b> Kerberos, X.509 Authentication, Public-Key Infrastructure.</p>	
	<b>III</b>	<p><b>Electronic Mail Security:</b> Pretty Good Privacy, S/MIME</p> <p><b>IP Security:</b> Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management</p> <p><b>Web Security:</b> Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction</p> <p><b>Intrusion:</b> Intruders, Intrusion Techniques, Intrusion Detection</p> <p><b>Malicious Software:</b> Viruses and Related Threats, Virus Countermeasures, DDOS</p> <p><b>Firewalls:</b> Firewall Design Principles, Types of Firewalls</p>	15 Hrs

### Course Code RUSCSP503

#### PRACTICAL OF INFORMATION AND NETWORK SECURITY

COURSE OUTCOME	DESCRIPTION
	After Completing this course student will be able to :
CO 1	Implement Security algorithms and Tools
CO 2	Evaluate and compare performance of cryptography algorithms for case study
CO 3	Apply hashing and authentication protocols

Course Code	PRACTICAL OF INFORMATION AND NETWORK SECURITY	Credits 1 / 15 Hours
<b>RUSCSP503</b>	<p>1. Write programs to implement the following Substitution Cipher Techniques:</p> <ul style="list-style-type: none"> <li>• Caesar Cipher</li> <li>• Monoalphabetic Cipher</li> </ul> <p>2 Write programs to implement the following Substitution Cipher Techniques:</p> <ul style="list-style-type: none"> <li>• Vernam Cipher</li> <li>• Playfair Cipher</li> </ul> <p>3 Write programs to implement the following Transposition Cipher Techniques:</p> <ul style="list-style-type: none"> <li>• Rail Fence Cipher</li> <li>• Simple Columnar Technique</li> </ul> <p>4 Write program to encrypt and decrypt strings using</p>	



	<ul style="list-style-type: none"> <li>• DES Algorithm</li> <li>• AES Algorithm</li> </ul> <p>5 Write a program to implement an RSA algorithm to perform encryption / decryption of a given string.</p> <p>6 Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys.</p> <p>7 Write a program to implement the MD5 algorithm to compute the message digest.</p> <p>8 Write a program to calculate HMAC-SHA1 Signature</p> <p>9 Write a program to implement SSL.</p> <p>10 Configure Windows Firewall to block:</p> <ul style="list-style-type: none"> <li>• A port</li> <li>• An Program</li> <li>• A website</li> </ul>	
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**References:**

1) Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson,2010

**Additional Reference(s):**

- Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2013.
- Cryptography and Network, Behrouz A Fourouzan, Debdeep Mukhopadhyay, 2<sup>nd</sup> Edition, TMH, 2011

**Course Code: RUSCS504**  
**Course Title: WEB SERVICES**  
**Academic year 2023-24**

**COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
<b>CO 1</b>	Understand the details of web services technologies like SOAP, WSDL, and UDDI
<b>CO 2</b>	Identify how to implement and deploy web service clients and servers.
<b>CO 3</b>	Understand the design principles and application of SOAP and REST based web services (JAX-WS and JAX-RS) Services
<b>CO 4</b>	Evaluate Spring web services and develop spring applications.
<b>CO 5</b>	Understand WCF service to develop secure web services and QoS of Web Services

**DETAILED SYLLABUS**

<b>Course Code</b>	<b>Unit</b>	<b>WEB SERVICES</b>	<b>Credits 3 / 45 Hours</b>
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<b>RUSCS504</b>	<b>I</b>	<b>Web services basics :</b> What Are Web Services? Types of Web Services Distributed computing infrastructure, , Building Web Services with JAX-WS, Registering and Discovering Web Services, Service Oriented Architecture, Web Services Development Life Cycle	15 Hrs
	<b>II</b>	<b>Spring Web Services:</b> Spring WS – Overview, Spring WS - Static WSDL, Spring WS – Writing Server, Spring WS - Unit Test Server, Spring WS - Writing Client, Spring WS - Unit Test Client, use of web Service in Android and testing	15 Hrs
	<b>III</b>	<b>Developing Service-Oriented Applications with WCF :</b> What Is Windows Communication Foundation, Fundamental Windows Communication Foundation Concepts, Windows Communication Foundation Architecture, WCF and .NET Framework Client Profile, Basic WC Programming, WCF Feature Details. Web Service QoS	15 Hrs

**Course Code RUSCSP504**  
**PRACTICAL OF WEB SERVICES**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	<b>Design web services</b>
CO 2	<b>Use spring web services</b>
CO 3	<b>Demonstrate secure web service</b>

Course Code	PRACTICAL OF WEB SERVICES	Credits 1 / 15 Hours
<b>RUSCSP504</b>	<ol style="list-style-type: none"> <li>1. Write a program to implement to create a simple web service that converts the temperature from Fahrenheit to Celsius and vice versa.</li> <li>2. Write a program to implement the operation can receive request and will return a response in two ways.               <ol style="list-style-type: none"> <li>a) One - Way operation</li> <li>b) Request -Response</li> </ol> </li> <li>3. Write a program to implement business UDDI Registry entry.</li> <li>4. Develop client which consumes web services developed in different platforms.</li> <li>5. Write a JAX-WS web service to perform the following operations. Define a Servlet / JSP that consumes the web service.</li> <li>6. 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.</li> </ol>	



	<p>7. Define a RESTful web service that accepts the details to be stored in a database and performs CRUD operation.</p> <p>8. Implement a typical service and a typical client using WCF.</p> <p>9. Use WCF to create a basic ASP.NET Asynchronous JavaScript and XML (AJAX) service.</p> <p>10. Demonstrates using the binding attribute of an endpoint element in WCF.</p> <p>11. Demonstrate practicals on Spring in Web services</p>	
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**References:**

- 1) Web Services: Principles and Technology, Michael P. Papazoglou, Pearson Education Limited, 2008
- 2) RESTful Java Web Services, Jobinesh Purushothaman, PACKT Publishing, 2<sup>nd</sup> Edition, 2015
- 3) Developing Service-Oriented Applications with WCF, Microsoft, 2017  
<https://docs.microsoft.com/en-us/dotnet/framework/wcf/index>

**Additional Reference(s):**

- Leonard Richardson and Sam Ruby, RESTful Web Services, O'Reilly, 2007
- The Java EE 6 Tutorial, Oracle, 2013.

**Course Code: RUSCS505****Course Title: SKILL ENHANCEMENT: ETHICAL HACKING****Academic year 2023-24****COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Explain ethics, methodologies of ethical hacking.
CO 2	Identify security vulnerabilities and weaknesses in the target applications.
CO 3	Use tools to test and exploit systems
CO 4	Illustrate different types of attacks and its countermeasure

**DETAILED SYLLABUS**

Course Code	Unit	SKILL ENHANCEMENT: ETHICAL HACKING	Credits 3 / 45 Hours
<b>RUSCS505</b>	<b>I</b>	<p><b>Information Security:</b> Asset, Threat, Vulnerability, Attack, Exploit, Types of malware, Access Control, CIA, Risk.</p> <p><b>Introduction to Ethical Hacking:</b> Objective of Ethical Hacking, Asset, Vulnerability Threat, Exploit Ethical hacking types, Hacker types, Vulnerability assessment and Penetration Testing.</p> <p><b>Phases of Ethical hacking:</b> Footprinting, Reconnaissance, scanning, Enumeration.</p>	15 Hrs



	<p><b>II</b> <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</p> <p><b>Vulnerability Assessment and Penetration Testing (VAPT) Process:</b> Introduction to VA and PT, Threat modeling, Categories of Penetration Test, Tools used like WebInspect/Qualys, Nessus, Differences in VA and PT.</p>	15 Hrs
	<p><b>III</b> <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,, Cookie Theft, URL Obfuscation, buffer overflow, DNS poisoning, ARP poisoning, Identity Theft, IOT Attacks, BOTs and BOTNETs, Keylogging, Buffer Overflows, Privilege Escalation, ARP Poisoning, Password Cracking, WEP Vulnerabilities, MAC Spoofing, MAC Flooding, IPspoofing, SYN Flooding, Smurf attack, Applications hacking : SMTP/Email-based attacks, VOIP vulnerabilities, Directory traversal, Input Manipulation, , SQL injection, XSS, Intellectual property theft, Vulnerability Assessment and Penetration Testing (VAPT) Process, Instant messenger threats, Evading IDS</p> <p><b>Enforcement of security:</b> Firewall, Secure coding practices, Security policy</p>	15 Hrs

**Course Code RUSCSP505**

**PRACTICAL OF SKILL ENHANCEMENT: ETHICAL HACKING**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Demonstrate Ethical hacking phases with various tools
CO 2	Use tools for network monitoring
CO 3	Design application for logging

<b>Course Code</b>	<b>PRACTICAL OF SKILL ENHANCEMENT: ETHICAL HACKING</b>	<b>Credits 1 / 15 Hours</b>
<b>RUSCSP505</b>	1. Use Google and Whois for Reconnaissance	





	<p>2. a) Use CrypTool to encrypt and decrypt passwords using RC4 algorithm                  b) Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords</p> <p>3. a) Run and analyze the output of following commands in Linux - ifconfig, ping, netstat, traceroute                  b) Perform ARP Poisoning in Windows</p> <p>4. Use NMap scanner to perform port scanning of various forms - ACK, SYN, FIN, NULL, XMAS</p> <p>5. Use Wireshark (Sniffer) to capture network traffic and analyze</p> <p>6. Simulate persistent cross-site scripting attack</p> <p>7. Session impersonation using Firefox and Tamper Data add-on</p> <p>8. Perform SQL injection attack</p> <p>9. Create a simple logger using python</p>	
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**References**

- 1) Certified Ethical Hacker Study Guide v9, Sean-Philip Oriyano, Sybex; Study Guide Edition, 2016
- 2) CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2007

**Additional Reference(s):**

- [http://www.pentest-standard.org/index.php/PTES\\_Technical\\_Guidelines](http://www.pentest-standard.org/index.php/PTES_Technical_Guidelines)
- [https://www.owasp.org/index.php/Category:OWASP\\_Top\\_Ten\\_2017\\_Project](https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project)
- [https://www.owasp.org/index.php/Mobile\\_Top\\_10\\_2016-Top\\_10](https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10)
- [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)
- [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)
- <https://cve.mitre.org/>
- <https://access.redhat.com/blogs/766093/posts/2914051>
- <http://resources.infosecinstitute.com/applications-threat-modeling/#gref>
- <http://www.vulnerabilityassessment.co.uk/Penetration%20Test.html>

**Course Code: RUSCSP506**

**Course Title: PRACTICAL OF ADVANCED WEB PROGRAMMING**

**Academic year 2023-24**

**Course Code RUSCSP506**

**PRACTICAL OF ADVANCED WEB PROGRAMMING**





COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	<b>Demonstration the coding pattern in Angularjs</b>
CO 2	<b>Choose the merge the code with existing website</b>
CO 3	<b>Illustrate animation features in Angular</b>
CO 4	

Course Code	PRACTICAL OF ADVANCED WEB PROGRAMMING	Credits 1 / 15 Hours
<b>RUSCSP506</b>	<ol style="list-style-type: none"> <li>1. Write a program to read the data &amp; display it on the page simultaneously.</li> <li>2. Write a program to change the name displayed on the textbox.</li> <li>3. Write a program using ng-bind.</li> <li>4. Working with filters.</li> <li>5. Exploring AngularJS services.</li> <li>6. Program using AngularJS tables.</li> <li>7. Working with AngularJS Events.</li> <li>8. Working with AngularJS forms &amp; validations.</li> <li>9. Exploring AngularJS Animations</li> <li>10. Develop an application using AngularJS</li> </ol>	

### MODALITY OF ASSESSMENT

**Theory exam total marks: 100 Marks**

**Theory Examination Pattern:**

**A) Internal Assessment - 40% :40 marks.**

Sr No	Evaluation type	Marks
1	It will be conducted either using any open source learning management system such as Moodle (Modular object-oriented dynamic learning environment)	20
2	Project (group of 5 students)/Tutorial/Quizzes/Assignment	20
3	Total	40

**B) External examination - 60 % : 60 marks**

**Semester End Theory Examination:**



1. Duration - These examinations shall be of **2Hrs** duration.
2. Theory Question Paper Pattern:

<b>All Questions are Compulsory</b>			
<b>Questions</b>	<b>Options</b>	<b>Based On</b>	<b>Marks</b>
Q1	Any 3 out of 4	Unit I, II, & III	15
Q2	Any 3 out of 4	Unit I	15
Q3	Any 3 out of 4	Unit II	15
Q4	Any 3 out of 4	Unit III	15
<b>Total</b>			<b>60</b>

- All questions shall be compulsory with internal choice within the questions.

Practical exam total marks: 50 Marks

**Practical Examination Pattern:**

**A) Internal Examination: Internal Practical 40% - 20 Marks**

**10 Marks - Individual Practical Implementation & Performance**

- Each student will maintain an e-journal. After every practical student will upload his practicals in the form of documents along with the screen shots of output on an online portal (Moodle/Google site/any LMS).

**10 Marks –Design and implement innovative application of the technology**

<b>Particulars</b>	<b>Marks</b>
<b>Individual Practical Implementation &amp; Performance</b>	10
<b>Design and implement innovative application of the technology</b>	10
<b>Total</b>	<b>20</b>

**(B) External (Semester end practical examination): 60% - 30 Marks**

**30 Marks Practical Questions:**

- Students have to acquire at least 40% marks in each paper individually.

<b>Particulars</b>	<b>Practical</b>
Laboratory work	30
<b>Total</b>	<b>30</b>



**PASSING CRITERIA 40%:** - Student has to acquire minimum of 40% marks each course (Theory and Practical) both.

**Overall Examination & Marks Distribution Pattern  
Semester V**

<b>Course</b>	<b>501, 502, 503, 504, 505, 506</b>		
	<b>Internal</b>	<b>External</b>	<b>Total</b>
<b>Theory</b>	<b>40</b>	<b>60</b>	<b>500 (5 Papers)</b>
<b>Practicals</b>	<b>20</b>	<b>30</b>	<b>300 (6 Papers)</b>
<b>Individual Semester Total</b>			<b>800</b>

**Course Code: RUSCS601**  
**Course Title: CLOUD COMPUTING**  
**Academic year 2023-24**

**COURSE OUTCOMES:**

<b>COURSE OUTCOME</b>	<b>DESCRIPTION</b>
	<b>After Completing this course student will be able to :</b>
<b>CO 1</b>	Define and describe cloud computing and its architecture.
<b>CO 2</b>	Compare various cloud services available in the cloud.
<b>CO 3</b>	Choose the appropriate cloud services for various types of applications.
<b>CO 4</b>	Explain various of cloud computing such as security, privacy, and interoperability.
<b>CO 5</b>	Express the concepts, key technologies strengths and limitations of cloud computing.

**DETAILED SYLLABUS**

<b>Course Code</b>	<b>Unit</b>	<b>CLOUD COMPUTING</b>	<b>Credits 3 / 45 Hours</b>
<b>RUSCS601</b>	<b>I</b>	<b>Introduction to Cloud Computing:</b> Characteristics and benefits of Cloud Computing, Basic concepts of Distributed Systems, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing. Elements of Parallel Computing. Elements of Distributed Computing. Technologies for Distributed Computing. Cloud Computing Architecture. The cloud reference model. Infrastructure as a service. Platform as a service. Software as a service. Types of clouds.	15 Hrs



	<b>II</b>	<b>Virtualization:</b> Characteristics of Virtualized Environments. Taxonomy of Virtualization techniques. Virtualization and Cloud Computing. Pros and Cons of Virtualization. Virtualization using KVM, Creating virtual machines, oVirt - management tool for virtualization environment. Open challenges of Cloud Computing.	15 Hrs
	<b>III</b>	<b>Introduction to OpenStack technologies:</b> OpenStack test-drive, Basic OpenStack operations, OpenStack CLI and APIs, Tenant model operations, Quotas, Private cloud building blocks, Controller deployment, Networking deployment, Block Storage deployment, Compute deployment, deploying and utilizing OpenStack in production environments, Building a production environment, Application orchestration using OpenStack Heat.	15 Hrs

**Course Code RUSCSP601**  
**PRACTICAL OF CLOUD COMPUTING**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
<b>CO 1</b>	<b>Compare and use various service models (IAAS, PAAS, SAAS)</b>
<b>CO 2</b>	<b>Identify various tools for deploying the cloud application</b>
<b>CO 3</b>	<b>Demonstrate the installation of various cloud related softwares</b>

Course Code	PRACTICAL OF CLOUD COMPUTING	Credits 1 / 15 Hours
<b>RUSCSP601</b>	<ol style="list-style-type: none"> <li>1. Implementation of Infrastructure as a Service                             <ol style="list-style-type: none"> <li>a. VMWare Esxi Server</li> <li>b. Citrix Xenserver</li> </ol> </li> <li>2. Implementation of Remote Procedure Calls</li> <li>3. Implementation of Remote Method Invocation on Local machine as well as Remote machine</li> <li>4. Implementing Hadoop &amp; Map Reduce</li> <li>5. Application Development using Google App Engine</li> <li>6. Installation and configuration of virtualization using KVM</li> <li>7. Installation and configuration of OpenStack</li> <li>8. Study of AWS, Google Cloud &amp; Windows Azure</li> </ol>	

**References:**

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, Tata McGraw Hill Education Private Limited, 2013
1. OpenStack in Action, V. K. CODY BUMGARDNER, Manning Publications Co, 2016

**Additional Reference(s):**

- OpenStack Essentials, Dan Radez, PACKT Publishing, 2015
- OpenStack Operations Guide, Tom Fifield, Diane Fleming, Anne Gentle, Lorin Hochstein, Jonathan Proulx, Everett Toews, and Joe Topjian, O'Reilly Media, Inc., 2014



- <https://www.openstack.org>

**Course Code: RUSCS602**  
**Course Title: CYBER FORENSIC**  
**Academic year 2023-24**

**COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Explain the procedures for identification, preservation, and extraction of electronic evidence
CO 2	Illustrate procedure of network and mobile forensics
CO 3	Analyze legal aspect and Ethics in digital forensics
CO 4	Evaluate real time case study in digital forensics

**DETAILED SYLLABUS**

Course Code	Unit	CYBER FORENSIC	Credits 3 / 45 Hours
RUSCS602	I	<b>Computer Forensics :</b> Introduction to Computer Forensics, Understanding Computer Investigations, Data Acquisition, Processing Crime and Incident Scenes. <b>Network Forensic :</b> Introduction to Network Forensics and its challenges, Types of Digital evidence, Sources of Network based Evidence, Sources of log. <b>Cell Phone and Mobile Device Forensics:</b> Overview, Acquisition Procedures for Cell Phones and Mobile Devices.	15 Hrs
	II	<b>Internet Forensic :</b> Introduction to Internet Forensics, World Wide Web Threats, Hacking and Illegal access, Obscene and Indecent transmission, Domain Name Ownership Investigation, Reconstructing past internet activities and events <b>E-mail Forensics :</b> e-mail analysis, e-mail headers and spoofing, Laws against e-mail Crime, Messenger Forensics <b>Social Media Forensics:</b> Social Media Investigations <b>Browser Forensics:</b> Cookie Storage and Analysis, Analyzing Cache and temporary internet files, Web browsing activity reconstruction	15 Hrs
	III	<b>Legal aspects and Ethics of Digital Forensics:</b> Expert Testimony in High-Tech Investigations, Information Technology Act. <b>Case Study :</b> Cyber Crime cases	15 Hrs

**Course Code RUSCSP602**  
**PRACTICAL OF CYBER FORENSIC**



COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Demonstrate tools used for Image acquisition
CO 2	Apply examinations and analysis techniques on digital Evidences
CO 3	Illustrate techniques for data backup and restore

Course Code	PRACTICAL OF CYBER FORENSIC	Credits 1 / 15 Hours
<b>RUSCSP602</b>	<b>Make use of Forensics tools to perform following:</b> 1.Evidence acquisition 2. Cyber Forensics Case examination 3. Network Forensics 4. Network Tracking and Process Monitoring 5. Mobile Forensics 6. Email Forensics 7. Browser Forensics 8. Write a program for Database backup and its restoration.	

**References:**

1. Guide to computer forensics and investigations, Bill Nelson, Amelia Philips and Christopher Steuart, course technology,5th Edition,2015
2. Network Forensics, Sherri Davidoff, Jonathan HAM, Prentice Hall, 2012.

**Additional Reference(s):**

- Introduction to Social Media Investigation A Hands-on Approach, Jennifer Golbeck Judith L. Klavans, Technical Editor

**Course Code: RUSCS603**  
**Course Title: INFORMATION RETRIEVAL**  
**Academic year 2023-24**

**COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Understand of information retrieval and its relationship to search engines
CO 2	Apply information retrieval models on live dataset.
CO 3	Interpret issues in classical and web information retrieval
CO 4	Implement systems for gathering, indexing, and searching documents and of methods for evaluating systems.



## DETAILED SYLLABUS

Course Code	Unit	INFORMATION RETRIEVAL	Credits 3 / 45 Hours
<b>RUSCS603</b>	<b>I</b>	<b>Introduction to Information Retrieval:</b> Introduction, History of IR, Components of IR, and Issues related to IR, Boolean retrieval, Dictionaries and tolerant retrieval.	15 Hrs
	<b>II</b>	<b>Link Analysis and Specialized Search:</b> Link Analysis, hubs and authorities, Pagerank and HITS algorithms, Similarity, Hadoop & MapReduce, Evaluation, Personalized search, Collaborative filtering and content-based recommendation of documents and products, handling “invisible” Web, Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.	15 Hrs
	<b>III</b>	<b>Web Search Engine:</b> Web search overview, web structure, the user, paid placement, search engine optimization/spam, Web size measurement, search engine optimization/spam, Web Search Architectures. <b>XML retrieval:</b> 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.	15 Hrs

### Course Code RUSCSP603

### PRACTICAL OF INFORMATION RETRIEVAL

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
<b>CO 1</b>	<b>Develop Analytical solution to Real world data science Problem</b>
<b>CO 2</b>	<b>Apply statistical and mathematical techniques to explore data</b>
<b>CO 3</b>	<b>Compare and Implement various supervised and unsupervised Learning algorithms for specific use cases.</b>
<b>CO 4</b>	<b>Evaluate results of Analytics and suggest Solutions</b>
<b>CO 5</b>	<b>Articulate techniques for handling Time series and Semi-structured data</b>

Course Code	PRACTICAL ON INFORMATION RETRIEVAL	Credits 1 / 15 Hours
<b>RUSCSP603</b>	<b>Practical may be done using software/tools like Python / Java / Hadoop</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. 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.	
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**References:**

- 1) Introduction to Information Retrieval, C. Manning, P. Raghavan, and H. Schütze, Cambridge University Press, 2008
- 2) Modern Information Retrieval: The Concepts and Technology behind Search, Ricardo Baeza-Yates and Berthier Ribeiro - Neto, 2<sup>nd</sup> Edition, ACM Press Books 2011.
- 3) Search Engines: Information Retrieval in Practice, Bruce Croft, Donald Metzler and Trevor Strohman, 1<sup>st</sup> Edition, Pearson, 2009.

**Additional Reference(s):**

- 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)

**Course Code: RUSCS604**  
**Course Title: DATA SCIENCE**  
**Academic year 2023-24**

**COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	Develop Analytical solution to Real world data science Problem
CO 2	Apply statistical and mathematical techniques to explore data
CO 3	Compare and Implement various supervised and unsupervised Learning algorithms for specific use cases.
CO 4	Evaluate results of Analytics and suggest Solutions
CO 5	Articulate techniques for handling Time series and Semi-structured data

**DETAILED SYLLABUS**

Course Code	Unit	DATA SCIENCE	Credits 3 / 45 Hours
<b>RUSCS604</b>	<b>I</b>	<b>Introduction to Data Science:</b> What is Data? Different kinds of data, Data Science Process or lifecycle.	15 Hrs





		<b>Data Preprocessing:</b> Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation <b>Exploratory Data Analysis (EDA):</b> Measures of central tendency and dispersion, Bar plot, histogram, Box plots, stem-leaf diagram, multi-dimensional modeling	
	<b>II</b>	<b>Statistical Modeling and Machine Learning Algorithms:</b> Introduction to model selection: Regularization, bias/variance tradeoff e.g.parsimony, AIC, BIC, Cross validation <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, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis, Association rules from frequent itemsets. Ensemble methods: Increasing the Accuracy, Model Selection.	15 Hrs
	<b>III</b>	<b>Semi-structured systems:</b> Semi-structured data Model, management and querying of data. <b>Unstructured data analytics systems:</b> Unstructured data model, NoSQL databases, Text Analytics <b>Big data Analytics:</b> What is Big data? ,Document shingling	15 Hrs

**Course Code RUSCSP604**  
**PRACTICAL OF DATA SCIENCE**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
CO 1	<b>Apply tools and techniques for Exploratory Data Analysis</b>
CO 2	<b>Implement supervised and unsupervised algorithms, Visualizations using programming languages</b>
CO 3	<b>Analyze Time series and Semi-structured Data</b>

Course Code	PRACTICAL OF DATA SCIENCE	Credits 1 / 15 Hours
<b>RUSCSP604</b>	1. Data Cleaning 2. Exploratory Data Analysis 3. Regression 4. Decision Tree 5. Principal Component Analysis 6. Clustering 7. Association 8. Model validation 9. NoSQL database	



	10. Document shingling	
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**Reference(s):**

1. Doing Data Science, Rachel Schutt and Cathy O’Neil, O’Reilly,2013
2. J. Han and M. Kamber, ” Data Mining: Concepts and Techniques”, Second Edition, Elsevier, Reprinted2008
3. Elmasri and Navathe, “Fundamentals of Database Systems”, Pearson Education
4. Hadoop The Definitive Guide, Tom White, O’Reilly
5. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services
6. Big Data Analytics with R and Hadoop, Vignesh Prajapati, PACKT Publishing.
7. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

**Additional Reference(s):**

- Hands-On Programming with R, Garrett Grolemond,1<sup>st</sup> Edition, 2014
- An Introduction to Statistical Learning, James, G., Witten, D., Hastie, T., Tibshirani, R.,Springer,2015

**Course Code: RUSCS605**  
**Course Title: OPTIMIZATION TECHNIQUES**  
**Academic year 2023-24**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
<b>CO 1</b>	Appraise Optimization Techniques on real world problems.
<b>CO 2</b>	Develop optimize solution to given problem
<b>CO 3</b>	Implement optimal models for solving real world problems.

**DETAILED SYLLABUS**

Course Code	Unit	OPTIMIZATION TECHNIQUES	Credits 3 / 45 Hours
<b>RUSCS605</b>	<b>I</b>	<p><b>Introduction to Operation Research:</b> Operation Research approach, scientific methods, introduction to models and modeling techniques, general methods for Operation Research models, methodology and advantages of Operation Research, history of Operation Research.</p> <p><b>Linear Programming (LP):</b> Introduction to LP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using Big-M method, Two phase method, Duality in linear programming</p>	15 Hrs



	<b>II</b>	<b>Transportation &amp; Assignment Problems:</b> Introduction to Transportation problems, various methods of Transportation problem, Variations in Transportation problem, introduction to Assignment problems, variations in Assignment problems. traveling salesman problem. <b>Integer LP Models</b> Gomory's Cutting plane algorithms, branch and bound technique for integer programming	15 Hrs
	<b>III</b>	<b>Sequencing:</b> Introduction, processing N jobs through two machines, processing N jobs through three machines, processing N jobs through m machines. <b>Theory of Games:</b> Introduction, Two person Zero sum Games, Games with Saddle point	15 Hrs

**References:**

1. Operation research theory and Applications, J.K.Sharma, 5th Edition, MacMillan Publishing Co

**Additional Reference(s):**

- Taha H.A. - Operations Research; An Introduction, 7th ed., 2003, MacMillan Publishing Co

**Course Code: RUSCSP605**  
**Course Title: PROJECT IMPLEMENTATION**

COURSE OUTCOME	DESCRIPTION
	<b>After Completing this course student will be able to :</b>
<b>CO 1</b>	Apply SDLC models for software development
<b>CO 2</b>	Examine and compose software requirement specification
<b>CO 3</b>	Develop user interface with backend connection
<b>CO4</b>	Implement advanced technology to develop software as a product

**Academic year 2023-24**

Course Code	PROJECT IMPLEMENTATION	Credits 2 / 30 Hours
<b>RUSCSP605</b>	<b>Project Implementation Guidelines</b> <ol style="list-style-type: none"> <li>1. A learner is expected to carry out one project: in Semester VI.</li> <li>2. A learner can choose any topic which is covered in Semester I- semester VI or any other Topic with the prior approval from the head of the department/ project in charge.</li> <li>3. The Project has to be performed individually.</li> <li>4. A learner is expected to devote a minimum 180hrs of efforts in the project.</li> <li>5. The project can be application oriented/web-based/database/research based.</li> <li>6. It has to be an implemented work; just theoretical study will not be acceptable.</li> </ol>	



	<p>7. A learner can choose any programming language, computational techniques and tools Which have been covered during a BSc course or any other with the prior permission of the head of the department/ project guide.</p> <p>8. A project guide should be assigned to a learner. He/she will assign a schedule for the Project and hand it over to a learner. The guide should oversee the project progress on a weekly basis</p> <p>9. The quality of the project will be evaluated based on the novelty of the topic, scope of the work, relevance to computer science, adoption of emerging techniques/technologies and it's real-world application.</p> <p>10. A learner has to maintain a project report with the following subsections</p> <ul style="list-style-type: none"> <li>a) Title Page</li> <li>b) Certificate             <ul style="list-style-type: none"> <li>A certificate should contain the following information –</li> <li>- The fact that the student has successfully completed the project as per the syllabus and that it forms a part of the requirements for completing the BSc degree in computer science of University of Mumbai.</li> <li>- The name of the student and the project guide</li> <li>- The academic year in which the project is done</li> <li>- Date of submission,</li> <li>- Signature of the project guide and the head of the department with date along with the department stamp, Space for signature of the university examiner and date on which the project is evaluated.</li> </ul> </li> <li>c) Self-attested copy of the Plagiarism Report from any open source tool.</li> <li>d) Index Page detailing description of the following with their subsections:             <ul style="list-style-type: none"> <li>- Title: A suitable title giving the idea about what work is proposed.</li> <li>- Introduction: An introduction to the topic giving proper background of the topic.</li> <li>- Requirement Specification: Specify Software/hardware/data requirements.</li> <li>- System Design details : Methodology/Architecture/UML/DFD/Algorithms/protocols etc. used(whichever is applicable)</li> <li>- System Implementation: Code implementation</li> <li>- Results: Test Cases/Tables/Figures/Graphs/Screenshots/Reports etc.</li> <li>- Conclusion and Future Scope: Specify the Final conclusion and future scope</li> <li>-References: Books, web links, research articles, etc.</li> </ul> </li> </ul> <p>11. The size of the project report shall be around twenty to twenty five pages, excluding the code.</p> <p>12. The Project report should be submitted in a spiral bound form</p> <p>13. The Project should be certified by the concerned Project guide and Head of the department.</p> <p>14. A learner has to make a presentation of a working project and which will be evaluated.</p>	
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## MODALITY OF ASSESSMENT

**Theory exam total marks: 100 Marks**

**Theory Examination Pattern:**

**A) Internal Assessment - 40% :40 marks.**

Sr No	Evaluation type	Marks
1	It will be conducted either using any open source learning management system such as Moodle (Modular object-oriented dynamic learning environment)	20
2	Project (group of 5 students)/Tutorial/Quizzes/Assignment	20
3	Total	40

**B) External examination - 60 % : 60 marks**

**Semester End Theory Examination:**

1. Duration - These examinations shall be of **2 Hrs** duration.
2. Theory Question Paper Pattern:

All Questions are Compulsory			
Questions	Options	Based On	Marks
Q1	Any 3 out of 4	Unit I, II, & III	15
Q2	Any 3 out of 4	Unit I	15
Q3	Any 3 out of 4	Unit II	15
Q4	Any 3 out of 4	Unit III	15
Total			60

- All questions shall be compulsory with internal choice within the questions.

**Practical exam total marks: 50 Marks**

**Practical Examination Pattern:**

**A) Internal Examination: Internal Practical 40% - 20 Marks**

**10 Marks - Individual Practical Implementation & Performance**

- Each student will maintain an e-journal. After every practical students will upload his practicals in the form of documents along with the screen shots of output on online portal (Moodle/Google site/any LMS).

**10 Marks –Design and implement innovative application of the technology**

Particulars	Marks
Individual Practical Implementation & Performance	10



<b>Design and implement innovative application of the technology</b>	10
<b>Total</b>	20

**(B) External (Semester end practical examination): 60% - 30 Marks**

**30 Marks Practical Questions:**

- Students have to acquire at least 40% marks in each paper individually.

<b>Particulars</b>	<b>Practical</b>
Laboratory work	30
<b>Total</b>	<b>30</b>

**Project Exam total marks: 100 Marks**

**INTERNAL COMPONENT - 40 Marks**

- Project Proposal - 10 Marks
- Analysis Phase - 10 Marks
- Design Phase - 10 Marks
- Implementation - 10 Marks

Marking Scheme

- Each student has to follow the schedule for above mentioned phases as given by the Project Guide.
- Marks will be allotted on the basis of the presentation made by the student at each stage of project development.
- Students has to maintain regular phases completion chart and project documentation duly signed By internal guide

**EXTERNAL COMPONENT - 60 Marks**

- Project Quality - 20 Marks.
- Working of Project - 20 Marks.
- Student Presentation - 20 Marks.



**PASSING CRITERIA 40%:** Student has to acquire minimum of 40% marks each course (Theory/Practical/Project).

**Overall Examination & Marks Distribution Pattern  
Semester- VI**

Course			
	Internal	External	Total
<b>Theory</b>	<b>40</b>	<b>60</b>	<b>500 (5 Papers)</b>
<b>Practicals</b>	<b>20</b>	<b>30</b>	<b>200 (4 Papers)</b>
<b>Project</b>	<b>40</b>	<b>60</b>	<b>100</b>
<b>Individual Semester Total</b>			<b>800</b>