

4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

**List of Experiments beyond Syllabus: (Maximum 05)**

- [1] Learn how to setup Jenkins on docker
- [2] Learn how to do Jenkins maintenance
- [3] Learn how to work with Git and Jenkins

**Text Book:** John Ferguson Smart: Jenkins: The Definitive Guide, O'Reilly Media, Inc.

**Reference Books:**

- [1] Gene Kim, Jez Humble, Patrick Debois, and John Willis,: The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations
- [2] Gene Kim, Kevin Behr, and George Spafford,: The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win,
- [3] Andrew Davis, : Mastering Salesforce DevOps: A Practical Guide to Building Trust While Delivering Innovation, Apress.

**6KE08 EMERGING TECHNOLOGY - LAB II**

6KE08 Department Professional Elective Lab II is based on 6KE04 Professional Elective-II. Tentative FOSS Tools & Technology for Practicalø are as follows:

**AI** : Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural, Retext, TextBlob  
**Cloud** : Stack, FOSS cloud Eucalyptus  
**IoT** : Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring  
**Multimedia** : Inkscape, GIMP, Krita, Scribus, RawTherapee.

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**SYLLABUS PRESCRIBED FOR B.E. (INFORMATION TECHNOLOGY) SEM. V**

**5IT01 DATABASE MANGEMENT SYSTEMS**

**Course Objectives:**

1. Identify role of database system, find out its applications and learn about database file systems.
2. Understand concept of designing database schema and its mapping to relational table.
3. Apply the concepts of database integrity and security, encryption, authorization and Normalization.
4. Evaluate query expression, query cost, query optimization and different operation.
5. Understand the concept of transaction management and its properties.
6. Understand concept of concurrency control and various type of protocol.

**Course Outcomes:**

1. To understand concept of database system.
2. To understand and apply the concept related with data model
3. Apply concepts of database querying, integrity and security using SQL.
4. To understand query processing and query optimization.
5. To understand concept of transaction management and its properties.
6. To understand the concept of Concurrency control and study of various database protocols.

**Unit I: Introduction:** Database, types of databases, DBMS, Purpose of DBMS & its Applications, RDBMS, File System, DBMS Architecture & its types, DBMS: SQL, MYSQL, ORACLE, PostgreSQL, DB2, SQL Server, Database Users and Administrator **Data Models:** Types of data Models: network, relational, object based data model; Data model schema, Data dependence, types of database languages, ACID properties. E-R Model Concepts, E-R diagram Notations, Mapping Constraints, DBMS Keys, E-R diagram to Table conversion.

**Unit-II: Relational Data Model:** Concepts, Relational algebra, Join operation, Integrity constraint and its type, relational calculus, Normalization: functional dependencies, Decomposition, Domain & data dependency, types of Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF;  
**Transaction processing:** Operations on transaction, Properties: Atomicity, Consistency, Isolation and Durability, States, schedule, deadlock in DBMS.

**Unit-III: SQL Introduction:**

**SQL:** Characteristic, advantages, data types, operators, wildcard operators, expressions, **Database commands:** create, drop, select and show database, Create table, drop table, Query with Select statements, Insert statement, Update statement, Delete statement with use of where, and, or clauses, Use of like and top clause, Alter command, Distinct Command, View in SQL, Create view using one or multiple table, delete view, Index creation & Drop, Null Values, SQL sub queries rules, sub queries using select, insert, update, delete statements, **SQL clauses:** having, group by, order by, join, **SQL Aggregate functions:** Count, sum average, max, min; Date function, **SQL Join:** inner, left, right, full, **SQL Set Operations,** Cursors, triggers

**Unit-IV: Concurrency Control:** Lock based protocol, Timestamp based schedulers, Validation based protocol, Serializability of scheduling, multiple granularity, and Concurrency Control schemes.

**Unit-V: Database Security:** Authentication, Authorization and access control, DAC, Mandatory Access Control and Role-Based Access Control models, Intrusion detection, SQL injection.

**Unit-VI: Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

**Text Book:** Korth, Sudarshan : Database System Concept , Mc Graw Hill, 6th Edition

**Reference Books:**

1. Raghu Ramkrishnan : Database system
2. C.J.Date : Database System, 7th ed.
3. Connolly & Begg : Database System, Low Price Ed.

## 5IT02: THEORY OF COMPUTATION

**Course Prerequisite:** Discrete Mathematics, Data Structures.

**Course Objectives:**

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages
3. To study computing machines and comparing different types of computational models
4. To understand the fundamentals of problem decidability and Un-Decidability.

**Course Outcomes:**

On completion of the course, the students will be able to

1. To construct finite state machines to solve problems in computing.
2. To write regular expressions for the formal languages.
3. To construct and apply well defined rules for parsing techniques in compiler
4. To construct and analyze Push Down, Turing Machine for formal languages
5. To express the understanding of the Chomsky Hierarchy.
6. To express the understanding of the decidability and un-decidability problems.

**Unit I: Finite State Machines :**

Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton)

**Unit II: Regular Expression and Regular Grammar :**

Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs (proofs not required), Regular grammar, Equivalence of RG ( RLG and LLG) and FA.

**Unit III: Context Free Grammar and Languages:**

Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.

**Unit IV: Pushdown Automata:**

Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion, Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.

**Unit V: Turing Machines:**

Formal definition of a Turing Machine, Design of TM, Computable Functions, Church's hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.

**Unit VI: Decidability and Un-Decidability:**

Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory.

**Text Books:**

1. Hopcraft H.E. & Ullman J: Introduction to Automata Theory, Languages and Computation
2. Peter Linz: An Introduction to Formal Languages and Automata .

**Reference Books:**

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill, 2010
3. Lewis H.P. and Papadimition C.H.: Elements of Theory of Computation
4. Mishra & Chandrashekharan: Theory of Computation
5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
6. Vivek Kulkarni: Theory of Computation, OUP India, 2013.

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**5IT03 SOFTWARE ENGINEERING**

**Course Objectives:**

1. To understand the nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
2. To know methods of capturing, specifying, visualizing and analyzing software requirements.
3. To learn about project planning, execution, tracking, audit and closure of project.
4. To introduce principles of agile software development, the SCRUM process and agile practices.
5. To understand project management through life cycle of the project.
6. To understand current and future trends and practices in the IT industry.

**Course Outcomes:**

1. To identify unique features of various software application domains and classify software applications.
2. To analyze software requirements by applying various modeling techniques.
3. To choose and apply appropriate lifecycle model of software development.
4. To describe principles of agile development, discuss the SCRUM process and distinguish agile process model from other process models.
5. To understand IT project management through life cycle of the project and future trends in IT Project Management.

**Unit I:** Evolving role of Software. Software crises & myths. Software engineering. Software process & process models: Linear sequential, prototyping, RAD, Evolutionary Product & Process. Project management concepts: People, Product, Process, Project. W5HH principles, critical practice.

**Unit II:** Measures, Metrics & Indicators. Metrics in process & project domains-software measurement, Metrics for software quality, small organization. Software projects Planning: Scope, resources, estimation, decomposition technique, Tools. Software risks : identification, risk projection, refinement & RMMM plan.

**Unit III:** Project Scheduling: Concepts. Peoples Efforts. Task set, Task network. Scheduling. EV analysis, Project Plan. Software quality concepts. SQ Assurance, Software reviews, technical reviews, software reliability, ISO 900 L, SQA Plan. SCM process. Version control. SCM standard.

**Unit IV:** System Engineering: Hierarchy, Business Process & Product engineering: Overviews. Requirement engineering, System modeling. Requirement analysis. Analysis principles. Software prototyping. Specification. Design Process. Design Principles & Concepts. Effective modular design. Design model & documentation.

**Unit V:** Software architecture, Data Design, Architectural styles, Requirement mapping. Transform & Transaction mappings. User interface design : Golden Rule. UTD, Task analysis & modeling, ID activities, Tools, design evaluation. Component level design : Structure programming, Comparison of design notation.

**Unit VI:** Software testing fundamentals; test case design, Whitebox testing. Basis path, control structure-, Blackbox-Testing, & for specialized environments. Strategic approach to S/W testing. Unit testing, integration testing, validation testing, system testing. Debugging. Technical metrics for software.

**Text Book:** Pressman Roger. S: Software Engineering, A Practitioner's Approach, TMH. (5/e)

**Reference Books:**

1. Fairly R: Software Engineering (McGraw Hill)
2. Davis A: Principles of Software Development (McGraw Hill)
3. Shooman, M.L: Software Engineering (McGraw-Hill)

**5IT04 PROFESSIONAL ELECTIVE - I (i) INFORMATION SECURITY SYSTEM**

**Course Objectives:**

1. Understand the basics of Information Security
2. Know the legal, ethical and professional issues in Information Security
3. Know the aspects of risk management
4. Become aware of various standards in this area
5. Know the technological aspects of Information Security

**Course Outcomes:**

The learning outcomes are:

1. Study the foundational theory behind information security.
2. Discuss the basic information security.
3. Illustrate the legal, ethical and professional issues.
4. Discuss the aspects of risk management.
5. Summarize various standards for information security.
6. Explain the security techniques.

**Course Contents:**

**UNIT I: Introduction to Information Security:** History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

**UNIT II : Security Investigation:** Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues.

**UNIT III : Legal, Ethical, and Professional Issues in Information Security:** Law and Ethics in Information Security, International Laws and Legal Bodies, Ethics and Information Security.

**UNIT IV : Security Analysis:** An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies.

**UNIT V : Planning for Security:** Information Security Planning and Governance. Information Security Policy, Standards, and Practices, the Information Security Blueprint, Security Education, Training, and Awareness Program. Continuity Strategies .

**UNIT VI : Cryptography:** Foundations of Cryptology, Cipher Methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems.

**TEXT BOOK :** Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.

**REFERENCE BOOKS:**

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.111
2. William Stallings, "Cryptography and Network Security: Principles and Practice", 6th Edition, Prentice Hall
3. M. Stamp, "Information Security: Principles and Practice", 2nd Edition, Wiley, ISBN: 0470626399, 2011.
4. Nina Godbole, "Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
5. Mark Merkow, "Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288- 7.

**5IT04 PROFESSIONAL ELECTIVE - I (ii) DATA SCIENCE & STATISTICS**

**Course Objectives:**

Throughout the course, students will be expected to demonstrate their understanding of Data Science & Statistics by being able to do each of the following:

1. Organize, manage and present data.
2. Understand basic theoretical and applied principles of statistics.
3. Analyze statistical data using measures of central tendency, dispersion and location.
4. Introduce students to the basic concepts and techniques of Data Science.
5. Acquire knowledge of regression methods and classification methods.

**Course Outcomes:**

On completion of the course, the students will be able to:

1. Gain knowledge about basic concepts of Data Science & Statistics.
2. Demonstrate proficiency with statistical analysis of data.
3. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
4. Develop the ability to build and assess data-based models.
5. Evaluate models generated from data

**UNIT I Python for Data Science :**

Mean, Median, Mode, Variance, Standard Deviation Numpy: The Basics of NumPy Arrays, Universal Functions, Aggregators, Broadcasting, Fancy Indexing; Pandas: Introducing Pandas Objects, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat, Append, merge and join, aggregation and grouping , pivot Tables.

**UNIT II Exploratory Data Analysis and Statistics:**

EDA: Matplotlib and Seaborn: Simple Line Plots, Simple Scatter Plots, Density and Contour Plots, Histograms, Binnings, and Density ,Random Sampling, Distributions: Uniform Distribution, Normal Distribution, Poisson Distribution, Binomial Distribution.

**UNIT III Statistical Experiments and Significance Testing:**

Hypothesis Test: The Null Hypothesis, Alternative Hypothesis, One way, Two way Hypothesis Test; Statistical Significance and P-Values: P-value, alpha, type 1 error , type 2 error; t-Tests, Degrees of Freedom, ANOVA: F statistics, Two-way Anova; Chi-Square Test: A Resampling Approach.

**UNIT IV Regression Techniques:**

Introduction to Machine Learning, Hyper parameter and Model Validation, Feature engineering, Assumptions in Regression, Simple Linear Regression, Multiple Linear Regression.

**UNIT V Classification: Logistic regression:**

Logistic Response Function and Logit, Predicted Values from Logistic Regression, Interpreting the Coefficients and Odds Ratios; Evaluating Classification Models: Confusion Matrix, Precision, Recall, and Specificity, ROC Curve, AUC

**UNIT VI Decision Tree and Radom Forest:**

A Simple Example, The Recursive Partitioning Algorithm, Measuring Homogeneity or Impurity, Stopping the Tree from Growing, Predicting a Continuous Value; Random Forest

**Text Books:**

- [1] Practical Statistics for Data Scientists By Peter Bruce, Andrew Bruce, O'Reilly Media, Inc.
- [2] Python Data Science Handbook By Jake VanderPlas O'Reilly Media, Inc

**Reference Books:**

- [1] Introduction to Machine Learning with Python By Andreas C. Müller, Sarah Guido, O'Reilly Media, Inc.
- [2] Think Stats By Allen B. Downey O'Reilly Media, Inc.

**5IT04 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS**

**Course Objectives:**

The educational objectives of this course are:

- To explore various components of Internet of things
- To Recognize various devices, sensors and applications
- To build a couple of applications that will communicate with IoT hardware and software.
- To understand the IoT Reference Architecture and Real World Design Constraints.

**Course Outcomes:**

At the end of this course, the student would be able:

- To design small scale as well as sophisticated embedded system.
- To implement standalone application and GUI based application for real life projects.
- To recognize the role of professional societies in providing solution for real world problem.

**Unit I: Introduction to IoT:**

Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

**Unit II: M2M to IoT:**

From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains.

**Unit III: M2M vs IoT An Architectural Overview:**

Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.

**Unit IV: IoT Reference Architecture:**

Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Constraints affecting design in IoT world- Introduction, Technical design Constraints.

**Unit V: Developing IoT solutions:**

Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi. Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities

**Unit VI: Security, Privacy & Trust:**

IoT security challenge, Spectrum of security considerations, Unique security challenges of IoT devices, Internet of things privacy background, Unique privacy aspects of internet of things, Trust for IoT.

**Text Books:**

- [1] Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014
- [2] Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM & MUMBAI

**Reference Books:**

- [1] "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", Ovidiu Vermesan, Peter Friess, River Publishers.
- [2] Bernd ScholzReiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

**5IT05 OPEN ELECTIVE - I (I) SOFT SKILLS & INTERPERSONAL COMMUNICATIONS**

**Course objectives:**

1. Explain and elaborate fundamentals of communication
2. Apply knowledge of verbal and nonverbal communication in business cases
3. Elaborate the barriers of communication and apply it improve communication

**Course outcomes:**

Student will be able to

1. Use and apply interaction skills
2. Use and apply leadership skills
3. Use and apply negotiations skills.

**Unit I:** Introduction, Need for Communication, Process of Communication, Written and Verbal Communication, Visual communication, Signs, Signals and Symbols, Silence as a Mode of Communication, Inter-cultural, Intra-cultural, Cross-cultural and International communication, Communications skills, Communication through Questionnaires, Business Letter Writing, Electronic Communication.

**Unit II:** Business Cases and Presentations, Letters within the Organizations, Letters from Top Management, Circulars and Memos, Business Presentations to Customers and other stakeholders, Presenting a Positive Image through Verbal and Non-verbal Cues, Preparing and Delivering the Presentations, Use of Audio-visual Aids, Report Writing.

**Unit III:** Barriers to Communication, Improving Communication Skills, Preparation of Promotional Material, Non-verbal communication, Body language Postures and gestures, Value of time, Organizational body language, Importance of Listening, Emotional Intelligence.

**Unit IV:** Individual Interaction and skills, Basic Interaction Skills "Within family, Society, Personal and interpersonal intrapersonal skills, Types of skills; conceptual, supervisory, technical, managerial and decision making skills. Problem Solving, Lateral Thinking, Self Awareness and Self Esteem, Group Influence on Interaction Skills, Human relations examples through role "play and cases.

**Unit V:** Leadership Skills, Working individually and in a team, Leadership skills, Leadership Lessons through Literature, Team work & Team building, Interpersonal skills "Conversation, Feedback, Feed forward, Interpersonal skills "Delegation, Humor, Trust, Expectations, Values, Status, Compatibility and their role in building team "work Conflict Management "Types of conflicts, how to cope with them, Small cases including role "plays will be used as teaching methodology.

**Unit VI :** Negotiation Skills (To be Taught through Role Plays and Cases), Types of Negotiation, Negotiation Strategies, Selling skills "Selling to customers, Selling to Superiors, Selling to peer groups, team mates & subordinates, Conceptual selling, Strategic selling, Selling skills "Body language,

**Books Recommended:**

1. Peggy Klaus, The Hard Truth about Soft Skills.
2. Nitin Bhatnagar. Effective Communication and Soft Skills. Pearson Education India.
3. Eric Garner. Team Building. 4. Wendy Palmer and Janet Crawford. Leadership Embodiment.

**5IT05 OPEN ELECTIVE - I (II) COMPUTATIONAL BIOLOGY**

**Unit I: Introduction:** Molecular Biology Introduction, Cell, Nucleus, Genes, DNA, RNA, Proteins, And Chemical structure of DNA, RNA, Transcription and Translation Process. Protein Structure and Functions, Nature of Chemical Bonds Molecular Biology tools, Polymerase chain reaction

**Unit II: Sequence Alignment:** Simple alignments, Gaps, Scoring Matrices, Global and Local Alignments, Smith-Waterman Algorithm, Multiple sequence Alignments, Gene Prediction, Statistical Approaches to Gene Prediction

**Unit III: Genome Algorithms:** Genome Rearrangements, Sorting by Reversals, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time, Protein Sequencing and Identification, the Peptide Sequencing Problem, Introduction to Nature Inspired Algorithms.

**Unit IV: Microarray Data Analysis:** Microarray technology for genome expression study, Image analysis for data extraction, Data analysis for pattern discovery, gene regulatory network analysis

**Unit V: Phylogenetic:** Neighbor-joining method, Neighbor-joining method, Maximum likelihood Approaches, Multiple Sequence Methods Structural Biology, Sequence, organisms, 3D structures, complexes, Assemblies, Case Studies, examples

**Unit VI: Drug Discovery & Next Gen Sequencing:** Similarities/differences between drugs and receptors, protein-ligand docking, Massively Parallel Signature Sequencing (MPSS), SOLiD sequencing, Single molecule real time (SMRT) sequencing .

**Text Books:**

- 1) Dan E. Krane, Michael L. Raymer, "Fundamental Concepts of Bioinformatics", Pearson Education, Inc. Fourth Edition, 9780805346336.
- 2) Harshwardhan P. Bal, "Bioinformatics Principles and Applications", Tata McGraw-Hill, seventh reprint, 9780195692303.

**Reference Books:**

- 1) Teresa Attwood, David Parry-Smith, "Introduction to Bioinformatics", Pearson Education Series, 9788180301971
- 2) R. Durbin, S. Eddy, A. Krogh, G. Mitchison., "Biological Sequence Analysis: Probabilistic Models of proteins and nucleic acids", Cambridge University Press, 9780521629713.

**SIT05 OPEN ELECTIVE - I (III) CYBER LAW & ETHICS**

**Course Objectives:**

1. To identify and describe the major types of cyber crime.
2. To identify cyber crime vulnerabilities and exploitations of the Internet.
3. To understand the law with regards to the investigation and prosecution of cyber criminals.
4. To identify appropriate law enforcement strategies to both prevent and control cyber crime.
5. Explain jurisdictional challenges that nations face when responding to cybercrime

**Course outcomes:**

1. Understand Cyber laws
2. Describe Information Technology act and Related Legislation
3. Demonstrate Electronic business and legal issues.
4. Interpret Cyber Ethics.

**Unit I: Introduction to Cyber law:** Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

**Unit II Information Technology Act:** Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

**Unit III : Cyber law and Related Legislation:** Patent Law, Trademark Law, Copyright, Software ó Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).

**Unit IV : Electronic Business and legal issues:** Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

**Unit V: Cyber Ethics:** The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

**Unit VI :** Case Study On Cyber Crimes: Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.

**Reference Books:**

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
3. Information Security policy & Implementation Issues, NIIT, PHI
4. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
5. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,
6. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).
7. The Information Technology Act, 2005: A Handbook, OUP Sudhir Naib,, New York, (2011) .

**5IT06 DATABASE MANGEMENT SYSTEMS - LAB**

1. **Practical 1:** To Study a Database Modeling Tool. Study of Data Modeling Tools
  - Take a description of the enterprise, create its corresponding ER Diagram and build a database model using any modeling tool. The following basic features of the modeling should be covered while building the model:
    - Logical / Physical Modeling
    - Adding an entity / its attributes , relationships (all kinds of relationships viz., parent-child, foreign key references, one to many, many to many etc)
    - Forward / reverse engineering
    - Details of forward engineering / schema generation
    - Steps to generate the schema
2. **Practical 2:** To Study and implement DDL Commands  
Implement the model created in Practical 1, in any of the DBMS like Oracle, MySQL, or Microsoft SQL Server database software.
  - Creating the proper tables
  - Insert the data into it.
  - Study Dropping and Altering the Tables. Study the cascaded deletes.
3. **Practical 3:** To Study and implement DML Commands-I
  - SQL queries : Write and execute different SQL queries
  - Execute Simple queries using SELECT, FROM, WHERE clauses,
  - In Where clause use different predicates involving OR,AND, NOT
  - Rename operation
  - Tuple Variables
  - Write SQL for various String operations (% ,\_ ,\*)
    - Match beginning with
    - Match ending with
    - Substring
    - Match exactly n characters
    - Match at least n characters
  - Sort the output of the query using **Order by**
  - Write SQL using **Having**
4. **Practical 4 :** To Study and implement DML Commands-II  
Write SQL queries and perform
  - Set membership operations
  - In, not in
  - Some
  - All
  - Exists and not exists, Test for emptyness using exists, not exists
  - Test for absence of duplicates.
  - Nested queries
5. **Practical 5.** Study and implement aggregation functions.  
Write different queries using following Aggregate functions
  - a. Min (minimum 3 SQL queries)
  - b. Max (minimum 3 SQL queries)
  - c. Avg (minimum 3 SQL queries)
  - d. Sum (minimum 3 SQL queries)
  - e. Count (minimum 3 SQL queries)



6. **Practical 6:** Write SQL to create Views and Indexes.
7. **Practical 7:** Write SQL to perform the modifications to the database
8. **Practical 8 :** PL /SQL
9. **Practical 9 :** Database Access Using Cursors  
Write a trigger to find the names and cities of customers who have more than xyz in any account.
10. **Practical 10 :** Triggers
  - Write a trigger for dealing with the overdrafts (set the account balance to zero, and creating a loan in the amount of the overdraft. Keep account number as loan number in the loan table)
  - Write a trigger for dealing with blank cities (set the city field to null when it is blank)
11. **Practical 11:** Procedures, functions
  - Write atleast 2 functions, and demonstrate its use
  - Write atleast 2 procedures, and demonstrate its use
12. **Practical 12 :** Web Programming with PL/SQL. (**Contents Beyond Syllabus**)  
HTTP, A Simple Example., Printing HTML Tables., Passing Parameters., Processing HTML Forms., Multi-Valued Parameters.
13. **Practical 13:** Develop a JDBC Applications, Retrieve the information by connecting to the database using a host language (JAVA, C, C++) (**Contents Beyond Syllabus**)
14. **Practical 14:** Web Programming with Java Servlets. (**Connecting to the database ) (Contents Beyond Syllabus**)  
A Simple Servlet., HTTP Servlet API Basics.,HTML Form Processing in Servlets.
15. **Practical 15:** PHP : Develop a simple application to access the database using PHP (**Contents Beyond Syllabus**)
16. Study of Open Source NoSQL Databases
17. Based on the concepts covered in text create a Mini Project:

**Suggested Topics:**

- i. Bank database (Given in Korth book)
- ii. University Database (Given in Korth book)
- iii. Airline Flight Information System.
- iv. Library Database Application.
- v. University Student Database.
- vi. Video Chain Database.
- vii. Banking Database.
- viii. BiBTeX Database.
- ix. Music Store Database.
- x. Online Auctions Database.
- xi. A Web Survey Management System.

**5IT07 SOFTWARE ENGINEERING LAB.**

**Minimum eight experiments/programming assignments must be completed based on the respective syllabus uniformly covering each of the units and a mini project based on the syllabus using case studies.**

**LIST OF EXPERIMENTS:**

1. Preparing Software Requirements Specifications
2. Identifying Domain Classes from the Problem Statements
3. Modeling UML Class Diagrams and Sequence diagrams
4. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
5. E-R Modeling
6. State chart and Activity Modeling
7. Modeling Data Flow Diagrams
8. Estimation of Project Metrics
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites
11. Preparing Final Project Report

**5IT08 PROFESSIONAL ELECTIVE – I (I) INFORMATION SECURITY SYSTEM LAB .**

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

**5IT08 PROFESSIONAL ELECTIVE - I (II) DATA SCIENCE & STATISTICS**

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units

**List of Experiments:**

Experiment No.	EXPERIMENT DESCRIPTION
01	Study of setting up the Python environment of and how it is useful for data science.
02	Study of Pandas, NumPy, SciPy and Matplotlib Libraries in Python and their importance in data science and statistics.
03	Write a python program to plot a sine wave using Matplotlib library.
04	Write a python program to understand the tokenization of string data.
05	Write a python program to handle the data in series and Data Frame format using NumPy Library.
06	Write a python program to read a csv file and display data from specific rows and specific columns from it.
07	Write a python program to print a 3D plot using matplotlib library.
08	Write a python program to understand the linear regression of data and display it.
09	Write a python program to read a time series data from a csv file and display it in a graph.
10	Write a python program to understand and implement the Naïve Bayes Algorithm.

**5IT08 PROFESSIONAL ELECTIVE - I (III) INTERNET OF THINGS**

Minimum eight experiments must be completed based on the syllabus uniformly covering each of the units.

**LIST OF EXPERIMENTS:**

1. To Interface **PRI Motion Sensor** with Raspberry Pi and write a program to control LED.
2. To Interface **Optical Sensor** with Raspberry Pi and write a program to control LED.
3. To Interface **Rain Drop Sensor** with Raspberry Pi and write a program to sound an alarm.
4. To Interface **Moisture Sensor** with Raspberry Pi and write a program to display value.
5. To Interface **Touch Sensor** with Raspberry Pi and write a program to detect and record physical touch.
6. To Interface **Gas Sensor** with Raspberry Pi and write a program to sounds an alarm.
7. To Interface **Pressure Sensor** with Raspberry Pi and write a program to display value.
8. To Interface **Ultrasonic Sensor** with Raspberry Pi and write a program to measure the distance between any two objects.

**5IT 09 COMPUTER SKILL LAB - III**

Minimum eight experiments/programming assignments must be completed based on the syllabus uniformly covering each of the units.

**LIST OF EXPERIMENTS:**

Sr. No.	Title for Experiment
1	Understanding and use of HTML & CSS Programming
2	Understanding and use of Java Script
3	Understanding and use of Type Script
4	Introduction to Angular
5	Angular Environment Set up
6	Creating Angular Project and basic introduction about project structure / directory.
7	Understanding Components and how to create components in Angular
8	Understanding of data binding in Angular component and view files.
9	Understanding and use of different types of Angular directives
10	Understanding of modules and routing in angular.
11	Understanding of services and component :-s life cycle method
12	Understanding of package. json file in Angular Project.
13	Understanding of how to fetch data from the API using services.

**Pre-requisites -Before proceeding with this Angular tutorial course, students should have a basic understanding of HTML, CSS, and JavaScript, basic oops concept.**<https://dotnettutorials.net/lesson/creating-angular-project/>

**Angular Tutorials Links:**

<https://angular.io/>

<https://www.javatpoint.com/angular-7-tutorial>

<https://www.tutorialsteacher.com/angular>

<https://www.tutorialspoint.com/angular7/index.htm>

**Reference Books:**

1. Angular in Action "by **Jeremy Wilken: Manning Publications**
2. Angular: Up and Running: Learning Angular, Step by Step by Shyam eshadri: Shroff/O'Reilly PUBLICATIONS
3. Beginning Angular with Typescript By : Greg Lim
4. Learning Angular By **Aristeidis Bampakos and Pablo Deeleman Packt Publishing Limited.**

**B.E. SEMESTER VI [INFORMATION TECHNOLOGY]**

**6IT01 COMPILER DESIGN**

**Course Objectives:**

Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

1. To learn concepts of programming language translation and phases of compiler design
2. To understand the common forms of parsers.
3. To study concept of syntax directed definition and translation scheme for the representation of language
4. To illustrate the various optimization techniques for designing various optimizing compilers.

**Course Outcomes:**

On completion of the course, the students will be able to:

1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

**Unit I:** Introduction to Compiling: Definition of Compiler, Phases of a Compiler, Grouping of Phases, Compiler Construction Tools.

Lexical Analysis: The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, language for specifying lexical analysis, lex and yacc tools, finite automata, from regular expressions to finite automata and state minimization of DFA.

**Unit II:** Syntax Analysis: The role of the parser, Review of context free grammar for syntax analysis.

Top down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, Non recursive predictive parsing, FIRST and FOLLOW, Construction of predictive parsing tables, LL (1) grammars. Non recursive predictive parsing, Error recovery in predictive parsing.

**Unit III:** Bottom up parsing: Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing, LR parsers: LR parsing algorithm, Construction of SLR parsing table, canonical LR parsing tables and canonical LALR parsing tables. Error recovery in LR parsing, The parser generator Yacc.

**Unit IV:** Syntax Directed Translation: Syntax directed definitions, synthesized and inherited attributes, dependency graphs, Evaluation orders. Construction of syntax trees. Syntax directed definition for constructing syntax trees, directed acyclic graphs for expressions. Bottom up evaluation of s-attributed definitions, L-attributed definition. Top down translation, Design of a predictive translator.

**Unit V:** Run Time Environments: Source language issues: Activation trees, control stacks, storage organization, scope of a declaration, Storage Organization, Storage allocation strategies, static allocation, stack allocation, dangling references, heap allocation. Access to non-local names, Parameter passing, Symbol table: Entries, Storage allocation, Hash tables, Scope information.

**Unit VI:** Intermediate Code Generation: Intermediate languages, Translation of Declarations & Assignments statements. Design issues of a Code generator, Target machine, Runtime storage management, Basic blocks and flow graphs. Introduction to Code Optimization, Principal Sources of Optimization.

**Text Book:** Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: Principles, Techniques and Tools, Pearson Education (Low Price Edition).

**Reference Books:**

- [1] D. M. Dhamdhere, Compiler Construction Principles and Practice, (2/e), Macmillan India.
- [2] Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: Principles, Techniques and Tools, Pearson Education Second Edition
- [3] Andrew Appel, Modern Compiler Implementation in C, Cambridge University press
- [4] K C. Louden Compiler Construction Principles and Practice India Edition, CENGAGE
- [5] Bennett J.P., Introduction to Compiling Techniques, 2/e (TMH).

**6IT02 DESIGN & ANALYSIS OF ALGORITHM**

**Course Objectives:**

1. To teach paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice.
2. To make students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms.
3. To explain different computational models (e.g., divide-and-conquer), order notation and various complexity measures.
4. Study of various advanced design and analysis techniques such as greedy algorithms, dynamic programming
5. Synthesize efficient algorithms in Common Engineering situations.

**Course Outcomes:**

- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
- Able to understand the concept of Backtracking, Polynomial Time & Non Polynomial Time Algorithms.

**Unit I:** Top-Down Design: Structured Programming, Control Constructs, Procedures & Functions, Recursion. Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.

**Unit II:** Divide and Conquer: Multiplication Algorithm and its analysis, Application to Graphics Algorithms: Introduction to Triangulation, Convex Hulls.

**Unit III:** Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstra's Shortest Path Algorithm.

**Unit IV:** Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation. Single Source Shortest Paths

**Unit V:** Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework-8-Queen's problem, graph coloring, Some Typical State Spaces, Branch-and-Bound Algorithms.

**Unit VI:** Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

**Text Book:** Dave and Dave: "Design and Analysis of Algorithms" Pearson Education

**Reference Books:**

1. Aho, Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
2. G. Brassard, P. Bratley: "Fundamentals of Algorithmics", PHI
3. Horowitz & Sahani: "Fundamental Algorithms", Galgotia.
4. Cormen, T.H, Lierson & Rivest: "Introduction to Algorithms", Mc Graw-Hill .

### 6IT03 ARTIFICIAL INTELLIGENCE

**Course Objectives:**

1. Familiarity with basic principles of AI
2. Capable of using heuristic searches
3. Aware of knowledge based systems
4. Able to use fuzzy logic
5. Learn various applications domains AI.

**Course Outcomes:** Students will be able to

1. Define Artificial Intelligence and identify problems for which solution by AI methods can be devised.
2. Evaluate of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.
3. Design and Analysis of informed search algorithms on well formulated problems.
4. Formulate and solve given problem using Propositional and First order logic.
5. Apply reasoning for non-monotonic AI problems.
6. have a basic understanding of some of the more advanced topics of AI such as learning, Understanding, Natural Language Processing.

**Unit-I: Introduction to Artificial Intelligence:** The AI Problems, The Underlying Assumption, What is an AI Technique; Tic-Tac-Toe, **Problems, Problem Spaces, and Search**, Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs.

**Unit-II:** Basic Problem Solving methods: Reasoning, Problem trees and graphs, Knowledge Representation, **Uninformed Search Strategies:** Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search.

**Unit-III: Informed Search Strategies** Generate-and-Test, Hill Climbing, Best-first Search, A\* Algorithm, Problem Reduction, AND-OR Graphs, The AO\* Algorithm, Constraint Satisfaction, Means ends Analysis.

**Unit -IV: Knowledge Representation Issues:** Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, **Predicate Logic:** Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural Deduction **Representing Knowledge Using Rules**, Procedural Versus Declarative Knowledge, Logic Programming Forward Versus Backward Reasoning.

**Unit-V: Symbolic Reasoning Under Uncertainty** Introduction to Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function. Probability and Bayesøtheorem, Bayesian Networks.

**Unit-VI: Understanding** What is Understanding?, Understanding as Constraint Satisfaction, **Natural Language Processing**, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking, **Common Sense** Qualitative Physics.

**TEXT BOOK:** Artificial Intelligence ó Elaine Rich, Kevin Knight, Nair (Third Edition) [Mc Graw Hill]

**REFERENCE BOOKS:**

1. Introduction to Artificial Intelligence and expert system ó Dan W. Patterson
2. Introduction to Artificial Intelligence ó Rajendra Akerkar
3. Nils Nilson: ö Principles of Artificial Intelligenceö.(Addison-Wesley)
4. R. J. Winston: ö Artificial Intelligenceö.(Wiley)
5. Patterwson öIntroduction to Artificial Intelligence and Expert Systemsö (PHI).
6. Rolston öPrinciples of Artificial Intelligence and Expert Systemsö, McGraw Hill.

**6IT04 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY AND NETWORK SECURITY**

**Course Objectives:**

Throughout the course, students will be expected to demonstrate their understanding of Cryptography & Network Security by being able to do each of the following:

ÉTo understand the fundamental concepts of Cryptography & Network Security.

ÉTo familiarize the students with basic taxonomy and terminology of Cryptography & Network Security.

ÉTo understand various protocols for network security to protect against the threat in the network.

ÉTo understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

**Course Outcomes:**

On completion of the course learner will be able to

- Understand the principles and fundamental concept of Cryptography & Network Security.
- To learn Encryption and Decryption Techniques.
- Evaluate various Key Encryption Algorithms.
- Understand IP Security system and protocols.
- Identify and understand Network Security controls.
- Explore web and system security and its applications to digital world.

**Unit I: Introduction :** OSI Security Architecture, Security Attacks: Threats, Vulnerability and Controls, Security Services: Confidentiality, Integrity, Availability, Introduction to Cryptography, Conventional Encryption: Conventional encryption model - classical encryption techniques.

**Unit II: Encryption and Decryption:** Characteristics of Good Encryption Technique: Properties of Trustworthy Encryption Systems; Types of Encryption Systems: Based on Key, Based on Block; Confusion and Diffusion; Cryptanalysis.

**Unit III: Symmetric Key Encryption and Public Key Encryption:** Data Encryption Standard (DES) Algorithm: Double and Triple DES, Security of the DES; Advanced Encryption Standard (AES) Algorithm, DES and AES Comparison, RSA Technique, Digital Signature.

**Unit IV IP Security:** Overview of IP Security (IPSec); IP Security Architecture; Modes of Operation; Security Associations, Security Parameter Index (SPI), SA Management, Security Policy: Authentication Header (AH); Encapsulating Security Payload (ESP); Internet Key Exchange.

**Unit V Network Security:** Network Concepts; Threats in Networks, Threats in Transit: Eavesdropping and Wiretapping, Protocol Flaws, Impersonation; Network Security Controls: Architecture, Encryption, Virtual Private Networks, Public Key Infrastructure (PKI) and Certificates.

**Unit VI Web and System Security:** Web Security: Secure socket layer and transport layer security, Secure Electronic transaction, System Security: Intruders, Viruses and related threads; Network Security Controls: Architecture, Public Key Infrastructure (PKI) and Certificates, Security Features of Trusted Operating Systems.

**Text Book:** William Stallings, öCryptography and Network security Principles and Practicesö, Pearson/PHI.

**Reference Books:**

1. W. Mao, öModern Cryptography ó Theory and Practiceö, Pearson Education.
2. Wade Trappe, Lawrence C Washington, öIntroduction to Cryptography with coding theoryö, Pearson.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger öSecurity in computingö, Prentice Hall of Ind

6IT04 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS

**Course Objectives:**

1. To make the students aware about the basics concepts of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop and NoSql
3. To discuss the basic concepts and operations of map-Reduce
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To introduce several new algorithms for big data mining like classification, clustering and finding frequent patterns
6. To introduce to the students several types of big data like social media, web graphs and data streams and help them to solve real world problems in for decision support.

**Course Outcomes:**

On completion of the course the student(s) will be able to

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques like Hadoop, and NO SQL in big data analytics.
3. Achieve basic knowledge and operations of Map-Reduce
4. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
5. Implement algorithms for Clustering, Classifying and finding associations in Big Data
6. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications.

**UNIT I: Introduction to Big Data:**

Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.

**UNIT II: Introduction to big data frameworks: Hadoop and NoSQL:**

Introduction to Hadoop, Hadoop Components; Hadoop Ecosystem; Overview of : Apache Spark, Pig, Hive, Hbase, Sqoop ,Introduction to NoSQL, NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Mongo DB.

**UNIT III: MapReduce Paradigm:**

MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce.

**UNIT IV: Mining Big Data Stream:**

The Stream Data Model: A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter. Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-IndykMotwani Algorithm, Query Answering in the DGIM Algorithm.

**UNIT V: Big Data Mining Algorithms:**

Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce. Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, K-Nearest Neighbor classifications for Big Data, One Nearest Neighbour.

**UNIT VI: Big Data Analytics Applications**

Link Analysis : PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank, PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm, Mining Social- Network Graphs : Social Networks as Graphs, Types , Clustering of Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. Recommendation Engines: Content based Recommendation, Collaborative Filtering.

**Text Books:**

1. Radha Shankarmani, M Vijayalakshmi, öBig Data Analyticsö, Wiley Publications
2. Anand Rajaraman and Jeff Ullman öMining of Massive Datasetsö, Cambridge University Press.

**Reference Books:**

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Alex Holmes öHadoop in Practiceö, Manning Press, Dreamtech Press.
3. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
4. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf,O'Reilly Publications
5. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited Hadoop: The Definitive Guide by Tom White, O'Reilly Publications.

**6IT04 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS**

**Course Learning Objectives:**

- To learn concept behind working of various types of Sensors.
- To understand available sensor to measure each physical parameters used in Industry and normal measurement applications.
- To interface real sensors for meaningful output in Electrical form.

**Course Outcomes:**

- Concept behind working of measurement systems and different types of sensors and actuators.
- Understanding of electric and magnetic sensors and actuators and their applications.
- Understanding of optical sensors and other sensors and their applications.
- Understanding of smart sensors and their uses.

**UNIT I: Introduction:**

Definitions, Classification of Sensors and Actuators, General Requirements for Interfacing, Measuring Units, Performance Characteristics of Sensors and Actuators, Input and Output characteristics.

**UNIT II: TEMPERATURE SENSORS AND THERMAL ACTUATORS:**

Introduction, Thermosensitive Sensors: Thermistors, Resistance Temperature Sensors and Silicon Resistive Sensors, Thermoelectric Sensors, P-N junction Sensors. Optical and Acoustical Sensors, Thermomechanical Sensors and Actuators.

**UNIT III: OPTICAL SENSORS AND ACTUATORS:**

Introduction, Optical Units, Materials, Effects of Optical Radiation, Quantum Based Optical Sensors, Photoelectric Sensors, Coupled Charge (CCD) Sensors and Detectors, Thermal-Based Optical Sensors, Optical Actuators.

**UNIT IV: ELECTRIC AND MAGNETIC SENSORS AND ACTUATORS:**

Introduction, Units, The Electric Field: Capacitive Sensors and Actuators, Magnetic Fields: Inductive Sensors and Hall Effect Sensors, MHD Sensors and Actuators, Magnetic Actuators, Voltage and Current Sensors.

**Unit V: MECHANICAL / ACOUSTIC SENSORS AND ACTUATORS :**

Introduction, Definitions/Units, Force Sensors, Accelerometers, Velocity Sensing. Microphones, Acoustic Actuators, Ultrasonic Sensors and Actuators. Piezoelectric Actuators, Resonators and SAW Devices.

**Unit VI: MEMS AND SMART SENSORS:**

Introduction, MEMS Sensors and Actuators with Applications, Smart Sensors/Actuators Issues. Wireless Sensors and Actuators, Modulation/Demodulation, Encoding/Decoding Sensor Networks.

**Text Book:** Nathan Ida, *Sensors, Actuators, and their Interfaces: A Multidisciplinary Introduction*, SciTech Publishing.

**Reference Books:**

1. Patrick F Dunn, *Fundamentals Of Sensors For Engineering And Science* CRC Press, Taylor & Francis Group, 2014
2. Patranabis D., "Sensors and Transducers", Prentice-Hall India, 2nd Ed., 2004.
3. Shawsney A. K., "Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai & Sons, 1994.
4. J. Fraden, *Handbook of Modern Sensors: Physical, Designs, and Applications*, AIP Press,

**6IT05 OPEN ELECTIVE II (I) ECONOMIC POLICY IN INDIA**

**Course Objectives:**

1. Student will be able explain and elaborate fundaments Indian economy
2. Student will be able to explain, elaborate and identify the role of agriculture in Indian economy
3. Student will be able to explain elaborate and identify the role of industrial sector in Indian economy.

**Course Outcomes:**

1. Student will be able to explain, elaborate and indentify the impact of external sector on Indian economy
2. Student will be able to explain, elaborate and indentify the impact monetary and fiscal policies in India
3. Student will be able to explain ,elaborate and analyze the issues of Indian economy.

**UNIT - I : Indian Economy and Development** Basic characteristics of the Indian economy - Major issues of development - The determinants of economic development - sustainable development - Demographic features of Indian population - Rural Urban Migration - poverty and Inequality.

**UNIT - II :** The Agricultural Sector The Role of Agriculture in Economic development - Place of Agriculture in the Economy of India - Land Reforms in India - Inter dependency of Agriculture and Industry - Agricultural Finance - Agricultural prices, policies and Food problem - Agricultural development.

**UNIT - III :** The Industrial Sector A review on Industrial Policy - Role of large scale and small scale Industries in development. Private Sector and public sector - Industrial sickness - Industrial Finance - Industrial monopoly and Multinational corporations - Role of Information Technology in Industrial development.

**UNIT - IV :** External Sector Structure and Direction of Foreign trade, Balance of Trade & Balance of payments - composition of Trade - Important of Foreign trade for developing economy - Exchange rate - Foreign capital and MNCs in India - Globalisation and its impact on Indian economy - WTO and its impact on the different sectors of the economy.

**UNIT V:** Monetary and Fiscal Policies in India, Credit and Monetary Policy, Capital Market and its Regulation, Public Finance and Fiscal Policy, Fiscal Federalism in India.

**UNIT VI:** Some Issues of Indian Economy: National Institution for Transforming India (NITI Aayog), National Development Council (NDC); Developing Grass-Root Organizations for Development: Panchayatiraj; Role of Non Government Organizations (NGOs) and Pressure Groups in India's Economy. Public Private Partnership (PPP).

**Text Books:**

1. Ahluwalia, IJ and IMD Little (Eds) (1999), Indian Economic Reforms and Development. (Essays in Honour of Manmohansingh) Oxford University, Press, New Delhi.
2. Bardhan, P.K (9th edition) (1999), The political economy of development in India, Oxford University, Press, New Delhi.

**Reference Books:**

1. Bawa, R.S and P.S.Raikhy (Ed) (1997) structural changes in Indian economy, Guru Nanak Dev University Press, Amritsar.
2. Brahmananda, P.R. and V.R Panchmukhi (Eds) (2001) Development Experience in the Indian economy: Interstate Perspectives, Bookwel Delhi.
3. Chakravartym .S (1987), Development Planning : The Indian Experience, Oxford University, Press, New Delhi.
4. Government of India, Economic Survey (Annual) Ministry of Finance, New Delhi.
6. Jaban. B,(1992) The Indian Economy & problems and prospects, Viking New Delhi.
7. Parikh.K.S (1999) India Development Report & 1999 & 2000 Oxford University, Press, New Delhi.
8. Reserve Bank of India, Report on currency and finance (Annual) 10. Sri R.K. and B. Chatterjee (2001) Essays in Honour of Prof.P.R.Brahmanandha), Deep & Deep Publications, New Delhi.

**6IT05 OPEN ELECTIVE II (II) HUMAN RESOURCE DEVELOPMENT & ORGANIZATION BEHAVIOR**

**Course Objective:**

The objective of the course is to familiarise the students about the different aspects of managing people in the organisations from the stage of acquisition to development and retention.

**Course Outcome:**

1. To have an understanding of the basic concepts, functions and processes of human resource management
2. To be aware of the role, functions and functioning of human resource department of the organizations.
3. To Design and formulate various HRM processes such as Recruitment, Selection, Training, Development, Performance appraisals and Reward Systems, Compensation Plans and Ethical Behaviour.
4. Develop ways in which human resources management might diagnose a business strategy and then facilitate the internal change necessary to accomplish the strategy.
5. Evaluate the developing role of human resources in the global arena.

**UNIT I: Introduction:** Conceptual foundations; Human aspect of management, Human Relations; Human Resource Management- Concept, Scope and Importance; Competencies of HR Manager: Employer branding and Competency mapping; Changing role of HRM- Workforce diversity, Technological change, Restructuring and rightsizing, Empowerment; TQM, Managing ethical issues.

**UNIT II: Human Resource Planning, Job Analysis, and Job Design:** Assessing Human Resource requirements; Human resource forecasting; Work load analysis ; Job analysis; Job description and specifications; Job design; Job characteristic approach to job design

**UNIT III: Recruitment, Selection, Training, and Development:** Factors affecting recruitment; Sources of recruitment (internal and external); Basic selection model; Psychological tests for selection; Interviewing; Placement and Induction; Job Changes- Transfers, Promotions, and Separations; An overview of Training and Development; Emerging trends in Recruitment, Selection, and development.

**UNIT IV: Understanding Organisation:** Significance of Scientific Study of Human Behaviour, Hawthorn Studies its importance & implication, Approaches-Cognitive, Behaviouristic & Social learning framework Human Need, theory, Maslow & Herzberg Motivation Process.



**UNIT V: Perspectives of Organisation:** Perception & Impression, Personality & Attitudes, Learning Values. Group Dynamics, Group formation, Group interaction, Conflict Management, Team Management & Morale

**UNIT VI: Leadership:** Managerial styles Managerial effectiveness, Indian Manager & His effectiveness, Delegation, Decision Making.

**Text Books:**

1) D'Ceazo, David A., Stephen P. Robbins, and Susan L. Verhulst, *Human Resource Management*, John Wiley and Sons, New Delhi.

2) Keith Devis Human Behaviour at Work.

3) Kundson & Fleeror Management of Organizational Behaviour.

**Reference Books:**

1. Gomez-Mejia, Luis R., D. B. Balkin, and R. L. Cardy, *Managing Human Resources*, Prentice Hall New Jersey.
2. Ian, Beardwell, and Len Holden, *Human Resource Management*, Prentice Hall.
3. Dessler, Garry, *Human Resource Management*, Prentice Hall of India.
4. Saiyadain, Mirza S., *Human Resource Management*, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
5. Noe, Raymond A., John R. Hollenbeck, Barry Gerhart and Patrick M. Wright, *Human Resource Management*, Tata McGraw Hill.
6. Korman A.K. *Organizational Behaviour*.
7. Prasad *Organization Theory & Behaviour*.

**6IT05 OPEN ELECTIVE II (III) INTELLECTUAL PROPERTY RIGHT**

**Course Objectives:**

Throughout the course, students will be expected to demonstrate their understanding of Intellectual Property Rights in the following:

1. This course is intended to impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. To make familiarizing students with the shades of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their project and research activities.
3. To make the students familiar with basics of IPR and their implications in Project research, development and commercialization.
4. To impart awareness on intellectual property rights and various regulatory issues related to IPR.

**Course Outcomes:**

On completion of the course, the students will be able to

1. Demonstrate a breadth of knowledge in Intellectual property.
2. Assess fundamental aspects of Intellectual Property Rights.
3. Discuss Patents, Searching, filling and drafting of Patents
4. Discuss the basic principles of geographical indication, industrial designs, and copyright.
5. Explain of Trade Mark and Trade Secret,
6. Investigate current trends in IPR and Government initiatives in fostering IPR.

**UNIT I: Overview of Intellectual Property Rights:**

Discovery, Invention, Creativity, Innovation, History & Significance of Intellectual Property Rights (IPR), Overview of IPR - Patent, Copyright, Trade Mark, Trade Secret, Geographical Indication, Industrial Design & Integrated Circuit, Non-patentable criteria.

**UNIT II: Patents:**

Patents: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Overview of Patent Search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board.

**UNIT III: Copyrights:**

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties & Related Rights - Distinction between related rights and copyrights.

**UNIT IV: Trademarks:**

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

**UNIT V: Design & Geographical Indication:**

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection.

Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection.

**UNIT VI: IPR: Current Contour:** India`s New National IP Policy, 2016 ó Govt. of India step towards promoting IPR ó Govt. Schemes in IPR ó Career Opportunities in IP - IPR in current scenario with case studies.

**Text Books:**

1. K. V. Nithyananda (2019), *Intellectual Property Rights: Protection and Management*, IN: Cengage Learning India Private Limited.
2. P. Neeraj and D. Khusdeep (2014), *Intellectual Property Rights*, PHI learning Private Limited.

**Reference Books:**

- [1] Deborah E. Bouchoux, *Intellectual Property for Paralegals ó The law of Trademarks, Copyrights, Patents & Trade secrets*, 4th Edition, Cengage learning, 2012.
- [2] N. S. Gopalakrishnan and T. G. Agitha, *Principles of Intellectual Property*, Eastern Book Company, Lucknow, 2009.
- [3] M. M. S. Karki, *Intellectual Property Rights: Basic Concepts*, Atlantic Publishers, 2009.
- [4] Ganguli Prabuddha, *Intellectual Property Rights--Unleashing the Knowledge Economy*, Tata McGrawHill, 2001.
- [5] V. K. Ahuja, *Law relating to Intellectual Property Rights*. India, IN: Lexis Nexis, 2017.
- [6] P. Narayanan; *Law of Copyright and Industrial Designs*; Eastern law House, Delhi, 2010.
- [7] Ajit Parulekar and Sarita DøSouza, *Indian Patents Law ó Legal & Business Implications*; Macmillan India ltd, 2006.
- [8] B. L. Wadehra. *Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications*; Universal law Publishing Pvt. Ltd., India 2000.
- [9] Ganguli Prabuddha, *Gearing up for Patentsí The Indian Scenario*, Universities Press, 1998.

**6IT06 COMPILER DESIGN LAB**

**Suggested List of Experiments:**

Experiment No.	<i>EXPERIMENT DESCRIPTION</i>
01	Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines.
02	Write a C program to identify whether a given line is a comment or not.
03	Write a C program to recognize strings under 'a*', 'a*b+', 'abb'.
04	Write a C program to test whether a given identifier is valid or not.
05	Write a C program to simulate lexical analyzer for validating operators.
06	Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
07	Write a LEX Program to scan reserved word and Identifiers of C Language.
08	Design Predictive Parser for the given language.
09	Implement SLR(1) Parsing algorithm.
10	Design a LALR bottom up parser for the given language.
11	Write a C program to generate three address codes.
12	Write a LEX Program to convert the substring abc to ABC from the given input string.
13	Write a lex program to find out total number of vowels, and consonants from the given input sting.

**6IT07 DESIGN & ANALYSIS OF ALGORITHM LAB**

**Suggested List of Experiments:**

1. To study various algorithm designing strategies.
2. Implement Multiplication algorithm using divide and conquer technique and analyze time complexity.
3. Implement Knapsack problem using greedy method
4. Implement Dijkstras Shortest Path Algorithm.
5. Implement Primø algorithm using greedy method.
6. Implement travelling salesman problem using dynamic programming.
7. Implement search and traversal using backtracking approach.
8. To study polynomial time and non-polynomial time algorithms.

**6IT08 PROFESSIONAL ELECTIVE – II (I) CRYPTOGRAPHY & NETWORK SECURITY- LAB.**

Concerned faculty member should suitably frame at least 8 laboratory assignments from the following list or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged instead of that you can add comparison between different algorithms.

**Suggested List of Experiments:**

1. To download various security tools which are available on Internet.
2. WAP to demonstrate any substitution stream cipher algorithm.
3. WAP to demonstrate any transposition stream cipher algorithm.
4. WAP to implement Fesital Cipher Algorithm for 8 bit data, for single round.(Assume that the session Key is 1100 & complex function -Føbe simple -XORø
5. WAP to demonstrate authentication using password.
6. Activation of Firewall on the system & their setting.
7. How to detect Trojans by using óNetstat,fPort,TCPview
8. Steganography using tools: Merge Streams, image hide,Stealth Files
9. Scanning for vulnerabilities using(Angry IP,HPing2,IPSacnner)
10. Braking Mono-alphabetic Substation cipher.

**6IT08 PROFESSIONAL ELECTIVE – II (II) BIG DATA ANALYTICS LAB**

**List of Experiments :**

1. Installation of Hadoop & R
2. Building Hadoop MapReduce Application for counting frequency of words/phrase in simple text file.
3. Study of R: Declaring Variable, Expression, Function and Executing R script.
4. Creating List in R ó merging two lists, adding matrices in lists, adding vectors in list.
5. Manipulating & Processing Data in R ó merging data sets, sorting data, plotting data, managing data using matrices & data frames 4. Implementation of K-Means Clustering with R
6. Text Analysis using R: analyzing minimum three different data sets
7. Twitter Data Analysis with R
8. Sentiment Analysis of Whatsapp data with R

**6IT08 PROFESSIONAL ELECTIVE – II (III) SENSORS & ACTUATORS LAB**

Concerned faculty member should suitably frame at least 8 laboratory assignments from the entire syllabus or can design suitably 1 or 2 practical from each unit. Study practical are highly discouraged.

**6IT09 - COMPUTER SKILL LAB IV #**

(# C Skill Lab IV - Mini project based on Software Engineering to be decided by Individual Dept. of respective College)

While designing a Mini Project student should follow the following steps;

1. Identifying the Requirements from Problem Statements
2. Estimation of Project Metrics
3. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
4. E-R Modeling from the Problem Statements
5. Identifying Domain Classes from the Problem Statements
6. Statechart and Activity Modeling
7. Modeling UML Class Diagrams and Sequence diagrams
8. Modeling Data Flow Diagrams
9. Estimation of Test Coverage Metrics and Structural Complexity
10. Designing Test Suites

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