IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme Based on AICTE Flexible Curriculum

Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.)

List of open electives offered by Department of Computer Science & Engineering

S. No	Subject Title	Category	Subject Code	Preferred Branch
1	Digital Marketing & SEO	IOC	CS-01	CSIT
2	JAVA	IOC	CS-02	CSE
3	Data Structure	IOC	CS-03	CSE
4	Internet of Things (IoT)	IOC	CS-04	CSEIoT
5	Data Science	IOC	CS-05	CSEDS
6	Artificial Intelligence and Machine Learning	IOC	CS-06	CSEIML
7	Basics of Python	IOC	CS-07	CSIT
8	Data Base Management System	IOC	CS-08	CSIT
9	E-Commerce & Web Technology	IOC	CS-09	CSE
10	Data Ethics	IOC	CS-10	CSEDS
11	Instrumentation and measurement for IoT	IOC	CS-11	CSEIoT
12	No SQL databases	IOC	CS-12	CSITCS
13	Computational Intelligence	IOC	CS-13	CSITCS

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IOC Offered by CSIT Branch

IOC-CS01	Digital Marketing and SEO	3L: 0T: 0P (3hrs.)	3 credits

Course Objective:

Developing an overall understanding of digital marketing / online marketing platforms, mainly web analytics, social media tools, marketing through search engines, search engine optimization, mobile marketing, email marketing, Pay per click, digital display marketing, content marketing and Strategizing marketing.

Course Contents: (40 hrs.)

Module 1: **(8hrs.)**

Digital Marketing: Introduction, Moving from Traditional to Digital Marketing, Integrating Traditional and Digital Marketing, Reasons for Growth. Need for a comprehensive Digital Marketing Strategy. Concepts: Search Engine Optimization (SEO); Concept of Pay Per Click

Module 2: **(8hrs.)**

Social Media Marketing: Introduction, Process - Goals, Channels, Implementation, Analyze Tools: Google and the Search Engine, Face book, Twitter, YouTube and LinkedIn, Issues: Credibility, Fake News, Paid Influencers, Social Media and Hate/ Phobic campaigns, Analytics and linkage with Social Media, The Social Community.

Module 3: **(10hrs.)**

Email Marketing: Introduction, email marketing process, design and content, delivery, discovery. Mobile Marketing: Introduction and concept, Process of mobile marketing: goals, setup, monitor, analyze; Enhancing Digital Experiences with Mobile Apps. Pros and Cons; Targeted advertising. Issues: Data Collection, Privacy, Data Mining, Money and Apps, Security, Spam. Growth Areas.

Module 4: **(4hrs.)**

Managing Digital Marketing: Content Production; Video based marketing; Credibility and Digital Marketing; IoT; User Experience; Future of Digital Marketing.

Module 5: **(10hrs.)**

SEO Analytics, Monitoring & Reporting : Google Search Console (GSC),Key Sections & Features of GSC; How to monitor SEO progress with Key Features of GSC: Overview,

Performance, URL Inspection, Coverage, Sitemaps, Speed, Mobile Usability, Backlinks, Referring Domains, Security & Manual Actions, How to do SEO Reporting

Course Outcomes:

1. Understand the concept of digital marketing and its real-world iterations.
2. Articulate innovative insights of digital marketing enabling a competitive edge.
3. Understand how to create and run digital media based campaigns.
4. Identify and utilize various tools such as social media etc.
5. Understand how to do SEO Audit.

List of Text / Reference Books:

1. Dodson, Ian: The Art of Digital Marketing - The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns. Wiley.
2. Ryan, Damien: Understanding Digital Marketing - Marketing Strategies for Engaging the Digital Generation. Kogan Page Limited.
3. Gupta, Sunil: Driving Digital Strategy. Harvard Business Review Press.
4. Tuten, Tracy L. and Solomon, Michael R.: Social Media Marketing. Sage.
5. Bhatia, Puneet S.: Fundamentals of Digital Marketing. Pearson.
6. Kotler, Philip: Marketing 4.0: Moving from Traditional to Digital. Wiley.

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IOC-CS02	Java	2L: 1T: 0P (3 hrs.)	3 credits

Prerequisite: C++

Course Objective:

This course provides a foundation to understand the concepts and techniques which form the object oriented programming paradigm.

Course Contents:

Module 1: **(06 hrs)**

Basics of JAVA: Overview of Java, Feature of Java, Difference between Java, C++ and C, Structure of java program, Basics of JDK, JRE and JVM, java keywords, data types, variable declaration and initialization, the scope and life time of variable, operators, Control loops, Arrays, type conversion and casting.

Module2: **(06 hrs)**

Classes & Objects; State, Behavior & Identity of an object. Methods, Calling of constructors, Keywords: this, static, String in Java: Overview of string, Immutable String, String class methods.

Module 3: **(10 hrs)**

Generalization-Specialization, Association, Aggregation and Composition: Inheritance, Types of Inheritance, Ambiguity in multiple inheritances, Concept of interfaces; Static and Dynamic Binding: Polymorphism, Method Overriding & Overloading; Keywords: super, abstract, final.

Module 4: **(08 hrs)**

Exception Handling: Defining exception, types of exception, exception class, try and catch block, multiple catch blocks, Nested try, finally block, throw keyword, Exception Propagation, throws Keyword. Java Packages: Need of package, Definition of package, types of packages, importing package, creating package.

Module 5: **(10 hrs)**

Multithreading: Overview of thread, thread types, Life Cycle of a thread, creating thread, concept of Thread synchronization, Daemon thread. Scanner classes, Introduction to File Handling and AWT.

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Course Outcomes:

1. Understand object oriented programming concepts and core JAVA and apply them in solving problems.
2. Develop skill in data abstraction and message passing.
3. Understand fundamentals of relationship amongst objects.
4. Learn about the need of exception and errors.
5. Understand the concept of multiprogramming and able to run specified problems.

List of Text / Reference Books:

1. E. Balagurusamy, Programming with java A Primer, McGraw-Hill.
2. Herbert Schildt, The Complete Reference Java 2, Tata McGraw-Hill.
3. G. Booch, “Object Oriented Analysis & Design”, Pearson.
4. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001.

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Bachelor of Technology (B.Tech.) [Computer Science & Engineering]

IOC CS-03	**Data Structure**	**2L: 1T: 0P (3 hrs.)**	**3 credits**

Course Objective:

This course aims to provide a comprehensive understanding of key data structures, their implementation, and application, while developing skills to analyze and optimize algorithms for real-world problem-solving.

Course Contents:

Module 1: **(08 hrs)**

Review of C programming language. Introduction to Data Structure: Concepts of Data and Information, Classification of Data structures, Concept of Linear and Non-Linear, Static and Dynamic, Primitive and Non-Primitive Data structure, Overview of array, one dimensional array and multidimensional array, Pointers, Recursive functions

Module2: **(08 hrs)**

Stack, Primitive Stack operations, Array Implementation of Stack, Multiple Stack, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Queue, Overview of Queue, Operations on Queue, Circular Queues, Array implementation of Queues, Dequeue and Priority Queue.

Module 3: **(8 hrs)**

Concept of Linked List organization, Singly List, Doubly List, Circular list and doubly circular Linked List Operations: Linked list implementation of stack and queue, Applications of Linked List data structure.

Module 4: **(8 hrs)**

Trees, Basic terminology, Binary Trees, Binary Tree Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal, Threaded Binary trees, AVL tree, Heaps. Graphs: Introduction, Classification of graph: Directed and Undirected graphs, etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS).

Module 5: **(8 hrs)**

Searching and Sorting, Sequential search, Binary Search, Internal and external Sort, Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Radix Sort, Quick Sort and Merge Sort. Hashing: Hash Function, Collision Resolution Strategies, Storage Management: Garbage Collection and Compaction.

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Course Outcomes:

1. Analyze linear and non-linear data structures and evaluate their applications.
2. Understand and apply the concepts of Stack and Queue data structures.
3. Explain the concepts of Linked Lists and differentiate between their types.
4. Describe the concepts of Tree and Graph representations and compare their use cases.
5. Identify various searching and sorting algorithms and assess their time and space complexities.

List of Text / Reference Books:

Text Books

1. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft. Data Structures and Algorithms

2. Tenebaum, Langsam&Augenstein, Data Structures Using C, Pearson

3. DebasisSamanta, Classic Data Structures, PHI learning

References

1. Horowitz and Sahani, “Fundamentals of data Structures”, University Press

2. Trembley and Sorenson, “Data Structures”, TMH Publications

3. Venkatesan , Rose, “Data Structures” Wiley India Pvt.Ltd

4. Seymour Lipschutz, Data Structures, Schaum’s Outlines Series, TMH

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Scheme Based on AICTE Flexible Curriculum

Department of Computer Science & Engineering (IoT)

Bachelor of Technology (B.Tech.)

VI Semester

IOC-CS04	Internet of Things (IoT)	3L:0T:0P (3hrs.)	3 Credits

OBJECTIVES:

i) To study the fundamentals about IoT
ii) To study about IoT Communication Architectures and Protocols
iii) To study the Technologies Behind IoT
iv) To study the basics of Sensors, Actuators and Interfacing.
v) To study about various IoT case studies and applications.

Module1: **(08hrs.)**

IoT Fundamentals: Definition and Characteristics of Internet of Things (IoT) - Challenges and Issues - Physical Design of IoT - Logical Design of IoT - IoT Functional Blocks.

Module2: **(08 hrs.)**

IoT Communication Architectures and Protocols: Bluetooth – Zigbee, 6LoWPAN, MQTT, Internet Communication- IP Addresses, SOAP, REST, HTTP.

Module3: **(08hrs.)**

Technologies Behind IoT: Four pillars of IoT paradigm: RFID, Wireless Sensor Networks, Supervisory Control and Data Acquisition (SCADA) - M2M - IoT Enabling Technologies: Big Data Analytics, Cloud Computing, Embedded Systems.

Module4: **(08hrs.)**

Sensors, Actuators and Interfacing: Roles of Sensors & Actuators, Types of sensors ,Active and passive, analog and digital, Contact and no-contact, Absolute and relative

Working of Sensors: Position, occupancy and motion, velocity and acceleration, pressure, flow, Acoustic, Humidity, temperature, chemical, biosensor, camera, Types of development boards - Arduino, Raspberry ESP8266

Module5: **(08hrs.)**

Applications of IoT: Business models for IoT - Green energy buildings and infrastructure - Smart farming, Smart Environment, Smart Healthcare, Smart retailing and smart fleet management

Course Outcomes:

At the end of this course, students will be able to

1) Understand the basics of IoT.
2) Understand the Communication Protocols and Architectures of IoT.
3) Understand design methodology and technologies involved in IoT.
4) Understand the basics of sensors and actuators.
5) Design and compare IOT Applications in Industrial & real world.

Reference Books:

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit2).
2. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer,2011.
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition,Michael Margolis,Arduino Cookbook and O"Reilly Media,2011.

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IOC Offered by Data Science branch

IOC - CS-05	**Data Science**	**3L: 0T: 0P(3hrs.)**	**Credits: 3**

Course Objective: This course provides a concise introduction to the fundamental concepts of Data Science

Course Contents :

Module 1: **(08hrs.)**

Introduction: What is Data Science? Big Data and Data Science – Datafication - Current landscape of perspectives - Skill sets needed; Matrices - Matrices to represent relations between data, and necessary linear algebraic operations on matrices Statistics: Descriptive Statistics: distributions and probability.

Module 2: **(09hrs.)**

Data preprocessing: Data cleaning - data integration - Data Reduction Data Transformation and Data Discretization. Evaluation of classification methods –Exploratory Data Analysis - Basic tools (plots, graphs and summary statistics) of EDA,

Module 3: **(08hrs.)**

Introduction to Machine Learning Concepts, Types of Machine Learning, Machine Learning Workflow, Linear Regression, Logistic Regression, Decision Tree, Model Training and Testing.

Module 4: **(09hrs.)**

Clustering: Choosing distance metrics - Different clustering approaches - hierarchical agglomerative clustering, k-means (Lloyd's algorithm), - DBSCAN - Relative merits of each method - clustering tendency and quality.

Module 5: **(06hrs.)**

Case Studies/Projects related to data science, Exploratory Data Analysis using Python (NumPy, Pandas, Matplotlib, Seaborn), Interactive Dashboard Creation using Tableau, Data Visualization using BITools.

Course Outcome:

1. State the overview of the Data Science.
2. Explain the process of Data preprocessing.
3. Discuss the various Machine Learning Algorithms.
4. Explain the clustering techniques.
5. Discuss the usage of Data Science technologies.

List of Text /Reference Books:

1. Cathy O'Neil and Rachel Schutt, " Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014
2. Jiawei Han, Micheline Kamber and JianPei, "Data Mining: Concepts and Techniques",Third Edition. ISBN 0123814790, 2011.
3. Mohammed J.Zaki andWagner Miera Jr,"Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2014.
4. Matt Harrison,"Learning the Pandas Library:Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.
5. Joel Grus,"Data Science from Scratch :First Principles with Python",O'Reilly Media, 2015.
6. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 2012.
7. NPTEL Course Link :https://nptel.ac.in/courses/106/106/106106212/
8. NPTEL Course Link :https://nptel.ac.in/courses/106/106/106106179/

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IOC-CS06	Artificial Intelligence & Machine Learning	3L:0T: 0P(3hrs.)	Credits:03

Prerequisite: Nil

Course Objective: To provide basic conceptual understanding of Artificial Intelligence and Machine Learning, along with their problem-solving approaches, applications, and ethical implications

Course Content:

Module 1: Introduction to Artificial Intelligence:
Artificial Intelligence, AI Evolution, AI Objectives, AI Classification, Human vs AI, AI Applications, AI Benefits, AI Limitations.

Module 2: Intelligent Systems and Decision Making:
Intelligent Systems, AI Components, AI Reasoning, Decision Making, Knowledge Representation, Real-World AI Examples, AI Constraints.

Module 3: AI Problem Solving Techniques:
Problem Solving, State Space, Search Techniques, Uninformed Search, Informed Search, A* Search, Hill Climbing, Search Comparison.

Module 4: Machine Learning Fundamentals:
Machine Learning, AI–ML Relationship, Data in ML, Learning Paradigms, Supervised Learning, Unsupervised Learning, Reinforcement Learning, ML Applications, ML Advantages, ML Limitations.

Module 5: Ethical and Future Perspectives of AI:
AI Ethics, Algorithmic Bias, Data Privacy, AI Transparency, Automation Impact, AI Challenges, Future Trends, Responsible AI.

Course Outcomes:

1. Explain basic concepts, evolution, objectives, and applications of Artificial Intelligence.
2. Describe intelligent systems and AI-based decision-making processes with real-world examples.
3. Illustrate fundamental AI problem-solving techniques such as search methods at a conceptual level.
4. Explain core concepts of Machine Learning, learning paradigms, and common applications.
5. Discuss ethical issues, societal impact, and future trends related to Artificial Intelligence and Machine Learning.

List of Textbooks/Reference Books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Ed., Pearson Education.
2. Tom M. Mitchell, “Machine Learning”, McGraw Hill Education.
3. Ethem Alpaydin, “Introduction to Machine Learning”, 3rd Ed., MIT Press.
4. Tom Taulli, “Artificial Intelligence Basics: A Non-Technical Introduction”, Apress, 2019.
5. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.

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IOC Offered by CSIT Branch

IOC-CS07	Basics of Python	3L: 0T: 0P (3hrs.)	3 credits

Course Objective:

The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language. Learning Outcomes: Problem solving and programming capability

Course Contents: (40 hrs.)

Module 1: **(07 hrs.)**

Introduction, History, Features, Python –Environment Setup Local Environment Setup, Getting Python, Installation of Python, Use of IDE

Module 2: **(10 hrs.)**

Python –Basic Syntax Python Identifiers, Reserved Words, Lines & Indentation, Multiline Statements, Quotation in Python, Comments & other useful constructs, Python –Variables Assigning Values to Variables, Multiple Assignment, Standard Data Types

Module 3: **(08 hrs.)**

Python –Variables, Assigning Values to Variables, Multiple Assignment, Standard Data Types; Python Numbers, Python Strings, Python Lists, Python Tuples, Dictionary, Data Type Conversion

Module 4: **(08 hrs.)**

Python –Basic Operators, Types of Operators, Arithmetic Operators, Comparison Operators, Assignment Operators, Bitwise Operators, Logical Operators, Operator Precedence, Python – Decision Making & Loops, Flowchart, If statement Syntax

Module 5: **(08 hrs.)**

Python-Functions, Syntax for defining a function, Calling a Function, Function Arguments, Anonymous Functions Python-Applications & Further Extensions, Data analysis packages.

Course Outcome:

1. Install Python and have knowledge of syntax of Python.
2. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.

3. Express different Decision Making statements and Functions.
4. Develop code in Python using functions, loops etc.
5. Design GUI Applications in Python and evaluate different database operations.

List of Text Books / Reference Books:

1. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", No Starch Press.
2. ZedA. Shaw, "Learn Python the Hard Way" (3rdEdition), Addison Wesley.
3. Paul Barry, "Head-First Python", O'Reilly.
4. John Zelle, Franklin,"Python Programming", Beedle & Associates Inc.

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IOC Offered by CSIT Branch

IOC-CS08	Database Management System	2L:1T:0P	3 credits

Course Objective:

The main objective of this course is to understand ER modeling, SQL, normalization, and transaction management for proficient database design and administration.

Course Contents: (40 hrs.)

Course Contents:

Module 1: **(06 hrs.)**

Introduction to DBMS, File system vs DBMS, Advantages of database systems, Database System architecture, Data models, Schemas and instances, Data independence, Functions of DBA and designer, Design Issues, Entity-Relationship model: Basic Concepts, Design Process, ER diagrams, weak entity sets, extended E-R features –generalization, specialization and aggregation

Module 2: **(08 hrs.)**

Structure of relational databases, Domains, Relations, Relation algebra – fundamental operators and syntax, relational algebra queries, Types of relational calculus i.e. Tuple oriented and domain oriented relational calculus and its operations, Integrity constraints, Key Concept: Super Key, Candidate Key, Primary Key, Alternate Key, Foreign Key

Module 3: **(14 hrs.)**

SQL concepts : Introduction to data definition language, data manipulation, data control and transaction control language, Basic queries, Aggregation and Grouping, Data Modification Commands, Joins and subqueries, Constraints and views in SQL, Cursor Management, Data storage and definitions, Query Processing & Query Optimization, Transformation of relational expressions. Case Study of ORACLE and DB2.

Module 4: **(09 hrs.)**

Functional Dependency –definition, types of FD, Armstrong's axioms/Properties of FD, closure of FD set, closure of attributes, irreducible set of FD, Canonical cover, Normalization – Need of Normalization, 1NF, 2NF, 3NF, Decomposition using FD- dependency

preservation, lossless join, BCNF, Multi-valued dependency, 4NF, Join dependency and 5NF.

Module 5: **(08 hrs.)**

Introduction of transaction: ACID properties, States of Transaction, transaction processing and recovery, Concurrency control: Lock Management, specialized locking techniques, concurrency control without locking, Protection and Security, Introduction to Distributed Databases, Basic Concepts of Object Oriented database system.

Course Outcomes

1. Describe basic concepts of DBMS and Explain ER model.
2. Solve queries using Relational Algebra and Relational Calculus.
3. Analyze and renovate to use a DDL, DML, Data Retrieval Query and discuss the Query optimization methods.
4. Understanding of Functional Dependencies, Normalization theory and applying knowledge to the design of a database.
5. Explain Terms like Transaction Processing, concurrency control and distributed database.

List of Text/Reference Books:

1. Date CJ, "An Introduction to Database System", Pearson Educations, 8thEdition, 2003.
2. Korth, Silbertz, Sudarshan, "Fundamentals of Database System", McGraw-Hill, 5th Edition, 2006.
3. PeterRob, "Database System: Design Implementation & Management", engage Learning 4th Edition, 2000.
4. Elmasri, Navathe, "Fundamentals of Database Systems", Pearson Educations, 7thEdition2017.
5. Atul Kahate, "Introduction to Database Management System", Pearson Educations, 2004.
6. Oracle9i Database Administration Fundamental-I, Volume I, Oracle Press, TMH.
7. Paneer selvam,"DataBase Management System", PHI Learning, 3rdEdition, 2018.
8. J.D. Ullman, "Principles of Database and Knowledge Base Systems", Computer Science Press, 2nd Edition 1988.
9. Serge Abite boul, Richard Hull, Victor Vianu, "Foundations of Databases", Addison-Wesley, 1995.

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IOC-CS09	E-Commerce & Web Technology	2L: 1T: 0P (3 hrs.)	3 credits

Course Objectives :

- To understand the fundamentals of E-Commerce and digital business models
- To learn core web technologies used in building websites
- To gain knowledge of online payments, security, and legal aspects
- To understand current trends in E-Commerce and Web applications

Module 1: **(6 hrs)**

Introduction to E-Commerce**:** Meaning and scope of E-Commerce, Evolution of E-Commerce, Traditional commerce vs E-Commerce, Types of E-Commerce: B2B, B2C, C2C, C2B, G2C, Advantages and limitations of E-Commerce, E-Commerce framework and components, E-Business vs E-Commerce

Module 2: **(8 hrs)**

E-Commerce Business Models & Applications: E-Commerce business models: Portal, E-tailer, Content provider, Transaction broker, Market creator, Service provider, Digital marketing basics, Online advertising and promotion, E-Commerce applications: Online shopping, Online banking and insurance, E-learning and E-governance, Supply chain and logistics in E-Commerce

Module 3: **(8 hrs)**

Web Technology Basics: Introduction to World Wide Web (WWW), Web architecture and client–server model, Internet protocols: HTTP, HTTPS, FTP, TCP/IP, Web browsers and web servers, Domain Name System (DNS) and web hosting, Introduction to website types: static vs dynamic

Module 4: **(10 hrs)**

Web Designing Technologies: HTML: Structure of HTML document, Common tags, lists, tables, forms, CSS: Types of CSS (Inline, Internal, External), Styling text, layouts, colors, JavaScript basics: Variables, functions, events, Form validation (basic), Responsive web design (basic concept)

Module 5: **(8 hrs)**

E-Commerce Security, Payments & Legal Issues: E-Payment systems: Credit/Debit cards, Net banking, UPI and digital wallets, Electronic Data Interchange (EDI), Security issues in E-Commerce, Encryption and digital, signatures (basic concepts), Cyber threats and cyber laws, Legal, ethical, and social issues in E-Commerce, Future trends in E-Commerce and Web Technology

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Course Outcomes:

After completing this course, students will be able to:

1. Understand fundamentals, types, and models of E-Commerce
2. Explain E-Commerce applications and digital business practices
3. Understand basic web technologies and Internet architecture
4. Create simple web pages using HTML, CSS, and JavaScript
5. Understand online payment systems, security, and legal issues in E-Commerce

Suggested Textbooks / References:

1. Gary P. Schneider – *Electronic Commerce*
2. Jeffrey F. Rayport & Bernard J. Jaworski – *Introduction to E-Commerce*
3. Deitel & Deitel – *Internet & World Wide Web: How to Program*
4. Laudon & Traver – *E-Commerce: Business, Technology, Society*

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IOC Offered by Data Science branch

Prerequisite: Concepts of Data Science and related Programming

Course Objectives:

To make the students aware regarding the ethics they must inculcate in themselves in order to make effective use of data science techniques while safeguarding the interests of the people serving as the sources of data.

IOC- CS10	Data Ethics	3L: 0T: 0P (3 hrs.)	Credits:03

Course Content:

Module 1: **(08 Hrs.)**

What are ethics: Simple utilitarian ethics, agreement about right or wrong, arguments & counter arguments, Need of ethics in Data Science, History & concept of informed consent, welfare of human subjects, limitations of informed consent, examples of Human subject research.

Module 2: **(09 Hrs.)**

Data Ownership & Privacy: Personal data, copyrights, ownership of content on the internet, limits of recording & use of data. Significance of Privacy, History of privacy, degrees of privacy, modern privacy risks.

Module 3: **(08 Hrs.)**

Data Validity: choice of attributes & measures, Population & representative samples, errors in data processing, errors in model design, managing changes in the process.

Algorithmic Fairness: Need of a fair analysis, Kinds of biases & their effects, Case study: High throughput biology & geopricing.

Module 4: **(09 Hrs.)**

Societal Consequences: Societal impact, ossification, surveillance, Understanding status quo: current state of the world, Information asymmetry, Code of ethics & morality.

Module-5: **(06 Hrs.)**

Case Study:

Examining real-world ethical dilemmas in data usage.

Ethical decision-making frameworks applied to case studies.

Open data and its ethical implications.

Ethical challenges in data visualization.

Course Outcomes:

1. Understand the meaning & need of ethics in data science.
2. Knowing about significance of privacy & ownership of content.
3. Evaluating validity & fairness of data & algorithms.
4. Learning about the social aspects of Ethics.

List of Resources:

1. Ethics and Data Science by Mike Loukides (Author), Hilary Mason (Author), D. J. Patil (Author)
2. Data Science Ethics: Course from Coursera.

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Department of Computer Science & Engineering (IoT)

Bachelor of Technology (B.Tech.)

VI Semester

IOC-CS11	Instrumentation and Measurement for IoT	3L:0T:0P (3hrs.)	3 Credits

Course Objectives: This course will enable the students to

1) Impart with the knowledge of generalized measurement systems. and errors in measuring instruments.
2) Understand the concepts of Ammeters, Voltmeter and Multimeters.
3) Impart with the basic concepts of CRO and its usage for the measurement of various parameters.
4) Analyze the circuits for the measurement of Resistance, Capacitance, Inductance, and Frequency.
5) Understand the concepts of transducers and A-D and D-A converters.

Module1: **(08hrs.)**

Measurements: introduction, Significance of measurements, methods of measurements, instruments and measurement systems, Functions of instruments and measurement systems, Applications of measurement systems.

Measurement Errors: Introduction Gross errors and systematic errors, Absolute and relative errors, basic concepts of accuracy, Precision, Resolution and Significant figures, Measurement error combinations. (relevant problems)

Module2: **(08hrs.)**

Ammeters, Voltmeter and Multimeters: Introduction AC- DC ammeter, AC-DC voltmeter, Multi-range voltmeter RMS voltmeters

Digital Instruments: Introduction, Block diagram of a Basic Digital Multimeter. Digital frequency meters: Basic circuit of a Digital frequency meter, Basic circuit for frequency measurement.

Module3: **(08hrs.)**

Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO,CRT features, horizontal and vertical deflection systems, dual trace/beam CRO, Basic of DSO.

Signal generations and waveform analyzing instruments: Function generator- Square, triangular Sinusoidal waveform generator, Spectrum analyzer

Module4: (08hrs.)

A. C And D. C Bridges: General equation for bridge balance, Bridges for measurement of R, L and C, D.C. bridges, Wheatstone bridge, Kelvin's double bridge, General form of an A.C. bridge, Maxwell's inductance –capacitance bridge, Hay's bridge, Anderson's bridge, Schering bridge, Wien's bridge, Sources of errors in bridge measurement, Shielding and Grounding, Wagner earthing device

Module5: (08hrs.)

Transducers: Basic principle and applications of Resistive, Inductive, Capacitive, Piezoelectric, Hall-Effect, Photo emissive, Photo Diode/ Photo Transistor, Photovoltaic, LVDT, Strain Gauge, Display devices: Light Emitting diodes (LED) and Liquid Crystal Display(LCD).

Converters: Digital-to-analog conversion (DAC) Weighted Resistor DAC , R-2R Ladder DAC Analog-to digital Conversion (ADC) – Flash type, Dual Slope, Successive Approximations.

Course Outcomes:

After studying this course, students will able to:

1) Analyze instrument characteristics, errors and generalized measurement system.
2) Use of Ammeters, Voltmeter and Multimeters
3) Use of CRO and its usage for the measurement.
4) Analyze and use the circuit for the measurement of R, L, C etc
5) Understand and use different types of transducers and converters.

Text Books

1) Doeblin, E.O., Measurement systems, Tata McGraw Hill (20017).
2) Nakra, B.C. and Chaudhry, K.K., Instrumentation Measurement and Analysis, Tata McGraw−Hill (2009) 3 rd ed.
3) Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India (2008) 2nd ed.
4) Sawhney, A.K. and Sawhney, P., A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai (2008) 18th ed.

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Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.)

IOC Offered by CSITCS Branch

IOC-CS12	No SQL databases	2L:1T:0P(3hrs.)	3credits

Prerequisite: - Database Management Systems.

Course Objective: The objective of this course is to provide a strong foundation on fundamental concepts in NoSQL databases, their types, data models, and applications in modern big data scenarios.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**
Introduction to NoSQL Databases; Need for NoSQL, Limitations of Relational Databases, CAP Theorem, BASE Properties, Types of NoSQL Databases Key-Value, Document, Column-Family, Graph.

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Module 2: **(14 hrs.)**
Key-Value and Document Databases: Concepts, Data Modeling, Redis, DynamoDB, MongoDB, CouchDB, CRUD Operations, Indexing, Aggregation Framework in MongoDB.

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Module 3: **(08 hrs.)**
Column-Family Databases: Concepts, Wide-Column Stores, Data Modeling, Examples (Apache Cassandra, HBase); Architecture, Replication, Consistency Tuning, Query Language (CQL)

Module 4: **(06 hrs.)**
Graph Databases: Concepts, Property Graph Model, Use Cases, Neo4j, Cypher Query Language, Graph Traversal Algorithms

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Module 5: **(06 hrs.)**
NoSQL in Big Data Ecosystem: Integration with Hadoop/Spark, Polyglot Persistence, Choosing the Right NoSQL Database, Security and Scaling Considerations, Real-world Applications and Case Studies.

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Course Outcomes:

1. Describe the fundamental concepts, types, and characteristics of NoSQL databases.
2. Compare and contrast NoSQL databases with traditional relational databases.
3. Analyze data modeling techniques for different NoSQL categories.
4. Perform CRUD operations and queries on popular NoSQL systems like MongoDB, Cassandra, and Neo4j.
5. Design and apply NoSQL solutions for real-world big data problems

List of Textbooks/ Reference Books:

1. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley, 2012.
2. Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly Media, 3rd Edition, 2019.
3. Eelco Plugge et al., "The Definitive Guide to MongoDB", Apress.
4. Nishant Shukla, "Cassandra: The Definitive Guide", O'Reilly Media.
5. Ian Robinson et al., "Graph Databases", O'Reilly Media, 2nd Edition, 2015.
6. Guy Harrison, "Next Generation Databases: NoSQL, NewSQL, and Big Data", Apress, 2015.

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IOC Offered by CSITCS Branch

IOC-CS13	Computational Intelligence	3L:0T:0P(3hrs.)	3credits

Prerequisite:

Course Objective: The objective of this course is to provide a strong foundation on fundamental concepts in Computational Intelligence and its application.

Course Contents: (40 hrs.)

Module 1: **(06 hrs.)**
Introduction to Computational Intelligence; types of Computational Intelligence, components of Computational Intelligence. Concept of Learning/ Training model. Parametric Models, Nonparametric Models. Multilayer Networks: Feed Forward network, Feedback network.

Module 2: **(14 hrs.)**
Fuzzy Systems: Fuzzy set theory: Fuzzy sets and operations, Membership Functions, Concept of Fuzzy relations and their composition, Concept of Fuzzy Measures; Fuzzy Logic: Fuzzy Rules, Inferencing; Fuzzy Control - Selection of Membership Functions, Fuzzification, Rule Based Design & Inferencing, Defuzzyfication.

Module 3: **(08 hrs.)**
Genetic Algorithms: Basic Genetics, Concepts, Working Principle, Creation of Offsprings, Encoding, Fitness Function, Selection Functions, Genetic Operators-Reproduction, Crossover, Mutation; Genetic Modeling, Benefits.

Module 4: **(06 hrs.)**
Rough Set Theory - Introduction, Fundamental Concepts, Set approximation, Rough membership, Attributes, Optimization. Hidden Markov Models, Decision tree model.

Module 5: **(06 hrs.)**
Introduction to Swarm Intelligence, Swarm Intelligence Techniques: Ant Colony Optimization, Particle Swarm Optimization, Bee Colony Optimization etc. Applications of Computational Intelligence.

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Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.)

IOC Offered by CSITCS Branch

Course Outcomes:

1. Describe in-depth about theories, methods, and algorithms in computation Intelligence.
2. Compare and contrast traditional algorithms with nature inspired algorithms.
3. Examine the nature of a problem at hand and determine whether a computation intelligent technique/algorithm can solve it efficiently enough.
4. Design and implement Computation Intelligence algorithms and approaches for solving real-life problems.
5. Apply Computational Intelligence techniques to analyze, optimize, and solve complex real-world problems in diverse domains.

List of Textbooks/ Reference Books:

1. Russell C. Eberhart and Yuhui Shi, Computational Intelligence: Concepts to Implementations, Morgan Kaufmann Publishers.
2. Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley Publishing. Simon Haykin, Neural Networks: A Comprehensive Foundation, Prentice Hall. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education.
3. Jagdish Chand Bansal, Pramod Kumar Singh, Nikhil R. Pal, Evolutionary and swarm Intelligence Algorithms, Springer Publishing, 2019.
4. S. Rajeskaran, G.A. Vijaylakshmi Pai, “Neural Networks, Fuzzy Logic, Genetic Algorithms Synthesis and Applications”.
5. J.S. Roger Jang, C.T.Sun, E. Mizutani, “Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning & Machine Intelligence”, PHI, 2002