Department of Computer Science and Engineering

Data Science
3150511

COURSE OBJECTIVES

- To provide the fundamental knowledge of Data Sciences, along with essential Python programming skills..
- Apply data manipulation, statistical analysis, and visualization techniques using Python libraries like NumPy and pandas.
- Develop, implement, and evaluate machine learning models while using statistical methods to derive insights and validate results.

Unit – I

Introduction to Data Science: Introduction, Definition, applications of Data Science, Impact of Data Science, Data Analytics Life Cycle, role of Data Scientist.

Basics of Python: Essential Python libraries, Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set, Type Conversion- Operators. Decision Making: Looping-Loop Control statement, Math and Random number functions. User defined functions.

Vectorized Computation: The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing.

Unit-II

Data Analysis (with Pandas): Series, DataFrame, Essential Functionality: Dropping Entries, Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis. Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

Unit-III

Exploratory Data Analysis and Visualisation: Handling Missing Data, Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers, Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Unit-IV

Introduction to Machine Learning: Types of Learning, Linear Regression- Simple Linear Regression, Implementation, plotting and fitting regression line, Logistic Regression, K-Nearest Neighbors (KNN), K-Means Clustering.

Unit-V

Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score

Hypothesis Testing: Mean and Variance Tests, p-value, Errors, Z-Test, t-Test, Paired t-Test, and F-Test, Analysis of Variance (ANOVA) and Contingency Table Analysis

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RECOMMENDED BOOKS

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
3. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop
5. James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: springer, 2013.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1: Analyze Data Science concepts and apply Python programming for data tasks, including data manipulation with NumPy.
CO2: Analysis of the data for applying various statistical modeling approaches.
CO3: Develop expertise in managing missing data and assessing the impact of visualizations on data insight communication.
CO4: Design and implement machine learning algorithms and assess model performance.
CO5: Develop statistical tests and **evaluate** machine learning models.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	3	2	-	-	1	2	1	1	3	2
CO2	3	3	2	2	3	2	-	1	1	2	2	1	3	3
CO3	2	2	2	1	3	2	-	1	1	3	3	2	3	2
CO4	3	3	3	2	3	3	-	1	1	2	3	2	3	3
CO5	3	3	2	2	3	3	1	1	1	2	2	2	3	3

1-Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

Data Science
3150511

List of Experiments

1. Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, Set
2. Solve problems using decision and looping statements.
3. Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem
4. Handle numerical operations using math and random number functions.
5. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
6. Computation on NumPy arrays using Universal Functions and Mathematical methods.
7. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
8. Create Pandas Series and DataFrame from various inputs.
9. Import any CSV file to Pandas DataFrame and perform the following:
    1. Visualize the first and last 10 records
    2. Get the shape, index and column details
    3. Select/Delete the records(rows)/columns based on conditions.
    4. Perform ranking and sorting operations.
    5. Do required statistical operations on the given columns.
    6. Find the count and uniqueness of the given categorical values.
    7. Rename single/multiple columns.
10. Import any CSV file to Pandas DataFrame and perform the following:
    1. Handle missing data by detecting and dropping/ filling missing values.
    2. Transform data using different methods.
    3. Detect and filter outliers.
    4. Perform Vectorized String operations on Pandas Series.
    5. Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
11. Use the scikit-learn package in python to implement the regression model and its related methods.

Course Outcomes (COs)

CO1: Apply fundamental Python programming constructs such as data types, control structures, and functions to design ethical and efficient solutions for real-life problems.
CO2: Analyze and process structured and unstructured data using Python libraries like NumPy and Pandas to derive meaningful insights while considering societal relevance and responsible data handling.
CO3: Develop real world data science applications using Python

Course Articulation Matrix

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

1-Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

Data Science

3150511

list of skill-based mini project

- Exploratory Data Analysis (EDA): Perform an in-depth analysis of a dataset, including data cleaning, visualization, and statistical analysis to gain insights and understand the underlying patterns and relationships.
- Predictive Modeling: Build a machine learning model to predict a specific outcome or target variable based on a given dataset. This could include classification, regression, or time series forecasting tasks.
- Natural Language Processing (NLP): Develop a text classification or sentiment analysis model using techniques such as tokenization, word embeddings, and recurrent neural networks (RNNs) to analyze and understand text data.
- Image Recognition: Create an image recognition system using convolutional neural networks (CNNs) to classify or identify objects, faces, or patterns in images.
- Recommendation System: Build a recommendation engine that suggests personalized recommendations to users based on their preferences and behavior, using collaborative filtering or content-based filtering techniques.
- Clustering Analysis: Implement clustering algorithms such as k-means, hierarchical clustering, or DBSCAN to group similar data points together and discover hidden patterns or segments within a dataset.
- Time Series Analysis: Analyze time-dependent data, such as stock prices or weather data, using techniques like autoregressive integrated moving average (ARIMA), exponential smoothing, or recurrent neural networks (RNNs).
- Anomaly Detection: Develop an anomaly detection system that can identify unusual or suspicious patterns in data, which can be useful for fraud detection, network intrusion detection, or outlier detection.
- Social Media Sentiment Analysis: Use data from social media platforms to analyze public sentiment towards specific topics, brands, or events using natural language processing techniques and sentiment analysis algorithms.
- Data Visualization Dashboard: Create an interactive dashboard using libraries like Plotly or Dash to visualize and explore data, providing users with an intuitive interface to interact with and gain insights from the data.

Please Note: *Each project has to be submitted by a group of 1 or 2 students, and each group will be assigned only one project.*

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Department of Computer Science and Engineering

DATA SCIENCE
2150511 (OLD)

COURSE OBJECTIVES

- To provide the fundamental knowledge of Data Sciences.
- To analyse the working of various techniques used in Data Sciences.
- To understand the basic representation and exploratory data analysis used in Data Sciences.

Unit-I

Introduction to Data Science: Introduction, Definition, applications of Data Science, Impact of Data Science, Data Analytics Life Cycle, role of Data Scientist.

Basics of Python: Essential Python libraries, Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set, Type Conversion- Operators. Decision Making: Looping-Loop Control statement, Math and Random number functions. User defined functions, function arguments & its types.

Unit-II

Vectorized Computation: The NumPy nd-array- Creating nd-arrays- Data Types for nd-arrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing, Boolean Indexing, Transposing Arrays. Universal Functions: Fast Element, Wise Array Functions, Mathematical and Statistical Methods – Sorting Unique and Other Set Logic.

Unit-III

Data Analysis: Series, Data Frame, Essential Functionality: Dropping Entries, Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis. Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

Unit-IV

Inferential Statistics in Data Science: Types of Learning, Linear Regression- Simple Linear Regression, Implementation, plotting and fitting regression line. Multiple Linear Regression, Introduction, implementation, comparison with simple linear regression, Correlation Matrix, F-Statistic, Identification of significant features. Polynomial regression.

Unit-V

Exploratory Data Analysis and Visualisation: Handling Missing Data, Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers, Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

RECOMMENDED BOOKS

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
3. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop

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COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. **Define** basic concepts of Data Sciences and Python.
CO2. **Identify** various methods for the representation and manipulation of vectors.
CO3. **Analysis** of the data for applying various statistical modeling approaches.
CO4. **Develop** the skill to use statistical measures to identify significant features, evaluate model performance and perform regression analysis.
CO5. **Develop** expertise in managing missing data and assessing the impact of visualizations on data insight communication.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3												
CO2			2				3						1	
CO3					2				2			2	2	
CO4					1								1	
CO5					2							1	3	1

1-Slightly; 2 - Moderately; 3 – Substantially

Networking with TCP/IP
3150512

COURSE OBJECTIVES

- To understand TCP/IP Internetworking and Addressing.
- To understand framing, Routing, Address resolution and Error reporting mechanism used in the Internet
- To understand the working of Application layer protocols
- To Troubleshoot networking issues

Unit-1

TCP/IP model, Addressing- Physical, logical and port addressing, IPv4 addresses: Classful addressing, Classless addressing. Special addresses, DHCP and NAT. Subnetting and Supernetting.

Unit-2

IP Datagram- format, options, fragmentations, checksum, IPsec. Address Resolution Protocol (ARP), Reverse address resolution protocol (RARP). Internet Control message protocol (ICMP).

Unit-3

TCP: TCP Reliable data transfer, Connection Establishment & Release, TCP Frame, Header Checksum, Sliding Window Concept for error control, congestion control and TCP timers. UDP: Format, Pseudo header, Encapsulation, Checksum, Multiplexing & Demultiplexing. Stream Control Transmission Protocol.

Unit-4

Routing Protocols- RIP, OSPF and BGP, Application Layer: DNS, FTP, TFTP, Mail Transfer protocols, TELNET, HTTP.

Unit- 5

IPv6 Protocol, ICMPv6, IPv6 addressing, Voice over IP, RTP, SNMP, Internet security and Firewall: Internet Security, IP security, Firewall Implementation, Study of network packet analyzer tools: Wireshark, CISCO packet Tracer etc. Scanner Tools: Nmap, Nessus etc.

Internet of Things (IoT) Networking, 5G and Next-Generation Mobile Networks, Edge and Fog Computing in Networking, Zero Trust Network Architecture

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RECOMMENDED BOOKS

- Data and Computer Communication - W. Stalling, Pearson
- Internetworking with TCP/IP - Vol. - I - D.E. Comer, PHI
- Data Communication & Networking -B.A. Forouzan
- ISDN and Broad band ISDN with Frame Relay & ATM - W. Stalling
- LANs - Keiser

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. Illustrate the architecture of the TCP/IP model and demonstrate addressing schemes used in network communication.

CO2. Identify and explain the role of core Internet layer protocols including IP, ARP, ICMP, and IPsec.

CO3. Analyze the features of TCP, UDP, and SCTP transport protocols and their mechanisms for reliable communication.

CO4. Explain the operation of routing and application layer protocols in data communication.

CO5. Simulate and evaluate network topologies and security protocols using modern network analysis tools.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1	2	1				1		1	2	1
CO2	3	3			2							1	2	1
CO3	3	3	2	2	2							2	2	1
CO4	3	3	2	2	2		1			1		2	2	2
CO5	3	3	3	3	3	1	2	1	2	2	2	3	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

NETWORKING WITH TCP/IP
2150512 (OLD)

COURSE OBJECTIVES

- To understand TCP/IP Internetworking and Addressing.
- To understand framing, Routing, Address resolution and Error reporting mechanism used in the Internet
- To understand the working of Application layer protocols
- To Troubleshoot networking issues

Unit-1

TCP/IP model, Addressing- Physical, logical and port addressing, IPv4 addresses: Classful addressing, Classless addressing. Special addresses, DHCP and NAT. Subnetting and Supernetting.

Unit-2

IP Datagram- format, options, fragmentations, checksum, IPsec. Address Resolution Protocol (ARP), Reverse address resolution protocol (RARP). Internet Control message protocol (ICMP).

Unit-3

TCP: TCP Reliable data transfer, Connection Establishment & Release, TCP Frame, Header Checksum, Sliding Window Concept for error control, congestion control and TCP timers. UDP: Format, Pseudo header, Encapsulation, Checksum, Multiplexing & Demultiplexing. Stream Control Transmission Protocol

Unit-4

Routing Protocols- RIP, OSPF and BGP, Application Layer: DNS, FTP, TFTP, Mail Transfer protocols, TELNET, HTTP.

Unit- 5

IPv6 Protocol, ICMPv6, IPv6 addressing, Voice over IP, RTP, SNMP, Internet security and Firewall: Internet Security, IP security, Firewall Implementation, Study of network packet analyzer tools: Wireshark, CISCO packet Tracer etc. Scanner Tools: Nmap, Nessus etc.

RECOMMENDED BOOKS

- Data and Computer Communication - W. Stalling, Pearson
- Internetworking with TCP/IP - Vol. - I - D.E. Comer, PHI
- Data Communication & Networking -B.A. Forouzan
- ISDN and Broad band ISDN with Frame Relay & ATM - W. Stalling
- LANs - Keiser

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. **Illustrate** the basic functionality of TCP/IP layers.

CO2. **Identify** various network layer protocol

CO3. **Analyze** the working of Transport layer protocols

CO4. **Explain** the working of Application layer protocols

CO5. **Simulate** network protocols & Topologies

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1							1				2		
CO2				1			1	1		1		2		
CO3		2	2	2	2		1	1	2		1	2	3	2
CO4		2		1			1	1		1		2	2	
CO5	1	3	3	2	2			1	2	1	1	2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Information Security
3150513

COURSE OBJECTIVES

- To provide conceptual understanding of Information security principles, issues, challenges and mechanisms.
- To understand how to apply encryption techniques to secure data in transit across data networks.

Unit-I

Security: Principles and Attacks, Basic Number Theory, Fundamentals of Cryptography, Steganography, Cryptanalysis, Code Breaking, Block Ciphers and Steam Ciphers, Substitution Ciphers, Transposition Ciphers, Caesar Cipher, Play-Fair Cipher, Hill Cipher.

Unit-II

Cryptography: Symmetric Key Cryptography, Public Key Cryptography, Principles of Public Key Cryptosystem, Classical Cryptographic Algorithms: RC4, RSA, Distribution of Public Keys and Key Management, Diffie-Hellman Key Exchange.

Unit-III

Hash Functions: Hash Functions, One Way Hash Function, SHA (Secure Hash Algorithm). Authentication: Requirements, Functions, Kerberos, Message Authentication Codes, Digital Signatures, Digital Certificates.

Unit -IV

IP & Web Security Overview: SSL (Secure Socket Layer), TLS (Transport Layer Security), SET (Secure Electronic Transaction). IDS (Intrusion detection system), Firewalls: Types, Functionality and Polices.

Unit -V

Phishing: Attacks and its Types, Buffer Overflow Attack, Session Hijacking, Hacker: Hacking and Types of Hackers, Foot Printing, Scanning: Types: Port, Network, Vulnerability), Sniffing in Shared and Switched Networks, Sniffing Detection & Prevention, Spoofing, Zero Trust Architecture: Core Principles of Zero Trust, Key Components of Zero trust, Zero trust implementation Frameworks.

RECOMMENDED BOOKS

- Cryptography and Network Security, William Stallings, Pearson Education.
- Cryptography and Network Security, Atul Kahate, McGraw Hill Education.
- Incident Response and Computer Forensics, Kevin Mandia, Chris Prosise, Tata McGraw Hill.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. **Explain** Principles & attacks, basic number theory and fundamental of cryptography.

CO2. **Illustrate** public key algorithms to real-world security problems.

CO3. **Analyze** the security requirements of hash functions & Kerberos.

CO4. **Describe** the **SET protocol's role** in securing e-commerce transactions (dual signatures, merchant/payment gateway trust).

CO5. **Classify** Phishing attacks and hacker types (black hat, white hat, gray hat, script kiddies) and their motives.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2		2	2	2	1			2	3	3
CO2	3	3	3	3	2	2	1	1	1		1	1	3	3
CO3	3	3	3	3	1	1	1		1	1	1	1	3	3
CO4	3	2	3	1	1	2	1	2	1	1			2	2
CO5	2	2	2	2	2	3	2	3	2	2	3	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Information Security
3150513

List of Experiments

1. Perform encryption, decryption using the following substitution techniques
   I. Ceaser cipher II. Hill Cipher
2. Perform encryption and decryption using following transposition techniques:
   Rail fence and Row & Column Transformation
3. Implement Playfair Cipher with key entered by user.
4. Implement polyalphabetic Cipher
5. Implement AutoKey Cipher
6. Implement Hill Cipher.
7. Implement Rail fence technique
8. Implement Transposition technique
9. Implement substitution technique
10. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

COURSE OUTCOMES

After completion of the course students would be able to:

CO1: **Illustrate Encrypt/decrypt** messages using substitution ciphers
CO2: Design and implement the Playfair Cipher with user-defined keys, handling digraph substitutions.
CO3: **Configure and test** a basic IDS using Snort to detect port scans (`nmap` activity)

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2				1	1		2	2	2
CO2	3	2	3		2				2	1	1	2	2	
CO3	3	3	2	2	3	1		1	2	2	2	3	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Information Security
3150513

List of skill-based mini project

1. Develop an email monitoring system.
2. Develop a web application firewall
3. Develop a Log Analyzer
4. Develop a Malware Analysis Sandbox
5. Develop an Encryption Software
6. Develop a Caesar code Decoder
7. Develop a user authentication system
8. Develop an Image Steganography system
9. Develop an Anomaly detection system

Please Note: *Each project has to be submitted by a group of 1 or 2 students, and each group will be assigned only one project.*

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Information Security

2150513 (OLD)

COURSE OBJECTIVES

- To provide conceptual understanding of Information security principles, issues, challenges and mechanisms.
- To understand how to apply encryption techniques to secure data in transit across data networks.

Unit-I

Security: Principles and Attacks, Basic Number Theory, Fundamentals of Cryptography, Steganography, Cryptanalysis, Code Breaking, Block Ciphers and Steam Ciphers, Substitution Ciphers, Transposition Ciphers, Caesar Cipher, Play- Fair Cipher, Hill Cipher.

Unit-II

Cryptography: Symmetric Key Cryptography, Public Key Cryptography, Principles of Public Key Cryptosystem, Classical Cryptographic Algorithms: RC4, RSA, Distribution of Public Keys and Key Management, Diffie-Hellman Key Exchange.

Unit-III

Hash Functions: Hash Functions, One Way Hash Function, SHA (Secure Hash Algorithm). Authentication: Requirements, Functions, Kerberos, Message Authentication Codes, Digital Signatures, Digital Certificates.

Unit -IV

IP & Web Security Overview: SSL (Secure Socket Layer), TLS (Transport Layer Security), SET (Secure Electronic Transaction). IDS (Intrusion detection system), Firewalls: Types, Functionality and Polices.

Unit -V

Phishing: Attacks and its Types, Buffer Overflow Attack, Session Hijacking, Hacker: Hacking and Types of Hackers, Foot Printing, Scanning: Types: Port,

Network, Vulnerability), Sniffing in Shared and Switched Networks, Sniffing Detection & Prevention, Spoofing.

RECOMMENDED BOOKS

- Cryptography and Network Security, William Stallings, Pearson Education.
- Cryptography and Network Security, Atul Kahate, McGraw Hill Education.
- Incident Response and Computer Forensics, Kevin Mandia, Chris Prosise, Tata McGraw Hill.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. **Explain** attacks, hash algorithms and authentication mechanisms.
CO2. **Illustrate** fundamentals of number theory and security principles.
CO3. **Apply** various algorithms to achieve principles of network security.
CO4. **Analyze** the cause for various existing network attacks and describe the working of available security controls.
CO5. **Examine** the vulnerabilities in IT infrastructure.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	2	2	1	1	1	1	1	3	3
CO2	3	3	3	3	2	1	2	1	1	1	1	1	3	3
CO3	3	3	3	3	2	1	1	1	1	1	1	1	3	3
CO4	3	3	3	3	2	1	1	1	1	1	1	1	2	3
CO5	3	3	3	2	3	1	1	1	1	1	1	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

Compiler Design
3150514

COURSE OBJECTIVES

- To learn finite state machines and context free grammar.
- To learn, various phases of compiler
- To understand process of compiler implementation.

Unit-I

Overview of Translation Process: Introduction to Compiler, Major Data Structures in Compiler, Other Issues in Compiler Structure, BOOT Strapping and Porting, Compiler Structure: Analysis-Synthesis Model of Compilation, Various Phases of a Compiler, Compiler Design Tools.

Unit-II

Lexical Analysis: Input Buffering, Symbol Table, Token, Recognition of Tokens, Lexeme and Patterns, Difficulties in Lexical Analysis, Error Reporting and Implementation. Regular Grammar & Language Definition, Transition Diagrams, Design of a Typical Scanner using LEX.

Unit-III

Syntax Analysis: Context Free Grammars (CFGs), Ambiguity, Basic Parsing Techniques: Top Down Parsing, Recursive Descent Parsing, Transformation on the Grammars, Predictive Parsing LL(1) Grammar, Bottom-UP Parsing, Operator Precedence Parsing, LR Parsers (SLR, CLR, LALR), Design of a Typical Parser Using YACC.

Unit-IV

Semantic Analysis: Compilation of Expression, Control, Structures, Conditional Statements, Various Intermediate Code Forms, Syntax Directed Translation, Memory Allocation and Symbol Table Organizations, Static and Dynamic Array Allocation, String Allocation, Structure Allocation etc., Error Detection Indication and Recovery, Syntax and Semantic Errors.

Department of Computer Science and Engineering

Unit-V

Code Generation and Code Optimization: Issues, Basic Blocks and Flow Graphs, Register Allocation, Code Generation, DAG Representation of Programs, Code Generation from DAGS, Peep-hole Optimization, Code Generator Generators, Specification of Machine. Code Optimization: Source of Optimizations, Optimization of Basic Blocks, Loops, Global Data Flow Analysis, Solution to Iterative Data Flow Equations, Data Flow Analysis of Structured Flow Graphs.

RECOMMENDED BOOKS

- Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. D. Ullman, Pearson Education.
- Compiler Construction: Principles and Practice, K.C. Louden, Cengage Learning.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. **Build** an understanding of the working phases and concepts of a compiler.

CO2. **Apply** Lex and Yacc tools to develop lexical analyzers and parsers.

CO3. **Compare** and apply various parsing techniques for syntax analysis.

CO4. **Perform** semantic analysis, symbol table management, and memory allocation.

CO5. **Implement** code generation and optimization techniques for efficient execution.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	1	-	-	-	-	-	-	1	2	-
CO2	2	-	-	-	3	-	-	-	1	2	-	1	2	1
CO3	3	2	-	-	-	-	-	-	-	2	-	1	2	-
CO4	3	2	-	-	-	-	-	-	-	1	-	1	1	2
CO5	3	2	2	-	-	-	-	-	1	2	2	1	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

COMPILER DESIGN

2150514 (OLD)

COURSE OBJECTIVES

- To learn finite state machines and context free grammar.
- To learn, various phases of compiler
- To understand process of compiler implementation.

Unit-I

Overview of Translation Process: Introduction to Compiler, Major Data Structures in Compiler, Other Issues in Compiler Structure, BOOT Strapping and Porting, Compiler Structure: Analysis-Synthesis Model of Compilation, Various Phases of a Compiler, Compiler Design Tools.

Unit-II

Lexical Analysis: Input Buffering, Symbol Table, Token, Recognition of Tokens, Lexeme and Patterns, Difficulties in Lexical Analysis, Error Reporting and Implementation. Regular Grammar & Language Definition, Transition Diagrams, Design of a Typical Scanner using LEX.

Unit-III

Syntax Analysis: Context Free Grammars (CFGs), Ambiguity, Basic Parsing Techniques: Top Down Parsing, Recursive Descent Parsing, Transformation on the Grammars, Predictive Parsing LL(1) Grammar, Bottom-UP Parsing, Operator Precedence Parsing, LR Parsers (SLR, CLR, LALR), Design of a Typical Parser Using YACC.

Unit-IV

Semantic Analysis: Compilation of Expression, Control, Structures, Conditional Statements, Various Intermediate Code Forms, Syntax Directed Translation, Memory Allocation and Symbol Table Organizations, Static and Dynamic Array Allocation, String Allocation, Structure Allocation etc., Error Detection Indication and Recovery, Syntax and Semantic Errors.

Unit-V

Code Generation and Code Optimization: Issues, Basic Blocks and Flow Graphs, Register Allocation, Code Generation, DAG Representation of Programs, Code Generation from DAGS, Peep-hole Optimization, Code Generator Generators, Specification of Machine. Code Optimization: Source of Optimizations, Optimization of Basic Blocks, Loops, Global Data Flow Analysis, Solution to Iterative Data Flow Equations, Data Flow Analysis of Structured Flow Graphs.

RECOMMENDED BOOKS

- Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. D. Ullman, Pearson Education.
- Compiler Construction: Principles and Practice, K.C. Louden, Cengage Learning.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. **Build** the concept of working of compiler.
CO2. **Apply** the knowledge of lex & yacc tool to develop a scanner & parser.
CO3. **Examine** various parsing techniques and their comparison.
CO4. **Implement** various code generation and code optimization techniques.
CO5. **Analyze** different tools and techniques for designing a modern compiler.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	-	-	-	-	-	2	1	1	-
CO2	3	-	-	-	2	-	-	-	1	-	1	2	2	1
CO3	3	2	-	2	2	-	-	-	-	1	1	1	1	-
CO4	2	3	-	3	-	-	-	-	-	-	-	1	1	2
CO5	2	1	3	2	3	-	-	-	1	2	2	1	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

Cloud Computing and Virtualization
3150515

COURSE OBJECTIVES

- To Provide the basics of cloud computing concepts along with virtualization techniques.
- To provide overview of the field of Cloud Computing, and an in-depth study into its enabling technologies and main building blocks.
- To develop the skills needed to become a practitioner or carry out research projects in this domain.

Unit I - Introduction:

Definition and evolution of cloud computing, Cloud components, Essential characteristics, advantages and limitations of cloud computing, Issues in cloud computing, Virtualization: Need of virtualization, Features of Virtualization, limitations, Classification of virtualization: Hardware virtualization, Desktop virtualization.

Unit II – Virtualization Concepts:

Server Virtualization: Introduction, types of server virtualization, Virtual machine basics, types of virtual machines, hypervisor concepts and types, Utility Computing, Elastic Computing, Virtualization applications in enterprises, Pitfalls of virtualization, Multitenant software, Virtualization security management, Datacenter Virtualization, Client Virtualization, Cloud Virtualization.

Unit III – Cloud Architecture:

Cloud architecture, Layers in cloud architecture, Service Models: Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Application as a Service, Functions as a Service, features and benefits of each. Deployment Models: Public clouds, Private clouds, Community clouds, Hybrid clouds.

Unit IV – Cloud Storage & Security:

Introduction to Storage Systems, Data in the cloud: Relational databases, Cloud Storage Concepts, Cloud file systems: GFS and HDFS. Cloud Databases (HBase, MongoDB, Cassandra, and DynamoDB), Cloud Object Storage, Features and functions of cloud computing platforms, Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud: Cloud computing security architecture.

Unit V – Tools and Techniques:

Distributed Programming for the Cloud, Map-Reduce and extensions: Parallel computing, The Map-Reduce model, Example/Application of MapReduce, Introduction to Simulators, CloudSim simulator, GreenCloud simulator, VMWare Simulator, Oracle Virtual Box. Case Study: AWS.

Reference Books:-

- Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
- Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
- Kai Hawang, Geoferrey C Fox, "Distributed and Cloud Computing", Elseveir publication, 2012
- David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

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COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. **Build** the fundamental ideas behind Cloud Computing, the evolution of the paradigm, and introduce the virtualization concepts.

CO2. **Understand** ideas and principles of Virtualization and its applications**.**

CO3. **Describe** fundamental concepts of cloud infrastructures and Service Oriented Architecture.

CO4. **Illustrate** the fundamental concepts of cloud storage and cloud security**.**

CO5. **Study** of various tools and technologies for implementing applications of Cloud**.**

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		1						1	1	3	2
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CO4	3	1	1		2						1	2	3	2
CO5	3	2	3	2	3						2	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

Cloud Computing and Virtualization
2150519(OLD)

COURSE OBJECTIVES

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CO4	3	1	1		2						1	2	3	2
CO5	3	2	3	2	3						2	3	3	2

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Department of Computer Science and Engineering