# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

**(AUTONOMOUS)**
**Accredited by NAAC & NBA (Under Tier - I), ISO 21001:2018 Certified Institution**
**Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada**
**L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.**
http://lbrce.ac.in/it/index.php, hodit@lbrce.ac.in , Phone: 08659-222933, Fax: 08659-222931

## DEPARTMENT OF INFORMATION TECHNOLOGY


## COURSE HANDOUT

### PART-A

**Name of Course Instructor** : Dr.S.Naganjaneyulu
**Course Name & Code** : INFORMATION SECURITY (20CS17)
**L-T-P Structure** : 3-0-0 Credits : 3
**Program/Sem/Sec** : B.Tech., IT, VI-Sem., Section – A A. Y : 2024 - 2025
**PRE-REQUISITE** : Computer Networks, Number theory and programming language

### COURSE EDUCATIONAL OBJECTIVES (CEOs):

The Objective of the course is to course elevates the security aspects and provides the knowledge to understand the basic concept of Cryptography and Network Security principles. It antilight 's different types of cipher mechanisms and various symmetric and asymmetric algorithms. Also provides the knowledge on digital signatures, different threats, viruses, intruders, and firewalls.

**COURSE OUTCOMES (COs):** At the end of this course, the student will be able to

| | |
|---|---|
| **CO1** | Summarize encryption algorithms to achieve data confidentiality. **(Understand-L2)** |
| **CO2** | Apply Secure hash functions for attaining data integrity. **(Apply-L3)** |
| **CO3** | Illustrate the email security mechanisms to achieve authentication. **(Understand- L2)** |
| **CO4** | Demonstrate the techniques of web security. **(Understand-L2)** |
| **CO5** | Examine the threats and remedial measures for system security. **(Apply-L3)** |

**COURSE ARTICULATION MATRIX** (Correlation between COs, POs & PSOs):

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO3** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO4** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO5** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |

**Note:** Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

**1-** Low **2 –**Medium **3** High

**TEXTBOOKS:**

**T1** William Stallings, "Network Security Essentials (Applications and Standards)", Pearson
**T2** Education, 1999.
*William Stallings, "Cryptography and Network Security", PHI/Pearson, fourth edition, 2000.*

**REFERENCE BOOKS:**

**R1** Whitman, "Principles of Information Security", Thomson, PHI, 2000.
**R2** Robert Bragg, Mark Rhodes, Network Security: The complete reference, TMH
**R3** Buchmann, Introduction to Cryptography, Springer,2010.
**R4** Jeetendra pande, Ajay, "Digital Foresnsics', ISBN: 978-93-84813-94-9.

## PART-B

**COURSE DELIVERY PLAN (LESSON PLAN):**

**UNIT-I: INTRODUCTION**

| S.No | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 1. | Introduction to IS, | 1 | 2/12/24 | | | |
| 2. | Security Attacks | 1 | 3/12/24 | | | |
| 3. | Security Services, Mechanisms | 1 | 4/12/24 | | | |
| 4. | Integrity, Authentication Confidentiality & &Non-Repudiation | 1 | 6/12/24 | | | |
| 5. | Substitution Techniques, | 1 | 09/12/24 | | | |
| 6. | Transposition Techniques | 1 | 10/12/24 | | | |
| 7. | Block Cipher, Block Cipher | 1 | 11/12/24 | | | |
| 8. | Fiestal Structure | 1 | 13/12/24 | | | |
| 9. | DES, Triple DES Algorithm | 1 | 16/12/24 | | | |
| 10. | AES Algorithm | 1 | 17/12/24 | | | |
| 11. | Cipher Block Modes of Operations | 1 | 18/12/24 | | | |
| 12. | Placement of encryption | 1 | 20/12/24 | | | |
| 13. | Traffic Analysis | 1 | 23/12/24 | | | |
| 14. | Key Distribution | 1 | 27/12/24 | | | |
| 15. | Assignment-1 | 1 | 30/12/24 | | | |
| No. of classes required to complete UNIT-I | | 15 | | | | |

## UNIT-II: PUBLIC -KEY CRYPTOGRAPHY

| S.No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 16. | Approaches of Message Authentication, | 1 | 31/12/24 | | | |
| 17. | Hash & MAC functions | 1 | 03/01/25 | | | |
| 18. | HMAC Algorithm | 1 | 06/01/25 | | | |
| 19. | Public-Key Encryption Algorithm- RSA | 1 | 07/01/25 | | | |
| 20. | Diffie –Hellman Key Exchange Algorithm | 1 | 08/01/25 | | | |
| 21. | SHA-512 | 1 | 10/01/25 | | | |
| 22. | Digital Signatures | 1 | 17/01/25 | | | |
| 23. | Public Key Infrastructure, Digital Certificates | 1 | 20/01/25 | | | |
| 24. | Certificate Authority, Key Management | 1 | 21/01/25 | | | |
| 25. | Kerberos, X.509 Directory Authentication Service | 1 | 22/01/25 | | | |
| 26. | Assignment-2 | 1 | 24/01/25 | | | |
| sNo. of classes required to complete UNIT-II | | 10 | | No. of classes taken: | | |

## UNIT-III: EMAIL PRIVACY

| S.No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 27. | Email privacy, Pretty Good Privacy (PGP) | 1 | 27/01/25 | | | |
| 28. | PGP Key Management | 1 | 28/01/25 | | | |
| 29. | MIME and S/ MIME | 1 | 29/01/25 | | | |
| 30. | IP Security Overview, IP Security Architecture, | 1 | 31/01/25 | | | |
| 31. | Authentication Header Encapsulating Security Payload, | 1 | 10/02/25 | | | |
| 32. | Tunnel and Transport Modes | 1 | 11/02/25 | | | |
| 33. | Combining Security Associations, Key Exchange | 1 | 12/02/25 | | | |
| 34. | Cryptographic Suites | 1 | 14/02/25 | | | |
| 35. | Unit Overview and Discussion | 1 | 17/02/25 | | | |
| 36. | Assignment - 3 | 1 | 18/02/25 | | | |
| No. of classes required to complete UNIT-III | | 10 | | No. of classes taken: | | |

## UNIT-IV: WEB SECURITY

| S.No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 37. | Web Security Requirements | 1 | 19/02/25 | | | |
| 38. | Secure Socket Layer (SSL)Architecture, | 1 | 24/02/25 | | | |
| 39. | SSL Handshake Protocol | 1 | 25/02/25 | | | |
| 40. | Transport Layer Security | 1 | 28/03/25 | | | |
| 41. | Secure Electronic Transaction (SET) | 1 | 03/03/25 | | | |
| 42. | Payment Processing | 1 | 04/03/25 | | | |
| 43. | HTTPs. HTTP vs HTTPs | 1 | 05/03/25 | | | |
| 44. | Unit Overview and Discussion | 1 | 07/03/25 | | | |
| No. of classes required to complete UNIT-IV | | 08 | | No. of classes taken: | | |

## UNIT-V: INTRUDERS

| S.No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 45. | Intruder Behavior Patterns | 1 | 12/03/25 | | | |
| 46. | Intrusion Techniques | 1 | 17/03/25 | | | |
| 47. | Honeypot | 1 | 18/03/25 | | | |
| 48. | Malicious Software | 1 | 19/03/25 | | | |
| 49. | Viruses and Related Threats | 1 | 21/03/25 | | | |
| 50. | DDOoS | 1 | 24/03/25 | | | |
| 51. | Firewall Design principles | 1 | 25/03/25 | | | |
| 52. | Trust Management System | 1 | 26/03/25 | | | |
| 53. | Introduction to Digital forensics | 1 | 28/03/25 | | | |
| 54. | 4&5 Overview and Discussion | 1 | 01/04/25 | | | |
| 55. | Unit 1,2,3, Overview and Discussion | 1 | 02/04/25 | | | |
| No. of classes required to complete UNIT-V | | 11 | | No. of classes taken: | | |

| Teaching Learning Methods | | | |
|---|---|---|---|
| **TLM1** | Chalk and Talk | **TLM4** | Demonstration (Lab/Field Visit) |
| **TLM2** | PPT | **TLM5** | ICT (NPTEL/Swayam Prabha/MOOCS) |
| **TLM3** | Tutorial | **TLM6** | Group Discussion/Project |

## PART C

**EVALUATION PROCESS (R17 Regulations):**

| Evaluation Task | Marks |
|---|---|
| **Assignment– 1 (Units I,II&III(Half of the Syllabus))** | **A1=5** |
| **I-Descriptive Examination (Units I, II&III (Half of the Syllabus))** | **M1=15** |
| **I-Quiz Examination (Units I, II&III (Half of the Syllabus))** | **Q1=10** |
| **Assignment– 2 (Units III (remaining Half of the Syllabus),IV&V))** | **A2=5** |
| **II- Descriptive Examination (Units III (remaining Half of the Syllabus), IV&V))** | **M2=15** |
| **II-Quiz Examination (Units III (remaining Half of the Syllabus), IV&V))** | **Q2=10** |
| **Mid Marks=80% of Max((M1+A1+Q1),(M2+A2+Q2))+ 20% of Min((M1+A1+Q1),(M2+A2+Q2))** | **M=30** |
| **Cumulative Internal Examination (CIE): M** | **30** |
| **Semester End Examination (SEE):** | **70** |
| **Total Marks=CIE+SEE** | **100** |

# PART-D

**PROGRAMME OUTCOMES (POs):**

| | |
|---|---|
| **PO 1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO 2** | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO 4** | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO 5** | **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO 6** | **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO 7** | **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development |
| **PO 8** | **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO 9** | **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO 10** | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO 11** | **Project management and finance**: Demonstrate knowledge and understanding of the engineering **and management principles and apply these to one's own work, as a member and** leader in a team, to manage projects and in multidisciplinary environments |
| **PO 12** | **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**PROGRAMME SPECIFIC OUTCOMES (PSOs):**

| | |
|---|---|
| **PSO 1** | Organize, Analyze and Interpret the data to extract meaningful conclusions. |
| **PSO 2** | Design, Implement and Evaluate a computer-based system to meet desired needs. |
| **PSO 3** | Develop IT application services with the help of different current engineering tools. |

| | **Course Instructor** | **Course Coordinator** | **Module Coordinator** | **Head of the Department** |
|---|---|---|---|---|
| **Name of the Faculty** | Dr S Naganjaneyulu | | | Dr. B.Srinivasa Rao |
| **Signature** | | | | |

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## DEPARTMENT OF INFORMATION TECHNOLOGY


## COURSE HANDOUT

**PROGRAM** : B.Tech. VI-Sem., IT A Sec

**ACADEMIC YEAR** : 2024-25

**COURSE NAME & CODE** : **INFORMATION SECURITY LAB & 20CS61**

**L-T-P STRUCTURE** : 0-0-3 **COURSE CREDITS** : 1.5

**COURSE INSTRUCTOR** : **Dr.S.Naganjaneyulu**

**Pre-requisites:** : Computer Programming, Mathematics, Computer Networks.

**Course Educational Objectives (CEOs):**

The Objective of the course is to provide practical level training that enables the usage of security algorithms for handling security projects. It also provides foundation level training for network analysis to find out the intruders in a network traffic.

**Course Outcomes (COs):** At the end of this course, the student will be able to:

CO 1 Demonstrate the security concepts, type of attacks and network security algorithms. (Understand - L2)

CO 2 Apply symmetric and asymmetric cryptography technique to encrypt and decrypt text. (Apply - L3

CO 3 Apply network-based tools for network analysis.( Apply - L3)

CO 4 Improve individual / teamwork skills, communication & report writing skills with ethical values.

### 1. Course Articulation Matrix:

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | 2 | 1 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 | - |
| CO4 | - | - | - | - | - | - | - | 2 | 1 | - | - | - | - | 2 | - |

**Note:** Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
**1-** Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High).

**TEXTBOOKS:**

**T1** William Stallings, "Network Security Essentials (Applications and Standards)", Pearson Education, 1999.

**T2** Snort 2.1 Intrusion Detection by Jay Beale, Andrew R.Baker , Second Editio

**REFERENCE BOOK(S):**

1.William Stallings, "Cryptography and Network security", Pearson Education, Fourth Edition.Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language UserGuide", Pearson Education, 2nd Edition, ISBN: 0- 201-57168-4, 1998.

2. https://www.snort.org/documents/snort-3-1-0-0-on-ubuntu-18-202007.

3. https://www.wireshark.org/download/docs/user-guide.pdf

## PART-B

**COURSE DELIVERY PLAN (LESSON PLAN):**

| S.No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 1. | Lab Cycle-1 | 3<br>3 | 5/12/24<br>12/12/24 | | **DM5** | |
| 2. | Lab Cycle -2 | 3<br>3 | 19/12/24<br>26/12/24 | | **DM5** | |
| 3. | Lab Cycle-3 | 3<br>3 | 02/01/25<br>09/01/25 | | **DM5** | |
| 4. | Lab Cycle-4 | 3 | 23/01/25 | | **DM5** | |
| 5. | Lab Cycle-5 | 3 | 30/01/25 | | **DM5** | |
| 6. | Lab Cycle-6 | 3 | 13/02/25 | | **DM5** | |
| 7. | Lab Cycle-7 | 3 | 20/02/25 | | **DM5** | |
| 8. | Lab Cycle-8 | 3 | 27/02/25 | | **DM5** | |
| 9. | Lab Cycle-9 | 3 | 06/03/25 | | **DM5** | |

| **Teaching Learning Methods** | | | |
|---|---|---|---|
| **DM1** | Chalk and Talk | **DM4** | Assignment/Test/Quiz |
| **DM2** | ICT Tools | **DM5** | Laboratory/Field Visit |
| **DM3** | Tutorial | **DM6** | Web-based Learning |

# PART-D

**PROGRAMME OUTCOMES (POs):**

| | |
|---|---|
| **PO 1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO 2** | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO 4** | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO 5** | **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
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| **PO 10** | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO 11** | **Project management and finance**: Demonstrate knowledge and understanding of the engineer**ing and management principles and apply these to one's own work, as a member and** leader in a team, to manage projects and in multidisciplinary environments |
| **PO 12** | **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**PROGRAMME SPECIFIC OUTCOMES (PSOs):**

| | |
|---|---|
| **PSO 1** | Organize, Analyze and Interpret the data to extract meaningful conclusions. |
| **PSO 2** | Design, Implement and Evaluate a computer-based system to meet desired needs. |
| **PSO 3** | Develop IT application services with the help of different current engineering tools. |

| | **Course Instructor** | **Course Coordinator** | **Module Coordinator** | **Head of the Department** |
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| **Name of the Faculty** | Dr S Naganjaneyulu | | | Dr. B.Srinivasa Rao |
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**DEPARTMENT OF INFORMATION TECHNOLOGY**


## COURSE HANDOUT

## PART-A

**Name of Course Instructor Dr D Ratna Kishor**
**Course Name & Code** **:** Compiler Design, 20CS18
**L-T-P Structure** **: 3-0-0** **Credits:** 03
**Program/Sem/Sec** : B.Tech-IT / VI SEM / B
**A.Y.** **:** 2024-25

**PRE-REQUISITE:** Programming language, and Automata theory and formal languages

**COURSE EDUCATIONAL OBJECTIVES (CEOs):** The objective of the course is to understand and list the different stages in the process of compilation, identify different methods of lexical analysis, design top-down and bottom-up parsers, develop syntax directed translation schemes, and develop algorithms to generate code for a target machine..

**COURSE OUTCOMES (COs):** At the end of the course, students will be able to

| | |
|---|---|
| **CO1** | Design the lexical analyzer using LEX tool. (Apply- L3) |
| **CO2** | Design a parser using top-down and bottom-up parser design methods. (Apply- L3) |
| **CO3** | Construct syntax-directed translator for semantic checking and intermediate code generation Using YACC tool (Apply –L3) |
| **CO4** | Demonstrate the machine dependent and machine independent code optimization techniques. (Understand-L2) |
| **CO5** | Understand the design issues of the code generator and run-time environment of the program. (Understand-L2) |

**COURSE ARTICULATION MATRIX** (Correlation between COs, POs & PSOs):

| CO | Program Outcomes (POs) | | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 2 | | | | | | | | | | | 2 | 1 | |
| CO2 | 3 | 2 | | | | | | | | | | | | 1 | |
| CO3 | 3 | 2 | | | | | | | | | | | | 2 | 3 |
| CO4 | 3 | 2 | | | | | | | | | | | 2 | 2 | 2 |
| CO5 | 1 | 2 | | | | | | | | | | | | 2 | 2 |

**Note:** Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
**1-** Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

**TEXTBOOKS:**

1. Alfred V.Aho, Jeffrey Ullman, Ravi sethi, “Compilers Principles, Techniques and Tools”, Pearson Education, 2nd Edition, 2008.

**REFERENCE BOOKS:**

1. ParagH.Dave, HimanshuB.Dave ,“Compilers Principles and Practice” , Person Education, First Edition, 2012.

2. Andrew W.appel ,“Modern compiler implementation in C” ,Cambridge, Revised Edition, 2010.
3. http://nptel.ac.in/courses/106108052/(Video lectures for Compiler design)

**COURSE DELIVERY PLAN (LESSON PLAN):**

**UNIT-I: Introduction to Compiler &v Lexical Analysis**

| S.No | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | Learning Outcomes | HOD Sign Weekly |
|---|---|---|---|---|---|---|---|
| 1. | Language Processing System | 1 | 03/12/24 | | **TLM1** | CO1 | |
| 2. | Compiler Vs Interpreter | 1 | 04/12/23 | | **TLM1** | CO1 | |
| 3. | The Phases of Compiler | 1 | 06/12/24 | | **TLM1** | CO1 | |
| 4. | The Phases of Compiler | 1 | 07/12/24 | | **TLM1** | CO1 | |
| 5. | Compiler Construction Tools | 1 | 10/12/24 | | **TLM1** | CO1 | |
| 6. | Boot Strapping Concept | 1 | 11/12/23 | | **TLM2** | CO1 | |
| 7. | The Role of Lexical Analyzer | 1 | 13/12/24 | | **TLM2** | CO1 | |
| 8. | Input Buffering | 1 | 14/12/24 | | **TLM2** | CO1 | |
| 9. | Input Buffering | 1 | 17/12/24 | | **TLM2** | CO1 | |
| 10. | Specification of Tokens | 1 | 18/12/24 | | **TLM2** | CO1 | |
| 11. | Recognition of Tokens | 1 | 20/12/24 | | **TLM1** | CO1 | |
| 12. | LEX Tools | 1 | 21/12/24 | | **TLM1** | CO1 | |
| 13. | Examples on LEX Tool | 1 | 24/12/24 | | **TLM1** | CO1 | |
| No. of classes required to complete UNIT-I | | 13 | No. of classes taken: | | | | |

**UNIT-II: Syntax Analyzer & TOP down Parsing**

| S.No | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | Learning Outcomes | HOD Sign Weekly |
|---|---|---|---|---|---|---|---|
| 1. | The Role of parser | 1 | 27/12/24 | | **TLM1** | CO2 | |
| 2. | Writing a Grammar | 1 | 28/12/24 | | **TLM1** | CO2 | |
| 3. | Elimination of left recursion | 1 | 31/12/24 | | **TLM2** | CO2 | |
| 4. | Left factoring | 1 | 01/1/25 | | **TLM1** | CO2 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5. | Recursive decent parsing | 1 | 03/1/25 | | **TLM1** | CO2 | |
| 6. | Predictive Parsing | 1 | 04/1/25 | | **TLM1** | CO2 | |
| 7. | Pre-processing steps required for predictive parsing | 1 | 07/1/25 | | **TLM2** | CO2 | |
| 8. | LL(1) Grammar | 1 | 08/1/25 | | **TLM1** | CO2 | |
| 9. | Examples on LL(1) Parser | 1 | 10/1/25 | | **TLM1** | CO2 | |
| 10. | Error recovery in predictive parsing temple | 1 | 11/1/25 | | **TLM1** | CO2 | |
| 11. | Backtracking | 1 | 17/1/25 | | **TLM1** | CO2 | |
| No. of classes required to complete UNIT-2 | | 11 | No. of classes taken: | | | | |

**UNIT – III: Bottom-Up parsing**

| S.No | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | Learning Outcomes | HOD Sign Weekly |
|---|---|---|---|---|---|---|---|
| 1. | Handle pruning | 1 | 18/1/25 | | **TLM1** | CO3 | |
| 2. | Shift reduce Parsing | 1 | 21/1/25 | | **TLM1** | CO3 | |
| 3. | Operator precedence Parsing | 1 | 22/1/25 | | **TLM1** | CO3 | |
| 4. | SLR parser | 1 | 24/1/25 | | **TLM1** | CO3 | |
| 5. | Examples on SLR parser | 1 | 25/1/25 | | **TLM2** | CO3 | |
| 6. | CLR parser | 1 | 28/1/25 | | **TLM1** | CO3 | |
| 7. | Examples on CLR parser | 1 | 29/01/25 | | **TLM1** | CO3 | |
| 8. | LALR parser | 1 | 31/01/25 | | **TLM1** | CO3 | |
| 9. | Examples on LALR Parser | 1 | 1/2/25 | | **TLM2** | CO3 | |
| 10. | Handling Ambiguous Grammar | 1 | 11/2/25 | | **TLM2** | CO3 | |
| 11. | Error recovery in LR parser | 1 | 12/2/25 | | **TLM2** | CO3 | |
| 12. | YACC-Automatic parser Generator | 1 | 14/2/25 | | **TLM2** | CO3 | |
| No. of classes required to complete UNIT-3 | | 12 | No. of classes taken: | | | | |

**UNIT-IV: Syntax Directed Translation & Intermediate Code Generation**

| S.No | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | Learning Outcomes | HOD Sign Weekly |
|---|---|---|---|---|---|---|---|
| 1. | Syntax directed definitions | 1 | 15/2/25 | | **TLM1** | CO4 | |
| 2. | Evaluation order of SDD's | 1 | 18/2/25 | | **TLM1** | CO4 | |
| 3. | Application of SDD | 1 | 19/2/25 | | **TLM1** | CO4 | |
| 4. | Syntax directed Translation schemes | 1 | 21/2/25 | | **TLM1** | CO4 | |
| 5. | Syntax directed Translation schemes | 1 | 22/2/25 | | **TLM1** | CO4 | |
| 6. | Syntax Tree | 1 | 25/2/25 | | **TLM1** | CO4 | |
| 7. | Polish Notation | 1 | 26/2/25 | | **TLM1** | CO4 | |
| 8. | Three Address Code | 1 | 28/2/25 | | **TLM1** | CO4 | |
| 9. | Static single assignment | 2 | 01/3/25 | | **TLM1** | CO4 | |
| 10. | Translation of expressions and control flow statements-Boolean expressions | 2 | 04/3/25 | | **TLM1** | CO4 | |
| No. of classes required to complete UNIT-4 | | 12 | No. of classes taken: | | | | |

**UNIT-V: Code Optimization & Code Generation**

| S.No | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | Learning Outcomes | HOD Sign Weekly |
|---|---|---|---|---|---|---|---|
| 1. | Basic blocks and flow graphs | 1 | 5/03/25 & 7/03/25 | | **TLM1** | CO5 | |
| 2. | Principle Sources of optimization | 2 | 11/03/25 & 11/03/25 | | **TLM1** | CO5 | |
| 3. | Loop Optimization | 2 | 15/03/25 & 18/03/25 | | **TLM1** | CO5 | |
| 4. | Design issues & Object code forms | 1 | 19/03/25 | | **TLM1** | CO5 | |
| 5. | Optimization of Basic Blocks | 1 | 21/03/25 | | **TLM1** | CO5 | |
| 6. | DAG Representation of basic blocks | 1 | 22/03/25 | | **TLM1** | CO5 | |
| 7. | Code Generation using DAG | 1 | 25/03/25 & 26/03/25 | | **TLM1** | CO5 | |
| 8. | A simple Code Generator | 1 | 28/03/25 & 29/03/25 | | **TLM1** | CO5 | |
| 9. | Peephole Optimization | 1 | 01/04/25 02/04/25 | | **TLM1** | CO5 | |
| 10. | Register Allocation and assignment | 1 | 04/04/25 & 05/04/25 | | **TLM1** | CO5 | |

| | | |
|---|---|---|
| No. of classes required to complete UNIT-5 | 17 | No. of classes taken: |

| | | | |
|---|---|---|---|
| **TLM1** | Chalk and Talk | **TLM4** | Demonstration (Lab/Field Visit) |
| **TLM2** | PPT | **TLM5** | ICT (NPTEL/SWAYAM/MOOCS) |
| **TLM3** | Tutorial | **TLM6** | Group Discussion/Project |

**EVALUATION PROCESS:**

| **Evaluation Task** | **Marks** |
|---|---|
| Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus)) | A1=5 |
| I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus)) | M1=15 |
| I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus)) | Q1=10 |
| Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V) | A2=5 |
| II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V) | M2=15 |
| II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V) | Q2=10 |
| Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2)) | M=30 |
| Cumulative Internal Examination (CIE): M | 30 |
| Semester End Examination (SEE) | 70 |
| Total Marks = CIE + SEE | 100 |

## PART-D

**PROGRAMME OUTCOMES (POs):**

| | |
|---|---|
| **PO 1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO 2** | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO 4** | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO 5** | **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO 6** | **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO 7** | **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development |

| | |
|---|---|
| **PO 8** | **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO 9** | **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO 10** | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO 11** | **Project management and finance**: Demonstrate knowledge and understanding of the engineer**ing and management principles and apply these to one's own work, as a member and** leader in a team, to manage projects and in multidisciplinary environments |
| **PO 12** | **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**PROGRAMME SPECIFIC OUTCOMES (PSOs):**

| | |
|---|---|
| **PSO 1** | Organize, Analyze and Interpret the data to extract meaningful conclusions. |
| **PSO 2** | Design, Implement and Evaluate a computer-based system to meet desired needs. |
| **PSO 3** | Develop IT application services with the help of different current engineering tools. |

| **Title** | **Course Instructor** | **Course Coordinator** | **Module Coordinator** | **Head of the Department** |
|---|---|---|---|---|
| **Name of the Faculty** | Dr D Ratna Kishor | Dr. D Veeraiah | | Dr. B.Srinivasarao |
| **Signature** | | | | |

# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

**(AUTONOMOUS)**
**Accredited by NAAC with 'A' Grade & NBA (Under Tier - I)**
**An ISO 21001:2018,14001:2015,50001:2018 Certified**
**Institution Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada**
**L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.**
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## DEPARTMENT OF INFORMATION TECHNOLOGY


## COURSE HANDOUT

## PART-A

**Name of Course Instructor:** PAVITRA RAMACHANDRAPURAM
**Course Name & Code** : BIGDATA ANALYTICS & 20CS19
**L-T-P Structure** : **3-0-0** **Credits:** 3
**Program/Sem/Sec** : B.Tech/VI/B **A.Y.:** 2024-25

**PREREQUISITE: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.**

**COURSE EDUCATIONAL OBJECTIVES (CEOs):**

Understanding the process of distributed data (Structured, Semi-Structured and Unstructured) that process the Terabytes of data using Hadoop Eco System Tools.

**COURSE OUTCOMES (COs):** At the end of the course, student will be able to

| | |
|---|---|
| **CO1** | Identify Big Data and its Business Implications. **(Understand-L2)** |
| **CO2** | Process of distributed file system using Hadoop. **(Apply-L3)** |
| **CO3** | Illustrate the Map Reduce mechanism. **(Apply-L3)** |
| **CO4** | Develop Structured data processing tools. **(Apply-L3)** |
| **CO5** | Develop semi/ unstructured data processing tools. **(Apply– L3)** |

**COURSE ARTICULATION MATRIX** (Correlation between COs, POs & PSOs):

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - | - |
| CO2 | 2 | - | 2 | - | - | - | - | - | - | - | - | 2 | 1 | - | 2 |
| CO3 | 2 | - | 2 | - | - | - | - | - | - | - | - | 2 | 1 | - | 3 |
| CO4 | 2 | 3 | - | - | 1 | - | - | - | - | - | - | 2 | 2 | - | 3 |
| CO5 | 2 | 3 | - | - | 1 | - | - | - | - | - | - | 2 | - | - | 2 |
| **1 -** Low | | | | | | **2 –**Medium | | | | | | **3 -** High | | | |

**TEXTBOOKS:**


**T1** Tom White" Hadoop: The Definitive Guide" Third Edit, O'reilyMedia,2012.
**T2** Big Data and Analytics, 2ed Seema Acharya, Subhashini Chellappan, Wiley2015.


**REFERENCE BOOKS:**


**R1** Michael Berthold, DavidJ.Hand,"Intelligent DataAnalysis", Springer,2007.
**R2** Jay Liebowitz ,"Big Data and Business Analytics" Auerbach Publications ,CRCpress (2013).
**R3** Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop",McGraw-Hill/Osborne Media(2013),Oracle press.
**R4** AnandRajaramanandJefreyDavidUlman,"MiningofMassiveDatasets",Cambri dgeUniversityPress,2012

# PART-B

## COURSE DELIVERY PLAN (LESSON PLAN):

### UNIT-I: Introduction to Big data

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 1. | Introduction to Big data, CEOs and Cos discussion | 1 | 02-12-2024 | | TLM1 | |
| 2. | Types of Digital Data | 1 | 05-12-2024 | | TLM1 | |
| 3. | Classification of Digital Data | 1 | 06-12-2024 | | TLM1 | |
| 4. | Characteristics of Data | 1 | 07-12-2024 | | TLM2 | |
| 5. | Evolution of Big Data | 1 | 09-12-2024 | | TLM2 | |
| 6. | Definition of Big Data, Challenges with Big Data | 1 | 12-12-2024 | | TLM1 | |
| 7. | What is Big Data? Other Characteristics of Data Which are not Definitional Traits of Big Data | 1 | 13-12-2024 | | TLM1 | |
| 8. | Why Big Data? analyzing Data with Unix tools | 1 | 14-12-2024 | | TLM1 | |
| 9. | Analyzing Data with Hadoop | 1 | 16-12-2024 | | TLM1 | |
| 10. | Hadoop Streaming | 1 | 19-12-2024 | | TLM2 | |
| 11. | Hadoop Echo System | 1 | 20-12-2024 | | TLM2,6 | |
| 12 | Tutorial | 1 | 23-12-2024 | | TLM3 | |
| **No. of classes required to complete UNIT-I: 12** | | | | **No. of classes taken:** | | |

### UNIT-II: Hadoop Distributed File System

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 13. | The Design of HDFS | 1 | 26-12-2024 | | TLM1 | |
| 14. | HDFS Concepts | 1 | 27-12-2024 | | TLM1 | |
| 15. | Command Line Interface | 1 | 28-12-2024 | | TLM2 | |
| 16. | Hadoop file system interfaces | 1 | 30-12-2024 | | TLM1 | |
| 17. | Dataflow, Data Ingestion with Sqoop and Hadoop archives, | 1 | 28-12-2024 | | TLM2 | |
| 18. | Dataflow, Data Ingestion with Sqoop and Hadoop archives, | 1 | 30-12-2024 | | TLM2 | |
| 19. | Hadoop I/O: Compression | 1 | 02-01-2025 | | TLM2 | |
| 20. | Serialization | 1 | 03-01-2025 | | TLM1 | |
| 21. | Avro and File-Based Data structures | 1 | 04-01-2025 | | TLM1 | |
| 22. | Bigdata Applications | 1 | 06-01-2025 | | TLM1 | |
| 23. | Bigdata Analytics Use cases | 1 | 09-01-2025 | | TLM1 | |
| 24. | Bigdata Analytics Use cases | 1 | 10-01-2025 | | TLM1 | |
| 25. | Bigdata Analytics Challenges | 1 | 16-01-2025 | | TLM1 | |
| 26. | Tutorial | 1 | 17-01-2025 | | TLM3 | |
| **No. of classes required to complete UNIT-II: 14** | | | | **No. of classes taken:** | | |

## UNIT-III: Map Reduce Technique

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 27. | How Map Reduce works? | 1 | 18-01-2025 | | TLM1 | |
| 28. | Anatomy of a Map Reduce Job Run | 2 | 20-01-2025<br>23-01-2025 | | TLM2 | |
| 29. | Job Failures | 2 | 24-01-2025<br>25-01-2025 | | TLM1,6 | |
| 30. | Job Scheduling | 1 | 27-01-2025 | | TLM1 | |
| 31. | Shuffle and Sort | 1 | 30-01-2025 | | TLM1 | |
| 32. | Task Execution | 1 | 31-01-2025 | | TLM1 | |
| 33. | Map Reduce Types and Formats | 1 | 01-02-2025 | | TLM1 | |
| 34. | Map Reduce Features | 1 | 01-02-2025 | | TLM1 | |
| 35. | Tutorial | 1 | 10-02-2025 | | TLM3 | |
| **No. of classes required to complete UNIT-III: 11** | | | | **No. of classes taken:** | | |

## UNIT-IV: Structured Data Processing Tools

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 36. | Hive: Installation | 1 | 13-02-2025 | | TLM1 | |
| 37. | Running Hive | 1 | 14-02-2025 | | TLM1 | |
| 38. | Hive QL | 1 | 15-02-2025 | | TLM1 | |
| 39. | Tables, Querying Data | 2 | 15-02-2025<br>17-02-2025 | | TLM1 | |
| 40. | User Defined functions | 2 | 20-02-2025<br>21-02-2025 | | TLM1,6 | |
| 41. | Sqoop: Introduction | 1 | 22-02-2025 | | TLM1 | |
| 42. | generate code | 1 | 24-02-2025 | | TLM1 | |
| 43. | Database import | 2 | 27-02-2023<br>28-02-2023 | | TLM2 | |
| 44. | working with imported data | 2 | 28-02-2025<br>01-03-2025 | | TLM1 | |
| 45. | Importing large objects | 1 | 03-03-2025 | | TLM1 | |
| 46. | performing an export | 1 | 06-03-2025 | | TLM1 | |
| 47. | Applications | 1 | 07-03-2025 | | TLM1 | |
| 48. | Tutorial | 1 | 08-03-2025 | | TLM3 | |
| **No. of classes required to complete UNIT-IV: 19** | | | | **No. of classes taken:** | | |

## UNIT-V: Semi-structured and unstructured Data Processing Tools Pig

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 49. | Introduction to PIG | 1 | 10-03-2025 | | TLM1 | |
| 50. | Execution Modes of Pig | 1 | 13-03-2025 | | TLM1 | |
| 51. | Comparison of Pig with Databases | 1 | 15-03-2025 | | TLM2 | |
| 52. | Grunt, Pig Latin | 1 | 17-03-2025 | | TLM2 | |
| 53. | User Defined Functions | 1 | 20-03-2025 | | TLM2 | |
| 54. | Data Processing operators | 1 | 21-03-2025 | | TLM2 | |
| 55. | HBase: Basics | 1 | 22-03-2025 | | TLM2 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 56. | Concepts, Clients | 1 | 24-03-2025 | | TLM2 | |
| 57. | Example | 1 | 27-03-2025 | | TLM2 | |
| 58. | HBase Versus RDBMS | 1 | 28-03-2025 | | TLM2 | |
| 59. | Tutorial | 1 | 29-03-2025 | | TLM3 | |
| **No. of classes required to complete UNIT-V: 12** | | | | **No. of classes taken:** | | |

**CONTENT BEYOND THE SYLLABUS**:

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 1. | BDA Use case – I | 1 | 03-04-2025 | | TLM2 | |
| 2. | BDA Use case – II | 1 | 04-04-2025 | | TLM2 | |
| 3. | BDA Use case - III | 1 | 04-04-2025 | | TLM2 | |
| 4. | BDA Use case - IV | 1 | 05-04-2025 | | TLM2 | |
| | | | | **No. of classes taken:** | | |

| **Teaching Learning Methods** | | | |
|---|---|---|---|
| **TLM1** | Chalk and Talk(35) | **TLM4** | Demonstration (Lab/Field Visit) |
| **TLM2** | PPT(21) | **TLM5** | ICT (NPTEL/Swayam Prabha/MOOCS) |
| **TLM3** | Tutorial (5) | **TLM6** | Group Discussion(3)/Project |

## PART-C

**EVALUATION PROCESS (R17 Regulation):**

| **Evaluation Task** | **Marks** |
|---|---|
| Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus)) | A1=5 |
| I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus)) | M1=15 |
| I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus)) | Q1=10 |
| Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V) | A2=5 |
| II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V) | M2=15 |
| II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V) | Q2=10 |
| Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2)) | M=30 |
| Cumulative Internal Examination (CIE): M | 30 |
| Semester End Examination (SEE) | 70 |
| Total Marks = CIE + SEE | 100 |

# PART-D

## PROGRAMME OUTCOMES (POs):

| | |
|---|---|
| **PO 1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO 2** | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO 4** | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO 5** | **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO 6** | **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO 7** | **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| **PO 8** | **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO 9** | **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO 10** | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO 11** | **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **PO 12** | **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change |

## PROGRAMME SPECIFIC OUTCOMES (PSOs):

| | |
|---|---|
| **PSO 1** | Organize, Analyze and Interpret the data to extract meaningful conclusions. |
| **PSO 2** | Design, Implement and Evaluate a computer-based system to meet desired needs. |
| **PSO 3** | Develop IT application services with the help of different current engineering tools.. |

| Title | Course Instructor | Course Coordinator | Module Coordinator | Head of the Department |
|---|---|---|---|---|
| **Name of the Faculty** | **R Pavitra** | **Dr K.Devi Priya** | **Dr. K.Phaneendra** | **Dr. B.Srinivasa Rao** |
| **Signature** | | | | |

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**DEPARTMENT OF INFORMATION TECHNOLOGY**


## COURSE HANDOUT

## PART-A

**Name of Course Instructor:** PAVITRA RAMACHANDRAPURAM
**Course Name & Code** : DATA ANALYTICS AND VISUALIZATION LAB & 20CS62
**L-T-P Structure** : **0-0-3** **Credits:** 1.5
**Program/Sem/Sec** : B.Tech /VI/B **A.Y.:** 2024-25

**PREREQUISITE: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment**

### COURSE EDUCATIONAL OBJECTIVE(CE0):

The Objective of the course is to provide practical, foundation level training that enables immediate and effective participation in Big Data and other Analytics projects using Hadoop and Data Visualization using Tableau.

### COURSE OUTCOMES (CO):

**CO1:** Demonstrate the installation of Big data analytic tools. **(Understand–L2)**
**CO2:** Apply data modeling techniques to large datasets. **(Apply–L3)**
**CO3:** Conduct exploratory data analysis using visualization. **(Understand–L2)**
**CO4:** Improve individual / teamwork skills, communication & report writing skills with ethical values.

### COURSE ARTICULATION MATRIX (Correlation between Cos, Pos & PSOs):

| Cos | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - |
| CO2 | 2 | - | - | 3 | - | - | - | - | - | - | - | 1 | - | - | - |
| CO3 | 2 | 1 | - | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - |
| CO4 | - | - | - | - | - | - | - | 2 | 1 | - | - | - | - | - | - |

**Note: 1-** Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High)

**PART-B:**

**COURSE DELIVERY PLAN (LESSON PLAN):**

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | HOD Sign |
|---|---|---|---|---|---|
| 1. | Refreshing Linux Commands and Installation of Hadoop | 3 | 04-12-2024 | | |
| 2. | Implementation of Run a basic Word Count Map Reduce program | 3 | 11-12-2024 | | |
| 3. | Implementation of Matrix Multiplication with Hadoop Map Reduce | 3 | 18-12-2024 | | |
| 4. | Implementation of Weather mining by taking weather dataset using Map Reduce | 3 | 01-01-2025 | | |
| 5. | Installation of Hive along with practice examples | 3 | 08-01-2025 | | |
| 6. | Installation of Sqoop along with Practice examples | 3 | 15-01-2025 | | |
| 7. | Downloading and installing Tableau Understanding about importing data, saving, opening, and sharing work books | 3 | 22-01-2025 | | |
| 8. | Data Preparation with Tableau | 3 | 12-02-2025 | | |
| 9. | Charts: Bar Charts, Legends, Filters ,and Hierarchies ,Step Charts, Line Charts | 3 | 19-02-2025 | | |
| 10. | Maps: Symbol Maps, Filled Maps, Density Maps, Maps with Pie Charts | 3 | 26-02-2025 | | |
| 11. | Interactive Dash boards | 3 | 05-03-2025 | | |
| 12. | Interactive Dash boards | 3 | 12-03-2025 | | |
| 13. | Interactive Dash boards and Other Visualization tools | 3 | 19-03-2025 & 26-03-2025 | | |
| 14. | Lab Internal Exam | 3 | 02-04-2025 | | |

# PART-C

## PROGRAMME OUTCOMES (POs):

| | |
|---|---|
| **PO 1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO 2** | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO 4** | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO 5** | **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO 6** | **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO 7** | **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| **PO 8** | **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO 9** | **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO 10** | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO 11** | **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **PO 12** | **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change |

## PROGRAMME SPECIFIC OUTCOMES (PSOs):

| | |
|---|---|
| **PSO 1** | Organize, Analyze and Interpret the data to extract meaningful conclusions. |
| **PSO 2** | Design, Implement and Evaluate a computer-based system to meet desired needs. |
| **PSO 3** | Develop IT application services with the help of different current engineering tools.. |

| Title | Course Instructor | Course Coordinator | Module Coordinator | Head of the Department |
|---|---|---|---|---|
| **Name of the Faculty** | **Mrs.R pavitra** | **Dr K.Devi Priya** | **Dr. K.Phaneendra** | **Dr.B.Srinivasa Rao** |
| **Signature** | | | | |

# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

**(AUTONOMOUS)**
**Accredited by NAAC & NBA (Under Tier - I), ISO 9001:2015 Certified Institution**
**Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada**
**L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.**

## DEPARTMENT OF INFORMATION TECHNOLOGY

# COURSE HANDOUT

## PART-A

**Name of Course Instructor:** K.RAVITEJA
**Course Name & Code** **:** DIGITAL IMAGE PROCESSING & 20IT03
**L-T-P Structure** **: 3-0-0** **Credits:** 3
**Program/Sem/Sec** : B.Tech/VI/A & B **A.Y.:** 2024-25

**PREREQUISITE:** Knowledge of computer graphics.

**COURSE EDUCATIONAL OBJECTIVES (CEOs)**:

Image processing deals with processing of images which are digital in nature. Study of the subject is motivated by three major applications. The first application is in improvement of pictorial information for human perception i.e. enhancing the quality of the image so that the image will have a better look. The second is for autonomous machine applications which have wider applications in industries, particularly for quality control in assembly automation and many similar applications. This course will introduce various image processing techniques, algorithms and their applications.

**COURSE OUTCOMES (COs):** At the end of this course, the student will be able to

| | |
|---|---|
| **CO1** | Summarize the fundamentals of digital image processing (Remembering- L1) |
| **CO2** | Apply image Transform and Enhancement techniques. (Understanding –L2) |
| **CO3** | Apply restoration and color image processing techniques to improve the fidelity of images. (Understanding –L2) |
| **CO4** | Analyze image compression, morphological image processing techniques for various applications. (Understanding –L2) |
| **CO5** | Evaluate the methodologies for image segmentation (Apply –L3) |

**COURSE ARTICULATION MATRIX** (Correlation between COs, POs & PSOs):

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - |
| CO2 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | 2 | 1 | **1** |
| CO3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | **3** | - | **2** |
| CO4 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | **3** |
| **1 -** Low | | | | | | | **2 –**Medium | | | | | | **3 -** High | | |

**TEXTBOOKS:**

1. Digital Image Processing, Rafeal, C.Gonzalez, Richard E.Woods, Pearson Education/PHI.2nd Edition.

**BOOKS:**

| | |
|---|---|
| **R1** | Milan Sonka, Vaclav Hlavacand Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, Second Edition |
| **R2** | Alasdair Mc. Andrew, Introduction to Digital Image Processing with Matlab, Thomson Course Technology |
| **R3** | Computer Vision and Image Processing, Adrian Low, B.S. Publications,2nd edition. |
| **R4** | RafealC. Gonzalez, Richard E.Woods, Steven L. Eddins, Digital Image Processing using Matlab, Pearson Education. |
| **R5** | http://freevideolectures.com/Course/2316/Digital-Image-Processing-IIT-Kharagpur/1 |

| | |
|---|---|
| **R6** | http://nptel.ac.in/courses/117105079/ |
| **R7** | http://nptel.ac.in/courses/117105135/ |

# PART-B

## COURSE DELIVERY PLAN (LESSON PLAN):

### UNIT-I: Introduction:

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 1. | Introduction to Subject, Course Outcomes | 1 | 02/12/24 | | TLM2 | |
| 2. | Introduction to UNIT-I | 1 | 03/12/24 | | TLM2 | |
| 3. | Introduction: Examples of fields that use digital image processing | 1 | 05/12/24 | | TLM2 | |
| 4. | Fundamental Steps In Digital Image Processing, | 1 | 07/12/24 | | TLM2 | |
| 5. | Components Of Image Processing System | 1 | 09/12/24 | | TLM2 | |
| 6. | Digital Image Fundamentals: A Simple Image Formation Model | 2 | 10/12/24<br>12/12/24 | | TLM2 | |
| 7. | Image Sampling And Quantization | 2 | 16/12/24<br>17/12/24 | | TLM2 | |
| 8. | Basic Relationships Between Pixels | 1 | 19/12/24 | | TLM2 &4 | |
| 9. | Numerical on pixels | 1 | 21/12/24 | | TLM1 | |
| **No. of classes required to complete UNIT-I: 11** | | | | **No. of classes taken:** | | |

### UNIT-II: IMAGE TRANSFORMS AND ENHANCEMENT

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 10. | Introduction to UNIT-II | 1 | 23/12/24 | | TLM2 | |
| 11. | Introduction, Need for Transform | 1 | 24/12/24 | | TLM2 | |
| 12. | Image Transforms, 2D Discrete Fourier Transform | 2 | 26/12/24<br>28/12/24 | | TLM2 | |
| 13. | Discrete Cosine Transform | 2 | 30/12/24<br>31/12/24 | | TLM2 | |
| 14. | Singular Value Decomposition | 2 | 02/1/25<br>04/1/25 | | TLM2 | |
| 15. | Basic Intensity Transformation Functions | 2 | 06/1/25<br>07/1/25 | | TLM1&4 | |
| 16. | histogram processing | 2 | 09/1/25<br>16/1/25 | | TLM1&4 | |
| 17. | enhancement using arithmetic and logic operators | 1 | 18/1/25 | | TLM2 | |
| 18. | basic spatial filtering | 1 | 20/1/25 | | TLM2 | |
| 19. | Smoothing of spatial filters | 1 | 21/1/25 | | TLM2 | |
| 20. | sharpening of spatial filters | 1 | 23/1/25 | | TLM2 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 21. | Numerical on enhancement , transforms | 1 | 25/1/25 | | TLM1 | |
| **No. of classes required to complete UNIT-II: 17** | | | | **No. of classes taken:** | | |

**UNIT-III: IMAGE RESTORATION**

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 22. | Introduction to UNIT-III | 1 | 27/1/25 | | TLM2 | |
| 23. | Image restoration: A model of the image degradation/restoration process | 1 | 28/1/25 | | TLM2 | |
| 24. | noise models | 2 | 30/1/25<br>01/02/25 | | TLM2 | |
| 25. | restoration in the presence of noise –only spatial filtering | 2 | 10/2/25<br>11/2/25 | | TLM2 | |
| 26. | Weiner filtering | 2 | 13/2/25<br>15/2/25 | | TLM2 | |
| 27. | constrained least squares filtering | 1 | 17/2/25 | | TLM2 | |
| 28. | Geometric transformations. | 1 | 18/2/25 | | TLM2 | |
| 29. | Introduction to Fourier transform and frequency domain | 1 | 20/2/25 | | TLM2 | |
| 30. | Estimating the degradation function | 1 | 22/2/25 | | TLM2 | |
| 31. | Color fundamentals | 1 | 24/2/25 | | TLM2 | |
| 32. | Color models , | 2 | 25/2/25<br>27/2/25 | | TLM2 | |
| **No. of classes required to complete UNIT-III:15** | | | | **No. of classes taken:** | | |

**UNIT-IV: IMAGE COMPRESSION**

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 33. | Introduction to UNIT-IV, Fundamentals | 1 | 01/03/25 | | TLM1 | |
| 34. | image compression models | 1 | 03/03/25 | | TLM1 | |
| 35. | Lossless Compression | 2 | 04/03/25<br>06/03/25 | | TLM2 | |
| 36. | A brief discussion on Lossy Compression | 1 | 10/03/25 | | TLM1 | |
| 37. | compression standards | 2 | 11/03/25<br>13/03/25 | | TLM5 | |
| **No. of classes required to complete UNIT-IV: 07** | | | | **No. of classes taken:** | | |

**UNIT-V: IMAGE SEGMENTATION.**

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 38. | Image Segmentation: Detection of discontinuous | 2 | 15/03/25<br>17/03/25 | | TLM2 | |
| 39. | Line and Edge Detection | 2 | 18/03/25<br>20/03/25 | | TLM2 &3 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 40. | Thresholding | 3 | 22/03/25<br>24/03/25<br>25/03/25 | | TLM2 | |
| 41. | Region based segmentation | 2 | 27/03/25<br>29/03/25 | | TLM2 | |
| **No. of classes required to complete UNIT-V: 09** | | | | **No. of classes taken:** | | |

**CONTENT BEYOND THE SYLLABUS**:

| S. No. | Topics to be covered | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---|---|---|---|---|---|---|
| 1. | Morphological Image Processing | 2 | 01/04/25<br>03/04/25 | | TLM6 | |

| **Teaching Learning Methods** | | | |
|---|---|---|---|
| **TLM1** | Chalk and Talk (5) | **TLM4** | Demonstration (Lab/Field Visit) (2) |
| **TLM2** | PPT (33) | **TLM5** | ICT (NPTEL/Swayam Prabha/MOOCS) (1) |
| **TLM3** | Tutorial (1) | **TLM6** | Group Discussion/Project (1) |

## PART-C

**PEVALUATION PROCESS (R20 Regulation):**

| **Evaluation Task** | **Marks** |
|---|---|
| Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus)) | A1=5 |
| I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus)) | M1=15 |
| I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus)) | Q1=10 |
| Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V) | A2=5 |
| II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V) | M2=15 |
| II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V) | Q2=10 |
| Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2)) | M=30 |
| Cumulative Internal Examination (CIE): M | 30 |
| Semester End Examination (SEE) | 70 |
| Total Marks = CIE + SEE | 100 |

## PART-D

**PROGRAMME OUTCOMES (POs):**

| | |
|---|---|
| **PO 1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO 2** | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **Design/development of solutions**: Design solutions for complex engineering |

| | |
|---|---|
| | problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO 4** | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO 5** | **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
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| **PO 12** | **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change |

**PROGRAMME SPECIFIC OUTCOMES (PSOs):**

| | |
|---|---|
| **PSO 1** | The ability to apply Software Engineering practices and strategies in software project development using open-source programming environment for the success of Organization. |
| **PSO 2** | The ability to design and develop computer programs in networking, web applications and IoT as per the society needs |
| **PSO 3** | To inculcate an ability to analyze, design and implement database applications. |

| **Title** | **Course Instructor** | **Course Coordinator** | **Module Coordinator** | **Head of the Department** |
|---|---|---|---|---|
| **Name of the Faculty** | **Mr K.Raviteja** | **Mr K.Raviteja** | **Mrs M.Hemalatha** | **Dr.B.Srinivasa Rao** |
| **Signature** | | | | |