<table>
<tr><td colspan="8">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="4">Semester: VI</td></tr>
<tr><td colspan="8">Course: Software Engineering</td><td colspan="4">Course Code: DJ19CEC601</td></tr>
<tr><td colspan="8">Course: Software Engineering Laboratory</td><td colspan="4">Course Code: DJ19CEL601</td></tr>
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</table>

**Prerequisite:**

1. Concepts of Object Oriented Programming & Methodology
2. Knowledge of developing applications with front end & back end connectivity.

**Objectives:** To provide the knowledge of Standard Software Engineering discipline.

**Outcomes:** On completion of the course, learner will be able:

1. Understand and Demonstrate basic knowledge in Software Engineering.
2. Identify requirements, analyse, design and develop the software projects.
3. Plan, schedule and track the progress of the projects.
4. Identify risks, manage the configuration and change in software.
5. Apply testing principles on software projects.
6. Apply latest tools and techniques on software projects.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Hours |
|---|---|---|
| 1 | **Introduction to Software Engineering and Process Models:**<br>Nature of Software, Software Engineering, Software Process, CMM, Generic Process Model.<br>**Prescriptive Process Models:** The Waterfall Model, V Model.<br>**Incremental Process Model:** Incremental Model<br>**Evolutionary Process Models:** Prototyping Paradigm, The Spiral Model<br>**Concurrent Process Models:** Concurrent Process Model<br>**The Unified Process**<br>**Agile Methodology:** Agility Principals, Agile Process Models: Extreme Programming (XP), Adaptive Software Development (ASD), Dynamic Systems Development Method (DSDM), Scrum, Crystal, Feature Driven Development (FDD), Agile Modeling (AM), Kanban Model. | 10 |
| 2 | **Requirement Analysis and Project Estimation:** Requirement Elicitation, Software Requirement Specification (SRS).<br>**Requirement Models:** Scenario Based Models, Class Based Models, Behavioural Models and Flow Models.<br>**Software Project Estimation:** LOC, FP, Empirical Estimation Models COCOMO I COCOMO II, Specialized Estimation Techniques. | 08 |
| 3 | **Design Engineering and Analysis:**<br>Design Principles, Design Concepts, Effective Modular Design-Cohesion and Coupling.<br>**Translating the requirement models into the design model.**<br>**Designs**<br>Architectural Design, Component Level Design, User Interface Design. | 06 |
| 4 | **Project Scheduling and Control:**<br>Management Spectrum, 3Ps, Process and Project Metrics<br>**Scheduling**<br>Work Breakdown Structure, Network Diagram, Gantt Chart. | 04 |
| 5 | **Software Risk:**<br>Risk Identification, Risk Assessment, Risk Projection, Risk Refinement, RMMM Plan.<br>**Software Configuration Management:**<br>SCM, SCM Repositories, SCM Process, Change Control and Version Control. | 05 |
| 6 | **Software Testing Fundamentals:**<br>Strategic Approach to Software Testing, Unit Testing, Integration Testing, Verification, Validation Testing, System Testing, Test Strategies for WebApps<br>**Software Testing Techniques:**<br>White Box Testing, Basis Path Testing, Control Structure Testing and Black Box Testing.<br>TDD | 06 |
| 7 | **Latest Trends In Software Development Engineering:**<br>**DevOps:** DevOps Toolchain, DevOps Architecture (e.g. Docker), DevOps for Deployment. | 03 |

**Books Recommended:**

*Text books:*

1. Roger Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill Publications 7th Edition.
2. Ian Sommerville, "Software Engineering", Pearson Education 9th Edition.
3. Ali Behfrooz and Fredeick J. Hudson, "Software Engineering Fundamentals", Oxford University Press.

*Reference Books:*

1. Ugrasen Suman, "Software Engineering-Concepts and Practices", Cengage Learning
2. Pankaj Jalote, "An integrated approach to Software Engineering", Springer/Narosa
3. Jibitesh Mishra and Ashok Mohanty, "Software Engineering", Pearson
4. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India.
5. "Machine Learning Applications in Software Engineering" Volume 16, World Scientific by Du Zhang and P Tsai

**Suggested List of Experiments:**

| Lab Session | Title |
|---|---|
| **1** | Prepare detailed statement of problem for the selected / allotted mini project and identify suitable process model for the same with justification. |
| **2** | Develop Software Requirement Specification (SRS) document in IEEE format for the project. |
| **3** | Use project management tool to prepare schedule for the project. |
| **4** | Prepare RMMM plan for the project. |
| **5** | Identify scenarios & develop UML Use case and Class Diagram for the project. |
| **6** | Draw DFD (upto 2 levels) and prepare Data Dictionary for the project. |
| **7** | Develop Activity / State Transition diagram for the project. |
| **8** | Develop Sequence and Collaboration diagram for the project. |
| **9** | Change specification and make different versions using any SCM Tool. |
| **10** | Develop test cases for the project using testing techniques. |
| **11** | Experiment on DevOps application. |

Any other practical covering the syllabus topics and subtopics can be conducted.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to **75 marks**.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus of course **DJ19CEC601** including the practical performed during laboratory sessions of course **DJ19CEL601**.
2. Oral examination will be of **25 marks**.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEL601** with minimum 10 experiments.

The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal Documentation (Write-up and Mini Project): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Note: Mini Project Presentations can be conducted if required.

Prepared by Checked by Head of the Department Principal

<table>
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<tr><td colspan="8">Course : Advance Algorithm</td><td colspan="3">Course Code: DJ19CEC602</td></tr>
<tr><td colspan="8">Course: Advance Algorithm Laboratory</td><td colspan="3">Course Code: DJ19CEL602</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme<br>(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
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</table>

**Prerequisite:** Concepts of Data structures, Discrete Mathematics and Analysis of Algorithm

**Objectives:** To provide conceptual and practical knowledge of Advance Algorithm

**Outcomes:** On completion of the course, learner will be able to:

1. Analyze the chosen algorithm.
2. Choose appropriate data structure and algorithm for given problem statement.
3. Design the algorithm.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Hours |
|---|---|---|
| 1 | **Analysis of Algorithm Based on Time:**<br>**Asymptotic notations:** Omega, Theta, Big-O, Small-o, small Omega and Tilde<br>**Amortized Analysis:** Aggregate Method, Accounting Method, Potential Method<br>Beyond worst-case analysis<br>Dynamic tables and its amortized analysis<br>RAM model analysis of algorithm | 6 |
| 2 | **Probabilistic and Randomized Algorithm:**<br>Probabilistic approach to algorithm and Randomized Analysis<br>Indicator Random Variable (IRV)<br>Randomized Quick Sort<br>Analysis of Hiring Problem (Flipped Classroom: Analysis of Birthday Paradox Problem, Bins and Balls Problem using IRV)<br>Numerical Probabilistic algorithms with example<br>Las Vegas and Monte Carlo algorithm<br>Game theoretic randomized algorithm techniques (Tic-Tac-Toe) | 6 |
| 3 | **Advanced Data Structures:**<br>**Balanced Search Trees:** Red-Black Tree, Randomized BST, Tango Tree<br>**Heap and Operations:** Binomial Tree, Binomial Heap<br>**Spatial Data Structure:** KD Tree, R Tree (Flipped Classroom: R* Tree)<br>**Probabilistic Data Structure:** LogLog and HyperLogLog, MinHash with Data mining context. (Flipped Classroom: Count-Min Sketch with Data mining context) | 12 |
| 4 | **Graph Based Algorithms:**<br>**Flow Network Introduction:** Residual Network, Augmenting Path, Ford-Fulkerson Method, Edmonds-Karp Method, Push-Relable Algorithm (Flipped Classroom: Relable to Front algorithm)<br>**Bipartite Matching:** Maximum Bipartite Matching, Weighted Bipartite Matching, Weighted Non-Bipartite Matching (Edmonds algorithm)<br>**Max Flow Min Cut** | 6 |
| 5 | **Computational Geometry:** Line Segment Properties, Convex Hull Graham's scan algorithm, Determining whether any pair of segments intersects, Finding the closest pair of points. (Flipped Classroom: Conic Programming)<br>**Geometric Searching:** Point Location in polygon using Ray Crossing.<br>**Online Algorithms:** River Search Problem, Competitive Ratio, K-Server (Flipped Classroom: List accessing, Paging) | 6 |

| | | |
|---|---|---|
| **6** | **Algorithm Classes:** P, NP, NP Hardness and NP Completeness<br>**Np Completeness Proofs:** Satisfiability(3 sat), Reducibility, TSP (Flipped Classroom: Sum of Subsets)<br>**Approximation Algorithms:** Vertex Cover Problem, Travelling SalesPerson problem<br>**Network Approximation:** Randomized Rounding, Primal Dual algorithms<br>**Randomized Classes:** RP, BPP, ZPP (Adleman's theorem)<br>**Special Topic:** Turing Machine Halting Problem (time and space bounds, nondeterminism), Diagonalization problem. | **6** |

**Books Recommended:**

*Text books:*

1. Introduction to Algorithms by Thomas H Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, Third Edition.
2. Design and analysis of algorithms by S. Sridhar
3. Horowitz, Sahani and Rajsekaran, ―Fundamentals of Computer Algorithms‖, Galgotia.
4. Harsh Bhasin, Algorithms Design and Analysis, Oxford, 2015.

*Reference Books:*

1. Rajeev Motwani, Prabhakar Raghavan, Randomized Algorithm, Cambridge University
2. S. K. Basu, Design Methods and Analysis of Algorithm, PHI
3. Vijay V. Vajirani, Approximation Algorithms, Springer.
4. Computational Complexity, Stanford University.

**Suggested List of Experiments:**

| Lab Session | Title |
|---|---|
| **1** | Experiment on Amortized Analysis |
| **2** | Experiment on Randomized Algorithms (Randomized Quick Sort) |
| **3** | Experiment on Advanced Data Structure (Red-black Tree Operations) |
| **4** | Experiment on Graph Based Algorithms (Ford Fulkerson Method) |
| **5** | Experiment on Online Algorithms (K-Server algorithm) |
| ● Students need to select the problem statement of relevance and provide the implementable solution by selecting appropriate Advance Data structure and Advance Algorithm.<br>● Also perform Analysis of the same. | |

Any other practical covering the syllabus topics and subtopics can be conducted.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to **75 marks**.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral and practical examination will be based on the entire syllabus of course **DJ19CEC602** including the practical performed during laboratory sessions of course **DJ19CEL602**.
2. Oral and practical examination will be of **25 marks**.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEL602** with minimum 6 experiments to be incorporated.

The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal Documentation (Write-up and solution of selected problem statement): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

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<tr><td colspan="8">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="4">Semester : VI</td></tr>
<tr><td colspan="8">Course : Information Security</td><td colspan="4">Course Code: DJ19CEC603</td></tr>
<tr><td colspan="8">Course : Information Security Laboratory</td><td colspan="4">Course Code: DJ19CEL603</td></tr>
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**Pre-requisite:** Knowledge of Programming Basics and Computer Network.

**Objectives:**

1. To introduce classical encryption techniques and concepts of modular arithmetic and number theory.
2. To explore the working principles and utilities of symmetric cryptographic algorithms.
3. To distinguish symmetric and asymmetric cryptography and explore the working principles and utilities of asymmetric cryptographic algorithms.
4. To understand data integrity and explore the design issues and working principles of various authentication protocols, PKI standards and various secure communication standards
5. To understand network and system attacks and develop utility programs for secure communication.
6. To explore Software vulnerability and develop and apply preventive measures.

**Outcomes:** On completion of the course, learner will be able to:

1. Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
2. Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
3. Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
4. Apply different digital signature algorithms to achieve authentication and design secure applications
5. Understand network security basics, analyze different attacks on networks and systems.
6. Understand Software vulnerability and Apply preventive measures.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Introduction and Number Theory**<br><br>Services, Mechanisms and attacks-the OSI security architecture-Network security model classical Encryption techniques (Symmetric cipher models, substitution techniques, transposition Techniques), Number theory Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields-Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem, Chinese Remainder theorem. | 07 |
| 2 | **Symmetric Cryptography:**<br><br>Block cipher principles block cipher modes of operation, Simplified Data Encryption Standard (DES), DES, Double DES, Triple DES, Simplified Advanced Encryption Standard (S-AES), AES- Blowfish, IDEA. | 07 |
| 3 | **Asymmetric Cryptography:**<br><br>Symmetric vs. Asymmetric Cryptography, Principles of public key cryptosystems, and Essential Number Theory for Public-Key Algorithm: Euclidean algorithm, Extended Euclidean Algorithm, Euiler's Phi Function, Fermat's Little Theorem and Euiler's Theorem. The RSA algorithm, Key management, Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography. | 08 |
| 4 | **Integrity, Authentication and Digital Certificates:**<br><br>Cryptographic hash functions, Properties of secure hash function, MD5, SHA-1, MAC, HMAC, CMAC. User Authentication and Entity Authentication, One-way and mutual authentication schemes, Needham Schroeder Authentication protocol, Kerberos Authentication protocol. RSA Signature Schemes, Elgamal Digital Signatures, Digital Signature Algorithm. Digital Certificate: X.509, PKI. | 07 |
| 5 | **Network Security:**<br><br>Network security basics: TCP/IP vulnerabilities (Layer wise), Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP syn flood, DNS Spoofing. Denial of Service: Classic DOS attacks, Source Address spoofing, ICMP flood, SYN flood, UDP flood, Distributed Denial of Service, Defenses against Denial-of-Service Attacks. Internet Security Protocols: SSL, IPSEC, Secure Email: PGP, Firewalls, IDS and types, Honey pots, Case Study on Network Security. | 08 |

| | | |
|---|---|---|
| 6 | **Software Security**<br><br>Software Vulnerabilities: Buffer Overflow, Salami Attack, Format string, cross-site scripting, SQL injection, Malware: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits Introduction to Secured Software Development Life Cycle. , Case Study on Software Security. | 05 |

**Books Recommended:**

*Text books:*

1. William Stallings, Cryptography and Network Security, Principles and Practice, 7thEdition, Pearson Education, June 2017.
2. Behrouz A. Ferouzan, ―Cryptography & Network Security, Tata Mc Graw Hill, 2007

*Reference Books:*

1. Applied Cryptography, Protocols Algorithms and Source Code in C, Bruce Schneier, Wiley.
2. Charles Pfleeger, Shari Lawrence Pfleeger & Jonathan Margulies, Security in Computing, 5th Edition, Prentice Hall
3. Secured Development Life Cycle by Michael Howard, Steve Lipner , Microsoft Press.

**List of Laboratory Experiments: (Any Seven)**

| Sr. No. | Title of the Experiment |
|---|---|
| 1 | Design and Implement Caesar cipher cryptographic algorithm by considering letter [A..Z] and digits [0..9]. Apply Brute Force Attack to reveal secret. |
| 2 | Design and Implement Encryption and Decryption algorithm using Simple Columnar Transposition cipher technique. Study how dictionary attack can be applied on it. |
| 3 | Design and Implement your “own” cipher combining “Substitution” and “Transposition” techniques. |
| 4 | Implement RSA Cryptosystem using RSA Algorithm / Implement Elliptical Curve Digital Signature Algorithm (ECDSA). |
| 5 | Demonstrate the data integrity using various cryptographic algorithms viz. MD-5, SHA-1 using VLAB, IIT Bombay. |
| 6 | Implement registration webpage asking for information along with the password (Strong enough). Store the password in database in encrypted form after adding few salt characters in the password. Verify the strength of password and perform analyses using various attack. |

| | |
|---|---|
| 7 | Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars. |
| 8 | Study of packet sniffer tools wireshark, : Download and install wireshark and capture icmp, tcp, and http packets in promiscuous mode. Explore how the packets can be traced based on different filters. |
| 9 | Implementation of Network Intrusion Detection System using SNORT and IPTABLE |
| 10 | Implement DOS Attack using HPing, Hping3 and other tools. |
| 11 | Implement Buffer Overflow Attack using Ollydbg, Splint, Cppcheck |

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral and practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

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<tr><td colspan="8">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="4">Semester : VI</td></tr>
<tr><td colspan="8">Course : Big Data Infrastructure</td><td colspan="4">Course Code: DJ19CEEC6011</td></tr>
<tr><td colspan="8">Course : Big Data Infrastructure Laboratory</td><td colspan="4">Course Code: DJ19CEEL6011</td></tr>
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</table>

**Pre-requisite:** Databases, Python ,Java,R, Linux OS

**Course Objectives:**

1. To define big data solutions for business intelligence.
2. To analyse business case studies for big data analytics.
3. To develop map-reduce analytics using Hadoop and related tools.
4. To perform data storage and management using NoSqL.
5. To perform realtime analysis on streaming data.

**Outcomes:** Students will be able to

1. Describe big data and use cases from selected business domains.
2. Perform map-reduce analytics using Hadoop.
3. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics
4. Build and maintain reliable, scalable, distributed systems using Apache Spark.
5. Design and build MongoDB based Big data Applications and learn MongoDB query language.
6. Use streaming tools for real time analysis of bigdata.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Introduction to Big Data and Hadoop**<br>● Introduction to Big Data<br>● Distributed file system<br>● Big Data characteristics, Drivers, types of Big Data,<br>● Traditional vs. Big Data business approach,<br>● Case Study of Big Data Solutions.<br>● Bigdata Applications<br>● Societal and Ethical issues associated with the use of big data analytics<br>● The key privacy issues. | 02 |
| 2 | **INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE**<br>● Big Data – Apache Hadoop & Hadoop EcoSystem<br>● Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce Concept of Hadoop<br>● HDFS Commands<br>● MApReduce-The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution | 08 |
| 3 | **HDFS, HIVE AND HIVEQL, HBASE**<br>● HDFS-Overview, Installation and Shell, Java API;<br>● Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating,<br>● Map Reduce Scripts, Joins & Sub queries<br>● HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG-Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts<br>● Zookeeper , how it helps in monitoring a cluster<br>● Build Applications with Zookeeper and HBase | 12 |
| 4 | **SPARK**<br>● Introduction to Data Analysis with Spark<br>● Downloading Spark and Getting Started<br>● Programming with RDDs<br>● Machine Learning with MLlib. | 06 |
| 5 | **NoSQL**<br>● Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL,<br>● Introduction to MongoDB key features: | 08 |

| | | |
|---|---|---|
| | ● Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents , MongoDB Query Language. | |
| **6** | **Processing of Real Time Data and Streaming Data**<br>● Data Streams: Introduction and Ingestion<br>● Kafka<br>● Storm & Storm Assignment<br>● Spark Streaming | 06 |

**Books Recommended:**

**Text Books**

1. Understanding Big data - Chris Eaton,Dirk derooset al. McGraw Hill
2. MongoDB in Action - Kyle Banker,Piter Bakkum, Shaun Verch, Dream tech Press
3. Beginning Apache Pig-Big Data Processing Made Easy-Balaswamy Vaddeman, Apress'
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
5. Eric Sammer, "Hadoop Operations", Reilly, 2012.

***Reference Books***

1. Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Understanding *Big Data: Analytics for Enterprise Class Hadoop and streaming Data*,The McGraw-Hill Companies, 2012.
2. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
3. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

***Suggested List of Experiments:***

| Sr. No. | Title of the Experiment |
|---|---|
| 1. | Installation of Hadoop on a single node cluster |
| 2. | Execution OF HDFS Commands. |
| 3. | Execution of MapReduce program for sorting of numbers and counting word occurrences in a text file. |
| 4. | Execute HIVE commands to load, insert, retrieve, update, or delete data in the tables. |
| 5. | Execute PIG built in commands and rum pig scripts on HDFS |
| 6. | Installation and Configuration of Apache Spark |
| 7. | Execution of ML algorithms using Apache Spark Mlib |

| | |
|---|---|
| 8. | Perform CRUD Operations using Mongodb |
| 9. | Read streaming data using Kafka. |
| 10. | Perform Twitter Sentiment analysis usinfg Spark Streaming |

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

Oral examination will be based on the entire syllabus including the practicals performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEEC6011** with minimum 06 experiments along with a mini project to be incorporated.

The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal Documentation (Write-up and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

<table>
<tr><td colspan="8">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="4">Semester : VI</td></tr>
<tr><td colspan="8">Course : Internet of Things</td><td colspan="4">Course Code: DJ19CEEC6012</td></tr>
<tr><td colspan="8">Course : Internet of Things Laboratory</td><td colspan="4">Course Code: DJ19CEEL6012</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme<br>(Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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</table>

**Pre-requisite:** Basics of python programming, Computer Networks

**Course Objectives:**

1. Provide an overview of concepts, trends and challenges of Internet of Things.
2. Impart the knowledge of sensors and embedded systems.
3. Describe IoT deployment levels and M2M technologies
4. Facilitate use of hardware and software technologies related to Internet of Things.
5. Provide the knowledge of IoT communication models and protocols.
6. Develop skills to relate the IoT technologies for practical IoT applications.

**Outcomes:** At the end of the course, learner will be able to

1. Comprehend the Internet of Things concepts and investigate the challenges.
2. Gain knowledge of sensors and embedded systems.
3. Develop and deploy IoT system prototype with enhanced IoT Technologies.
4. Get hand-on exposure to different IoT processors and controllers
5. Use IoT communication models and protocols.
6. Design and develop small IoT applications to create smart objects

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Introduction to WSN and IoT:**<br><br>Introduction to WSN and its Technologies, Architecture and characteristics of WSN, Scalability issues and challenges of a Wireless Sensor Network<br>Introduction to Internet of Things, Characteristics and applications of IoT, IoT Reference Model, Security issues in the IoT, Disambiguation of IoT vs IoE vs M2M vs others | 04 |
| 2 | **Transducers, Sensors and Actuators:**<br><br>Introduction and classification of Transducers, Sensors and Actuators, Types of Sensors: Motion Detectors, Occupancy Detectors, Force Sensors, Strain Sensors, Tactile sensors, Pressure sensors, Chemical sensors, Temperature Sensors etc. Types of Actuators, Solenoid, Voice Coil, DC Motor, AC Motor and Stepper motor, Embedded systems: Characteristics of Embedded Systems | 05 |
| 3 | **Introduction to Arduino and Raspberry Pi:**<br>Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board and its types, Introduction to Embedded C and Arduino platform<br><br>Introduction to Raspberry Pi, Comparison of various Rpi Models,<br>Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi | 08 |
| 4 | **IoT model and protocols:**<br><br>IoT Levels & Deployment Templates, IoT Level 1, IoT Level 2, IoT Level 3, IoT Level 4, IoT Level 5, IoT Level 6, M2M, Various operating systems, TinyOS, Contiki OS, MANTIS, Protocol Classification, MQTT, XMPP, DDS, AMQP, COAP, REST, IPv6, 6LoWPAN, Comparison of protocols<br><br>IoT Routing Protocols, Data-centric and Flat-Architecture Protocols, Flooding, Gossiping, Sensor Protocols for Information via Negotiation (SPIN), SPIN PP, SPIN EC ( Energy Conserve), SPIN BC, Hierarchical Protocols, LEACH, QoS-Based Protocols | 10 |
| 5 | **IoT applications :**<br><br>**IoT for Entertainment and wearables:** Bluetooth Headset, Fitness, Smart Watch, location and Tracking – Personal navigation Device<br>**IoT for Manufacturing:** Flow Optimization, Real Time Inventory, Asset Tracking Process, Analytics (pH, Gas, Concentration, Force& Humidity)- portable data terminal, **IoT for Employee safety** – Fire and safety detector, Predictive Maintenance, Firmware Updates, **IoT for healthcare** : Remote Monitoring-ECG, Ambulance Telemetry, Drug Tracking, Hospital Asset Tracking, Access Control, Predictive Maintenance, **IoT for Logistics & Supply chain**. Retail Supply chain control, NFC Payment, Intelligent shopping application, Smart product management, Case studies on Smart cities, Smart Home, Smart Environment, Smart Agriculture | 08 |

| | | |
|---|---|---|
| **6** | **IoT in Cloud, Fog and Edge Computing:**<br>Overview of Cloud and Fog Computing, Definition, Difference between Fog and Cloud, Related Paradigms and Technologies like MCC, MEC, Edge Computing, Taxonomy of Fog Computing, Different dimensions of Fog computing Advantages and Applications. Edge Computing: Architecture of Edge Computing, Benefits, Applications, Cloud, Fog and Edge Computing Use Case Scenarios for IoT | 05 |
| **7** | **Artificial Intelligence in IoT**<br><br>**Applications of Artificial Intelligence in Internet of Things,**<br><br>Real world examples: Tesla Motors – Self Driving Cars, WildTrack – Endangered Species Preservation, Nest Labs – Smart thermostat, Automated vacuum cleaner – iRobot Roomba<br><br>**IoT companies and vendors:** Commercially available IoT devices from vendors, Google Home Voice Controller, Amazon Echo Plus Voice Controller, August Doorbell Cam, August Smart Lock | 05 |

**Books Recommended:**

1) Internet of Things by Srinivasa K.G., Siddesh G.M., Hanumantha Raju R., CENGAGE publication (Text Book)
2) Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti, Universities Press
3) Internet of Things, Architecture and Design Principles by Raj Kamal, Mc Graw Hill Education

***Suggested List of Experiments:***

| Sr. No. | Title of the Experiment |
|---|---|
| | **Arduino** |
| 1. | LED glow |
| 2. | Traffic signal |
| 3. | Seven segment display |
| 4. | Piezo sensor |
| 5. | Light emission |
| 6. | PIR sensor |
| 7. | IR remote control sensor |
| 8. | Ultrasonic sensor |
| 9. | ESP8266 WiFi Module |

| | |
|---|---|
| 10. | ThingSpeak Platform |
| 11. | Blynk App |
| 12. | Working with Own Cloud Server (Hosting) |
| 13. | Creating a platform to control home appliances with own server |
| **R-Pi** | |
| 1. | Varying the brightness of LED using R-pi |
| 2. | Making a user interface to Turn Things On and Off |
| 3. | Controlling GPIO Outputs using a Web Interface |
| 4. | Create an user interface to control Servo motor |
| 5. | Camera Interfacing and Programming |
| 6. | Playing an Audio File |
| 7. | GSM/GPS interfacing and programming |
| 8. | Measuring distance |
| 9. | Displaying sensor values |
| 10. | Logging to a USB flash Drive |

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practical's performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.

3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEEL6012** with minimum 10 experiments to be incorporated.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

<table>
<tr><td colspan="5">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="5">Semester : VI</td></tr>
<tr><td colspan="5">Course : Business Analytics</td><td colspan="5">Course Code: DJ19CEEC6013</td></tr>
<tr><td colspan="5">Course : Business Analytics Laboratory</td><td colspan="5">Course Code: DJ19CEEL6013</td></tr>
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</table>

**Pre-requisite:** Basic statistics and Database

**Course Objectives:** Students will try to:

1. Business Analytics refers to skills, practices and techniques used in converting data into information and knowledge that aid business decision making.
2. Statistical learning including quantitative, qualitative analysis techniques
3. The use of the above analysis and visualization to aid decision making.

**Outcomes:** Students will be able to

1. Able to familiar with Base SAS programming.
2. Understand and demonstrate visual analytics.
3. Able to design the report using reporter
4. View various reports using different media devices.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Introduction to Base SAS:**<br>**SAS Program :** Introduction to SAS program, Submitting a SAS program – SAS Studio, SAS Enterprise Guide, SAS Windowing environment, SAS program syntax<br>**Accessing Data :**Examining SAS Data sets, Accessing SAS Libraries<br>**Producing Detail Reports:** Subsetting Report data, Sorting and Grouping Report data, Enhancing Reports<br>**Formatting Data Values:** Using SAS Formats, User defined Formats | 08 |
| 2 | **Reading SAS Dataset , Spreadsheet and Database data**<br>Reading SAS Dataset.<br>Customize SAS Dataset.<br>Router Reading Spreadsheet data<br>Reading database data. | 05 |
| 3 | **Visual Analytics**<br>Getting Stated with SAS Visual Analytics: Exploring SAS VA concepts, Using Home page<br>Administrating the Environment and Managing Data: Exploring Data Builder, Exploring Administrator.<br>Demonstrations and Exercises. | 04 |
| 4 | **Using the Explorer**<br>Selecting Data and defining Data Item properties<br>Creating Visualisations, Enhancing Visualisations with Analytics<br>Interacting with Visualizations and Explorations | 08 |
| 5 | **Designing Reports with Reporter**<br>Creating a Simple Report<br>Creating Data Items and Working with Graphs<br>Working with Filters and Report sections<br>Working with other objects<br>Demonstrations and Exercises | 08 |

| | | |
|---|---|---|
| **6** | **Viewing SAS VA Reports and Case Study**<br>Creating Analyses and Reports.<br>Viewing Reports on the Web<br>Viewing Reports on the Mobile Device/ Office Analytics<br>Case Study – Creating Analyses and Reports | 06 |

**Books Recommended:**

1. SAS programming 1 – Essentials.
2. SAS Visual Analytics – Fast Track.
3. SAS Support

***Suggested List of Experiments:***

| Sr. No. | Title of the Experiment |
|---|---|
| 1. | Importing data in SAS from Excel and CSV file. |
| 2. | Creating summary statistical data. |
| 3. | Exporting results to Excel and PDF. |
| 4. | Manipulating data with functions. |
| 5. | Using data with formats like charts and graphs. |
| 6. | Creating data by applying filters and performing data analysis on it. |
| 7. | Working with graph level display rules. |
| 8. | Analyzing a Text data source. |

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including the practical's performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1.Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.

2. Total duration allotted for writing each of the paper is 1 hr.

3. Average of the marks scored in the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEEL6013** with minimum 06 experiments along with a mini project to be incorporated.

The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal Documentation (Write-up and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

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<tr><td colspan="8">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="4">Semester : VI</td></tr>
<tr><td colspan="8">Course : Machine Learning</td><td colspan="4">Course Code: DJ19CEEC6021</td></tr>
<tr><td colspan="8">Course : Machine Learning Laboratory</td><td colspan="4">Course Code: DJ19CEEL6021</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme<br>(Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
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</table>

**Pre-requisite:** Data Structures, Basic Probability and Statistics, Algorithms

**Course Objectives:**

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression, classification and clustering tasks.
3. To become familiar with Dimensionality reduction Techniques.

**Outcomes:** Students will be able to

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Apply Dimensionality reduction techniques.
4. Solve the problems using various machine learning techniques
5. Understand the basics of Reinforcement and deep learning.
6. Design application using machine learning techniques

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Introduction to Machine Learning**<br>Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps involved in developing a Machine Learning Application. | 05 |
| 2 | **Learning with Regression and trees:**<br>Learning with Regression: Linear Regression, Logistic Regression.<br>Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART). | 07 |
| 3 | **Dimensionality Reduction:**<br>Dimensionality Reduction Techniques: Principal Component Analysis, Independent Component Analysis, Single value decomposition, | 07 |
| 4 | **Learning with Classification and Clustering**<br>**Learning with Classification**:<br>**Artificial Neural Networks-** Backpropagation Algorithm, Self-Organizing Maps<br>**Non-parametric classification:** K Nearest Neighbour Algorithm<br>**Support Vector Machine:** Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions.<br>**Bayesian belief Networks:** Markov Models, Markov Chain Monte Carlo Methods, , Markov Random Fields, Hidden Markov Models<br>**Learning with Clustering:**<br>K-means clustering, Hierarchical clustering, Expectation Maximization Algorithm Supervised learning after clustering, Radial Basis functions. | 12 |
| 5 | **Reinforcement and Deep Learning**<br>**Reinforcement Learning:**<br>Introduction, Elements of Reinforcement Learning, Model based learning, Temporal Difference Learning, Generalization, Partially Observable States**.**<br>**Deep Learning:**<br>Introduction to Deep Neural Network, Wide Vs. Deep Neural Network, Reasons to opt for deep neural network, Deep Neural networks for unsupervised learning | 05 |
| 6 | **Applications of Machine Learning**<br>Recommender Systems, Machine Learning for Image Recognition, Sentiment Analysis, Machine Learning for video surveillance | 04 |

**Books Recommended:**

***Text Books***

1. Peter Harrington ―Machine Learning In Action‖, DreamTech Press
2. Ethem Alpaydın, ―Introduction to Machine Learning‖, MIT Press
3. Tom M.Mitchell ―Machine Learning‖ McGraw Hill
4. Stephen Marsland, ―Machine Learning An Algorithmic Perspective‖ CRC Press
5. Kevin P. Murphy , Machine Learning ― A Probabilistic Perspective‖
6. Andreas C. Müller and Sarah Guido- Introduction to Machine Learning with Python: A Guide for Data Scientists,O'reilly
7. François Chollet, Deep Learning with Python| Manning
8. J.-S.R.Jang "Neuro-Fuzzy and Soft Computing" PHI 2003.

***Reference Books***

1. Han Kamber, ―Data Mining Concepts and Techniques‖, Morgann Kaufmann Publishers
2. Margaret.H.Dunham, ―Data Mining Introductory and Advanced Topics‖, Pearson Education

***Suggested List of Experiments:***

| Sr. No. | Title of the Experiment |
|---|---|
| 1. | To implement Linear Regression |
| 2. | To implement Logistic Regression |
| 3. | To implement CART decision tree algorithm. |
| 4. | To implement Support Vector Machine. |
| 5. | To implement Bayesian Classification. |
| 6. | To implement PCA. |
| 7. | To implement K-Nearest Neighbour. |
| 8. | To implement Radial basis functions. |
| 9. | Mini project based on any machine learning application. |

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus, summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including the practical's performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEEL6021** with minimum 06 experiments along with a mini project to be incorporated.

The distribution of marks for term work shall be as follows:

1. Laboratory work (Performance of Experiments): 15 Marks
2. Journal Documentation (Write-up and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

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<tr><td colspan="5">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="5">Semester: VI</td></tr>
<tr><td colspan="5">Course: Compiler Design</td><td colspan="5">Course Code: DJ19CEEC6022</td></tr>
<tr><td colspan="5">Course: Compiler Design Laboratory</td><td colspan="5">Course Code: DJ19CEEL6022</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme<br>(Hours / week)</td><td colspan="9">Evaluation Scheme</td></tr>
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</table>

**Pre-requisite:** Data Structures and Algorithms, Theory of Computation

**Course Objectives:**

1. To initiate an understanding of compilers in general and in brief about phases of compiler.
2. To provide a theoretical framework for optimizing the code.
3. To familiarize and encourage the students to use various compiler construction tools.

**Outcomes:** On successful completion of course learner will be able to:

1. Understand the basics of compilation steps.
2. Apply knowledge of automata theory and formal languages.
3. Understand and Implement a Parser.
4. Describe techniques for intermediate code and machine code optimization.
5. Apply various Error Recovery mechanisms.

**Detailed Syllabus: (unit wise)**

| Unit | Description | Duration |
|---|---|---|
| 1 | **Introduction to compilers:**<br>Compilers Analysis of source Program, the tasks of a compiler<br>Analysis of the Source Program, Phases and Passes in compilers, The Grouping of phases<br>Cousins of the compiler, Compiler - construction tools<br><br>**Introduction to Interpreters:** Phases of interpreter, Types of interpreter, Compiler vs. Interpreter | 04 |
| 2 | **Lexical Analysis:**<br>Role of a Lexical analyser<br>Input buffering, specification and recognition of tokens<br>Designing a lexical analyser generator, Pattern matching based on NFA's. | 04 |
| 3 | **Syntax Analysis:**<br>Role of Parser<br>Top--down parsing, Predictive parsers -(LL)<br>Bottom-Up parsing, Operator precedence parsing, SLR, CLR and LALR parsers. | 10 |
| 4 | **Syntax directed Translation:**<br>Syntax directed definitions, Inherited and Synthesized attributes, Evaluation order for SDDs,S - attributed Definitions, L- attributed Definitions | 04 |
| 5 | **Intermediate code generation:**<br>Intermediate Code types: Postfix, Parse tree and syntax tree, Three address code.<br>Types of Three address code: Quadruples, Triples and Indirect triples<br>Translation of Assignment statements, Boolean expression, case statements, array references and procedure calls. | 06 |
| 6 | **Code generation:**<br>Issues in the design of Code Generator, Basic Blocks and Flow graphs, Code generation algorithm, DAG representation of Basic Block. | 04 |
| 7 | **Code optimization:**<br>Principal sources of Optimization<br>Optimization of Basic Blocks, Loops in Flow graph, Peephole Optimization | 04 |
| 8 | **Run-time storage management:**<br>Data Structures for symbol table, representing scope information, Error detection and recovery, Error handling<br>Storage allocation strategies, parameter passing, introduction to garbage collection and compaction | 06 |

**Books Recommended:**

**Text Book:**

1. A. V. Aho, R. Shethi, Monica Lam, J.D. Ulman: Compilers Principles, Techniques and Tools, Pearson Education, Second Edition.

**Reference books:**

1. Lex & yacc, 2nd Edition by John R. Levine, Tony Mason & Doug Brown O 'Reilly

2. Compiler construction: principles and practices, Kenneth C.Louden ,CENGAGE Learning

***Suggested List of Experiments:***

| Sr. No. | Title of Experiments |
|---|---|
| 1. | Develop a lexical analyzer to recognize a few patterns in c (ex. Identifiers, constants, comments, operators etc.) |
| 2. | Implementation of lexical analyzer using lex tool. |
| 3. | Derive First and Follow of a variable. |
| 4. | Design LL (1) Parser. |
| 5. | Implementation of Intermediate code generation.<br>1. Assignment statement<br>2. Boolean statement<br>3. Loop |
| 6. | Implementation of code generator algorithm |
| 7. | Implementation of code optimization techniques (constant folding etc.) |
| 8. | Case study: LLVM |

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus, summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practical's performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the papers is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEEL6022** with 10 experiments to be incorporated including 07 from the above suggested list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

| Program: Third Year B.Tech. in Computer Engineering | Semester: VI |
|---|---|
| Course: Human Machine Interaction | Course Code: DJ19CEEC6023 |
| Course: Human Machine Interaction Laboratory | Course Code: DJ19CEEL6023 |

| Teaching Scheme (Hours / week) | | | | Evaluation Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Semester End Examination Marks (A) | | | Continuous Assessment Marks (B) | | | Total marks (A+ B) |
| Lectures | Practical | Tutorial | Total Credits | Theory | | | Term Test 1 | Term Test 2 | Avg. | |
| | | | | 75 | | | 25 | 25 | 25 | 100 |
| | | | | Laboratory Examination | | | Term work | | | |
| 3 | 2 | - | 4 | Oral | Practical | Oral &Practical | Laboratory Work | Tutorial / Mini project / presentation/ Journal | Total Term work | 50 |
| | | | | 25 | - | - | 15 | 10 | 25 | |

**Prerequisite:** Web Technologies; Experience in designing interfaces for applications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc

**Course Objectives:** At the end of the course, students will be able to –

1. Learn the foundation of human machine interaction.
2. Understand the importance of human psychology in designing good interfaces.
3. Be aware of mobile interaction design and its usage in day – to – day activities.
4. Understand various design technologies to meet user requirements.
5. Encourage to indulge into research in Machine Interaction Design.

**Outcomes:** On completion of the course, learner will be able to:

1. Identify User Interface (UI) design principles.
2. Analysis of effective user friendly interfaces.
3. Apply Interactive Design process in real world applications.
4. Evaluate UI design and justify.
5. Create application for social and technical task.

| Detailed Syllabus: (unit wise) | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **FOUNDATIONS OF HMI:**<br>The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving . The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms. | **7** |
| **2** | **DESIGN & SOFTWARE PROCESS:**<br>Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics, human consideration, Human interaction speeds .Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process. Evaluation Techniques: Universal Design. | **8** |
| **3** | **GRAPHICAL USER INTERFACE:**<br>The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design. | **6** |
| **4** | **SCREEN DESIGNING**:<br>Design goals , Screen planning and purpose, organizing screen elements, ordering of screen data and content , screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design. | **7** |
| **5** | **INTERFACE DESIGN FOR MOBILE DEVICES:**<br>Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. | **6** |
| **6** | **INTERACTION STYLES AND COMMUNICATION:**<br>Windows:Characteristics, Components, Presentation styles, Types of Windows, Management, operations. Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colors | **6** |

**Books Recommended:**

*Text books:*

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction‖, 3rdEdition, Pearson Education, 2004.

2. Wilbert O. Galitz, ―The Essential Guide to User Interface Design‖, Wiley publication.

3. Alan Cooper, Robert Reimann, David Cronin, ―About Face3: Essentials of Interaction design‖,

Wiley publication.

4. Jeff Johnson, ―Designing with the mind in mind‖, Morgan Kaufmann Publication.

5. Donald A. Normann, ― Design of everyday things‖,Basic Books; Reprint edition 2002.

6. Brian Fling, ―Mobile Design and Development‖, First Edition , O'Reilly Media Inc., 2009.

*Reference Books:*

1. Rogers Sharp Preece,‖Interaction Design:Beyond Human Computer Interaction‖,,Wiley.

2. Guy A. Boy ―The Handbook of Human Machine Interaction‖, Ashgate publishing Ltd.

3. Kalbnde,Kanade,Iyer,‖Galitz's Human Machine Interaction‖, Wiley Publications.

***Suggested List of Experiments:***

| Sr. No. | Title of Experiments |
|---|---|
| 1. | Design a Mobile app/ Website that can teach mathematics to children of 4-5 years age in schools in Rural /Urban Sector |
| 2. | Design a Mobile App/Website that can help people to sell their handmade products in metro cities |
| 3. | ATM machine/KIOSK screen design for rural people. |
| 4. | Design a Mobile App/Website to get an experience for passengers whose flight /train is delayed. |
| 5. | Design an UI application for Institute event management. |
| 6. | Design of User interface for the system using various interaction styles. |
| 7. | Statistical Graphics and its use in visualization |
| 8. | Design appropriate icons pertaining to a given domain .(Eg. Greeting cards) |
| 9. | Design UI for Motor paralysis for disabled people. |
| 10. | KIOSK design for hospital/school/educational campus/National Institute. |

**Evaluation Scheme:**

***Semester End Examination (A):***

*Theory:*

1. Question paper based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

*Laboratory:*

1. Oral examination will be based on the entire syllabus including, the practical's performed during laboratory sessions.

***Continuous Assessment (B):***

*Theory:*

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

*Laboratory: (Term work)*

Laboratory work will be based on **DJ19CEEL6023** with minimum 08 experiments to be incorporated.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

<table>
<tr><td colspan="6">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="7">Semester : VI</td></tr>
<tr><td colspan="6">Course : Innovative Product Development-IV</td><td colspan="7">Course Code: DJ19ILL2</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours/week)</td><td colspan="9">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="3">--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Termwork</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">02</td><td rowspan="2">--</td><td rowspan="2">01</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>25</td><td>--</td><td></td><td>--</td><td>--</td><td>25</td></tr>
</table>

**Objectives:**

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualise and create a successful product.

**Outcome:**

Learner will be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualising a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyse the impact of the proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of theteam or as theleader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare themselves to be successful entrepreneurs.

7. Demonstrate product/project management principles during the design and development work and also excel in written (Technical paper preparation) as well as oral communication.

**Guidelines for the proposed product design and development:**

- Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students in the team shall understand the effective need for product development and accordingly select the best possible design in consultation with the faculty supervisor.
- Students shall convert the best design solution into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
- Faculty supervisor may provide inputs to students during the entire span of the activity, spread over 2 semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity log-book is to be prepared by each team, wherein the team can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and approve the same on a weekly basis.
- The design solution is to be validated with proper justification and the report is to be compiled in a standard format and submitted to the department. Efforts are to be made by the students to try and publish a technical paper, either in the institute journal, "Techno Focus: Journal for Budding Engineers" or at a suitable publication, approved by the department research committee/ Head of the department.
- The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters V and VI.

**Guidelines for Assessment of the work:**

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student's contribution tothe team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Distribution of term work marks during the subsequent semester shall be as given below:
    - Marks awarded by the supervisor based on log-book : 10
    - Marks awarded by review committee : 10
    - Quality of the write-up : 05

In the last review of the semester VI, the term work marks will be awarded as follows.

- Marks awarded by the supervisor (Considering technical paper writing) : 15
- Marks awarded by the review committee : 10

**Review/progress monitoring committee may consider the following points during the assessment.**

- In the semester V, the entire design proposal shall be ready, including components/system selection as well as the cost analysis. Two reviews will be conducted based on the presentation given by the student's team.
    - First shall be for finalisation of the product selected.
    - Second shall be on finalisation of the proposed design of the product.
- In the semester VI, the expected work shall be procurement of components/systems, building of the working prototype, testing and validation of the results based on work completed in semester III.
    - First review is based on readiness of building the working prototype.
    - Second review shall be based on a presentation as well as the demonstration of the working model, during the last month of semester IV. This review will also look at the readiness of the proposed technical paper presentation of the team.

The overall work done by the team shall be assessed based on the following criteria;

1. Quality of survey/ need identification of the product.
2. Clarity of Problem definition (design and development) based on need.
3. Innovativeness in the proposed design.
4. Feasibility of the proposed design and selection of the best solution.
5. Cost effectiveness of the product.
6. Societal impact of the product.
7. Functioning of the working model as per stated requirements.
8. Effective use of standard engineering norms.
9. Contribution of each individual as a member or the team leader.
10. Clarity on the write-up and the technical paper prepared.

- The semester reviews (V and VI) may be based on relevant points listed above, as applicable.

**Guidelines for Assessment of Semester Reviews:**

- The write-up should be prepared as per the guidelines given by the department.
- The design and the development of the product shall be assessed through a presentation and demonstration of the working model by the student team to a panel of Internal and External Examiners, preferably from industry or any research organisations having an experience of more than five years, approved by the Head of the Institution. The presence of the external examiner is desirable only for the 2nd presentation in semester IV.Students are compulsorily required to present the outline of the technical paper prepared by them during the final review in semester VI.

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<table>
<tr><td colspan="8">Program: Third Year B.Tech. in Computer Engineering</td><td colspan="4">Semester : VI</td></tr>
<tr><td colspan="8">Course : Environmental Studies</td><td colspan="4">Course Code: DJ19A5</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme<br>(Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="5">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="5">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td></tr>
<tr><td colspan="5">-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="5">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="2">-</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td><td colspan="2">-</td><td>-</td></tr>
</table>

**Pre-requisite:** Interest in Environment and its impact on Human

**Objectives:**

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarise environment related legislation

**Outcomes:** On completion of the course, learner will be able to:

1. Understand how human activities affect environment
2. Understand the various technology options that can make a difference

| **Detailed Syllabus: (unit wise)** | | |
|---|---|---|
| **Unit** | **Description** | **Duration** |
| **1** | **Social Issues and Environment:**<br><br>Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests, Carbon emissions and Global Warming. | 4 |
| **2** | **Technological Growth for Sustainable Development:**<br><br>Social, Economical and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board. | 4 |
| **3** | **Green Technology:**<br>History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency. | 5 |

Books Recommended:

*Text books:*

1. Environmental Studies From Crisis to Cure, R. Rajagopalan, 2012
2. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education, Erach Bharucha
3. Green Information Technology A Sustainable Approach, Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, Morgan and Kaufman, Elsevier, 2015.

*Reference Books:*

1. Information Technologies in Environmental Engineering: New Trends and Challenges, Paulina Golinska, Marek Fortsch, Jorge Marx-Gómez, Springer, 2011.

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