



Shri Vile Parle Kelavani Mandal's  
**MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE &  
AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS  
(AUTONOMOUS)**

*NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),  
Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India  
Best College (2016-17), University of Mumbai*

Affiliated to the  
**UNIVERSITY OF MUMBAI**

**Program: T.Y.B.Sc.**

**Course: Computer Science**

**Semester: V & VI**

**Choice Based Credit System (CBCS) with effect from the**

**Academic year 2018-19**

**A.C. No: 1<sup>st</sup>**

**Agenda No: 6.5**

Neelam Jain

Ashish Gavande

Dr. Anmol Joshi  
Zohra S. Mulani

Tayshree Ravi

The courses are as follows: -

| <b>Semester – V</b>                    |                |                     |
|--|----------------|---------------------|
| <b>Course Title</b>                    | <b>Credits</b> | <b>Lecture/Week</b> |
| Artificial Intelligence                | 3              | 3                   |
| Software Testing and Quality Assurance | 3              | 3                   |
| Information and Network Security       | 3              | 3                   |
| Optimization Techniques                | 3              | 3                   |
| Web Services                           | 3              | 3                   |
| Project Implementation                 | 1              | 3                   |
| Computer Science Practical 11          | 2              | 6                   |
| Computer Science Practical 12          | 2              | 6                   |
| Computer Science Practical 13          | 1              | 3                   |

| <b>Semester – VI</b>                              |                |                     |
|---|----------------|---------------------|
| <b>Course Title</b>                               | <b>Credits</b> | <b>Lecture/Week</b> |
| Wireless Sensor Networks and Mobile Communication | 3              | 3                   |
| Cyber Forensics                                   | 3              | 3                   |
| Information Retrieval                             | 3              | 3                   |
| Deep Learning Applications                        | 3              | 3                   |
| Ethical Hacking                                   | 3              | 3                   |
| Project Implementation                            | 1              | 3                   |
| Computer Science Practical 14                     | 2              | 6                   |
| Computer Science Practical 15                     | 2              | 6                   |
| Computer Science Practical 16                     | 1              | 3                   |

- N.B.- (i) The duration of each theory lecture will be of 48 minutes. A course consists of 3 modules. For each module the number of lectures allotted are 15. The total number of lecture hours for each course will thus be 45.

For theory component value of One Credit is equal to 15 learning hours.

- (ii) There will be one practical per batch for all but one courses per semester. The duration of each practical will be of 2 hours 24 min.

For practical component the value of One Credit is equal to 30 learning hours.

- (iii) Thus in a week, a student will study 15 lecture hours of theory and 18 lecture hours of practical for semester V and VI.



## Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

### a) Details of Continuous Assessment (CA)

25% of the total marks per course:

| Continuous Assessment | Details   | Marks    |
|-----------------------|---|----------|
| Component 1 (CA-1)    | Class Test/Research Paper Review/<br>Assignment/ Presentation/ Mini Project | 15 marks |
| Component 2 (CA-2)    | Assignment/ presentation/mini project, etc                                  | 10 marks |

Minimum 2 component of Continuous Assessment need to be conducted per course.


### b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.

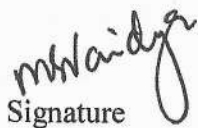
| Question Number | Description                     | Marks        | Total Marks      |
|-----------------|---------------------------------|--------------|------------------|
| Q.1             | Answer any 3 out of 4 Questions | 7 marks each | 3 x 7 = 21 marks |
| Q.2             | Answer any 3 out of 4 Questions | 7 marks each | 3 x 7 = 21 marks |
| Q.3             | Answer any 3 out of 4 Questions | 7 marks each | 3 x 7 = 21 marks |
| Q.4             | Answer any 3 out of 4 questions | 4 marks each | 3 x 4 = 12 marks |
| Total Marks     |                                 |              | 75 marks         |

### Evaluation for practical papers

In the Practical exams, there will be 20% assessment for the journal and laboratory work and 80% as term end component to be conducted as a semester end exam per course. For each course there will be one examiner per batch who will evaluate the practical.

  
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Approved by Vice –Principal

  
Signature

Approved by Principal

**SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben  
Jivanlal College of Commerce & Economics (AUTONOMOUS)**

|   |   |   |               |  |  |
|---|---|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>   |   |   |               | <b>Semester: V</b>                                     |  |
| <b>Course: Artificial Intelligence</b>  |   |   |               | <b>Course Code: USMACS501</b>                          |  |
| <b>Teaching Scheme</b>  |   |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>  | <b>Practical<br/>(Lectures<br/>per week)</b>  | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3   | 3   | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b><br><u>Artificial Intelligence (AI) and accompanying tools and techniques bring transformational changes in the world. Machines capability to match, and sometimes even surpass human capability, make AI a hot topic in Computer Science. This course aims to introduce the learner to this interesting area.</u>         |   |   |               |  |  |
| <b>Course Outcomes:</b><br><u>After completion of the course, learners would be able to:</u><br><b>CO1: The learner should get a clear understanding of AI and different search algorithms used for solving problems</b><br><b>CO2: The learner should also get acquainted with different learning algorithms and models used in machine learning</b> |   |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>  |   |   |               |  |  |
| <b>Module</b>   | <b>Description</b>  |   |               |  | <b>No of Lectures</b>  |
| 1   | AI Foundation, Intelligent Agents, Problem Solving by searching   |   |               |  | 15   |
| 2   | First Order Predicate Logic, Knowledge Representation   |   |               |  | 15   |
| 3   | Game Playing, Reinforcement learning  |   |               |  | 15   |
|   | <b>Total</b>  |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>   |   |   |               |  |  |
| 1   | Implement Breadth first search algorithm for Romanian map problem.  |   |               |  | 3  |
| 2   | Implement Iterative deep depth first search for Romanian map problem.   |   |               |  | 3  |
| 3   | Implement A* search algorithm for Romanian map problem.   |   |               |  | 3  |
| 4   | Implement recursive best-first search algorithm for Romanian map problem.   |   |               |  | 3  |
| 5   | Write a program to implement 8 Queen problem  |   |               |  | 3  |
| 6   | Write a program to implement tower of Hanoi.  |   |               |  | 3  |
| 7   | Write a program to find the solution for Wumpus world problem   |   |               |  | 3  |
| 8   | Implement passive reinforcement learning algorithm based on adaptive dynamic programming (ADP) for the 3 by 4 world problem |   |               |  | 3  |
| 9   | Implement passive reinforcement learning algorithm based on temporal differences (TD) for 3 by 4 world problem.             |   |               |  | 3  |



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| Unit            | Topic  | No. of Lectures /Credits |
|-----------------|--|--------------------------|
| <b>Module 1</b> | What Is AI: 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. | <b>15</b>                |
| <b>Module 2</b> | First Order Predicate Logic -Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information   | <b>15</b>                |
| <b>Module 3</b> | Game Playing: Overview and Example Domain, Min-max Search, Adding Alpha-Beta Cutoffs. The EM Algorithm. Reinforcement learning: Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, Applications of Reinforcement Learning.  | <b>15</b>                |
|                 |  |                          |

**Suggested Readings**

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

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|   |  |   |               |  |  |
|---|--|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>   |  |   |               | <b>Semester: V</b>                                     |  |
| <b>Course: Software Testing and Quality Assurance</b>   |  |   |               | <b>Course Code: USMACS502</b>                          |  |
| <b>Teaching Scheme</b>  |  |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>  | <b>Practical<br/>(Lectures<br/>per week)</b>   | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3   | 3  | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b>   |  |   |               |  |  |
| <ul style="list-style-type: none"> <li>• <u>To provide learner with knowledge in Software Testing techniques.</u></li> <li>• <u>To understand how testing methods can be used as an effective tool in providing quality assurance concerning for software.</u></li> <li>• <u>To provide skills to design test case plan for testing software</u></li> </ul> |  |   |               |  |  |
| <b>Course Outcomes:</b>   |  |   |               |  |  |
| After completion of the course, learners would be able to:  |  |   |               |  |  |
| CO1: <u>Understand various software testing methods and strategies.</u>   |  |   |               |  |  |
| CO2: <u>Understand a variety of software metrics, and identify defects and managing those defects for improvement in quality for given software.</u>  |  |   |               |  |  |
| CO3: <u>Design SQA activities, SQA strategy, formal technical review report for software quality control and assurance.</u>   |  |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>  |  |   |               |  |  |
| <b>Module</b>   | <b>Description</b>   |   |               |  | <b>No of Lectures</b>  |
| 1   | Software Testing and Introduction to quality, Software Testing Techniques  |   |               |  | 15   |
| 2   | Software Testing Strategies, Software Metrics, Defect Management   |   |               |  | 15   |
| 3   | Software Quality Assurance, Quality Improvement  |   |               |  | 15   |
|   | <b>Total</b>   |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>   |  |   |               |  |  |
| 1   | Install Selenium IDE; Write a test suite containing minimum 4 test cases for different formats.                              |   |               |  | 3  |
| 2   | Conduct a test suite for any two web sites.  |   |               |  | 3  |
| 3   | Install Selenium server (Selenium RC) and demonstrate it using a script in Java/PHP.   |   |               |  | 3  |
| 4   | Write and test a program to login a specific web page.   |   |               |  | 3  |
| 5   | Write and test a program to update 10 student records into table into Excel file   |   |               |  | 3  |
| 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). |   |               |  | 3  |
| 7   | Write and test a program to provide total number of objects present / available on the page.                                 |   |               |  | 3  |
| 8   | Write and test a program to get the number of items in a list / combo box.   |   |               |  | 3  |



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|----|--|---|
| 9  | Write and test a program to count the number of check boxes on the page checked and unchecked count.   | 3 |
| 10 | Load Testing using JMeter, Android Application testing using Appium Tools, Bugzilla Bug tracking tools.5. Finite state Automata and Finite state machines. | 3 |

| Unit            | Topic  | No. of Lectures / Credits |
|-----------------|--|---------------------------|
| <b>Module 1</b> | Software Testing and Introduction to quality : Introduction, Nature of errors, an example for Testing, Definition of Quality , QA, QC, QM and SQA , Software Development Life Cycle, Software Quality Factors Verification and Validation : Definition of V &V , Different types of V & V Mechanisms, Concepts of Software Reviews, Inspection and Walkthrough Software Testing Techniques : Testing Fundamentals, Test Case Design, White Box Testing and its types, Black Box Testing and its types  | 15                        |
|                 |  |                           |
| <b>Module 2</b> | Software Testing Strategies: Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, System Testing Software Metrics : Concept and Developing Metrics, Different types of Metrics, Complexity metrics Defect Management: Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.   | 15                        |
|                 |  |                           |
| <b>Module 3</b> | Software Quality Assurance: Quality Concepts, Quality Movement, Background Issues, SQA activities, Software Reviews, Formal Technical Reviews, Formal approaches to SQA, Statistical Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, , SQA Plan , Six sigma, Informal Reviews<br>Quality Improvement: Introduction, Pareto Diagrams, Cause-effect Diagrams, Scatter Diagrams, Run charts Quality Costs: Defining Quality Costs, Types of Quality Costs, Quality Cost Measurement, Utilizing Quality Costs for Decision-Making | 15                        |
|                 |  |                           |

**Suggested Readings**

1. Software Engineering for Students, A Programming Approach, Douglas Bell, 4 th Edition,, Pearson Education, 2005
2. Software Engineering – A Practitioners Approach, Roger S. Pressman, 5 th Edition, Tata McGraw Hill, 2001
3. Quality Management, Donna C. S. Summers, 5 th Edition, Prentice-Hall, 2010.
4. Total Quality Management, Dale H. Besterfield, 3 rd Edition, Prentice Hall, 2003.

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



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|  |   |   |               |  |  |
|--|---|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>  |   |   |               | <b>Semester: V</b>                                     |  |
| <b>Course: Information and Network Security</b>  |   |   |               | <b>Course Code: USMACS503</b>                          |  |
| <b>Teaching Scheme</b>   |   |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>   | <b>Practical<br/>(Lectures<br/>per week)</b>  | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3  | 3   | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b>  |   |   |               |  |  |
| To provide students with knowledge of basic concepts of computer security including network security and cryptography.   |   |   |               |  |  |
| <b>Course Outcomes:</b>  |   |   |               |  |  |
| After completion of the course, learners would be able to:   |   |   |               |  |  |
| <b>CO1: Understand the principles and practices of cryptographic techniques.</b>   |   |   |               |  |  |
| <b>CO2: Understand a variety of generic security threats and vulnerabilities, and identify &amp; analyze particular security problems for a given application.</b> |   |   |               |  |  |
| <b>CO3: Understand various protocols for network security to protect against the threats in a network</b>  |   |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>   |   |   |               |  |  |
| <b>Module</b>  | <b>Description</b>  |   |               |  | <b>No of<br/>Lectures</b>  |
| 1  | Introduction, Classical Encryption Techniques, Public-Key Cryptography and RSA  |   |               |  | 15   |
| 2  | Key Management, Digital Signatures and Authentication, Applications   |   |               |  | 15   |
| 3  | Electronic Mail Security, Web Security, Intrusion, Malicious Software, Firewalls  |   |               |  | 15   |
|  | <b>Total</b>  |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>  |   |   |               |  |  |
| 1  | Write programs to implement the following Substitution Cipher Techniques: -<br>Caesar Cipher - Monoalphabetic Cipher          |   |               |  | 3  |
| 2  | Write programs to implement the following Substitution Cipher Techniques: -<br>Vernam Cipher - Playfair Cipher                |   |               |  | 3  |
| 3  | Write programs to implement the following Transposition Cipher Techniques: -<br>Rail Fence Cipher - Simple Columnar Technique |   |               |  | 3  |
| 4  | Write program to encrypt and decrypt strings using - DES Algorithm - AES Algorithm  |   |               |  | 3  |
| 5  | Write a program to implement RSA algorithm to perform encryption / decryption of a given string.                              |   |               |  | 3  |
| 6  | Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys.                           |   |               |  | 3  |
| 7  | Write a program to implement the MD5 algorithm compute the message digest.  |   |               |  | 3  |
| 8  | Write a program to calculate HMAC-SHA1 Signature  |   |               |  | 3  |



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|-----------|--|---|
| <b>9</b>  | Write a program to implement SSL.                                      | 3 |
| <b>10</b> | Configure Windows Firewall to block: - A port - An Program - A website | 3 |

| <b>Unit</b>     | <b>Topic</b>   | <b>No. of Lectures /Credits</b> |
|-----------------|--|---------------------------------|
| <b>Module 1</b> | Introduction: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms Classical Encryption Techniques: 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 Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm | <b>15</b>                       |
| <b>Module 2</b> | Key Management: Public-Key Cryptosystems, Key Management, Diffie-Hellman Key Exchange Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and Macs, Secure Hash Algorithm, HMAC Digital Signatures and Authentication: Digital Signatures, Authentication Protocols, Digital Signature Standard Authentication Applications: Kerberos, X.509 Authentication, Public-Key Infrastructure                                  | <b>15</b>                       |
| <b>Module 3</b> | Electronic Mail Security: Pretty Good Privacy, S/MIME IP Security: Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management Web Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction Intrusion: Intruders, Intrusion Techniques, Intrusion Detection Malicious Software: Viruses and Related Threats, Virus Countermeasures, DDOS Firewalls: Firewall Design Principles, Types of Firewalls            | <b>15</b>                       |

**Suggested Readings**

1. Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson,2010
2. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2013.
3. Cryptography and Network, Behrouz A Fourouzan, Debdeep Mukhopadhyay, 2nd Edition, TMH,2011



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|  |  |   |               |  |  |
|--|--|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>  |  |   |               | <b>Semester: V</b>                                     |  |
| <b>Course: Optimization Techniques</b>   |  |   |               | <b>Course Code: USMACS504</b>                          |  |
| <b>Teaching Scheme</b>   |  |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>   | <b>Practical<br/>(Lectures<br/>per week)</b>                 | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3  | 3  | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b>  |  |   |               |  |  |
| <ul style="list-style-type: none"> <li>• <u>To understand importance of optimization of industrial process management</u></li> <li>• <u>To apply basic concepts of mathematics to formulate an optimization problem</u></li> <li>• <u>To analyze and appreciate variety of performance measures for various optimization problems</u></li> </ul> |  |   |               |  |  |
| <b>Course Outcomes:</b>  |  |   |               |  |  |
| <u>After completion of the course, learners would be able to:</u>  |  |   |               |  |  |
| CO1: <u>Formulate and solve real life problems</u>   |  |   |               |  |  |
| CO2: <u>Formulate research-oriented approach</u>   |  |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>   |  |   |               |  |  |
| <b>Module</b>  | <b>Description</b>   |   |               |  | <b>No of<br/>Lectures</b>  |
| 1  | Introduction, Introduction to Simplex Methods                |   |               |  | 15   |
| 2  | Advanced Simplex Methods, Dual Simplex Algorithm and Duality |   |               |  | 15   |
| 3  | Transportation and Assignment models                         |   |               |  | 15   |
|  | <b>Total</b>   |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>  |  |   |               |  |  |
| 1  | LPP for maximization /minimization of an objective function  |   |               |  | 3  |
| 2  | LPP using Simplex Method                                     |   |               |  | 3  |
| 3  | LPP using Big M method                                       |   |               |  | 3  |
| 4  | Transportation problem using NWCR Method                     |   |               |  | 3  |
| 5  | Transportation problem using Least Cost Method               |   |               |  | 3  |
| 6  | Transportation problem using VAM Method                      |   |               |  | 3  |
| 7  | Transportation problem using MODI Method                     |   |               |  | 3  |
| 8  | Assignment Problem   |   |               |  | 3  |

| Unit            | Topic  | No. of Lectures /Credits |
|-----------------|--|--------------------------|
| <b>Module 1</b> | Introduction: Need for optimization and historical development classification and formulation of optimization problem, Classical optimization methods, Calculus based methods, Enumerative schemes, Random search algorithms, Evolutionary algorithms. Linear Programming model: Formulation, objective function, constraints, decision variables, canonical and standard forms, parameters and variables, Graphical method for two variable problems. Introduction to Simplex Methods: Simple simplex algorithm and tabular representation, types of solution such as feasible / non feasible, degenerate / non degenerate, optimal / sub optimal, unique / alternate / infinite optimal, bounded / unbounded value and solution and their interpretations from simplex table, cycling phenomena, mutual solution of problems involving upto three iterations. Integer Programming, Branch and Bound Algorithm, Cutting plane Algorithm | <b>15</b>                |
| <b>Module 2</b> | Advanced Simplex Methods, Dual Simplex Algorithm and Duality: Artificial Variables, Big – M and Two Phase Simplex Methods, Degeneracy, unbounded solution, Infeasible Solution. Dual Simplex Method. Duality concept, dual problem formulation, dual simplex method, primal sub optimal - dual not feasible, and other primal - dual relations, interpretation of dual variables. Duality Properties, sensitivity analysis for variation of parameter at a time.   | <b>15</b>                |
| <b>Module 3</b> | Transportation and Assignment models: As special cases of LP model, Problem formulation and optimality conditions in Vogel's penalty and Hungarian methods of solution. Traveling salesman problem as a special case of assignment problem, sensitivity analysis manual solution of problems involving up to three iterations.   | <b>15</b>                |
|                 |  |                          |

### **Suggested Readings**

1. Operation Research-An Introduction: Taha H. A., McMillan Publishing Company, NY 2006
2. Introduction to Operation Research: Hillier F., and Lieberman G.J, Holden Day
3. Operations Research : P. K. Gupta & Hira, S. Chand 2014
4. Operations Research Applications and Algorithms: Waynel L. Winston Thomson 2006
5. Mathematical Programming Techniques: Kambo, N.S., McGraw Hill



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|  |  |   |               |  |  |
|--|--|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>  |  |   |               | <b>Semester: V</b>                                     |  |
| <b>Course: Web Services</b>  |  |   |               | <b>Course Code: USMACS505</b>                          |  |
| <b>Teaching Scheme</b>   |  |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>   | <b>Practical<br/>(Lectures<br/>per week)</b>   | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3  | 3  | -   | 2 + 1         | 25   | 75   |
| <b>Learning Objectives:</b>  |  |   |               |  |  |
| <ul style="list-style-type: none"> <li>• <u>To understand the details of web services technologies like SOAP, WSDL, and UDDI.</u></li> <li>• <u>To learn how to implement and deploy web service client and server.</u></li> <li>• <u>To understand the design principles and application of SOAP and REST based web services (JAX-WS and JAX-RS).</u></li> <li>• <u>To understand WCF service. To design secure web services and QoS of Web Services</u></li> </ul> |  |   |               |  |  |
| <b>Course Outcomes:</b>  |  |   |               |  |  |
| <u>After completion of the course, learners would be able to:</u>  |  |   |               |  |  |
| <b>CO1: <u>Emphasis on SOAP based web services and associated standards such as WSDL.</u></b>  |  |   |               |  |  |
| <b>CO2: <u>Design SOAP based / RESTful / WCF services</u></b>  |  |   |               |  |  |
| <b>CO3: <u>Deal with Security and QoS issues of Web Services</u></b>   |  |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>   |  |   |               |  |  |
| <b>Module</b>  | <b>Description</b>   |   |               |  | <b>No of<br/>Lectures</b>  |
| <b>1</b>   | Web services basics  |   |               |  | 15   |
| <b>2</b>   | The REST Architectural style   |   |               |  | 15   |
| <b>3</b>   | GraphQL  |   |               |  | 15   |
|  | <b>Total</b>   |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>  |  |   |               |  |  |
| <b>1</b>   | Write a program to implement to create a simple web service that converts the temperature from Fahrenheit to Celsius and vice a versa.             |   |               |  | 3  |
| <b>2</b>   | Write a program to implement the operation can receive request and will return a response in two ways. a) One - Way operation b) Request –Response |   |               |  | 3  |
| <b>3</b>   | Write a program to implement business UDDI Registry entry.   |   |               |  | 3  |
| <b>4</b>   | Develop client which consumes web services developed in different platform.  |   |               |  | 3  |
| <b>5</b>   | Write a JAX-WS web service to perform the following operations. Define a Servlet / JSP that consumes the web service.                              |   |               |  | 3  |
| <b>6</b>   | 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.        |   |               |  | 3  |
| <b>7</b>   | Define a RESTful web service that accepts the details to be stored in a database and performs CRUD operation.                                      |   |               |  | 3  |
| <b>8</b>   | Implement a simple GraphQL query using the Node.JS.  |   |               |  | 3  |

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|-----------|--|---|
| <b>9</b>  | Implement a simple GraphQL mutation using the Node.JS.       | 3 |
| <b>10</b> | Demonstrate a database connected GraphQL query using Prisma. | 3 |

| <b>Unit</b>     | <b>Topic</b>  | <b>No. of Lectures /Credits</b> |
|-----------------|---|---------------------------------|
| <b>Module 1</b> | Web services basics: 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>15</b>                       |
| <b>Module 2</b> | The REST Architectural style: 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>15</b>                       |
| <b>Module 3</b> | GraphQL: Introduction, GraphQL is the better REST, Core Concepts - The Schema Definition Language (SDL), Queries & Mutations, Schemas and Types, GraphQL client and server, Connecting with Database via Prisma, GraphQL Tools and Ecosystem, Security.   | <b>15</b>                       |

**Suggested Readings**

1. Web Services: Principles and Technology, Michael P. Papazoglou, Pearson Education Limited, 2008
2. RESTful Java Web Services, Jobinesh Purushothaman, PACKT Publishing, 2nd Edition, 2015
3. <https://graphql.org/learn/> and <https://www.howtographql.com/>
4. Leonard Richardson and Sam Ruby, RESTful Web Services, O'Reilly, 2007
5. The Java EE 6Tutorial, Oracle, 2013



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|   |   |  |                          |  |  |
|---|---|--|--------------------------|--|--|
| <b>Program: Bachelor of Science</b>   |   |  |                          | <b>Semester: V</b>   |  |
| <b>Course: Project Implementation</b>   |   |  |                          | <b>Course Code: USMACSP503</b>   |  |
| <b>Teaching Scheme</b>  |   |  | <b>Evaluation Scheme</b> |  |  |
| <b>Lecture<br/>(Hours<br/>per<br/>week)</b>                                   | <b>Practical<br/>/ week</b>   | <b>Tutorial<br/>(Hours per<br/>week)</b> | <b>Credit</b>            | <b>Continuous<br/>Assessment and<br/>Evaluation (CAE)<br/>(Marks - )</b> | <b>Term End<br/>Examinations (TEE)<br/>(Marks- 50<br/>in Project Viva)</b> |
| --  | 3   | -  | 1                        | NA   |  |
| <b>Guidelines for Project Phase-I Implementation in Semester – V</b>          |   |  |                          |  |  |
| <b>Unit</b>   | <b>Description</b>  |  |                          |  |  |
| 1   | A student is expected to devote at least 3 months (45 Hours) of efforts for the implementation based on the topics covered in UG Syllabus.  |  |                          |  |  |
| 2   | Student should submit a detailed project documentation report at the time of viva.  |  |                          |  |  |
| <b>Guidelines for Documentation of Project Proposal in Semester –V</b>        |   |  |                          |  |  |
| A Student should submit project implementation report with following details: |   |  |                          |  |  |
| 1.  | Title: Title of the project   |  |                          |  |  |
| 2.  | Preparation of Abstract   |  |                          |  |  |
| 3.  | Preliminary Investigation   |  |                          |  |  |
| 4.  | Feasibility Study   |  |                          |  |  |
| 5.  | Description of Modules  |  |                          |  |  |
| 6.  | UML Diagrams (System Analysis and Design)   |  |                          |  |  |
| 7.  | The report may be of around 30-35 pages, which needs to be signed by the teacher in charge and head of the Department. Student should submit the signed project phase-I implementation report along with evaluated copy of the project proposal documentation at the time of Project evaluation and viva as part of the Term End examination. |  |                          |  |  |



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|  |  |   |               |  |  |
|--|--|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>  |  |   |               | <b>Semester: VI</b>                                    |  |
| <b>Course: Wireless Sensor Networks and Mobile Communication</b>   |  |   |               | <b>Course Code: USMACS601</b>                          |  |
| <b>Teaching Scheme</b>   |  |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>   | <b>Practical<br/>(Lectures<br/>per week)</b>   | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3  | 3  | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b><br><u>In this era of wireless and adhoc network, connecting different wireless devices and understanding their compatibility is very important. Information is gathered in many different ways from these devices. Learner should be able to conceptualize and understand the framework. On completion, will be able to have a firm grip over this very important segment of wireless network.</u> |  |   |               |  |  |
| <b>Course Outcomes:</b><br><u>After completion of the course, learners would be able to:</u>   |  |   |               |  |  |
| <b>CO1: The learner should be able to list various applications of wireless sensor networks, describe the concepts, protocols, design, implementation and use of wireless sensor networks</b>  |  |   |               |  |  |
| <b>CO2: Also implement and evaluate new ideas for solving wireless sensor network design issues</b>  |  |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>   |  |   |               |  |  |
| <b>Module</b>  | <b>Description</b>   |   |               |  | <b>No of Lectures</b>  |
| 1  | Introduction, Sensor Node Hardware and Network Architecture  |   |               |  | 15   |
| 2  | Medium Access Control Protocols, Transport Control Protocols   |   |               |  | 15   |
| 3  | Wireless Transmission and Medium Access Control, Satellite Systems   |   |               |  | 15   |
|  | <b>Total</b>   |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>  |  |   |               |  |  |
| 1  | Understanding the Sensor Node Hardware. (For Eg. Sensors, Nodes(Sensor mote), Base Station, Graphical User Interface.)         |   |               |  | 3  |
| 2  | Exploring and understanding TinyOS computational concepts:- Events, Commands and Task. i. nesC model ii. nesC Components       |   |               |  | 3  |
| 3  | Understanding TOSSIM for i. Mote-mote radio communication ii. Mote-PC serial communication                                     |   |               |  | 3  |
| 4  | Create and simulate a simple adhoc network   |   |               |  | 3  |
| 5  | Understanding, Reading and Analyzing Routing Table of a network.   |   |               |  | 3  |
| 6  | Create a basic MANET simulation for Packet animation and Packet Trace.   |   |               |  | 3  |
| 7  | Implement a Wireless sensor network simulation.  |   |               |  | 3  |
| 8  | Create MAC protocol simulation implementation for wireless sensor Network.   |   |               |  | 3  |
| 9  | Simulate Mobile Adhoc Network with Directional Antenna   |   |               |  | 3  |
| 10   | Create a mobile network using Cell Tower, Central Office Server, Web browser and Web Server. Simulate connection between them. |   |               |  | 3  |



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| <b>Unit</b>     | <b>Topic</b>  | <b>No. of Lectures /Credits</b> |
|-----------------|---|---------------------------------|
| <b>Module 1</b> | Introduction: 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. Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC. Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts   | <b>15</b>                       |
| <b>Module 2</b> | Medium Access Control Protocols: Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study Routing Protocols: Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks. Transport Control Protocols: Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols.  | <b>15</b>                       |
| <b>Module 3</b> | Introduction, Wireless Transmission and Medium Access Control: Applications, A short history of wireless communication. Wireless Transmission: Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems. Telecommunication, Satellite and Broadcast Systems: GSM: 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 | <b>15</b>                       |

**Suggested Readings**

1. Protocols and Architectures for Wireless Sensor Network, Holger Kerl, Andreas Willig, John Wiley and Sons, 2005
2. Wireless Sensor Networks Technology, Protocols, and Applications ,Kazem Sohraby, Daniel Minoli and TaiebZnati, John Wiley & Sons, 2007
3. Mobile communications, Jochen Schiller,2nd Edition, Addison wisely , Pearson Education,2012
4. Fundamentals of Wireless Sensor Networks, Theory and Practice, Waltenequs Dargie, Christian Poellabauer , Wiley Series on wireless Communication and Mobile Computing, 2011
5. Networking Wireless Sensors, Bhaskar Krishnamachari , Cambridge University Press, 2005



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|  |  |   |               |  |  |
|--|--|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>  |  |   |               | <b>Semester: VI</b>                                    |  |
| <b>Course: Cyber Forensics</b>   |  |   |               | <b>Course Code: USMACS602</b>                          |  |
| <b>Teaching Scheme</b>   |  |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>   | <b>Practical<br/>(Lectures<br/>per week)</b>   | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3  | 3  | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b><br><u>To understand the procedures for identification, preservation, and extraction of electronic evidence, auditing and investigation of network and host system intrusions, analysis and documentation of information gathered</u>   |  |   |               |  |  |
| <b>Course Outcomes:</b><br>After completion of the course, learners would be able to:<br><b>CO1: <u>The student will be able to plan and prepare for all stages of an investigation - detection, initial response and management interaction, investigate various media to collect evidence, report them in a way that would be acceptable in the court of law</u></b> |  |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>   |  |   |               |  |  |
| <b>Module</b>  | <b>Description</b>   |   |               |  | <b>No of Lectures</b>  |
| 1  | Computer Forensics, Software Network Forensic, Device Forensics  |   |               |  | 15   |
| 2  | Internet Forensic, E-mail Forensics, Messenger Forensics   |   |               |  | 15   |
| 3  | Investigation, Evidence presentation and Legal aspects of Digital Forensics  |   |               |  | 15   |
|  | <b>Total</b>   |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>  |  |   |               |  |  |
| 1  | Creating a Forensic Image using FTK Imager/Encase Imager :<br>- Creating Forensic Image<br>- Check Integrity of Data<br>- Analyze Forensic Image                     |   |               |  | 3  |
| 2  | Data Acquisition:<br>- Perform data acquisition using:<br>- USB Write Blocker + Encase Imager<br>- SATA Write Blocker + Encase Imager<br>- Falcon Imaging Device     |   |               |  | 3  |
| 3  | Forensics Case Study:<br>- Solve the Case study (image file) provide in lab using Encase Investigator or Autopsy   |   |               |  | 3  |
| 4  | Capturing and analyzing network packets using Wireshark (Fundamentals) :<br>- Identification the live network<br>- Capture Packets<br>- Analyze the captured packets |   |               |  | 3  |



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| <b>5</b>  | Analyze the packets provided in lab and solve the questions using Wireshark :<br><ul style="list-style-type: none"> <li>- What web server software is used by www.snopes.com?</li> <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> | 3 |
| <b>6</b>  | Using Sysinternals tools for Network Tracking and Process Monitoring :<br><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>  | 3 |
| <b>7</b>  | Recovering and Inspecting deleted files<br><ul style="list-style-type: none"> <li>- Check for Deleted Files</li> <li>- Recover the Deleted Files</li> <li>- Analyzing and Inspecting the recovered files</li> <li>- Perform this using recovery option in ENCASE and also Perform manually through command line</li> </ul>   | 3 |
| <b>8</b>  | Acquisition of Cell phones and Mobile devices  | 3 |
| <b>9</b>  | Email Forensics<br><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>  | 3 |
| <b>10</b> | Web Browser Forensics<br><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>  | 3 |

| Unit            | Topic  | No. of Lectures /Credits |
|-----------------|--|--------------------------|
| <b>Module 1</b> | Computer Forensics : 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<br>Network Forensic : Introduction to Network Forensics and tracking network traffic, Reviewing Network Logs, Network Forensics Tools, Performing Live Acquisitions, Order of Volatility, Standard Procedure Cell Phone and Mobile Device Forensics: Overview, Acquisition Procedures for Cell Phones and Mobile Devices | <b>15</b>                |
| <b>Module 2</b> | Internet Forensic : 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 E-mail Forensics : e-mail analysis, e-mail headers and spoofing, Laws against e-mail Crime, Messenger Forensics: Yahoo Messenger Social Media Forensics: Social Media Investigations Browser Forensics: Cookie Storage and Analysis, Analyzing Cache and temporary internet files, Web browsing activity reconstruction   | <b>15</b>                |
| <b>Module 3</b> | Investigation, Evidence presentation and Legal aspects of Digital Forensics: Authorization to collect the evidence, Acquisition of Evidence, Authentication of the evidence, Analysis of the evidence, Reporting on the findings, Testimony Introduction to Legal aspects of Digital Forensics: Laws & regulations, Information Technology Act, Giving Evidence in court, Case Study – Cyber Crime cases, Case Study – Cyber Crime cases   | <b>15</b>                |
|                 |  |                          |

### **Suggested Readings**

1. Guide to computer forensics and investigations, Bill Nelson, Amelia Philips and Christopher Steuart, course technology,5th Edition,2015
2. Incident Response and computer forensics, Kevin Mandia, Chris Prorise, Tata McGrawHill,2nd Edition,2003



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|   |  |   |               |  |  |
|---|--|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>   |  |   |               | <b>Semester: VI</b>                                    |  |
| <b>Course: Information Retrieval</b>  |  |   |               | <b>Course Code: USMACS603</b>                          |  |
| <b>Teaching Scheme</b>  |  |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>  | <b>Practical<br/>(Lectures<br/>per week)</b>   | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3   | 3  | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b><br>To provide an overview of the important issues in classical and web information retrieval. The focus is to give an up-to-date treatment of all aspects of the design and implementation of systems for gathering, indexing, and searching documents and of methods for evaluating systems. |  |   |               |  |  |
| <b>Course Outcomes:</b><br>After completion of the course, learners would be able to:<br><b>CO1:</b> The learner should get an understanding of the field of information retrieval and its relationship to search engines.<br><b>CO2:</b> It will give the learner an understanding to apply information retrieval models |  |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>  |  |   |               |  |  |
| <b>Module</b>   | <b>Description</b>   |   |               |  | <b>No of<br/>Lectures</b>  |
| 1   | Introduction to Information Retrieval  |   |               |  | 15   |
| 2   | Link Analysis and Specialized Search   |   |               |  | 15   |
| 3   | Web Search Engine, XML retrieval   |   |               |  | 15   |
|   | <b>Total</b>   |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>   |  |   |               |  |  |
| 1   | Write a program to demonstrate bitwise operation.  |   |               |  | 3  |
| 2   | Implement Page Rank Algorithm.   |   |               |  | 3  |
| 3   | Implement Dynamic programming algorithm for computing the edit distance between strings s1 and s2. (Hint. Levenshtein Distance)  |   |               |  | 3  |
| 4   | Write a program to Compute Similarity between two text documents.  |   |               |  | 3  |
| 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). |   |               |  | 3  |
| 6   | Implement a basic IR system using Lucene.  |   |               |  | 3  |
| 7   | Write a program for Pre-processing of a Text Document: stop word removal.  |   |               |  | 3  |
| 8   | Write a program for mining Twitter to identify tweets for a specific period and identify trends and named entities.  |   |               |  | 3  |
| 9   | Write a program to implement simple web crawler.   |   |               |  | 3  |
| 10  | Write a program to parse XML text, generate Web graph and compute topic  |   |               |  | 3  |

|  |                    |  |
|--|--------------------|--|
|  | specific page rank |  |
|--|--------------------|--|

| Unit            | Topic   | No. of Lectures /Credits |
|-----------------|---|--------------------------|
| <b>Module 1</b> | Introduction to Information Retrieval: Introduction, History of IR, Components of IR, and Issues related to IR, Boolean retrieval, Dictionaries and tolerant retrieval.   | <b>15</b>                |
| <b>Module 2</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>15</b>                |
| <b>Module 3</b> | Web Search Engine: Web search overview, web structure, the user, paid placement, search engine optimization/spam, Web size measurement, search engine optimization/spam, Web Search Architectures. 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. | <b>15</b>                |

### **Suggested Readings**

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, 2nd Edition, ACM Press Books 2011.
3. Search Engines: Information Retrieval in Practice, Bruce Croft, Donald Metzler and Trevor Strohman, 1 st Edition, Pearson, 2009.
4. Information Retrieval Implementing and Evaluating Search Engines, Stefan Büttcher,
5. Charles L. A. Clarke and Gordon V. Cormack, The MIT Press; Reprint edition (February 12, 2016)



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|---|--|---|---------------|--|--|
| <b>Program: Bachelor of Science</b>   |  |   |               | <b>Semester: VI</b>                                    |  |
| <b>Course: Deep Learning Applications</b>   |  |   |               | <b>Course Code: USMACS604</b>                          |  |
| <b>Teaching Scheme</b>  |  |   |               | <b>Evaluation Scheme</b>                               |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b>  | <b>Practical<br/>(Lectures<br/>per week)</b>   | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b> | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3   | 3  | -   | 3 + 1         | 25   | 75   |
| <b>Learning Objectives:</b><br>Understanding basic deep learning concepts. Learning to detect and diagnose common data issues, such as <u>missing values, special values, outliers, inconsistencies, and localization</u> . Making aware of how to address <u>advanced statistical situations, Modeling and Machine Learning</u> .                                      |  |   |               |  |  |
| <b>Course Outcomes:</b><br>After completion of the course, learners would be able to:<br><b>CO1:</b> <u>Understand the fundamentals concepts of Artificial Intelligence, Machine Learning and Deep Learning</u><br><b>CO2:</b> <u>Apply machine learning and deep learning concepts to train pre-trained models for solving current machine learning based problems</u> |  |   |               |  |  |
| <b>Outline of Syllabus: (per session plan)</b>  |  |   |               |  |  |
| <b>Module</b>   | <b>Description</b>   |   |               |  | <b>No of<br/>Lectures</b>  |
| <b>1</b>  | Introduction to data, R-studio, statistics on data and regression  |   |               |  | 15   |
| <b>2</b>  | Types of machine learning algorithms, Introduction to classification, Non-parametric approaches                                |   |               |  | 15   |
| <b>3</b>  | Non-linear methods, Clustering, Introduction to Deep Learning, Practical aspects of training a Deep Learning model, Case study |   |               |  | 15   |
|   | <b>Total</b>   |   |               |  | <b>45</b>  |
| <b>PRACTICALS</b>   |  |   |               |  |  |
| <b>1</b>  | Study of Statistical concepts and Python packages  |   |               |  | <b>9</b>   |
| <b>2</b>  | To find Correlation Coefficient from scratch and using Python Packages   |   |               |  | <b>3</b>   |
| <b>3</b>  | Linear Regression from Scratch   |   |               |  | <b>3</b>   |
| <b>4</b>  | Regression Models using Python Libraries   |   |               |  | <b>6</b>   |
| <b>5</b>  | Logistic Regression using Python Libraries   |   |               |  | <b>3</b>   |
| <b>6</b>  | K-Nearest Neighbour using Python Libraries   |   |               |  | <b>3</b>   |
| <b>7</b>  | Study of Overfitting and Underfitting  |   |               |  | <b>3</b>   |
| <b>8</b>  | Decision Tree  |   |               |  | <b>6</b>   |
| <b>9</b>  | K-Means Clustering   |   |               |  | <b>3</b>   |
| <b>10</b>   | Demonstration of Neural Networks   |   |               |  | <b>6</b>   |



**SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben  
Jivanlal College of Commerce & Economics (AUTONOMOUS)**

| <b>Unit</b>     | <b>Topic</b>  | <b>No. of Lectures /Credits</b> |
|-----------------|---|---------------------------------|
| <b>Module 1</b> | <p>Introduction to data: data, data frames, data standardization, dealing with noise and missing values, transforming and normalizing data;<br/>Introduction to R Studio, practical examples of data import, data checking, extreme values, data normalization etc.<br/>Introduction to statistics on data: Common statistics, utility of statistics, hypothesis and their testing; practical examples using R Studio<br/>Introduction to regression: Linear regression, polynomial regression, multi-variate regression, introduction to exact pseudoinverse and its problems, Gradient descent, logistic regression.</p>  | <b>15</b>                       |
| <b>Module 2</b> | <p>Introduction to Artificial Intelligence and machine learning<br/>Types of machine learning algorithms: supervised and unsupervised, training models, accuracy measures<br/>Best practices in machine learning: Parameters vs. hyperparameters vs. model choice, training vs. validation vs. testing, practice examples of over-fitting, under-fitting.<br/>Introduction to classification: binary classification, t-test, threshold for classification, type I and type II errors, confusion matrix and error metrics, AU-ROC, linear classifiers.<br/>Non-parametric approaches: nearest neighbour classification, linear and non-linear interpolation for regression.</p>                        | <b>15</b>                       |
| <b>Module 3</b> | <p>Non-linear methods: Decision and regression trees, random forests, neural networks, model complexity, and training time.<br/>Clustering: goals, k-means, goodness of a clustering solution.<br/>Introduction to ANN models, forward propagation, tuning of weights and biases<br/>Introduction to Deep Learning: Data types useful for deep learning, problems that can be solved using DL, basic structure of deep neural networks models<br/>Practical aspects of training a Deep Learning model: hyperparameter tuning, stride size, batch normalization and dropout, vanishing/exploding gradients, regularization, activation functions<br/>Case study: Branch/Area Specific applications</p> | <b>15</b>                       |

**Suggested Readings**

1. Adam Gibson, Josh Patterson, Deep Learning, O'Reilly Media, Inc.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press
3. Duda, R.O., Hart, P.E., and Stork, D.G., Pattern Classification, Wiley.
4. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence 3



5. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press.
6. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning, Springer
7. Koller, D. and Friedman, N. Probabilistic Graphical Models. MIT Press
8. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer

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Jivanlal College of Commerce & Economics (AUTONOMOUS)**

|  |  |   |                          |  |  |
|--|--|---|--------------------------|--|--|
| <b>Program: Bachelor of Science</b>        |  |   |                          | <b>Semester: VI</b>                                    |  |
| <b>Course: Ethical Hacking</b>             |  |   |                          | <b>Course Code: USMACS605</b>                          |  |
| <b>Teaching Scheme</b>                     |  |   | <b>Evaluation Scheme</b> |  |  |
| <b>Lecture<br/>(Lectures<br/>per week)</b> | <b>Practical<br/>(Lectures<br/>per week)</b> | <b>Tutorial<br/>(Lectures<br/>per week)</b> | <b>Credit</b>            | <b>Continuous<br/>Assessment (CA)<br/>(Marks - 25)</b> | <b>Semester End<br/>Examinations (SEE)<br/>(Marks- 75<br/>in Question Paper)</b> |
| 3  | 3  | -   | 2 + 1                    | 25   | 75   |

**Learning Objectives:**

To understand the ethics, legality, methodologies and techniques of hacking.

**Course Outcomes:**

After completion of the course, learners would be able to:

**CO1:** The learner will know to identify security vulnerabilities and weaknesses in the target applications.

**CO2:** The learner will also know to test and exploit systems using various tools and understand the impact of hacking in real time machines.

**Outline of Syllabus: (per session plan)**

| Module | Description   | No of Lectures |
|--------|---|----------------|
| 1      | Information Security, Types of malware, Types of attacks and their common prevention mechanisms, Case-studies       | 15             |
| 2      | Ethical Hacking: Introduction and pre-attack, Approach, Enterprise strategy   | 15             |
| 3      | Ethical Hacking: Enterprise Security Phases, Applications hacking, Malware analysis, Additional Security Mechanisms | 15             |
|        | <b>Total</b>  | <b>45</b>      |

**PRACTICALS**

|   |   |   |
|---|---|---|
| 1 | Use Google and Whois for Reconnaissance   | 3 |
| 2 | a) Use CrypTool to encrypt and decrypt passwords using RC4 algorithm<br>b) Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords | 3 |
| 3 | a) Run and analyze the output of following commands in Linux – ifconfig, ping, netstat, traceroute<br>b) Perform ARP Poisoning in Windows   | 3 |
| 4 | Use NMap scanner to perform port scanning of various forms – ACK, SYN, FIN, NULL, XMAS  | 3 |
| 5 | a) Use Wireshark (Sniffer) to capture network traffic and analyze<br>b) Use Nemesy to launch DoS attack   | 3 |
| 6 | Simulate persistent cross-site scripting attack   | 3 |
| 7 | Session impersonation using Firefox and Tamper Data add-on  | 3 |
| 8 | Perform SQL injection attack  | 3 |
| 9 | Create a simple keylogger using python  | 3 |



|           |  |   |
|-----------|--|---|
| <b>10</b> | Using Metasploit to exploit (Kali Linux) | 3 |
|-----------|--|---|

| <b>Unit</b>     | <b>Topic</b>  | <b>No. of Lectures /Credits</b> |
|-----------------|---|---------------------------------|
| <b>Module 1</b> | <p>Information Security: Attacks and Vulnerabilities, Introduction to information security: Asset, Access Control, CIA, Authentication, Authorization, Risk, Threat, Vulnerability, Attack, Attack Surface, Malware, Security-Functionality-Ease of Use Triangle</p> <p>Types of malware: Worms, viruses, Trojans, Spyware, Rootkits</p> <p>Types of vulnerabilities: 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>Types of attacks and their common prevention mechanisms: 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 poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs and BOTNETs</p> <p>Case-studies: Recent attacks – Yahoo, Adult Friend Finder, eBay, Equifax, WannaCry, Target Stores, Uber, JP Morgan Chase, Bad Rabbit</p> | <b>15</b>                       |
| <b>Module 2</b> | <p>Ethical Hacking – I (Introduction and pre-attack)</p> <p>Introduction: 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.</p> <p>Approach: Planning - 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</p> <p>Enterprise strategy: Repeated PT, approval by security testing team, Continuous Application Security Testing, Phases: Reconnaissance/foot-printing/Enumeration, Phases: Scanning, Sniffing</p>  | <b>15</b>                       |
| <b>Module 3</b> | <p>Ethical Hacking:Enterprise Security</p> <p>Phases: Gaining and Maintaining Access: Systems hacking – Windows and Linux – Metasploit and Kali Linux, Keylogging, Buffer Overflows, Privilege Escalation, Network hacking - ARP Poisoning, Password</p>  | <b>15</b>                       |

|  |  |  |
|--|--|--|
|  | Cracking, WEP Vulnerabilities, MAC Spoofing, MAC Flooding, IPspoofing, SYN Flooding, Smurf attack, Applications hacking: SMTP/Email-based attacks, VOIP vulnerabilities, Directory traversal, Input Manipulation, Brute force attack, Unsecured login mechanisms, SQL injection, XSS, Mobile apps security, Malware analysis: Netcat Trojan, wrapping definition, reverse engineering Phases: Covering your tracks: Steganography, Event Logs alteration Additional Security Mechanisms: IDS/IPS, Honeypots and evasion techniques, Secure Code Reviews (Fortify tool, OWASP Secure Coding Guidelines) |  |
|  |  |  |

### **Suggested Readings**

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
3. Certified Ethical Hacker: Michael Gregg, Pearson Education, 1st Edition, 2013
4. Certified Ethical Hacker: Matt Walker, TMH, 2011
5. [http://www.pentest-standard.org/index.php/PTES\\_Technical\\_Guidelines](http://www.pentest-standard.org/index.php/PTES_Technical_Guidelines)
6. [https://www.owasp.org/index.php/Category:OWASP\\_Top\\_Ten\\_2017\\_Project](https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project)
7. [https://www.owasp.org/index.php/Mobile\\_Top\\_10\\_2016-Top\\_10](https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10)
8. [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)
9. [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)
10. <https://cve.mitre.org/>
11. <https://access.redhat.com/blogs/766093/posts/2914051>
12. <http://resources.infosecinstitute.com/applications-threat-modeling/#gref>
13. <http://www.vulnerabilityassessment.co.uk/Penetration%20Test.html>



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|   |                             |  |                          |  |  |
|---|-----------------------------|--|--------------------------|--|--|
| <b>Program: Bachelor of Science</b>         |                             |  |                          | <b>Semester: VI</b>  |  |
| <b>Course: Project Implementation</b>       |                             |  |                          | <b>Course Code: USMACSP603</b>   |  |
| <b>Teaching Scheme</b>                      |                             |  | <b>Evaluation Scheme</b> |  |  |
| <b>Lecture<br/>(Hours<br/>per<br/>week)</b> | <b>Practical<br/>/ week</b> | <b>Tutorial<br/>(Hours per<br/>week)</b> | <b>Credit</b>            | <b>Continuous<br/>Assessment and<br/>Evaluation (CAE)<br/>(Marks - )</b> | <b>Term End<br/>Examinations (TEE)<br/>(Marks- 50<br/>in Project Viva)</b> |
| --  | 3                           | -  | 1                        | NA   |  |

**Guidelines for Project Phase-II Implementation in Semester – VI**

| <b>Unit</b> | <b>Description</b>  |
|-------------|---|
| 1           | A student is expected to devote at least 3 months (45 Hours) of efforts for the implementation.                 |
| 2           | Student should submit project implementation proposed in Semester V Project Phase-I report at the time of viva. |

**Guidelines for Documentation of Project Proposal in Semester –V**

A Student should submit project implementation report with following details:

|    |  |
|----|--|
| 1. | Title: Title of the project  |
| 2. | Project Phase-I Implementation Report which was evaluated in Semester – V  |
| 3. | Experimental set up and results: A detailed explanation on how experiments were conducted, what software used and the results obtained. Details like screen shots, tables and graphs can come here. It shall be of 10 to 15 pages.   |
| 4. | Analysis of the results: A description on what the results means and how they have been arrived at. Different performing measures or statistical tools used etc. may be part of this. It shall be of 4 to 6 pages.   |
| 5. | Conclusion: A conclusion of the project performed in terms of its outcome (May be half a page).  |
| 6. | Future enhancement: A small description on what enhancement can be done when more time and resources are available (May be half a page).   |
| 7. | Program code: The program code should be given as appendix.  |
| 8. | The report may be of around 30 pages (excluding program code), which needs to be signed by the teacher in charge and head of the Department. Student should submit the signed project implementation report along with evaluated copy of the project proposal documentation (of semester –V) at the time of Project evaluation and viva as part of the Term End examination. |