JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
COURSE STRUCTURE & SYLLABUS (R22 Regulations)

Applicable from AY 2022-23 Batch

I Year I Semester

S. No.	Course Code	Course	L	T	P	Credits
1.	MA101BS	Matrices and Calculus	3	1	0	4
2.	CH102BS	Engineering Chemistry	3	1	0	4
3.	CS103ES	Programming for Problem Solving	3	0	0	3
4.	EE104ES	Basic Electrical Engineering	2	0	0	2
5.	ME105ES	Computer Aided Engineering Graphics	1	0	4	3
6.	CS106ES	Elements of Computer Science & Engineering	0	0	2	1
7.	CH107BS	Engineering Chemistry Laboratory	0	0	2	1
8.	CS108ES	Programming for Problem Solving Laboratory	0	0	2	1
9.	EE109ES	Basic Electrical Engineering Laboratory	0	0	2	1
		Induction Program				
		Total	**12**	**2**	**12**	**20**

I Year II Semester

S. No.	Course Code	Course	L	T	P	Credits
1.	MA201BS	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2.	PH202BS	Applied Physics	3	1	0	4
3.	ME203ES	Engineering Workshop	0	1	3	2.5
4.	EN204HS	English for Skill Enhancement	2	0	0	2
5.	EC205ES	Electronic Devices and Circuits	2	0	0	2
6.	CS206ES	Python Programming Laboratory	0	1	2	2
7.	PH207BS	Applied Physics Laboratory	0	0	3	1.5
8.	EN208HS	English Language and Communication Skills Laboratory	0	0	2	1
9.	CS209ES	IT Workshop	0	0	2	1
10.	*MC210	Environmental Science	3	0	0	0
		Total	**13**	**4**	**12**	**20**

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	DS301PC	Digital Electronics	3	0	0	3
2	DS302PC	Data Structures	3	0	0	3
3	DS303PC	Computer Oriented Statistical Methods	3	1	0	4
4	DS304PC	Computer Organization and Architecture	3	0	0	3
5	DS305PC	Object Oriented Programming through Java	3	0	0	3
6	DS306PC	Data Structures Lab	0	0	3	1.5
7	DS307PC	Object Oriented Programming through Java Lab	0	0	3	1.5
8	DS308PC	Data visualization- R Programming/ Power BI	0	0	2	1
9	*MC309	Gender Sensitization Lab	0	0	2	0
		Total	**15**	**1**	**10**	**20**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	DS401PC	Discrete Mathematics	3	0	0	3
2	SM402MS	Business Economics & Financial Analysis	3	0	0	3
3	DS403PC	Operating Systems	3	0	0	3
4	DS404PC	Database Management Systems	3	0	0	3
5	DS405PC	Software Engineering	3	0	0	3
6	DS406PC	Operating Systems Lab	0	0	2	1
7	DS407PC	Database Management Systems Lab	0	0	2	1
8	DS408PC	Real-time Research Project/ Societal Related Project	0	0	4	2
9	DS409PC	Node JS/ React JS/ Django	0	0	2	1
10	*MC410	Constitution of India	3	0	0	0
		Total	**18**	**0**	**10**	**20**

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	DS501PC	Algorithms Design and Analysis	3	0	0	3
2	DS502PC	Introduction to Data Science	3	1	0	4
3	DS503PC	Computer Networks	3	0	0	3
4		Professional Elective - I	3	0	0	3
5		Professional Elective - II	3	0	0	3
6	DS504PC	R Programming Lab	0	0	2	1
7	DS505PC	Computer Networks Lab	0	0	2	1
8	EN508HS	Advanced English Communication Skills Lab	0	0	2	1
9	DS506PC	ETL-Kafka/Talend	0	0	2	1
10	*MC510	Intellectual Property Rights	3	0	0	0
		Total	**18**	**1**	**08**	**20**

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	DS601PC	Automata Theory and Compiler Design	3	0	0	3
2	DS602PC	Machine Learning	3	0	0	3
3	DS603PC	Big Data Analytics	3	0	0	3
4		Professional Elective – III	3	0	0	3
5		Open Elective - I	3	0	0	3
6	DS604PC	Machine Learning Lab	0	0	2	1
7	DS605PC	Big Data Analytics Lab	0	0	2	1
8		Professional Elective - III Lab	0	0	2	1
9	DS606PC	Industrial Oriented Mini Project/ Summer Internship/ Skill Development Course (UI design- Flutter)	0	0	4	2
10	*MC609	Environmental Science	3	0	0	0
		Total	**18**	**0**	**10**	**20**

Environmental Science in III Yr II Sem Should be Registered by Lateral Entry Students Only.

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	DS701PC	Predictive Analytics	3	0	0	3
2	DS702PC	Web and Social Media Analytics	3	0	0	3
3		Professional Elective – IV	3	0	0	3
4		Professional Elective – V	3	0	0	3
5		Open Elective – II	3	0	0	3
6	DS703PC	Predictive Analytics Lab	0	0	2	1
7	DS704PC	Web and Social Media Analytics Lab	0	0	2	1
8	DS705PC	Project Stage – I	0	0	6	3
		Total Credits	**15**	**0**	**10**	**20**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	DS801PC	Organizational Behavior	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4	DS802PC	Project Stage – II including Seminar	0	0	22	11
		Total Credits	**9**	**0**	**22**	**20**

*MC – Satisfactory/Unsatisfactory

Professional Elective - I

DS511PE	Data Warehousing and Business Intelligence
DS512PE	Artificial Intelligence
DS513PE	Web Programming
DS514PE	Image Processing
DS515PE	Computer Graphics

Professional Elective - II

DS521PE	Spatial and Multimedia Databases
DS522PE	Information Retrieval Systems
DS523PE	Software Project Management
DS524PE	DevOps
DS525PE	Computer Vision and Robotics

Professional Elective - III

DS631PE	Software Testing Methodologies
DS632PE	Data Visualization Techniques
DS633PE	Scripting Languages
DS634PE	Mobile Application Development
DS635PE	Cryptography and Network Security

 # Courses in PE - III and PE - III Lab must be in 1-1 correspondence.

Professional Elective - IV

DS741PE	Quantum Computing
DS742PE	Database Security
DS743PE	Natural Language Processing
DS744PE	Information Storage Management
DS745PE	Internet of Things

Professional Elective - V

DS751PE	Privacy Preserving Data Publishing
DS752PE	Cloud Computing
DS753PE	Data Science Applications
DS754PE	Mining Massive Datasets
DS755PE	Exploratory Data Analysis

Professional Elective - VI

DS861PE	Data Stream Mining
DS862PE	Web Security
DS863PE	Video Analytics
DS864PE	Blockchain Technology
DS865PE	Parallel and Distributed Computing

Open Elective - I
1. DS611OE: Fundamentals of Data Science
2. DS612OE: R Programming

Open Elective - II
1. DS721OE: Data Mining
2. DS722OE: Data Analytics

Open Elective - III
1. DS831OE: Introduction to social media mining
2. DS832OE: Data Visualization using Python

DS501PC: ALGORITHM DESIGN AND ANALYSIS

B.Tech. III Year I Sem.   **L T P C**
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Prerequisites: Programming for problem solving and Data Structures

Course Objectives:
- Introduces the notations for analysis of the performance of algorithms.
- Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic programming, greedy, branch and bound methods) and mention problems for which each technique is appropriate;
- Describes how to evaluate and compare different algorithms using worst, average, and best-case analysis.
- Explains the difference between tractable and intractable problems, and introduces the problems that are P, NP and NP complete.

Course Outcomes:
1. Analyze the performance of algorithms
2. Choose appropriate data structures and algorithm design methods for a specified application
3. Understand the choice of data structures and the algorithm design methods

UNIT - I
Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation and Little oh notation.
Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

UNIT - II
Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue- Heaps, Heapsort
Backtracking: General method, applications, n-queen's problem, sum of subsets problem, graph Coloring, Hamiltonian cycles.

UNIT - III
Dynamic Programming: General method, applications- Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

UNIT - IV
Greedy method: General method, applications- Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.
Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, Connected components, Biconnected components.

UNIT - V
Branch and Bound: General method, applications - Travelling sales person problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.
NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

TEXT BOOK:
1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, University Press.

REFERENCE BOOKS:
1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R.Tamassia, John Wiley and sons.

DS502PC: INTRODUCTION TO DATA SCIENCE

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Course Objectives:
- Learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- Understand the basic types of data and basic statistics
- Identify the importance of data reduction and data visualization techniques

Course Outcomes:
- Understand basic terms of statistical modeling and data science
- Implementation of R programming concepts
- utilize R elements for data visualization and prediction

UNIT- I
Introduction
Definition of Data Science- Big Data and Data Science hype – and getting past the hype - Datafication - Current landscape of perspectives - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model – Over fitting.
Basics of R: Introduction, R-Environment Setup, Programming with R, Basic Data Types.

UNIT- II Data Types & Statistical Description
Types of Data: Attributes and Measurement, Attribute, The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes.
Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Interquartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

UNIT- III
Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector sub setting,
Matrices: Creating and Naming Matrices, Matrix Sub setting, Arrays, Class.
Factors and Data Frames: Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame, subsetting of Data Frames, Extending Data Frames, Sorting Data Frames.
Lists: Introduction, creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors

UNIT- IV
Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements.
Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.
Functions in R: Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

UNIT- V
Charts and Graphs: Introduction, Pie Chart: Chart Legend, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.
Regression: Linear Regression Analysis, Multiple Linear regression

TEXT BOOKS:
1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.
2. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:
1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
3. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
4. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
5. Paul Teetor, "R Cookbook", O'Reilly, 2011.

DS503PC: COMPUTER NETWORKS

B.Tech. III Year I Sem.   L T P C
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Prerequisites
1. A course on "Programming for problem solving"
2. A course on "Data Structures"

Course Objectives
- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes
- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Obtain the skills of subnetting and routing mechanisms.
- Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

UNIT - I
Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.
Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless Transmission.
Data link layer: Design issues, framing, Error detection and correction.

UNIT - II
Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.
Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols.
Medium Access sublayer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

UNIT - III
Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT - IV
Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

UNIT - V
Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

TEXT BOOK:
1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI

REFERENCE BOOKS:
1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

DS511PE: DATA WAREHOUSING AND BUSINESS INTELLIGENCE
(Professional Elective – I)

B.Tech. III Year I Sem.   L T P C
                                                                     3 0 0 3

Course Objectives:
- This course is concerned with extracting data from the information systems that deal with the day-to-day operations and transforming it into data that can be used by businesses to drive high-level decision making
- Students will learn how to design and create a data warehouse, and how to utilize the process of extracting, transforming, and loading (ETL) data into data warehouses.

Course Outcomes:
- Understand architecture of data warehouse and OLAP operations.
- Understand Fundamental concepts of BI
- Application of BI Key Performance indicators
- Understand Utilization of Advanced BI Tools and their Implementation.
- Implementation of BI Techniques and BI Ethics.

UNIT - I
Data Warehouse, Data Warehouse Modelling, OLAP operations, Data Qube Computation methods

UNIT - II
Business Intelligence Introduction – Definition, Leveraging Data and Knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics. BI Life Cycle. Data for BI - Data Issues and Data Quality for BI.

UNIT - III
BI Implementation - Key Drivers, Key Performance Indicators and Performance Metrics, BI Architecture/Framework, Best Practices, Business Decision Making, Styles of BI-vent-Driven alerts-A cyclic process of Intelligence Creation. The value of Business Intelligence-Value driven and Information use.

UNIT - IV
Advanced BI – Big Data and BI, Social Networks, Mobile BI, emerging trends, Description of different BI-Tools (Pentaho, KNIME)

UNIT - V
Business Intelligence and integration implementation-connecting in BI systems- Issues of legality-Privacy and ethics- Social networking and BI.

TEXT BOOKS:
1. Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER, Elsevier, 4th Edition.
2. Rajiv Sabherwal "Business Intelligence" Wiley Publications, 2012.

REFERENCE BOOKS:
1. Efraim Turban, Ramesh Sharda, Jay Aronson, David King, Decision Support and Business Intelligence Systems, 9th Edition, Pearson Education, 2009.
2. David Loshin, Business Intelligence - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.

3. Philo Janus, Stacia Misner, Building Integrated Business Intelligence. Solutions with SQL Server, 2008 R2 & Office 2010, TMH, 2011.
4. Business Intelligence Data Mining and Optimization for decision making [Author: Carlo-Verellis] [Publication: (Wiley)]
5. Data Warehousing, Data Mining & OLAP- Alex Berson and Stephen J. Smith- Tata McGraw-Hill Edition, Tenth reprint 2007
6. Building the Data Warehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.
7. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.

DS512PE: ARTIFICIAL INTELLIGENCE (Professional Elective – I)

B.Tech. III Year I Sem.   **L T P C**
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Prerequisites:
1. Programming for problem solving, Data Structures.

Course Objectives:
- To learn the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:
- Understand search strategies and intelligent agents
- Understand different adversarial search techniques
- Apply propositional logic, predicate logic for knowledge representation
- Apply AI techniques to solve problems of game playing, and machine learning.

UNIT - I
Introduction to AI, Intelligent Agents, problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces

UNIT - II
Problem Solving by Search-II and Propositional Logic
Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions. Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems. Propositional Logic: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

UNIT - III
Logic and Knowledge Representation
First-Order Logic: Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.
Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

UNIT - IV
Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.
Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

UNIT - V
Uncertain knowledge and Learning Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use
Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

TEXT BOOK:
1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:
1. Artificial Intelligence, 3rd Edn, E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henry Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education

DS513PE: WEB PROGRAMMING (Professional Elective – I)

B.Tech. III Year I Sem.	L	T	P	C
	3	0	0	3

Course Objectives:
- Understand the technologies used in Web Programming.
- Know the importance of object-oriented aspects of Scripting.
- Understand creating database connectivity using JDBC.
- Learn the concepts of web-based application using sockets.

Course Outcomes:
- Design web pages.
- Use technologies of Web Programming.
- Apply object-oriented aspects to Scripting.
- Create databases with connectivity using JDBC.
- Build web-based application using sockets.

UNIT – I Client side Programming
HTML- Basic Tags- List, Tables, Images, Forms, Frames, CSS
JAVA Script -
Web page Designing using HTML, Scripting basics- Client side and server side scripting. Java ScriptObject, names, literals, operators and expressions- statements and features- events - windows - documents - frames - data types - built-in functions- Browser object model - Verifying forms.-HTML5-CSS3- HTML 5 canvas - Web site creation using tools.

UNIT – II JAVA
Introduction to object-oriented programming-Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input/Output – Files – Utility Classes – String Handling.

UNIT – III JDBC
JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– InetAddress class – URL class- TCP sockets – UDP sockets, Java Beans –RMI.

UNIT – IV APPLETS
Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

UNIT – V XML AND WEB SERVICES
Xml – Introduction-Form Navigation-XML Documents- XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.

TEXT BOOKS:
1. Harvey Deitel, Abbey Deitel, Internet and World Wide Web: How To Program 5th Edition.
2. Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.
3. Michael Morrison XML Unleashed Tech media SAMS.

REFERENCE BOOKS:
1. John Pollock, Javascript - A Beginners Guide, 3rd Edition –- Tata McGraw-Hill Edition.
2. Keyur Shah, Gateway to Java Programmer Sun Certification, Tata McGraw Hill, 2002.

DS514PE: IMAGE PROCESSING (Professional Elective – I)

B.Tech. III Year I Sem.   **L T P C**
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Prerequisites
1. Students are expected to have knowledge in linear signals and systems, Fourier Transform, basic linear algebra, basic probability theory and basic programming techniques; knowledge of digital signal processing is desirable.
2. A course on "Computational Mathematics"
3. A course on "Computer Oriented Statistical Methods"

Course Objectives
- Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.
- The topics include image acquisition; sampling and quantization; preprocessing; enhancement; restoration; segmentation; and compression.

Course Outcomes
- Demonstrate the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
- Demonstrate the knowledge of filtering techniques.
- Demonstrate the knowledge of 2D transformation techniques.
- Demonstrate the knowledge of image enhancement, segmentation, restoration and compression techniques.

UNIT - I
Digital Image Fundamentals: Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

UNIT - II
Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

UNIT - III
Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT - IV
Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

UNIT - V
Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

TEXT BOOK:
1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2nd Ed, 2004.

REFERENCE BOOKS:
1. Fundamentals of Digital Image Processing: A. K. Jain, PHI.
2. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wiley, 3rd Edition, 2004.

DS515PE: COMPUTER GRAPHICS (Professional Elective – I)

B.Tech. III Year I Sem.   **L   T   P   C**
                                                                                     3   0   0   3

Prerequisites
1. Programming for problem solving and Data Structures

Course Objectives
- Provide the basics of graphics systems including Points and lines, line drawing algorithms, 2D, 3D objective transformations

Course Outcomes
- Explore applications of computer graphics
- Understand 2D, 3D geometric transformations and clipping algorithms
- Understand 3D object representations, curves, surfaces, polygon rendering methods, color models
- Analyze animation sequence and visible surface detection methods

UNIT - I
Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random-scan systems, graphics monitors and work stations and input devices
Output primitives: Points and lines, line drawing algorithms (DDA and Bresenham's Algorithm) circle-generating algorithms and ellipse - generating algorithms
Polygon Filling: Scan-line algorithm, boundary-fill and flood-fill algorithms

UNIT - II
2-D geometric transformations: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems
2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, clipping operations, point clipping, Line clipping-Cohen Sutherland algorithms, Polygon clipping-Sutherland Hodgeman polygon clipping algorithm.

UNIT - III
3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces, Polygon rendering methods, color models and color applications.

UNIT - IV
3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.
3-D viewing: Viewing pipeline, viewing coordinates, projections, view volume and general projection transforms and clipping.

UNIT - V
Computer animation: Design of animation sequence, general computer animation functions, raster animations, computer animation languages, key frame systems, motion specifications.
Visible surface detection methods: Classification, back-face detection, depth-buffer method, BSP-tree method, area sub-division method and octree method.

TEXT BOOKS:
1. "Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson Education

REFERENCE BOOKS:

1. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
2. Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
3. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.
4. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
5. Computer Graphics, Steven Harrington, TMH.

DS521PE: SPATIAL AND MULTIMEDIA DATABASES (Professional Elective - II)

B.Tech. III Year I Sem.   **L T P C**
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Course Objective:
- Introduce the basic concepts, data models and indexing structures for spatial data, multimedia data.

Course Outcomes:
- Understand data models, storage, indexing and design of spatial databases.
- Evaluate multidimensional data structures
- Represent image database with R-tree
- Store and retrieve audio, video and multimedia data.

UNIT - I
Introduction to Spatial Databases: Overview, beneficiaries, GIA and SDBMS, users, Space taxonomy, query language, query processing, query optimization.
Spatial Concepts and Data Models: Models of Spatial information, three step database design, Extending the ER model with spatial concept, object-oriented data modeling, Spatial Query Languages.

UNIT - II
Spatial Storage and Indexing: Storage-disks and files, spatial indexing, TR*, spatial join index.
Query processing and optimization – Evaluation of Spatial operations, query optimization, Analysis of Spatial index structures, distributed and parallel spatial database system.
Multidimensional Data Structures: k-d Trees, Point Quadtrees, The MX-Quadtree, R-Trees, comparison of Different Data Structures.

UNIT - III
Image Databases: Raw Images, Compressed Image Representations, Image Processing:
Segmentation, Similarity-Based Retrieval, Alternative Image DB Paradigms, Representing Image DBs with Relations, Representing Image DBs with R-Trees, Retrieving Images By Spatial Layout, Implementations.
Text/Document Databases: Precision and Recall, Stop Lists, Word Stems, and Frequency Tables, Latent Semantic Indexing, TV-Trees, Other Retrieval Techniques

UNIT - IV
Video Databases: Organizing Content of a Single Video, Querying Content of Video Libraries, Video Segmentation, video Standards
Audio Databases: A General Model of Audio Data, Capturing Audio Content through Discrete Transformation, Indexing Audio Data
Multimedia Databases: Design and Architecture of a Multimedia Database, Organizing Multimedia Data Based on The Principle of Uniformity, Media Abstractions, Query Languages for Retrieving Multimedia Data, Indexing SMDSs with Enhanced Inverted Indices, Query Relaxation/Expansion.

UNIT- V
Creating Distributed Multimedia Presentations: Objects in Multimedia Presentations, Specifying Multimedia Documents with Temporal Constraints, Efficient Solution of Temporal Presentation Constraints, Spatial Constraints.
Distributed Media Servers: Distributed multimedia server architecture, distributed retrieval plans, optimal distributed retrieval plans.

TEXT BOOKS:
1. Shashi Shekhar, Sanjiv Chawla, Spatial Databases-A Tour, Pearson Education.
2. V. S. Subrahmanian Principles of Multimedia Database Systems, Morgan Kauffman.

REFERENCE BOOKS:
1. Multimedia Databases: An object relational approach, Lynne Dunckley, Pearson Education.
2. Multimedia Database Systems, Prabhakaram, Springer.

DS522PE: INFORMATION RETRIEVAL SYSTEMS (Professional Elective - II)

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
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Prerequisites:
1. Data Structures

Course Objectives:
- To learn the concepts and algorithms in Information Retrieval Systems
- To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

Course Outcomes:
- Ability to apply IR principles to locate relevant information large collections of data
- Ability to design different document clustering algorithms
- Implement retrieval systems for web search tasks.
- Design an Information Retrieval System for web search tasks.

UNIT - I
Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

UNIT - II
Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

UNIT - III
Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages
Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

UNIT - IV
User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext
Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

UNIT - V
Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems
Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval

TEXT BOOK:
1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer

REFERENCE BOOKS:
1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.
3. Modern Information Retrieval by Yates and Neto Pearson Education.

DS523PE: SOFTWARE PROJECT MANAGEMENT (Professional Elective – II)

B.Tech. III Year I Sem.   **L T P C**
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Prerequisites:
  1. A course on "Software Engineering".

Course Objectives
  - To acquire knowledge on software process management
  - To acquire managerial skills for software project development
  - To understand software economics, workflows and frameworks.

Course Outcomes
  - Understand the software economics to improve various phases of development.
  - Examine the life cycle phases, artifacts, workflows and checkpoints of a process.
  - Demonstrate the software project framework components.
  - Analyze the need for various software management disciplines and metrics.

UNIT - I
Software Management Renaissance
Conventional Software Management: The waterfall model, conventional software Management performance. Evolution of Software Economics-Software economics, pragmatic software cost estimation. Improving Software Economics- Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

UNIT – II
A Software Management Process Framework-I
The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process. Life cycle phases- Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process- The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT – III
A Software Management Process Framework-II
Model based software architectures- A Management perspective and technical perspective. Work Flows of the process- Software process workflows, Iteration workflows. Checkpoints of the process- Major milestones, Minor Milestones, Periodic status assessments.

UNIT – IV
Software Management Discipline-I
Iterative Process Planning- Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. Project Organizations and Responsibilities- Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation building blocks, The Project Environment.

UNIT – V
Software Management Discipline-II
Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates. Future Software Project Management: modern Project Profiles, Next

generation Software economics, modern process transitions. Case Study: The command Center Processing and Display system- Replacement (CCPDS-R).

TEXT BOOK:
1. Software Project Management, Walker Royce, Addison-Wesley   Pearson Education, 2005.

REFERENCE BOOKS:
1. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
2. Software Project Management, Joel Henry, Pearson Education.
3. Software Project Management in practice, Pankaj Jalote, Pearson Education. 2005.

DS524PE: DEVOPS (Professional Elective – II)

B.Tech. III Year I Sem.   **L T P C**
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Pre-Requisites:
1. Software Engineering
2. Software Project Management

Course Objectives:
- Understand the skill sets and high-functioning teams involved in Agile, DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

Course Outcomes:
- Understand the various components of DevOps environment.
- Identify Software development models and architectures of DevOps
- Use different project management and integration tools.
- Select an appropriate testing tool and deployment model for project.

UNIT- I
Introduction to DevOps:
Introduction, Agile development model, DevOps and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, identifying bottlenecks.

UNIT- II:
Software development models and DevOps:
DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Micro services and the data tier, DevOps, architecture, and resilience.

UNIT- III
Introduction to project management:
The need for source code control, the history of source code management, Roles and code, source code management system and migrations, shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

UNIT- IV
Integrating the system:
Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

UNIT- V
Testing Tools and Deployment:
Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development. Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, SaltStackand Docker.

TEXT BOOK:
1. Joakim Verona., Practical DevOps, Packt Publishing, 2016.

REFERENCE BOOKS:
1. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications.
2. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley.