POs – PG (MCA)

1. Graduates are prepared to be creators of new knowledge leading to innovation, entrepreneur and employable in various sectors such as Private, Government and Research organizations.
2. Graduates are trained to evolve/ adopt new technologies in their own discipline.
3. Graduates are groomed to engage in lifelong learning process by exploring knowledge independently
4. Graduates are framed to design and conduct experiments/ demonstrate/ create models to analyze and interpret data.
5. Graduates ought to have the ability of effectively communicating the findings of Biological Sciences / Computing Sciences / Languages and Culture / Management Studies/ Physical Sciences/ and to incorporate with existing knowledge.

PSOs for PG Programme (MCA)
After completing the MCA Programme, the graduates will be able to

PSO1	implement the logic for solving the real life problems by using the knowledge gained
PSO2	understand, analyze, design, develop, test, implement and document software systems
PSO3	use their creative skill to evolve new ideas, defend their findings at the peer level and able to manage IT and ITES organizations.
PSO4	work in public and private sectors satisfying social and environmental obligations with multiple cultures
PSO5	act as socially responsible IT professionals or service minded entrepreneurs

				Department of Computer Science		
				MCA - 2020-21		
				COURSE STRUCTURE FOR PG PROGRAMME (MCA) (2020-21)		
Sem.	**Specification**	**No. of Courses**	**No. of Hours**	**Credits**	**Total Credits**
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I-IV	Core Courses: Theory	13	58	51	51
I-IV	Core Courses: Practical	6	18	12	12
II	Self-paced learning	1	-	2	2
IV	Comprehensive Examination	1	-	2	2
IV	Project work & Viva Voce	2	20	17	17
I- IV	Discipline Specific Elective	3	12	9	9
I	Ability Enhancement Course	-	-	-	-
II	Skill Enhancement Course (Soft Skills)	1	4	4	4
III	Generic Elective IDC (WS)	1	4	4	4
IV	Generic Elective IDC (BS)	1	4	4	4
II - IV	Online courses (MOOC)	2	-	(4)	(4)
I-IV	Outreach Programme	-	-	5	5
	Total		**120**		**110(4)**

Sem	Course Code	Course	Course Title	Hrs/Week	Credit	CIA	Sem	Total
			MCA COURSE PATTERN (TWO YEARS)					
I	20PCA1101	Core I	Programming in Java	5	4	100	100	200
	20PCA1102	Core II	Database Systems	5	4	100	100	200
	20PCA1103	Core III	Organizational Behavior	5	4	100	100	200
	20PCA1104	Core IV	Mathematical Foundation	5	4	100	100	200
	20PCA1201A	Elective-I	▪ Digital Computer Architecture	4	3	100	100	200
	20PCA1201B		▪ Operating System					
	20PCA1201C		▪ Microcontrollers					
	20PCA1105	Core V	Software Lab – 1 – Java	3	2	100	100	200
	20PCA1106	Core VI	Software Lab – 2 – RDBMS	3	2	100	100	200
TOTAL				30	23	700	700	1400
II	20PCA2107	Core VII	Online Course: Distributed Technologies	4	4	100	100	200
	20PCA2108	Core VIII	Accounting and Financial Management	4	4	100	100	200
	20PCA2109	Core IX	Probability and Statistics	4	4	100	100	200
	20PCA2202A	Elective-II	▪ Data Analysis using Python	4	3	100	100	200
	20PCA2202B		▪ Information Security					
	20PCA2202C		▪ Data Science for Business					
	20PCA2110	Core X	Software Lab – 3 – Distributed Programming	3	2	100	100	200
	20PCA2111	Core XI	Software Lab – 4 – Advanced Python	3	2	100	100	200
	18PSS2301	IDC-SS	Soft Skills	4	4	100	-	100
	20PCA2301A	IDC-(WS)	Applications of Statistical Techniques in R	4	4	100	100	200
	18PCA2301B		MATLAB					

20PCA2401	Extra-CC	Extra Credit Course-1: MOOC #	-	(2)	-	-	-
TOTAL			30	27+ (2)	800	700	1500

	20PCA3112	Core XII	Online Course: Programming Smart Devices	4	4	100	100	200
	20PCA3113	Core XIII	Compiler Design	4	4	100	100	200
	20PCA3114	Core XIV	Software Engineering	4	3	100	100	200
	18SCS3101	ID Core	Inter-Disciplinary Core: Design and analysis of Algorithms	4	4	100	100	200
III	20PCA3203A	Elective-III	▪ MEAN Stack Web Development	4	3	100	100	200
	20PCA3203B		▪ Ruby on Rails					
	20PCA3203C		▪ Php					
	20PCA3115	Core XV	Software Lab – 5 – Programming Smart Devices	3	2	100	100	200
	20PCA3116	Core XVI	Software Lab – 6 – Mean Stack Webapp Lab	3	2	100	100	200
	20PCA3302	**IDC-(BS)**	Web Design	**4**	**4**	100	100	200
	20PCA3117	Core XVII	Mini Project(summer Vacation) * / Internship	-	2	100	-	100
	20PCA3118	Core XVIII	Self-paced Learning: XML	**-**	**2**	50	50	100
	20PCA3402	Extra-CC	Extra Credit Course-2: MOOC #	-	(2)	-	-	-
TOTAL				30	30(2)	950	850	1800
	20PCA4119	Core XIX	Big data Analytics *	5	4	100	-	100
	20PCA4120	Core XX	Recent Trends in Computer Science *	5	4	100	-	100
	20PCA4121	Core XXI	Comprehensive Examination	**-**	**2**	50	50	100
	20PCA4122	Core XXII	Project work	20	15	100	100	200
TOTAL				30	25	350	150	500
	20PCW4501	Extension	Outreach Programme (SHEPHERD)	-	5			

GRAND TOTAL	**120**	**110+ (4)**	**2800**	**2400**	**5200**

* **Papers - Fully internal**   **# - Not considered for Grand Total and CGPA calculation**

Mandatory Bridge Courses for Non-Computer Science Stream Students

Sem	Course Code	Course	Course Title	Hrs/ Week	Credit	CIA	SE	Total
I	20MCA1ACC1	ADDL.Core I	C Programming **	-	5	100	-	100
	20MCA1ACC2	ADDL. Core II	C Programming Lab **	-	5	100	-	100
TOTAL				-	10	200	-	200
II	20MCA2ACC3	ADDL. Core III	Web Design (HTML5, Java Script & CSS) **	-	5	100	-	100
	20MCA2ACC4	ADDL. Core IV	Web Design (HTML5, Java Script & CSS) Lab **	-	5	100	-	100
TOTAL				-	10	200	-	200
III	20MCA3ACC5	ADDL. Core V	Web Graphics **	-	5	100	-	100
	20MCA3ACC6	ADDL. Core VI	Web Graphics Lab **	-	5	100	-	100
					10	200	-	200
Grand Total					**30**	**600**	**-**	**600**

** **Papers Fully Internal**

Semester I   **Hours/Week: 5**
20PCA1101   **Credits: 4**

PROGRAMMING IN JAVA

Course Outcomes

On completion of the course the student will be able to

1. Understand and explain the purpose of Object Oriented Programming concepts
2. Understand the applicability of Packages, Interfaces and write simple Applets in Java
3. Design User Interfaces using SWING Components and able to handle errors in programs
4. Develop Threaded applications and perform Data Access using JDBC
5. Develop distributed applications using RMI, Servlets and Cookies

Unit-I: (12)

CLASSES AND OBJECTS: General Form of A Class - Creation of Objects - Usage of Constructors - 'this' Keyword- Constructor Overloading-Copy Constructors-Static Data Members - Static Methods- Finalize Method. **INHERITANCE AND POLYMORPHISM:** Inheriting Variables in a Class - Inheriting Methods in a Class - Inheritance and Constructors – Abstract Classes - Final Classes.

Unit-II: (12)

INTERFACES AND PACKAGES: Interfaces-Structure of an Interface - Implementation of an Interface- Interface Inheritance. Packages - Placing the Classes in a Package - Package Hierarchy- Access Control Modifiers. **APPLETS:** The Life Cycle of an Applet -The Applet Class – Development and Execution of a Simple Applet - Syntax Of Applet Tag- Methods in the Graphic Class.

Unit-III: (12)

SWING:JApplet class - Icons - JLabel Control - JOptionPane Class – JtextField Control - JButton Control - JCheckBox Control - JRadioButton Control Menus. **EXCEPTION HANDLING:** Default Exception Handling – Exception and Error Classes - Catch Block Searching Pattern - Custom Exceptions. **I/O STREAMS:** Text And Binary Formats of Data - Input Stream and Output Stream Classes - Reader and Writer Classes - Data Output Stream and Data Input Stream Classes.

Unit-IV: (12)

THREADS: Life Cycle of a Thread - Creating And Running Threads – Method in the Thread Class - Setting The Priority Of A Thread - Synchronization. **NETWORKING:** TCP Server Socket Class - TCP Socket Class. **JAVA DATABASE CONNECTIVITY:** Establishing a Connection - Creation Of Data Tables Entering Data Into The Tables - Table Updating.

Unit-V: (12)

REMOTE METHOD INVOCATION: Remote Interface-Java.Rmi. Server Package The Naming Class - Creating RMI Client And Server Classes. **SERVLET:** Servlet and Dynamic Webpages Life Cycle of a Servlet a Simple Servlet JavaX. Servlet Package Retrieving the Values of Parameters. **COOKIES:** Creating a Cookie and sending it to the Client - Retrieving the Stored Cookies.

Book for Study:

1. C. Muthu, "Programming with JAVA**"**, Vijay Nicole Imprints Private Limited, 2nd Ed, Chennai, 2011

Books for Reference

1. Sagayaraj, Denis, Karthik and Gajalakshmi, "Java Programming-for Core and Advanced Users", Universities Press, Hyderabad, 2017.
2. Herbert Schildt, ⁻Java 2: Complete Reference, Tata McGraw Hill, 5th Ed., 2009

Semester	Course Code	Title of the Course							Hours	Credits
I	**20PCA1101**	**PROGRAMMING IN JAVA**							5	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	4	3	4	5	4	4	4	3	3	3.8
CO-2	5	4	3	4	4	4	4	4	3	3	3.8
CO-3	5	4	3	4	3	5	4	4	3	3	3.8
CO-4	4	4	5	4	4	4	4	4	3	3	3.9
CO-5	4	5	4	4	3	4	4	5	3	3	3.9
									Mean Overall Score		3.84
									Result		High

DATABASE SYSTEMS

Course Outcomes:
   On completion of the course the student will be able to
   1. Understand the workings of a relational database system and normalize data;
   2. Write SQL queries to access data.
   3. Normalize the data up to BCNF.
   4. Write PL/SQL routines to process the data in the database
   5. Implement concurrency and parallelism in a database.

Unit-I: (12)
Introduction to DBS: Basic Concepts and Definitions - Data Dictionary - Database System - DBA - Database Languages - Database System Architecture: Schemas, Sub-schemas and Instances - Three-level Architecture - Data Independence - Mappings -Data Models - Types-ER Model - Specialization and Generalization - Relational Algebra and Calculus: Structure - Relational Algebra - Relational Calculus

Unit-II: (12)
Relational Query Languages: Introduction - Codd's Rules-Information System Based Language - Structured Query Language (SQL)-Embedded SQL

Unit-III: (12)
Normalization: Introduction to Database Design - Functional Dependency and Decomposition - Normalization - Normal Forms - BCNF - Multi-valued and Join Dependencies

Unit-IV: (12)
PL/SQL: A Programming Language: History - Fundamentals -Data types - Operators. Control Structures: Control Structures - Nested Blocks - SQL in PL/SQL - Data Manipulation - Transaction Control statements. PL/SQL Cursors and Exceptions - Named Blocks: Procedures - Functions-Packages -Triggers

Unit-V: (12)
Transaction Processing and Concurrency Control - Database Recovery System - Database Security - Parallel Database Systems: Introduction to Parallel databases - Architecture - Key Elements of Parallel Database Processing -Distributed Databases - Architecture - Distributed Database design.

Books for Study

Unit I, II, III and V
1. S K Singh, "Database Systems Concepts, Design and Applications", Pearson Education, 2006.
Unit IV
2. Nilesh Shah, "Database Systems using ORACLE", Prentice Hall of India, 2005.

Books for Reference
1. Abraham Silberschatz, "Database Systems", McGraw Hill International, 1997.
2. CJ Date, "An Introduction to Database Systems", 6th Edn, Addison Wesley Publishing Company, New York, 1995.

Semester	Course Code	Title of the Course							Hours		Credit	
I	**20PCA1102**	**DATABASE SYSTEMS**							**5**		**4**	
Course Outcomes ↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**		
CO-1	5	4	4	3	4	4	4	4	3	3	3.8	
CO-2	5	5	4	3	3	4	4	3	3	3	3.7	
CO-3	4	4	4	3	4	4	4	4	3	3	3.7	
CO-4	4	4	5	4	4	4	5	3	3	3	3.9	
CO-5	4	4	4	5	3	3	4	4	3	3	3.9	
								Mean Overall Score			3.8	
								Result			High	

ORGANISATIONAL BEHAVIOUR

Course Objectives:
On completion of the course the student will be
1.   Familiar with the basic concepts of organizational structure and its behaviour.
2. Able to understand the development of Attitudes, Formation factors and attitude changes
3. Equippedin building the Perceptual Interpretation and Motivation.
4. Enhancing their Leadership skills through various activities.
5. Soundknowledge about organizational structure and projects

Unit – I:
NATURE OF ORGANIZATION – features – types – goals. NATURE OF ORGANIZATIONAL BEHAVIOR – Nature of OB – Role of OB – Foundations of OB.

Unit – II:
NATURE OF HUMAN BEHAVIOR: Nature and causes of individual differences – models of man. PERCEPTION: concept – process – perceptual selectivity and distortion – Developing perceptual skills. ATTITUDES: Concept – Theories – Formation factors – measurements – Attitude change.

Unit – III:
MOTIVATION: Definition – Motivation &Behavior – Theories – approaches – incentives. INTERPERSONAL BEHAVIOR: Transactional analysis – Ego states – life scripts – life positions – transactions – stroking – Psychological games – Benefits of TA.

Unit – IV:
GROUP DYNAMICS: Concepts & features of group – types of groups – group behavior – group decision making – committee – task group – inter group behavior. LEADERSHIP: Definitions – types – importance theories – styles. COMMUNICATION: Basics of communication – Communication network – Factors affecting communication – Business writing – Office management – Presentation strategies.

Unit – V:
ORGANIZATION THEORY: Classical organizational theory – neoclassical organization theory – DESIGNING OF ORGANIZATIONAL STRUCTURE: need – planning and process –

Departmentation Span of management – delegation of authorities – centralization & decentralization – FORMS OF ORGANIZATIONAL STRUCTURES: line and staff – functional – divisional – project – matrix – free form.

Book for study

1. Prasad LM, "Organisational Behavior", Sultan Chand and Sons, New Delhi, 2014.

Books for Reference

1. S. S. Khanka, "Organisational Behavior", S. Chand Ltd., New Delhi
2. K. Aswathappa, "Organisational Behavior", Himalaya Publishing house, New Delhi

Semester	CourseCode	TitleoftheCourse								Hours	Credit
I	**20PCA1103**	**ORGANISATIONAL BEHAVIOUR**								**5**	**4**
CourseOutcomes↓	ProgrammeOutcomes(PO)					ProgrammeSpecificOutcomes(PSO)					**MeanScores ofCOs**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	3	4	3	4	4	4	3	3	3	3.5
CO-2	4	4	3	4	4	5	4	4	3	3	3.8
CO-3	4	4	3	3	3	4	4	4	3	3	3.5
CO-4	4	5	4	3	3	4	5	4	3	3	3.8
CO-5	4	4	5	3	4	4	5	3	3	3	3.8
										MeanOverallScore	**3.68**
										Result	**High**

Sem. I   **Hours/Week: 5**
20PCA1104   **Credits: 4**

MATHEMATICAL FOUNDATIONS

Course Learning Outcomes

Upon successful completion of this subject, the student will be able to:

1. Ability to apply mathematical logic to solve problems and apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.
2. Understand sets, relations, relations, functions, and discrete structure and know the properties of lattices and Boolean Algebra
3. Solve polynomial equation using Birge-Vieta and Graffe's root squaring method and Solve linear system of equation using direct methods Gauss-elimination and Gauss-Jordan Method and Iterative methods Gauss-Jacobi and Gauss-Seidal Method.
4. Know the interpolation techniques and predicting the unknown values for a given value
5. Apply numerical integration using Trapezoidal, Simpson's rules and Romberg's Method

Unit – I: **(15)**

Mathematical Logic: Statements and Notation - Connectives – Statement Formulas and Truth Tables - Tautologies - Equivalence of Formulas – Duality Law. Tautological implications - Theory of inference - validity using truth tables-Rules of Inference

Unit – II: **(15)**

Basic concepts of Set Theory : Inclusion and Equality of sets - Power set -Operations on Sets - Venn Diagrams - Cartesian Products. Relations and Ordering - Binary & Equivalence relations - Partial Ordering. Functions Composition of functions, inverse functions, Binary & n-ary operations

Unit – III: **(15)**

Lattices as Partially ordered sets - Hasse diagrams - Properties of Lattices Distributive & Modular inequalities-Special lattices -Complete, Bounded, Complemented &Distributive lattices. Properties of Boolean Algebra

Unit – IV: **(15)**

Solution of polynomial equations: Birge-Vieta and Root squaring methods. System of linear algebraic equations: Gauss - elimination, Gauss - Jordan, Triangularization, Jacobi, Gauss-Seidal iterative methods.

Unit – V: **(15)**

Interpolation: Lagrange's and Newton's interpolation –interpolating polynomials using finite difference. Numerical integration: Trapezoidal, Simpson's rules and Romberg integration.

Note: Stress on solving Numerical Problems in Units IV and V

Books for Study

Units I, II, III

1. J.P.Tremblay&R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw-Hill International Edition, 2008.

Units IV, V

2. M.K.Jain, S.R.K.Iyengar& R.K. Jain, "Numerical Methods for Scientific and Engineering Computation", Wiley Eastern Limited, New Delhi, 2003.

Books for Reference

1. Bernard Kolman& Robert C. Busy by, "Discrete Mathematical Structures for Computer Science", Prentice Hall of India, New Delhi, 1987.

2. S.S. Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall of India, New Delhi, 2005.

Semester	Course Code	Title of the Course								Hours	Credits
I	**20PCA1104**	**MATHEMATICAL FOUNDATIONS**								5	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	3	3	4	4	4	3	4	3	3	3.5
CO-2	4	4	4	3	4	5	4	3	3	3	3.7
CO-3	4	5	5	4	3	4	4	4	3	3	3.9
CO-4	5	5	3	4	4	3	4	4	3	3	3.8
CO-5	4	5	4	3	3	4	4	3	3	3	3.6
									Mean Overall Score		3.7
									Result		High

Semester I   **Hours/Week: 3**
20PCA1105   **Credits: 2**

Software Lab-I: JAVA

Course Outcomes

On completion of the course the student will be able to

1. Solvereal world problems using OOP techniques.
2. Design GUI based applications using SWING
3. Develop Applets and Servlets for distributed web applications.
4. Perform Database Operations using JDBC
5. Design and Develop a Java Application for real time environment

List of Exercises

        1. Classes & Objects
        2. Inheritance & Polymorphism
        3. Packages & Interfaces
        4. Applet & Swing
        5. Exception Handling
        6. I/O Streams
        7. Multithreading
        8. Networking &JDBC
        9. RMI
        10. Servlets
        11. Cookies
        12. JDBC

Semester I   **Hours/Week: 3**
20PCA1106   **Credits: 2**
Software Lab-II: RDBMS

Course Outcomes

On completion of the course the student will be able to

1. Create tables with all possible integrity constraints.
2. Write complex SQL queries
3. Generate reports by using SQL plus commands
4. Use cursors, functions, procedures, packages and triggers in the back end
5. Design and Develop forms to interact with the database

1. DDL – Table creation with Integrity constraints
2. DML - Basic Operations – INSERT/UPDATE/DELETE/SELECT…[where]/order by/group by
3. DML - Join / Nesting / views / snapshots
4. SQL – Functions / operators / set operators
5. SQL Plus – Reports
6. PL/SQL – Block with Cursors
7. PL/SQL – Functions & Procedures
8. PL/SQL – Packages
9. PL/SQL – DB Triggers
10. Oracle Forms
11. Master-Detail form design.
12. Developing reports (Tabular, Master/detail, Matrix and Mailing label)

Elective-1A: DIGITAL COMPUTER ARCHITECTURE

Course Outcomes

On completion of the course the student will
1. Understand the fundamental concepts of digital computer
2. Know the logics of different ICs and Boolean Algebra
3. Learn the functionalities of Data processing circuits and Arithmetic circuits
4. be skilful in digital numbers systems and code conversions
5. Understand the CPU organization and different kinds of addressing formats

Unit-I:

Digital Logic: The Basic Gates-NOT, OR, AND - Universal Logic Gates: NOR, NAND - AND-OR-Invert Gates. Combinational Logic Circuits: Boolean Laws and Theorems - Sum-of-Products Method - Truth Table to Karnaugh Map - Pairs, Quads, and Octets - Karnaugh Simplifications - Don't-care Conditions - Product-of-sums Method - Product-of-sums Simplification.

Unit-II:

Data-Processing Circuits: Multiplexers - Demultiplexers - 1-of-16 Decoder - BCD-to-decimal Decoders - Seven-segment Decoders - Encoders – Exclusive-OR Gates. Number Systems and Codes: Binary Number System - Binary-to-decimal Conversion - Decimal-to-binary Conversion-Octal Numbers - Hexadecimal Numbers - The ASCII Code-The Excess-3 Code - The Gray Code.

Unit-III:

Arithmetic Circuits: Binary Addition - Binary Subtraction - Unsigned Binary Numbers - Sign-magnitude Numbers - 2's Complement Representation - 2's Complement Arithmetic- Arithmetic Building Blocks - The Adder-subtracter - Arithmetic Logic Unit - Binary Multiplication and Division. Flip-Flops: RS FLIP-FLOPs - Gated FLIP-FLOPs - Edge-triggered RS FLIP-FLOPs – Edge-triggered D FLIP-FLOPs - Edge-triggered JK FLIP-FLOPs - JK Master-slave FLIP-FLOPs.

Unit-IV:

Basic Computer Organisation and Design: Instruction codes-Computer registers - Computer Instructions - Timing and Control - Instruction cycle Memory reference instructions-Input/output & Interrupt-Design of Basic Computer-Design of Accumulator Logic.

Unit-V:

CPU: General register organisation - Stack organisation - Instruction formats addressing modes - data transfer and manipulation - Program Control RISC.

Books for Study:
Units 1 to III
1. Donald P. Leach and Albert Paul Malvino, "Digital Principles and Application", Seventh Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011.
Units IV & V
2. M. Morris Mano, "Computer System Architecture", Third Edition, Prentice Hall of India, New Delhi, 2003.
Books for Reference:
1. Morris Mano and Michael D Ciletti, "Digital Design", 4th Edition, Pearson publications, 2008.
2. Rafiquzzaman "Microprocessors Theory and Applications" Revised Edition, PHI Learning Pvt. Ltd, New Delhi, 2012.
3. SmrutiRanjanSarangi, "Computer Organisation and Architecture", TMH, New Delhi, ISBN: 9789332901834, 2014.

Semester	Course Code	Title of the Course								Hours	Credits
I	**20PCA1201A**	**Elective-1A: DIGITAL COMPUTER ARCHITECTURE**								4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	3	3	4	3	4	3	4	3	3	3.4
CO-2	5	4	3	4	4	4	3	3	3	3	3.6
CO-3	5	4	3	3	3	4	4	3	3	3	3.5
CO-4	4	4	3	4	4	3	4	4	3	3	3.6
CO-5	4	3	3	4	3	4	3	4	3	3	3.4
									Mean Overall Score		3.5
									Result		High

Semester: I   **Hours/Week: 4**
20PCA1201B   **Credit: 3**
Elective-1B: OPERATING SYSTEMS

Course Outcomes

On completion of the course the student will be able to

1. Understand the fundamental concepts of an Operating systems.
2. Design and solve synchronization, deadlock problems.
3. Understand and analyse theory concepts of Memory Management
4. Ability to analyse the structure and basic architectural components involved in
   file System
5. Acquire knowledge about protection and security mechanisms in Operating
   system

Unit-I:
Introduction: Operating System-Multiprocessor Systems-Distributed Systems- Real Time
Systems. Computer- System Structures: Computer System Operation- I/ O structure-Storage
Structure-Hardware Protection. Operating System Structure: System Components- Operating –
System Services –System Calls-System Programs-System Structure.

Unit-II:
Process Management: Processes: Process concept-Process Scheduling Operations On
processes-Cooperating Processes-Inter Process Communication. CPU scheduling: Basic
Concepts-Scheduling Criteria Scheduling Algorithms- Multi- Processor Scheduling-Real- Time
Scheduling. Process Synchronization: The Critical-Section Problem Synchronization
Hardware- Semaphores. Deadlocks: System model - deadlock characterization-Methods for
handling deadlocks-Deadlock Prevention-Deadlock Avoidance- Deadlock Detection Recovery
from Deadlock-Combined approach to deadlock handling.

Unit-III:
Memory Management: Background-Swapping-Contiguous Memory Allocation- Paging-
Segmentation-Segmentation with Paging. Virtual Memory: Demand Paging-Process Creation-
Page Replacement-Allocation of Frames - Thrashing.

Unit-IV:

File-System Interface: File Concept-Access Methods-Directory Structure File-Systems - Mounting-File sharing –Protection. File-System Implementation: File-System Structure - File-System Implementation-Allocation Methods- Free-Space Management.

Unit-V: Protection and Security : Protection-Goals of Protection-Domain of Protection-Access Matrix-Implementation of Access Matrix - Capability- Based Systems-Language- Based Protection - Security: The Security Problem-User Authentication- Program Threats System Threats-Securing System and Facilities-Intrusion Detection – Cryptography - Computer-Security Classifications.

Book for Study
1. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts" 6th edition, 2007.
Books for Reference
1. Harvey M. Deitel, "An Introduction to Operating System", Addison Wesley Publishing Company, California, 1984.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall of India Private Ltd, New Delhi, 1997.

Semester	Course Code	Title of the Course							Hours	Credits
I	**20PCA1201B**	**Elective-1B: OPERATING SYSTEM**							4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	4	4	3	3	5	4	3	3	3	3.6
CO-2	3	4	4	3	3	4	4	3	3	3	3.4
CO-3	4	4	3	3	3	3	4	4	3	3	3.4
CO-4	5	4	3	3	3	4	4	3	3	3	3.5
CO-5	5	4	4	3	3	4	3	3	3	3	3.5
									Mean Overall Score		3.48
									Result		High

Semester I   **Hours/Week: 4**
20PCA1201C   **Credits: 3**

Elective-IC: MICROCONTROLLERS

Course Outcomes

On completion of the course the student will be able to

1. Understand the difference between a Microprocessor and a Microcontroller.
2. Explain the basic architecture of 8051 microcontroller.
3. Implement the Logical and Arithmetic Operations of 8051.
4. Understand the concept of Subroutines and interrupts.
5. Implement the logic to develop Applications using 8051.

Unit-I: **(12)**
Introduction – Microprocessors and Microcontrollers – The Z80 and the 8051 - A Microcontroller Survey – Development Systems for Microcontrollers – **The 8051 Architecture:** Introduction – 8051 Microcontroller Hardware – Input / Output pins, Ports and Circuits – External Memory – Counter and Timers – Serial Data Input / Output – Interrupts

Unit-II: **(12)**
Moving Data: Introduction – Addressing Modes – External Data Moves – Code Memory Read-Only Data Moves – PUSH and POP Opcodes – Data Exchanges – Example Programs – **Logical Operations:** Byte-Level Logical Operations – Bit-Level Logical Operations – Rotate and Swap Operations.

Unit-III: **(12)**
Arithmetic Operations: Flags – Incrementing and Decrementing – Addition – Subtraction – Multiplication and Division – Decimal Arithmetic

Unit-IV: **(12)**
JUMP and CALL Opcodes: Introduction– The Jump and Call Program Range - Jumps – Calls and Subroutines – Interrupts and Returns

Unit-V: **(12)**
Applications: Introduction – Keyboards – Displays – D/A and A/D Conversions – Multiple interrupts.

Books for Study:

1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", 3rd Edition, Thomson/Cengage Learning.

Book for Reference

1. The 8051 Microcontroller Based Embedded Systems, Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Microcontrollers: Architecture, Programming, Interfacing and System Design, Raj Kamal, Pearson Education, 2005.

Semester	Course Code	Title of the Course										Hours	Credits
I	**20PCA1201C**	**Elective-IC: MICROCONTROLLERS**										4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**		
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5			
CO-1	5	4	4	3	3	4	3	4	3	3	3.6		
CO-2	4	4	3	3	4	5	4	3	3	3	3.6		
CO-3	5	4	3	3	4	4	4	3	3	3	3.6		
CO-4	5	5	3	3	4	3	4	3	3	3	3.6		
CO-5	4	4	4	3	3	3	4	4	3	3	3.5		
									Mean Overall Score		3.58		
									Result		High		

DISTRIBUTED TECHNOLOGIES

Course Outcomes:

On completion of the course the student will be
1. Able to compare the architectures of distributed systems.
2. Able to differentiate the technologies associated with presentation and interaction services.
3. Having sound knowledge in developing applications with components.
4. Know the art of developing ASP.NET pages with web server and HTML controls.
5. Familiar with the disconnected data access technology in ADO.NET.

Unit I   **(12)**

Client server architecture: 2-tier model - 3-tier model - n-tier model - J2EE architecture - DOTNET architecture - MVC architecture.

Unit II   **(12)**

Presentation services: Servlet - JSP - Javamail - Interaction services: RMI - CORBA – XML-XSL.

Unit III   **(12)**

Component model: EJB : Session Beans: Stateless and Stateful - Entity Beans- CMP and BMP - Message Driven Beans.

Unit IV   **(12)**

ASP.NET : Introduction - architecture - ASP.NET Runtime - ASP.NET Parser- Assembly - Page class. Web Server Controls - HTML Controls – AdRotator and Calendar controls - Validation Controls - Security Management.

Unit V   **(12)**

ADO.NET: System.Data, SqlClient and Xml namespaces - Provider objects and Consumer objects - Disconnected data access - GridView&FormView.

Books for Study:

Unit I,II
1. Justin Couch, Daniel H.Steinberg, "J2EE Bible", Wiley India(P) Ltd, New Delhi, 2002.

Unit III

2. Paul Tremblett, "Instant Enterprise Java y - Beans", Tata McGraw Hill Publishing Company, New Delhi, 2001.

Unit IV, V
3. Platt S David, "Introducing Micorsoft .Net", Prentice Hall of India, New Delhi, 2003.

Books for Reference:

1. Stephanie Bodoff, Dale Green, Eric Jendrock, "The J2EE tutorial", Addison-Wesley, 2002.
2. Hitesh Seth, "Microsoft .NET: kick start", Sams Publishing, 2004.

Semester	Course Code	Title of the Course									Hours	Credits
II	**20PCA1107**	**DISTRIBUTED TECHNOLOGIES**									4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	5	5	4	3	5	4	5	2	4	4.1	
CO-2	5	4	4	5	3	5	4	5	3	2	3.9	
CO-3	4	4	3	3	3	4	5	5	3	3	3.7	
CO-4	4	5	4	5	4	4	4	4	3	3	4.0	
CO-5	5	4	4	3	3	5	5	5	3	2	3.9	
										Mean Overall Score	3.92	
										Result	High	

ACCOUNTING AND FINANCIAL MANAGEMENT

Learning Outcomes:

On completion of the course the student will be able to

1. Analyze and record transactions, construct financial statements, and close the books for the accounting period and will have the ability to adjust and correct errors in the process of accounting.
2. Understand the fall in value of assets and use of accounting packages.
3. Identify and analyze the costing systems adopted in the business organizations and can demonstrate mastery of costing systems, cost management systems.
4. Appreciate budgeting systems and performance and critically analyze and provide recommendations to improve the operations of organizations.
5. Demonstrate the need for appropriate decision making, control and performance evaluation of an organization.

Unit – I: (15)
Accounting: Principles-Concepts-Conventions-Journals-Ledger-Trial Balance.

Unit – II: (15)
Trading account: Profit and Loss Account-Balance Sheet-Adjustments-Error Correction

Unit – III: (15)
Depreciation; Meaning - need - methods of charging depreciation (Straight Line Method, Diminishing Balance Method). Accounting Packages: General Framework - Accounting Applications.

Unit – IV: (15)
Marginal Costing - Break Even Analysis - Standard Costing: Analysis of Variance.

Unit – V: (15)
Budgeting: Characteristics - Advantages - Classification - Preparation of Budgets. Capital Budgeting: Meaning - Methods of Capital Investment Decision-making.

Book(s) for Study

1. T S Grewal's, "Double Entry Book Keeping", Sultan chand Sons, New Delhi, 2020.
2. S N Maheswari's "Management Accounting", Sultan chand Sons, New Delhi.

3. R Ramachandran & R Srinivasan, "Management Accounting" (Theories, Problems & Solutions), Sriram Publications, 2018.

Book(s) for Reference

1. RSN Pillai &Bagavathi "Management Accounting", Sultan chand Sons, New Delhi.
2. M C Shukla, T S Grewal and S C Gupta "Advanced Accounting", S Chand and Company (Pvt.) Ltd., Ram Nagar, New Delhi, 2016..

Semester	Course Code	Title of the Course		Hours	Credits
II	**20PCA1108**	**ACCOUNTING AND FINANCIAL MANAGEMENT**		4	4

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	5	4	4	3	5	3	3	3	2	3.6
CO-2	4	3	3	5	3	4	5	4	4	3	3.8
CO-3	5	3	4	4	3	5	4	5	3	3	3.9
CO-4	3	4	5	4	3	4	3	4	3	4	3.7
CO-5	5	4	5	5	4	4	5	3	4	3	4.2
									Mean Overall Score		3.84
									Result		High

PROBABILITY AND STATISTICS

Course Learning Outcomes
Upon successful completion of this subject, the student will be able to:
1. Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena and translate real-world problems into probability models and finding a reasonable solution
2. Understand and use the properties of discrete and continuous distribution functions and its applications
3. Apply Mathematical expectations, Correlation and Regression for Practical Problems and Identify when and how to use various tests of hypothesis such as t, F, Chi-square
4. Compute the ANOVA table for the testing of more than two means
5. Analyze variance and design Experiments in agricultural data

Unit – I: **(15)**
Sample space: Events - Probability - Probability axioms - addition and multiplication law of probabilities - conditional probability – Independent events - Baye's theorem.

Unit – II: **(15)**
Random Variables: distribution functions (discrete and continuous) – Joint probability distribution - Marginal and conditional distribution. Mathematical expectations - Moment Generating Functions. Chebyshev's inequality.

Unit – III: **(15)**
Discrete distributions: Binomial and Poisson -Continuous distributions: Uniform, Exponential and Normal. Correlation and Regression.

Unit – IV: **(15)**
Testing of hypothesis: Tests based on normal population. Applications of chi -square, Student's-T, F- distributions - Chi-square Test - goodness of fit - Test based on mean, means, variance, correlation and regression coefficients.

Unit – V: **(15)**
Analysis of Variance (one way and two way classifications). Design of Experiments - Principles of Design of Experiments - Completely Randomized Design - Randomized Block Design and Latin Square Design.

Note: Stress is given on the working of problems.

Books for Study

<u>Units I, II, III, IV</u>

1. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 11th edition, 2002.

<u>Unit V</u>

2. S.C. Gupta and V.K. Kapoor, "Fundamentals of Applied Statistics", Sultan Chand & Sons, New Delhi, 4th edition, 2007.

Books for Reference

1. Erwin Kryszig, "Introductory Mathematical Statistics", John Wiley & sons, New York, 1990.
2. J.S. Milton and J.C. Arnold, "Probability and Statistics in Engineering and Computer Science", McGraw Hill, New York, 1986.

Semester	Course Code	Title of the Course								Hours	Credits
II	**20PCA1109**	**PROBABILITY AND STATISTICS**								4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	4	5	4	5	5	4	5	3	2	4.1
CO-2	5	5	4	2	3	4	3	5	3	3	3.7
CO-3	5	4	5	5	3	4	4	3	2	4	3.7
CO-4	4	3	4	3	4	5	5	4	4	3	3.9
CO-5	3	4	3	4	2	3	3	5	3	2	3.2
										Mean Overall Score	3.72
										Result	High

Core Elective-II: DATA ANALYSIS USING PYTHON

Course Outcomes

On completion of the course the student will

1. Understand nuances of Python programming language
2. Know the usage of Functions, Modules, Packages and Files in Python
3. Implement Object Oriented Concepts and to handle errors in Python Programs and perform pattern matching
4. Perform number crunching using NumPy and data manipulation using Pandas in Python
 5. Visualize outcome of data analysis using Matplotlib in Python

Unit-I   **(10)**
Introduction to Python: Features of Python - How to Run Python - Indentation in Python - Multi-Line Statements - Multiple Statement Group (Suite) - Input, Output and Import Functions. Data Types and Operations: Numbers-Strings-List-Tuple-Set-Dictionary. **Flow Control:** Decision Making-Loops-Nested Loops-Types of Loops.

Unit-II   **(14)**
Functions: Function Definition-Function Calling - Function Arguments - Recursive Functions - Function with more than one return value. **Modules and Packages:** Built-in Modules - Creating Modules - import Statement - Locating Modules - Namespaces and Scope - dir() function - reload() function - Packages in Python - Date and Time Modules. **File Handling:** Opening a File - Closing a File - Writing to a File - Reading from a File - File Methods - Renaming a File - Deleting a File - Directories in Python.

Unit-III   **(12)**
Object Oriented Programming: Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes - Destructors in Python-Encapsulation - Data Hiding-Inheritance - Method Overriding-Polymorphism. **Exception Handling:** Built-in Exceptions - Handling Exceptions - Exception with Arguments - Raising Exception - User-defined Exceptions. **Regular Expressions:**match() function - search() function - Search and Replace - Regular Expression Modifiers: Option Flags - Regular Expression Patterns - findall() method - compile() method.

Unit-IV   **(14)**
Introduction to NumPy: Basics of NumPy Array – Computation on NumPy Array – Aggregations – Broadcasting – Comparisons, Masks and Boolean Logic – Sorting Arrays –

NumPy Structured Array. **Data Manipulation with Pandas**: Introducing Panda Objects – Data Indexing and Selection -   Operating Data on Pandas – Handling Missing Data – Hierrachical Indexing – Combining DataSets – Vectorized String Operations – Working with Time Series.

Unit-V   **(10)**

Visualization with Matplotlib: Simple Line Plots – Simple Scatter Plots – Visualizing Errors – Density and Contour Plots – Histograms, Binnings and Density – Customizing Plot Legends – Customising Colorbars – Multiple Subplots – Text and Annotation – Three Dimension Plotting in Matplotlib – Geographic Data with Basemap – Visualization with Seaborn

Text Book(s)
1. Jeeva Jose and P. SojanLal, "Introduction to Computing and Problem Solving with PYTHON", Khanna Book Publising Co. (P) Ltd., 2016.
    Units: I, II & III
2. Jake Vander Plas, "**Python Data Science Handbook: Essential Tools for Working with Data",** 1st Edition, O'Reilly Media, 2016.
    Units: IV & V

Book for References
1. Wesley J. Chun, "Core Python Programming", Second Edition, PrenticeHall Publication, 2006.
2. Timothy A Budd, "Exploring Python", Tata McGraw Hill, New Delhi, ISBN: 9780071321228

Semester	Course Code	Title of the Course								Hours	Credits
II	**20PCA2202A**	**Core Elective-II A:** **DATA ANALYSIS USING PYTHON**								4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	5	5	5	4	3	4	5	5	3	4	4.3
CO-2	3	4	4	3	2	5	4	4	3	2	3.4
CO-3	5	4	5	5	2	5	3	4	2	3	3.8
CO-4	5	5	3	4	3	3	5	5	2	3	3.8
CO-5	4	3	3	4	2	4	3	5	2	3	3.3
										Mean Overall Score	3.72
										Result	High

Core Elective-II B: Information Security

Course Outcome
On completion of the course the student will
1. Understand the Basic Elements of Information Security
2. Explore Data Encryption Techniques and Standards
3. Get enlightenment on Advanced Encryption Standard
4. Cognize different symmetric cipher techniques and Public Key Management Algorithms
5. Have the knowledge on the advanced Key Management Techniques and other information
    security techniques such as Authentication and Digital Signatures

UNIT I   **12 Hours**
Introduction to Information Security: Security – Elements of Information Security – Security
Policy – Security Techniques – Category of Computer Security – The operational model for
Network security – Security services – Basic Network security terminologies – Security Attacks
– Open source tools. **Data Encryption Techniques**: Introduction – Encryption methods –
Cryptography – Substitution Ciphers – Transposition ciphers – Cryptanalysis – Steganography.

UNIT II   **12 Hours**
Data Encryption Standards: Introduction – Block ciphers – Block cipher modes of operations
– Feistel Ciphers – Data Encryption Standard – Simplified Data Encryption Standard – Triple
DES – DES Design Criteria – Other Block ciphers – Differential Cryptanalysis – Linear
Cryptanalysis – Weak Keys in DES Algorithms.
UNIT III   **12 Hours**
Advanced Encryption Standard: Introduction – Advanced Encryption Standard (AES) – Key
Generation – Encryption – Decryption – Galois Field of Multiplication – Advantages of AES –
Comparison of AES with other ciphers – Simplified AES.

UNIT IV   **12 Hours**
Symmetric Ciphers: Introduction –BlowfishEncryption Algorithm – RC5 – RC4 – RC6 –
Comparison between RC6 and RC5 – IDEA. **Public Key Management**: Public Key
Cryptography – RSA Algorithm.

UNIT V   **12 Hours**
Key Management: Introduction – Key Distribution – Diffie Hellman Key Exchange – Elliptic
Curve Arithmetic – Elliptic Curve Cryptography (ECC) – Elliptic Curve Security and Efficiency.
Authentication: Authentication Methods. **Digital Signatures**: Introduction - Algorithms for
Digital Signature.

Book for Study:

1. V.K Pachghare, "Cryptography and Information Security", PHI publications, 2019, Third Edition.

Books Reference:

1. S. Musa, "Network Security and Cryptography", Mercury Learning and Information, 2018.
2. Dr. Manoj Kumar, "Cryptography and Network Security", Krishna Prkasan Media Pvt Limited, 2008, Third Edison.

Semester	Course Code	Title of the Course									Hours	Credits
II	**20PCA2202B**	**Core Elective-II: Information Security**									4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	5	4	4	4	3	5	5	4	3	2	3.9	
CO-2	4	4	5	5	3	4	4	5	2	3	3.9	
CO-3	5	3	3	5	3	4	5	3	2	2	3.5	
CO-4	5	4	3	5	2	4	5	5	3	3	3.9	
CO-5	5	5	4	4	2	5	5	4	3	3	4.0	
										Mean Overall Score	3.84	
										Result	High	

ELECTIVE II C: - DATA SCIENCE FOR BUSINESS

Course Outcomes
On successful completion of the course, the students will be able to

1.   Recall data science techniques and methodologies to business environment
2.   Demonstrate analytic thinking capacity to address business problems
3.   Interpret the findings using visualization techniques
4.   Make use of fundamental algorithmic ideas to process data
5.   Apply modeling and predictive strategies and make estimation and build models with efficient decision making abilities

Unit - I
Introduction: Data-Analytic Thinking - The Ubiquity of Data Opportunities -Data Science, Engineering, and Data-Driven Decision Making - Data Processing and "Big Data" - Data and Data Science Capability as a Strategic Asset. Business Problems and Data Science Solutions - From Business Problems to Data Mining Tasks - Supervised Versus Unsupervised Methods - Data Mining and Its Results - The Data Mining Process - Other Analytics Techniques and Technologies.

Unit - II
Introduction to Predictive Modeling: From Correlation to Supervised Segmentation - Models, Induction, and Prediction - Supervised Segmentation -Visualizing Segmentations - Trees as Sets of Rules - Probability Estimation.

Unit - III
Overfitting and Its Avoidance - Generalization - Overfitting - Overfitting Examined -From Holdout Evaluation to Cross-Validation - Learning Curves - Overfitting Avoidance and Complexity Control.

Unit - IV
Similarity, Neighbors, and Clusters - Similarity and Distance - Nearest-Neighbor Reasoning - Some Important Technical Details Relating to Similarities and Neighbors - Clustering - Stepping Back: Solving a Business Problem versus Data Exploration.

Unit - V

Decision Analytic Thinking: characteristics of a Good Model - Visualizing Model Performance - Representing and Mining Text

Text book
1.   Provost, Foster, and Tom Fawcett, "Data Science for Business: What you need to know about data mining and data-analytic thinking", O'Reilly Media, Inc., 2013.

References
1. Foster Provost and Tom Fawcett, "Data Science for Business", Published by O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472, 2013, ISBN: 978-1-449-36132-7.
2.Asllani, Arben, "Business Analytics with Management Science Models and Methods", FT Press, 2014.
3.Igual, Laura, and SantiSeguí, "Introduction to Data Science", In Introduction to Data Science, pp. 1-4. Springer, Cham, 2017.

Semester	Course Code	Title of the Course								Hours	Credits
II	**20PCA2202C**	**ELECTIVE II C: DATA SCIENCE FOR BUSINESS**								4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	5	5	5	4	3	5	5	4	2	3	4.1
CO-2	5	4	4	3	2	4	5	5	2	2	3.2
CO-3	4	5	5	2	2	3	5	5	3	3	3.7
CO-4	5	5	4	4	3	5	4	4	3	2	3.9
CO-5	4	5	5	3	3	4	5	4	3	3	3.9
										Mean Overall Score	3.76
										Result	High

Sem. II   **Hours/Week: 3**
20PCA2110   **Credits: 2**

Software Lab-III: DISTRIBUTED PROGRAMMING

Course Outcomes:

On completion of the course the student will

1. Have the ability to develop RMI/CORBA applications.
2. Have skills to develop web applications using Servlet and JDBC.
3. Have experience to create presentation services using JSP.
4. develop secured, robust and scalable distributed applications.
5. Have the knowledge to develop appropriate ASP.NET web applications and understand the disconnected data access technology in ADO.NET.

Exercises:

1. RMI - Invocation of server side methods.

CORBA - Invocation of server side methods.

2. Servlets - Returning Information received from the client.

3. Servlets and JDBC - Constructing a response by accessing a database.

4. JSP - use of scriptlet.

5. JSP - use of java beans.

6. EJB - Session Bean.

7. EJB - Entity Bean.

8. ASP.NET - Server & Client side controls.

9. ASP.NET and ADO.NET - use of disconnected data object.

10. ASP.NET: Databind Controls.

11. DOM usage on the server side.

12. AJAX: Dynamic client - server interaction example.

Sem. II   **Hours/Week: 3**
20PCA2111   **Credits: 2**

Software Lab-IV: Advanced Python

Course Outcomes:

On completion of the course the student will
1. Have the ability to develop basic Python programs.
2. Have skills to develop Object Oriented programs using Python.
3. Have experience to use NumPy.
4. develop applications using Pandas.
5. Have the knowledge to present graphical outputs using Python.

Basic Python Programs

    1.   Flow controls, Functions and String Manipulation
    2.   Operations on Tuples and Lists
    3.   Operations on Sets and Dictionary
    4.   Operations on Dictionary
    5.   Simple OOP – Constructors, Method Overloading, Inheritance
    6.   Reading and Writing Files – CSV, Excel, XML, JSON
    7.   Regular Expressions

NumPy

    8.   NumPy Arrays, Sorting and Searching on Arrays
    9.   String and DateTime Functions

Pandas

    10.   Data Series
    11.   Data Frame
    12.   Combining and Merging Data Sets
    13.   Handling Missing Values, Filter, Grouping and Aggregation

Visualization

    14.   MatPlotLib – Line Chart, Scatter Plot, Histogram
    15.   Seaborn – Boxplot, HeatMap

Sem. II   **Hours/Week: 4**
18PSS2301   **Credits: 4**

IDC: SOFT SKILLS

CourseOutcomes:

1. Studentsaretaughtthevarious nuancesofgroomingsuchas,good manners andetiquettes andtheyaretrainedtopracticetheminthe classrooms.
2. Studentsare empoweredwith publicspeakingskillsviaextempore speeches andprepared speeches,presentedbefore theclassand assessedbythetraineraswellasthecompanions whicheventually helpsbuildself-confidenceofthestudents.
3. Studentslearnthedifferenttypesofresumesanddifferenttypesof interviewskillsandwriteandprinttheirownresumesandpresentbefore theinterviewpanelfortheirmockinterview.
4. Studentsactivelylearnthetenparametersofgroupdiscussion,perform onthestagewiththeircolleagues,whichisvideotaped,reviewedand evaluated.
5. Asstudentsgothroughtheirteenage,self-discoverybecomesatool to developtheirpersonality facilitatedwithscientificpsychological personalitytests.
6. Students areguidedtoknowingtheirSWOT (Strengths,Weaknesses, Opportunities andThreats) andsettingtheirshorttermandlongterm goalsfortheirlives.

Module1: BasicsofCommunication:Definitionofcommunication,Process ofCommunication, BarriersofCommunication,Non-verbalCommunication, EffectiveCommunication:TheArtofListening,ExercisesinKinesthetics, ProductionofSpeech,OrganizationofSpeech,Modes ofdelivery, ConversationTechniques,Dialogue,GoodmannersandEtiquettes, Politenessmarkers&Listeninglinks.

Module   II: Resume   Writing:WhatisResume?TypesofResume? Chronological, FunctionalandMixedResume,Stepsinpreparationof Resume,structureandframework forwritingresume,Intensive training/ personalizedtrainingonresumewriting.InterviewSkills:Commoninterview questions,Attitude,BodyLanguage,Themockinterviews,Phoneinterviews, Behavioralinterviews.

ModuleIII: GroupDiscussion:GroupDiscussionBasics,GDTopicsfor Practice,PointsforGDTopics,Case-Basedand ArticlebasedGroup Discussions,PointsforCaseStudies,andNotesonCurrentIssuesforGDS &Practicumwithvideocoverage.TeamBuilding:TeamVsGroup–Synergy,

StagesofTeamFormation,BrokenSquare-Exercise,Winasmuchasyou win-Exercise,Leadership–Styles,Workethics.

ModuleIV: PersonalEffectiveness:SelfDiscovery,SelfEsteem,Goalsetting, Problem-solving,ConflictandStressManagement

ModuleV: NumericalAbility: Average,Percentage,ProfitandLoss,Problems onages,SimpleInterest,CompoundInterest, Area,VolumeandSurface Area,TimeandWork,PipesandCisterns,TimeandDistance,Problemson Trains,BoatsandStreams,Calendar,Clocks,PermutationsandCombinations, Probability.

ModuleVI: TestofReasoning:SeriesCompletion,Analogy,DataSufficiency, BloodRelations,Assertion andReasoning,LogicalDeduction,Direction. Non-VerbalReasoning:Series,Classification

TextBook

1. Melchias,G.,BalaiahJohn.,JohnLoveJoy(Eds)2015.Winnersinthe making.St.Joseph'sCollege,Trichy-2

References

1. Aggarwal, R. S. Quantitative Aptitude, S.Chand & Sons
2. Aggarwal, R.S. (2010). A Modern Approach to Verbal and Non VerbalReasoning. S. Chand & Co, Revised Edition.
3. Covey, Stephen. (2004). 7 Habits of Highly effective people, Free Press.
4. Egan Gerard (1994). The Skilled Helper (5th Ed). Pacific Grove, Brooks/ Cole.
5. Khera, Shiv (2003). You Can Win. Macmillan Books, Revised Edition.
6. Murphy, Raymond. (1998). Essential English Grammar. 2nd ed., Cambridge University Press.
7. Prasad, L. M. (2000). Organizational Behaviour, S.Chand& Sons.
8. Schuller, Robert. (2010). Positive Attitudes. Jaico Books.
9. Trishna's (2006). How to do well in GDs & Interviews, TrishnaKnowledge Systems.
10. Yate, Martin. (2005). Hiring the Best: A Manager's Guide to EffectiveInterviewing and Recruiting.

IDC (WS): APPLICATION OF STATISTICAL TECHNIQUES USING R
Course Outcomes

Aftercompleting this course the students will be able to

1. Understand the R environment and apply basic statistical commands in R
2. Interpret data in both Diagrammatic and Graphical Representation
3. Apply Probability Distributions in R environment
4. Perform Correlation Analysis and provide inference
5. Perform Regression Analysis for data prediction

UNIT I (10)
INTRODUCTION TO R: R as Statistical Software and Language – R as a Calculator – R Preliminaries – Methods of Data Input – Data Accessing or Indexing – Built-in Functions.

UNIT II (10)
GRAPHICS WITH R: Graphics Functions – Diagrammatic Representation of Data – Graphical Representation of Data – Measures of Central Tendency.

UNIT III (10)
PROBABLITY AND PROBABILITY DISTRIBUTIONS: Probability: Definition and Properties – Probability Distributions – Some Special Discrete Distributions

UNIT IV (10)
CORRELATION: Introduction – Types of Correlation – Scatter Diagram- Coefficient Correlation and its Properties – Computation of Correlation Coefficient - Inference Procedures for Correlation Coefficient.

UNIT V (10)
REGRESSION ANALYSIS: Linear Regression – Linear Regression Model – Model Assumptions – Linear Calibration **-** Inference Procedures for Simple Linear Model

Books for Study
1. Sudha G. Purohit, Sharad D. Gore, Shailaja R. Deshmukh, "Statistics Using R", Narosa, Publishing House Pvt. Ltd.. 2nd Ed., 2015.

Books for Reference
1. John Maindonald and John Braun. "Data Analysis and Graphics UsingR". Cambridge University Press, Cambridge, 2003.
2. Brian Everitt and TorstenHothorn. "A Handbook of Statistical Analyses Using R". Chapman & Hall/CRC, Boca Raton, FL, 2006. ISBN 1-584-88539-4.

Semester	Course Code	Title of the Course		Hours	Credits
II	**20PCA2301A**	**IDC (WS): APPLICATION OF STATISTICAL TECHNIQUES USING R**		4	4

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	5	5	5	3	3	5	5	3	2	3	3.9
CO-2	5	4	5	4	2	4	5	5	4	2	4.0
CO-3	4	3	5	3	4	3	5	4	4	2	3.7
CO-4	3	5	5	4	3	4	4	4	2	3	3.7
CO-5	5	4	5	3	2	4	3	5	3	2	3.6
									Mean Overall Score		3.78
									Result		High

IDC (WS): MATLAB

Course Outcomes

After learning this course, the learner would have acquired skills to

1. Associate Mathematical and computing techniques and Infer analytical and problem solving skills.
2. Prescribe commercial solution based on data analysis.
3. Interpret statistical manipulation of data and generate simulations for scientific problems.
4. Automate solutions for Algebraic Equations and predict graphical output for optimized outcomes.
5. Avail means to visualize given data in graphical format.

Unit-I: (10)
Basics of MATLAB: Basics, windows, Variables, File types, Matrices and Vectors, Matrix manipulation, Matrix and Array Operations.

Unit-II: (10)
Matrix functions: Arithmetic operations, Relational operations, Logical operations, Elementary math functions, Matrix functions, Manipulating character strings, Array Operations, Vectorization.

Unit-III: (10)
Built-in functions - Inline functions, Anonymous functions, Built-in functions, Complex Arithmetic, solving linear systems, Eigen Values and Vectors, Calculus.

Unit-IV: (10)
MATLAB programming: Script Files, Function Files, Curve Fitting and Interpolation, Numerical - Integration, Ordinary Differential Equations, Statistics, Nonlinear Algebraic Equations.

Unit-V: (10)
Graphics - Basic 2-D Plots, Specialized 2-D plots, 3-D Plots, 3-D Surface Graphics.

Book for Study:
1. RudraPratap, Getting started with MATLAB 7, Oxford University Press, 2008.

Book for Reference:
1. JaydeepChakravorty, "Introduction MATLAB Programming, Toolbox and Simulink", Universities press, Hyderabad, 2014.
2. Brain R Hunt, Ronald L Lipsman, Jonathan M Rosenberg, "A Guide to MATLAB for Beginners and Experienced Users", Cambridge University Press, 2003

Semester	Course Code	Title of the Course								Hours	Credits
II	**20PCA2301B**	**IDC (WS): MATLAB**								4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	5	4	5	4	3	5	5	4	4	2	4.1
CO-2	5	5	5	3	2	4	5	5	2	3	3.9
CO-3	4	5	4	2	2	3	5	5	2	3	3.5
CO-4	3	5	3	4	3	5	4	4	3	2	3.6
CO-5	4	3	5	3	3	4	5	3	3	2	3.5
										Mean Overall Score	3.72
										Result	High

Semester: III   **Hours/Week : 4**

Code: 20PCA3112   **Credit: 4**

PROGRAMMING SMART DEVICES

Course Outcomes:

1. To provide concepts to enable the students for creating applications on smart devices using React.
2. To learn how to use React components to build powerful and stylish mobile applications.
3. To obtain a better knowledge of the APIsandCross-Platform Native Modules in React.
4. To understand the familiarity of Debugging and Developer Tools to build native mobile applications in React JS.
5. To provide necessary skills and experiences to deploy applications on iOS App Store and Android Play Store.

Unit: I   **(12)**

React Native - Advantages of React Native- Working with React Native- React Native Work- Rendering Lifecycle- Creating Components in React Native- Working with Views- Using JSX- Styling Native Components- Host Platform APIs. - Building Your First Application: Setting Up Your Environment - Creating a New Application- Exploring the Sample Code - Building a Weather App.

Unit: II   **(12)**

Components for Mobile - Analogies Between HTML Elements and Native Components - The Text Component- The Image Component- Working with Touch and Gestures- Using TouchableHighlight- The GestureResponder System- PanResponder- Working with Organizational Components - Using ListView- Using Navigators- Other Organizational Components - Platform-Specific Components. **Styles**:- Declaring and Manipulating Styles- Organization and Inheritance- Positioning and Designing Layouts.

Unit: III   **(12)**

Platform APIs: Using Geolocation- Accessing the User's Images and Camera- Storing Persistent Data with AsyncStore- TheSmarterWeather Application. **Modules**: Installing JavaScript Libraries with npm- Native Modules for iOS- Native Modules for Android- Cross-Platform Native Modules.

Unit: IV   **(12)**

Debugging and Developer Tools : JavaScript Debugging Practices, Translated- React Native Debugging Tools - Debugging Beyond JavaScript- Testing Your Code- **Putting It All Together**: The Flashcard Application- Modeling and Storing Data   - Using the Navigator- A Look at Third-Party Dependencies - Responsive Design and Font Sizes.

Unit: V **(12)**

Deploying to the iOS App Store: Preparing Your Xcode Project- Uploading Your Application-Beta Testing with TestFlight- Submitting the Application for Review - **Deploying Android Applications:** Setting Application Icon- Building the APK for Release - Distributing via Email or Other Links - Submitting Your Application to the Play Store.

BOOK FOR STUDY:
1) *Bonnie Eisenman*, "Learning React Native" - Building Mobile Applications with JavaScript, O'Reilly Media, Inc., 2016

BOOK (S) FOR REFERENCE:
1) *JakobIversen, Michael Eierman*, "Learning Mobile App Development" -A Hands-on Guide to Building Apps with iOS and Android, Addison-Wesley, USA, Pearson Education, Inc.2013.
2) *Nader Dabit*, "React Native in Action"- Developing iOS and Android apps with JavaScript, Manning Publications Co. 2019.

WEB REFERENCE
1) https://reactjs.org/
2) https://www.digitalocean.com/community/tutorials/build-mobile-friendly-web-apps-with-react-native-web

Semester	Course Code	Title of the Course								Hours	Credits
III	**20PCA3112**	**PROGRAMMING SMART DEVICES**								4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	4	3	3	2	4	4	3	3	4	3.4
CO-2	3	4	4	3	4	4	4	4	4	4	3.8
CO-3	4	4	4	3	3	3	3	4	3	3	3.4
CO-4	4	4	2	4	3	4	2	3	3	4	3.3
CO-5	4	4	2	4	3	3	4	3	3	3	3.3
										Mean Overall Score	3.44
										Result	High

Semester III   **Hours/Week: 4**
Code: 20PCA3113   **Credits: 4**
COMPILER DESIGN

Course Outcomes:
1. To introduce the Language Processors and the structure of a compiler
2. To give the basic ideas on automata theory
3. To know the various parsing techniques.
4. To develop skills in generating intermediate code
5. To introduce code generation and optimization techniques

Unit I
Language Processors: Structure of Compilers: Lexical Analysis-Syntax Analysis-Semantic Analysis-Intermediate Code Generation-Code Generation-Symbol Table Management-The Grouping of Phases into Passes-Compiler-Construction Tools. **Programming Language Basics:** The Static/Dynamic distinction-Environment and States-Static Scope and Block Structure-Explicit Access Control- Dynamic Scope-Parameter Passing Mechanism-Aliasing.

Unit II
Lexical Analysis: Specification of Tokens: Operations on Languages-Regular Expressions-Regular Definitions-Extensions of Regular Expressions. **Recognition of Tokens:** Transition Diagrams -Recognition of Reserved Words and identifiers. **Lexical-Analyzer Generator-Lex:** Use of Lex-Structure of Lex Programs. **Finite Automata:** Non-deterministic Finite Automata-Transition Tables-Acceptance of Input Strings by Automata-Deterministic Finite Automata. **From Regular Expressions to Automata:** Conversion of an NFA to a DFA-Simulation of an NFA-Construction of an NFA from a Regular Expression. **Optimization of DFA:** Minimizing the Number of states of DFA.

Unit III
Syntax Analysis: The Role of Parser-Syntax Error Handling. **Context Free Grammar:** Formal Definition of CFG-Notational Conventions-Derivations-Parse Trees and derivations-Ambiguity-Context Free Grammars Versus Regular Expressions.
Writing a Grammar: Lexical Versus Syntactic Analysis-Eliminating Ambiguity-Elimination of Left Recursion-Left Factoring. **Top-Down Parsing**-Recursive-Descent Parsing. **Bottom-Up Parsing-**Reductions-Handle Pruning-Shift-Reduce Parsing.

Unit IV
Syntax-Directed Translation: Postfix Notation-Simple Syntax Directed Definitions-Tree Traversals-Translation Schemes-Inherited and Synthesized Attributes-Evaluating an SDD at the nodes of a Parse Tree. **Intermediate Code Generation: Variants of Syntax Trees:** Directed

Acyclic Graphs for Expressions-The Value-Number Method for Constructing DAG's. **Three Address Code:** Addresses and Instructions-Quadruples-Triples-Static Single-Assignment Form
Run-time Environments: Storage Organization: Static Versus Dynamic Storage Allocation.
Stack Allocation of Space: Activation Trees-Activation Records.

Unit V
Code Generation: Issues in the Design of a Code Generator: Input to the Code Generator-Target Program-Instruction Selection-Register Allocation-Evaluation Order. **The Target Language:** A simple Target Machine Model-Program and Instruction Costs. **Basic Blocks and Flow Graphs:** Basic Blocks-Flow graphs-Representation of Flow Graphs-Loops. **Optimization of Basic Blocks:** The DAG Representation of Basic Blocks-Finding Local Common Sub-Expressions-Dead-Code Elimination-The use of Algebraic Identities-Representation of Array References-Pointer Assignments and Procedure Calls-Resembling Basic Blocks from DAG's. **Simple Code Generator:** Register and Address Descriptors-The Code Generation Algorithm.

Text Book:
1. Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, *"Compilers Principles, Techniques and Tools"*, Anna University, Pearson Education, Inc. Publishing as Addison-Wesley Higher Education, II Edition, 2011.

Reference:
1. Alfred V. Aho, Jeffery D.Ullman, "Principles of Compiler Design", Narosa Publishing House, New Delhi, 1985.
2. TorbenÆgidius**Mogensen, "**Introduction to Compiler Design**".** Springer-Verlag London, 2011.
3. AAPutambekar, "Compiler Design", Technical Publications, 2010.

Semester	Course Code	Title of the Course									Hours	Credits
III	**20PCA3113**	**COMPILER DESIGN**									4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	3	4	1	3	3	3	4	4	3	3.2	
CO-2	4	4	3	2	4	4	3	2	4	2	3.2	
CO-3	4	4	3	1	4	4	3	4	4	3	3.4	
CO-4	4	3	3	2	3	3	4	3	3	3	3.1	
CO-5	4	3	4	1	4	4	4	4	4	3	3.5	

Mean Overall Score	3.28
Result	High

Semester III   **Hours/Week: 4**
Code: 20PCA3114   **Credits: 4**

Software Engineering

Course Outcomes:
1. To acquire knowledge in various software development models
2. Extract and analyze software requirements specifications for different projects
3. Develop skills in basic architecture/design and apply standard coding practices
4. Ability to define the basic concepts and importance of software project management concepts like cost estimation, scheduling and reviewing progress
5. Identify and implement of the software metrics
6. Apply different testing and debugging techniques and analyzing their effectiveness
7. Critically analyse and provide recommendations to improve the operations of the development of the project
8. Demonstrate the need for appropriate decision making, control and performance evaluation of a project.

Unit-I: (12)
Introduction to Software Engineering: The Evolving Role of Software-Software-The changing nature of software-Software Myths. A generic View of Process: A Layered technology-process models: The Waterfall Model-Evolutionary Process Models.

Unit-II: (12)
System Engineering: Computer-Based Systems-The System Engineering Hierarchy. Requirement Engineering: Requirements Engineering Tasks- Initiating the Requirement Engineering Process-Eliciting Requirements-Building the Analysis Model-Requirement Analysis-Data Modeling Concepts-Flow Oriented Modeling-Class based Modeling-Creating Behavior Model.

Unit-III: (12)
Design Engineering: Design process and Design Quality-Design Concepts-The Design Model. Creating the Architectural Design: Software Architecture-Data Design-Architectural Design-Mapping Data Flow into Software Architecture. Modeling component level design: Designing class based components-Performing User Interface Design: The Golden Rules-User Interface Analysis and Design-Interface Analysis-Interface Design Steps- Design Evaluation.

Unit-IV: (12)

Testing Strategies: A Strategic Approach of Software Testing-Test strategies for Conventional Software and Object Oriented Software-Validation Testing- System Testing-The art of Debugging. Testing Tactics: Software Testing Fundamentals-White Box Testing-Basis Path Testing-Control Structure Testing-Block Box Testing-Object Oriented Testing Methods.

Unit-V: (12)

Project Management: The Management Spectrum-The People-The Product-The Process-The Project. Estimation: The Project Planning Process-Resources-Software Project Estimation-Decomposition Techniques-Empirical Estimation Models. Project Scheduling: Project scheduling-Scheduling. Quality Management: Quality Concepts-Software Quality Assurance-Formal Technical Reviews.

Book for Study

1. Roger S. Pressman, "Software Engineering", McGraw Hill, International 8th Edition, New York.

Books for References

1. Richard Fairley, "Software Engineering Concepts", McGraw Hill, International Edition 2014.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI, New Delhi, 2014.

Semester	Course Code	Title of the Course						Hours	Credits
III	**20PCA3114**	**Software Engineering**						4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	3	3	3	4	4	4	4	3	3	3	3.4
CO-2	3	3	4	4	3	4	4	4	3	3	3.5
CO-3	4	4	3	3	4	3	4	4	3	3	3.5
CO-4	2	4	3	3	3	3	2	4	3	3	3.0
CO-5	4	4	3	3	4	3	4	4	3	3	3.5
CO-6	4	4	4	3	4	4	4	4	2	3	3.6
CO-7	4	3	4	4	4	3	4	4	3	3	3.6
CO-8	4	3	3	4	4	2	3	3	4	3	3.3
									Mean Overall Score		3.43
									Result		High

Semester III   **Hours/Week: 4**
Code: 18SCS3101   **Credits: 4**

Inter Disciplinary Core:
DESIGN AND ANALYSIS OF ALGORITHMS

Course Outcomes:
        On completion, the students will have
1. the knowledge to design and analyze algorithms
2. the skill in finding the complexity (order) of algorithms.
3. experience in the implementation of linked lists and trees
4. the required information in searching and sorting.
5. the skill to implement search and sort methods.

Unit-I: Algorithms: Introduction- Algorithm - Algorithm specification: Pseudocode Conventions, Recursive algorithms - Performance analysis: Space Complexity, Time Complexity, Asymptotic Notation, Practical Complexities. (Sections: 1.1, 1.2, 1.3.1 to 1.3.4)

Unit-II: Data structures and Queues Arrays – ordered lists- Representation of Arrays-Stack and Queues – Fundamentals-Evaluation of Expressions. (Sections: 2.2,2.4,3.1,3.3)

Unit-III: Linked lists and trees Linked Lists - Singly Linked Lists- Linked Stacks and Queues-More on Linked Lists-Simple algorithms of Doubly Linked Lists (insertion and deletion only).Trees- Binary Trees- Binary Tree Representations- Binary Tree Traversal. (Sections: 4.1,4.2,4.5,4.8,5.2,5.3,5.4).

Unit-IV: Search and Sort Divide and conquer - General method - Binary search - Finding the maximum and minimum in a set of items - Merge sort - Quick sort - Selection sort. Basic Traversal and Search Techniques for graphs: Breadth First Search - Depth First Search. (Sections: 3.1 to 3.5,6.2)

Unit-V: Interpolations Backtracking - The 8-Queens problem - Algebraic problems - The general method - Evaluation and interpolation - Horner's rule - Lagrange interpolation - Newtonian interpolation. (Sections: 7.1,7.2,9.1,9.2)

Textbooks:
1. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, Fundamentals of Computer algorithms, Galgotia Publications Pvt. Ltd., 2004. Units: I, IV, V

2. Ellis Horowitz, SartajSahni, Fundamentals of Data Structures, Galgotia Book Source, 1981.Units: II, III

References

1. A.V. Aho, J.E.Hopcroft, J.D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley Publ. Comp., 1974.
2. Seymour E.Goodman and S.T. Hedetniemi, Introduction to the design and analysis of algorithms, McGraw Hill International Edition, 2002.

Semester	Course Code	Title of the Course									Hours	Credits
III	**18SCS3101**	**Inter Disciplinary Core: DESIGN AND ANALYSIS OF ALGORITHMS**									4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	3	3	3	2	4	4	3	3	4	3.3	
CO-2	3	4	3	2	3	4	4	3	3	4	3.3	
CO-3	3	3	4	3	4	3	4	3	4	3	3.4	
CO-4	3	3	3	4	3	3	4	3	3	4	3.3	
CO-5	3	3	3	3	4	2	4	3	3	4	3.2	
									Mean Overall Score		3.3	
									Result		High	

Core Elective-III A:
MEAN STACK WEBAPP DEVELOPMENT

Course Outcomes:

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

1. Understand the fundamentals of Full Stack Development and MEAN Stack Architecture

2. Create and Setup a MEAN Project with Node and Express

3. Build a Data Model with Mongo DB using REST API

4. Demonstrate how to consume REST API

5. Ability to develop applications using AngularJS

Unit-I (11)

Introducing Full Stack Development: Brief History of Web Development – Towards Full Stack Development – Benefits of Full Stack Development –MEAN Stack – Node.js: The Web Server/Platform – Express: The Framework – MongoDB: The Database – AngularJS: The Front End Framework. **Designing a MEAN Stack Architecture:** Common MEAN Stack Architecture – Designing a Flexible MEAN Architecture

Unit-II (11)

Creating and Setting up MEAN Project: Creating an Express Project – Modifying Express for MVC – Import Bootstrap for Responsive Layouts. **Static Site with Node and Express:** Defining Routes in Express – Building Basic Controllers – Creating Some Views – Adding Rest of Views – Take Data out of Views and Make Smarter

Unit-III (11)

Data Model with MongoDB: Connecting Express Application to MongoDB using Mongoose – Model the Data – Simple Mongoose Schema – MongoDB Shell to create MongoDB Database **WritingREST API: Expose MongoDB database to Application:** Setting up API in Express – GET Methods: Reading Data from Mongo DB – POST Methods: Adding Data to MongoDB. PUT Methods: Updating Data in MongoDB. DELETE Method: Deleting Data from MongoDB

Unit – IV (11)

Consuming a REST API: Call API from Express – List of Data from an API – Getting Single Document from API – Adding Data to Database via API. **Adding Angular Component to an Express Application:** Getting and Running Angular – Displaying and Filtering the Homepage List – Getting Data from API – Ensuring Forms work as Expected

Unit-V (11)

Single Page Application with Angular: Groundwork for an Angular SPA – Switch from Express Routing to Angular Routing – Adding First Views, Controllers and Services. **Building SPA with Angular:** Full SPA **–** Adding Additional Pages and dynamically injecting HTML – Complex Views and Routing Parameters – Angular UI Components to create Modal Popup

Book for Study

1. Simon Holmes, "Getting MEAN with Mongo, Express, Angular, and Node, Manning Publications, 2016

Books for Reference

1. Jeff Dickey, "Write Modern Web Apps with the MEAN Stack: Mongo, Express, AngularJS, and Node.js", Peachpit Press, 2015.
2. Brad Dayley, Brendan Dayley, "Node.js, MongoDB and Angular Web Development", Addison Wesley, 2017.
3. Amos Q. Haviv, Adrian Mejia,"Web Application Development with MEAN ", Kindle, June 15, 2017.

Semester	Course Code	Title of the Course									Hours	Credits
III	**20PCA3203A**	**Core Elective-III A: MEAN STACK WEBAPP DEVELOPMENT**									4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	4	3	3	2	4	4	3	3	3	3.3	
CO-2	4	4	3	3	2	4	4	4	3	4	3.5	
CO-3	4	4	3	3	2	4	4	3	3	4	3.4	
CO-4	4	4	4	3	2	4	4	4	3	4	3.6	
CO-5	4	4	4	3	2	4	4	4	3	4	3.6	
										Mean Overall Score	3.48	
										Result	High	

Semester III   Hours / Week: 4
Code: 20PCA3203B   Credit: 3

Elective-III B:
RUBY ON RAILS

Course Outcomes

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

1. Understand the fundamental concepts of Ruby.
2. Construct and execute basic programs in Ruby.
3. write programs using classes, objects and methods
4. design programs based on Model-View-Controller Architecture
5. write applications to access databases and validate the data.

Unit – I:

Introduction: Installing Ruby and Rails - Getting started with Ruby – Working with numbers and string in Ruby – Storing data in Variables –Creating Constants – Interpolating variables in double-quoted strings – Reading text on the command Line – Creating symbols in Ruby – Working with Operators - Handling Operator Precedence - Working with Array – Using two Array Indices- Working with Hashes and Ranges.

Unit – II:

Conditionals, Loops, Methods and Blocks: The if   statement - Using the case statement – Using Loops – Creating and Calling a method – Making use of Scope – Working with Blocks.

Unit-III:

Classes and Objects: Creating a Class – Creating an Object – Basing One Class on Another – Understanding Ruby's Object Access – Overriding Methods – Creating Class Variables – Creating Class Methods – Creating Modules

Unit-IV:

Welcome to Rails: Putting Ruby on Rails – Introducing Model-View-Controller Architecture – Giving the View Something to Do – Mixing Ruby Code and HTML Inside the View – Passing Data from an Action to a View - **Building Simple Rails Applications:** Accessing Data the User Provides – Using Rails Shortcuts for HTML Controls

Unit-V:

Connecting to Databases: Tutorial on Databases – Creating a Data-Aware Rails Application – Creating the Database – Running the Store Application – Adding Another Record – **Working with Databases:** Displaying Items to the Customer – Creating a Shopping Cart – **Validating**

and Testing: Validating the Presence of Data – Validating if Data is Numeric – Validating if Data is Unique

Books for Study:

1. Steve Holzner, "Beginning Ruby on Rails", John Wiley & Sons, 2006

Books for Reference:

1. David Flanagan, Yukihiro Matsumoto, The Ruby Programming language, O'Reilly.
2. Noel Rappin, Professional Ruby on Rails, Wrox.
3. Michael Fitzgerald, Ruby - Pocket Reference, O'Reilly.

Semester	Course Code	Title of the Course								Hours	Credits
III	20PCA3203B	**Elective-III B:** **RUBY ON RAILS**								4	3

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	3	3	4	3	3	4	3	4	3	3.4
CO-2	4	3	3	4	3	4	4	4	3	3	3.5
CO-3	4	3	2	4	3	4	4	4	4	4	3.6
CO-4	3	4	3	4	3	4	3	4	3	4	3.5
CO-5	4	3	3	4	3	4	4	4	3	3	3.5
									Mean Overall Score		3.5
									Result		High

Semester: III   Hours/Week: 4
Code: 20PCA3203C   Credits: 3

Elective-III C:
PHP Programming

Course Outcomes

After learning this course, the learner would have:

1. The knowledge to design static and dynamic websites using HTML, CSS and Java scripts.
2. The idea about basic administration activities on Linux environment.
3. Skill to develop and Test PHP programs and host the websites in the Web Server.

4. Knowledge on the basic concepts of frameworks used to develop web applications.
5. Acquired the skillset to develop websites using Laravel framework.

Unit I   **(12 hours)**
HTML: Structuring Documents for the Web - Links and Navigation - Images, Audio, and Video - Tables - Forms - Frames - CSS: Cascading Style Sheets - More Cascading Style Sheets - Page Layout - JS: Learning JavaScript - Working with JavaScript - Putting Your Site on the Web.

Unit II   **(12 hours)**
Linux: Introduction - Download and Install - Decisions, Decisions – Linux Partition Sizes - Accounts - Apache Web server: Starting and Stopping and Restarting Apache - Configuration - Securing Apache - Create the Web Site - Apache Log Files - PHP: Embedding PHP into HTML - Configuration - Language Syntax: Variables - Data Types - Web variables - Operators - Flow Control Constructs- Writing PHP Functions.

Unit III   **(12 hours)**
Built in PHP functions - Important Functions - Array Functions – String Functions - Other Functions - PHP and MySQL: MySQL Functions - My SQL: Commands - Database Independent Interface - Tables – Loading and Dumping Database.

Unit IV   **(12 hours)**
Introduction: Laravel - Framework - History - Setting up a Laravel Development Environment – System Requirements - Composer - Local Development Environments - Creating a New Laravel Project - Laravels Directory Structure - Configuration - Routing and Controllers - Introduction to MVC, HTTP verbs, REST - Route Definitions - Views - Controllers - Route Model binding - Form Method Spoofing - Redirects - Custom Responses.

Unit V   **(12 hours)**
Frontend components - Collecting and Handling User Data – Injecting Request Object - Route Data - Upload files - Validation - Artisian - Request, Response and Middleware - Request lifecycle - Request Object - Response Object - Laravel and Middleware - Container - Writing APIs : The Basics of REST - Controller - Reading and Sending Headers - Eloquent Pagination - Sorting and Filtering - Transforming Results - Mail - Notifications - Storage and Retrieval: Basic File Uploads and Manipulation - Sessions - Cache - Cookies - Full-Text Search with Laravel Scout.

Book for Study
1. Jon Duckett, "Beginning HTML, XHTML, CSS, and JavaScript", Wiley Publishing, Indiana, 2010. (Unit I)

2. James Lee and Brent Lee "Open Source Development with LAMP Using Linux, Apache, MySQL, Perl and PHP", Pearson Education, 2009. (Unit 2, 3)

3. Matt Stauffer, "LARAVEL Up and Running, A Framework for building modern PHP Apps", 2nd Edition, O'REILLY, 2019. (Unit 4, 5)

Book for Reference

1. John Dean, "Web Programming with HTML5, CSS and Javascript" Jones & Bartlett Learning, 2019.

2. JsonGerner, Elizabeth Naramore, Morgan Owens and Matt Warden, "Professional LAMP - Using Linux , Apache, My SQL and PHP5 Web development", Wiley Publisher, 2006.

Semester	Course Code	Title of the Course									Hours	Credits
III	20PCA3203C	**Elective-III C: PHP Programming**									4	3
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	4	3	3	3	4	4	3	2	3	3.3	
CO-2	4	4	4	3	2	4	4	4	3	2	3.4	
CO-3	3	4	4	3	3	3	4	4	3	3	3.4	
CO-4	4	4	4	3	3	4	4	4	2	3	3.5	
CO-5	3	4	4	3	3	3	4	4	3	3	3.4	
									Mean Overall Score		3.4	
									Result		High	

Sem. III   **Hours/Week: 3**
20PCA3115   **Credits: 2**

<div align="center">

Software Lab-V:
PROGRAMMING SMART DEVICES

</div>

Course Outcomes:

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

1. Use the features of React Native
2. Create effective mobile app with components, views, state and properties
3. Handle styling and layout for a mobile app
4. to interact with external APIs
5. Develop geo-location awareness on mobile app

ReactJS:

1. Create an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and Event Listeners
3. Create a native calculator application.
4. Develop an application that draws basic Graphical Primitives on the screen.
5. Develop a native application that uses GPS location information.
6. Implement an application that writes data to the SD card
7. Implement an application that creates an alert upon receiving a message.
8. Write a mobile application that creates alarm clock.
9. Develop a photo gallery with search option.
10. Database: Student Biodata
11. Tablet Programming
12. Media Player

Software Lab-VI:
MEAN STACK WEBAPP LAB

Course Outcomes:
On successful completion of the course, the students will be able to
1. Execute Programs based on DOM and JavaScript Frameworks
2. Execute programs using basic functionality available in AngularJS and NodeJS
3. Demonstrate how to consume REST API using Express
4. Perform basic data access operations in MongoDB
5. Ability to develop simple web application connecting all the components of MEAN Stack

JavaScript
1. Document Object Model
2. JavaScript Frameworks – jQuery, AngularJS, BootStrap

Angular JS
3. Directives, Expressions, Controllers and Filters
4. AngularJS Modules and Forms

Node JS
5. CallBacks, Events, Global Objects
6. Buffers, Streams and File System

Express
7. Express Framework
8. RESTFul API

MongoDB
9. Data Modeling – Create Database, Drop Database
10.   CRUD Operations
11.   Document Querying and Functions

Project
12.   Simple Web Application connecting component of MEAN Stack

Semester III   **Hours/Week: 4**
20PCA3302   **Credits: 4**
IDC (BS): WEB DESIGN
Course Outcomes
        After completing this course the students will be able to
1. Understand the basic concepts of Internet
2. Identify the features of HTML tags
3. Design the HTML tables, frames and forms
4. design applications with JavaScript Programming
5. Comprehend the objects in HTML and Java Script

Unit-I: (12)
Networking Concepts: INTERNET - History - Applications-Users – Protocols - Host Machines and Host Names - Internet Architecture and Packet Switching- Client Server Model - Band width and Asynchronous Communication. Connection: Dial-up Access-Direct and Dedicated Connections - shell or TCP/ IP accounts - Domains and Addresses – IP addresses.

Unit-II: (12)
HTML: Introduction to HTML Tags - Document Layout - Comments - Headings-Paragraphs - Breaks - Texts - Lists - Special Characters.

Unit-III: (12)
HTML (Contd.): Tables - Linking documents - Frames - Form and its elements.

Unit-IV: (12)
JavaScript: Introduction to JavaScript - JavaScript in web pages-writing JavaScript with HTML - Basic programming techniques - operators and expressions - conditional checking - loops - functions - user defined functions - dialog boxes.

Unit-V: (12)
JavaScript (Contd.): JavaScript DOM: JSS DOM - understanding objects in HTML - browser objects - web page object hierarchy - Handling events - The form object - built-in objects-user defined objects - cookies - setting a cookie.

Books for Study
1. Wendy G.Lehnert, "Internet 101 - A beginners guide to the Internet and the World Wide

Web", Addison Wesley, 1999. (Unit I)
2. Ivan N. Bayross, "Web enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP", 4th Revised Edition, BPB Publications, New Delhi, 2010. (Units II, III, IV and V)

Books for Reference
1. Chuck Musciano& Bill Kennedy, "HTML - The Definitive Guide", Shroff Publishers & Distributors Pvt. Ltd., Calcutta - 1999.
2. Raj Kamal, " Internet And Web Technologies", TMH, New Delhi, ISBN:9780070472969

Semester	Course Code	Title of the Course								Hours	Credits
III	**20PCA3302**	**IDC (BS): WEB DESIGN**								4	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	3	2	3	2	4	4	4	3	3	3.2
CO-2	4	4	2	3	2	4	4	4	3	3	3.2
CO-3	4	3	3	4	2	4	4	4	3	4	3.5
CO-4	4	3	3	4	2	4	4	4	3	4	3.5
CO-5	4	4	3	4	2	4	4	4	3	4	3.6
										Mean Overall Score	3.42
										Result	High

Semester III   **Hours/Week: -**
20PCA3117   **Credits: 2**

Mini Project
(During Summer Vacation)

Course Outcomes:
        Students should have acquired
        1. the knowledge and skills for system development
        2. the familiarity with various domains like Banking, Finance, Health Care, Job portal and Insurance
        3. the knowledge on the design aspects
        4. the skills in the development, installation and testing of software
        5. report generating skills

Semester	Course Code	Title of the Course								Hours	Credits
III	**20PCA3117**	Mini Project								-	2
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	4	4	3	2	4	4	4	4	3	3.6
CO-2	4	4	4	3	2	4	4	4	4	3	3.6
CO-3	4	4	4	3	2	4	4	4	4	3	3.6
CO-4	4	4	4	3	2	4	4	4	4	3	3.6
CO-5	4	4	4	3	2	4	4	4	4	3	3.6
										Mean Overall Score	3.6
										Result	High

Self-paced Learning: XML

Course Outcomes

After learning this course, the learner will be able to

1. Create well-formed XML documents
2. Present web contents by using Style sheets
3. Write type definitions to validate XML documents
4. use the Xlinks and Xpointers to connect distributed XML documents
5. apply the XML syntax in different applications

Unit-I
Introduction to XML - XML Document structure - elements and attributes - Well-Formed XML Document.

Unit-II
Formatting Languages: CSS - XSL documents - XSL Basics - linking XSL with XML - XSL Tags.

Unit-III
Validity - Document Type Declaration - Document Type Definitions (DTDs) - DTD Syntax: Element and Attribute Declarations - Entity Declaration.

Unit-IV
Xlink: Simple and extended links - Xpath - Xpointers - XML namespaces.

Unit-V
XML Applications: Mathematical markup languages - chemical markup languages - wireless markup languages - Data interchange.

Book for Study
1. Elliotte Rusty Harold, "XML Bible", John Wiley & Sons, 2nd Edition, 2001.

Books for Reference
1. Erik T. Ray, "Learning XML", O'Reilly Media, First Edition, 2001.

2. Sandra Eddy & John E. Schnyder, "Teach yourself XML", Hungry minds, 1999

Semester	Course Code	Title of the Course									Hours	Credits
III	**20PCA3118**	**Self-paced Learning: XML**									-	2
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	3	4	3	3	4	3	3	4	3	3.4	
CO-2	3	4	3	2	4	3	4	3	4	3	3.3	
CO-3	3	4	4	3	4	3	4	4	3	3	3.5	
CO-4	4	3	3	4	3	4	3	4	3	3	3.4	
CO-5	3	4	4	3	3	3	4	4	3	3	3.4	
										Mean Overall Score	3.4	
										Result	High	

BIG DATA ANALYTICS

Course Outcomes

On successful completion of the course, the students will be able to
1. Acquire the knowledge on the basics of Big Data and its role in various Industries
2. Understand the various techniques of Big Data Analytics
3. Learn the cutting edge tools and technologies to analyze Big Data
4. Ability to appreciate the Big Data Storage concepts and Data Visualization techniques
5. To get insights into social media and mobile analytics

UNIT I   **(15)**
Overview of Big Data: Big Data - History of Data Management – Evolution of Big Data - Structuring Big Data - Types of Data - Elements of Big Data - Big Data Analytics - Careers in Big Data. **Use of Big Data in Business Context**: Use of Big Data in Social Networking – Use of Big Data in Preventing Fraud Using Big Data Analytics - Use of Big Data in Detecting Fraudulent Activities in Insurance Sector - Use of Big Data in Retail Industry.

UNIT II   **(15)**
Understanding Analytics and Big Data: Reporting and Analysis - Types of Analytics - Points to Consider during Analysis – Understanding Text Analytics. **Analytical Approaches and Tools to Analyze Data**: Analytical Approaches - History of Analytical Tools - Introducing Popular Analytical Tools - Comparing Various Analytical Tools.

UNIT III   **(15)**
Introducing Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data - Introducing Hadoop - Cloud Computing and Big Data - In-Memory Computing Technology for Big Data. **Understanding Hadoop Ecosystem:** Hadoop Ecosystem - Hadoop Distributed File System – MapReduce - Features of MapReduce -Hadoop YARN – Hbase - Features of HBase – Hive - Pig and Pig Latin – Sqoop – ZooKeeper – Flume – Oozie.

UNIT IV   **(15)**
NoSQL Data Management: Introduction to NoSQL - Aggregate Data Models - Key Value Data Model - Document Databases –Relationships - Graph Databases - Schema-Less Databases - Materialized Views - Distribution Models – Sharding - MapReduce Partitioning and Combining - Composing MapReduce Calculations. **Data Visualization:** Introducing Data Visualization - Techniques Used for Visual Data Representation - Types of Data Visualization - Applications of Data Visualization - Visualizing Big Data - Tools Used in Data Visualization.

UNIT V (15)

Social Media Analytics and Text Mining: Introducing Social Media - Introducing Key Elements of Social Media - Introducing Text Mining - Understanding Text Mining Process - Sentiment Analysis - Performing Social Media Analytics and Opinion - Mining on Tweets.
Mobile Analytics: Introducing Mobile Analytics - Introducing Mobile Analytics Tools - Performing Mobile Analytics - Challenges of Mobile Analytics.

Book for Study:
1.   Big Data (Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization) Black Book, published by Dreamtech Press, 2016.

Book(s) for Reference:
1.   Paul Buhler, WajidKhattak and Thomas Erl, "Big Data Fundamentals: Concepts, Drivers & Techniques", Prentice Hall Publications, January 2016, ISBN: 9780134291185.
2.   SoumendraMohanty, MadhuJagadeesh, and HarshaSrivatsa, "Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics", Published by Apress Media, 2013.
3.   Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reilly Media, 2012.

Semester	Course Code	Title of the Course								Hours	Credits
IV	**20PCA4119**	**BIG DATA ANALYTICS**								5	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	4	3	3	2	4	4	3	3	3	3.3
CO-2	3	4	3	4	3	3	4	3	4	4	3.5
CO-3	4	4	4	4	4	4	3	3	4	3	3.7
CO-4	4	4	4	2	3	4	4	4	2	3	3.4
CO-5	3	4	4	4	3	3	4	4	3	3	3.5
									Mean Overall Score		3.48
									Result		

Semester IV   **Hours/Week: 5**
20PCA4120   **Credits: 4**

RECENT TRENDS IN COMPUTER SCIENCE

Course Outcome
On successful completion of the course, the students will be able to

1. Recall the basic concepts of cloud computing technology
2. Understand the fundamental concepts of Internet of Things (IoT), Things and objects used and emerging IoT enabled Smart Applications
3. Understand the fundamental concepts of Artificial Intelligence
4. Distinguish different learning methods with Machine Learning Techniques
5. Understand the fundamental concepts of block chain technology

Unit - I: **(15)**
Evolution of Cloud Computing -Essential Characteristics of cloud computing - Operational models such as private, dedicated, virtual private, community, hybrid and public cloud - Service models such as IaaS, PaaS and SaaS - Governance and Change Management - Business drivers, metrics and typical use cases. Example cloud vendors - Google cloud platform, Amazon AWS, Microsoft Azure, Pivotal cloud foundry and Open Stack.

UNIT II   **(15)**
Fundamentals of Internet of Things **:** Introduction – Characteristics of IoT – The Physical design of IoT – IoT Architecture and components – Logical design of IoT – Communication models – IoT Communication APIs – Emerging Applications in IoT -IoT Architectures and Protocols :Introduction – Three Layer and five layer architecture of IoT – Cloud and fog based architecture-of IoT - Representative architecture – Near Field Communication (NFC) – Wireless Sensor Network (WSN) – IoT network protocol stack – IoT technology stack – Bluetooth, Zigbee and 6Lowpan

UNIT III   **(15)**
Introduction: Definitions of Artificial Intelligence – Artificial Intelligence Problems – Topics of Artificial Intelligence – Timelines of Artificial Intelligence – Production Systems – State Space Representation – Branches of Artificial Intelligence – Applications of Artificial Intelligence.

UNIT IV   **(15)**
Learning : Types of Learning – Machine Learning: Types in Machine Learning – History of Machine Learning – Aspects of Inputs to Training – Learning Systems – Machine Learning Applications- Quantification of Classification – Intelligent Agents

Unit V (15)

Fundamentals of Blockchain: Origin of Blockchain - Blockchain Solution - Components of Blockchain - Block in a Blockchain - The Technology and the Future. Blockchain Types and Consensus Mechanism: Introduction - Decentralization and Distribution - Types of Blockchain - Consensus Protocol.

Books for Study :

1. Buyya, Vecciola and Selvi, "Mastering Cloud Computing: Foundations and Applications Programming", Tata McGraw Hill, 2013.

2. Dr.KamleshLakhwani, Dr.Hemant Kumar Gianey, Joseph Kofi Wireko, Kamal Kant Hiran, " Internet of Things (IoT), Principles, Paradigms and Applications of IoT", BPB Publications, 2020,

3. Vinod Chandra S. S. and AnandHareendran S. "Artificial Intelligence and Machine Learning", PHI Learning Pvt Ltd, 2014.

4. Chandramouli. S, Asha A George, Abhilash K A, and MeenaKarthikeyan, "Blockchain Technology", Universities Press(India) Private Limited, Hyderabad-500029, Copyright Year: 2021. ISBN: 978-93-89211-63-4, First Edition.

Books Reference:

1. Joseph Ingeno , "Software Architect's Handbook", PacktPublishing,2018.

2. Stuart J. Russell and Peter Norvit, "Artifical Intelligence A Modern Approach", Third Edition, Pearson Education Limited 2016.

3. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education

4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. "Bitcoin and cryptocurrency technologies: a comprehensive introduction". Princeton University Press, 2016.

Semester	Course Code	Title of the Course								Hours	Credits
IV	**20PCA4120**	**RECENT TRENDS IN COMPUTER SCIENCE**								5	4
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	4	4	3	3	3	4	4	4	3	3	3.5
CO-2	4	4	4	3	3	3	4	4	4	3	3.6
CO-3	4	4	3	4	3	4	4	4	3	3	3.6
CO-4	4	3	4	3	2	3	3	4	3	3	3.2
CO-5	4	3	4	3	2	3	4	4	4	2	3.3
										Mean Overall Score	3.44
										Result	High

Semester IV **Hours/Week: -**
20PCA4121 **Credits: 2**

COMPREHENSIVE EXAMINATION

Course Outcomes
On successful completion of the course, the students will be able to

1. Solve the problems using c and object oriented programming language, C++.
2. Explain the intricacies of Programming Languages Java and Python
3. Manipulate data structures and explain the features of Operating Systems.
4. Apply the standard procedures in the system design and database design.
5. Comprehend the technologies for distributed system and for mobile app development

Unit-I
     C Debugging - Object Oriented Programming with C++
Unit-II
     Java Language – Python Language
Unit-III
     Data Structures - Algorithms – Operating Systems
Unit-IV
     Database Concepts - Software Engineering.
Unit-V
     Web Technologies – Mobile app Development.

Semester	Course Code	Title of the Course		Hours	Credits
IV	**20PCA4121**	**COMPREHENSIVE EXAMINATION**		-	2

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	5	4	4	3	3	5	4	2	3	2	3.5
CO-2	4	3	5	4	5	3	4	5	4	1	3.8
CO-3	4	4	5	3	4	4	5	3	5	2	3.9
CO-4	5	5	4	4	3	5	4	5	4	3	4.2
CO-5	4	4	4	3	3	4	4	3	4	3	3.6

Mean Overall Score	3.8
Result	High

Semester IV   **Hours/Week: -**
20PCA4122   **Credits: 14**

PROJECT

The second half of the fourth semester is allotted to do a project work in an organization with sufficient infrastructure to carry out the MCA project work. The students would choose an organization and submit the details of the organization to the project guide and HoD. The students should send a requisition letter from the HoD to the organization and should get the letter of acceptance from the organization.The students can send only one such requisition letter at a time. Only after non-acceptance of the company the student can request another organization for doing the project work. The guide and HoD have to approve the company / organization and in case of any change suggested by the guide or HoD, the student should change the organization. The change would be suggested by the guide &HoD if they find the company not having sufficient infrastructure for computing and an external guide in the organization with required educational qualification such as MCA or ME / MTech who can be external guides in the organization. Only upon the receipt of the acceptance letter, the student will be relieved from the College to join the company. They should submit the acceptance letter from the organization for having accepted the student for pursuing his/her MCA project work. The marks awarded by the external guide in the organization carries a weightage of ten percent.

The students would join the organization in the third week of January and send their joining report on or before the fixed date as fixed by the Department. The students will be supplied with all the details of what are to be done before and after joining the company. They should appear for first review mid-way and they will report the progress of their project work in the presence of their classmates and guide.

The students should send emails to their guides every fifteen days of their progress after joining the organization. Failure to submit the joining report and failure to be present for the first review (except under exempted circumstances by the Department of Computer Science due to long distance) will result in non-acceptance of their project work and such students would repeat the same procedure in the next academic year with the approval of the Principal, Controller of Examinations and the Department of Computer Science after the payment of the fees of the particular semester.

The students appear for the second review during the end semester examinations in the college along with the manuscript of the project work. The manuscript should be prepared along the guidelines supplied to them by the Department; students should submit three volumes to the Department before the date stipulated by the Department. The viva-voce of the project work would be conducted by both the internal and the external examiners along with semester examinations of the College.

Semester	Course Code	Title of the Course									Hours	Credits
IV	**20PCA4122**	**PROJECT**									-	14
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	4	4	4	2	4	4	4	4	4	3.8	
CO-2	4	4	4	3	2	4	4	4	4	4	3.7	
CO-3	4	4	4	3	2	4	4	4	4	4	3.7	
CO-4	4	4	4	4	4	4	4	4	4	4	4	
CO-5	4	4	4	4	3	4	4	4	4	4	3.9	
										Mean Overall Score	3.82	
										Result	High	

Department of Computer Science
St Joseph's College (Autonomous) – Tiruchirappalli

Mandatory Bridge Courses for Non-Computer Science Stream Students

Semester I   **Hours/Week: -**
20MCA1ACC1   **Credits: 5**

C-PROGRAMMING

Course Outcomes:

Upon successful completion of this course, students will be able

1. To understand the concept of Algorithm and Flow chart.
2. To know the flow of the various control structures.
3. To learn the concept of Strings and Arrays.
4. To handle various types of Functions
5. To make familiar in the logic of Structures and Union.

Unit- I

   Introduction to Algorithms - Flow charts - Developing algorithms and flowcharts for solving Simple problems using sequential, selection and iterative programming Structures.

Unit- II

   Data Types - Variables - Operators - Control structures - Looping structures - Arrays- Type of Arrays - Strings.

Unit- III

   Functions - Built-in-functions - Types of functions –User defined functions- Scope of Variables - Call by value and call by reference.

Unit- IV

   Pointers- Array of Pointers - Pointer as Function arguments - Pointer of Pointer - Pointer and structures - Type modifiers and storage class specifiers.

Unit-V

   Basics of Structures – Declaration of structure – Referencing Structures elements - Array of Structures – Nesting of structures – Union- Introduction to Files.

Books for Study

1. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, New Delhi, Seventh Edition, 2016.

Semester	Course Code	Title of the Course		Hours	Credits
I	**20MCA1ACC1**	**C-PROGRAMMING**		-	5
Course Outcomes	Programme Outcomes (PO)	Programme Specific Outcomes (PSO)		**Mean Scores**	

	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	of Cos
CO-1	4	4	3	4	4	5	5	4	3	3	3.9
CO-2	4	5	3	4	4	5	5	4	3	4	4.1
CO-3	4	3	3	3	4	4	4	4	3	3	3.4
CO-4	5	4	4	4	4	5	5	4	4	3	4.2
CO-5	4	3	3	4	3	4	4	4	3	3	3.5
									Mean Overall Score		3.8
									Result		high

Semester I   **Hours/Week: -**
20MCA1ACC2   **Credits: 5**

Software Lab: C PROGRAMMING

Course Outcomes:

Upon successful completion of this course, students will be able

1. To develop programs using Control Structures.
2. To write programs using Arrays.
3. To make programs using Functions.
4. To understand the programs using Pointers.
5. To write programs using Structures and Union.

    1) Simple Programs using Operators
    2) Branching structures
    3) Looping structures
    4) Arrays
    5) Strings
    6) Functions
    7) Mathematical and Recursive functions
    8) Pointers
    9) Structures
    10) Union
    11) Files

Semester II   **Hours/Week: -**
20MCA2ACC3   **Credits: 5**

WEB DESIGN (HTML 5, Java Script &CSS)

Course Outcomes:
Upon successful completion of this course, students will

1. Have in-depth knowledge on the features of HTML 5
2. Have better understanding on the design of web pages using HTML tags and CSS
3. Acquire skill to implement JavaScript Programming within web pages
4. Have the experience to handle the events and set the cookies in Java Script
5. Be trained in designing web pages using HTML and JavaScript

Unit-I: (12)
HTML: Introduction to HTML Tags - Document Layout - Comments - Headings-Paragraphs - Breaks - Texts - Lists - Special Characters.

Unit-II: (12)
HTML: Tables - Linking documents - Frames - Form and its elements.

Unit-III: (12)
Introduction to Cascading Style Sheets - Concept of CSS - Creating Style Sheet -CSS Properties - CSS Styling (Background, Text Format, Controlling Fonts) - Working with block elements and objects - Working with Lists and Tables - CSS Id and Class

Unit-IV: (12)
JavaScript: Introduction to JavaScript - JavaScript in web pages-writing JavaScript with HTML - Basic programming techniques - operators and expressions - conditional checking - loops - functions - user defined functions - dialog boxes.

Unit-V: (12)

JavaScript: JavaScript DOM: JSS DOM - understanding objects in HTML - browser objects - web page object hierarchy - Handling events - The form object - built-in objects-user defined objects - cookies - setting a cookie.

Books for Study:
1. Wendy G.Lehnert, "Internet 101 - a beginners guide to the internet and the world wide web", addition wesley, 1999. (Unit I, II)
2. Powell and Thomas, "HTML & CSS: The Complete Reference", McGraw Hill (Unit III)
3. Ivan N. Bayross, "Web enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP", 4th Revised Edition, BPB Publications, New Delhi, 2010. (Unit- IV and V)

Book for Reference
1. Chuck Musciano& Bill Kennedy, "HTML - The Definitive Guide", Shroff Publishers & Distributors Pvt. Ltd., Calcutta - 1999.
2. Raj Kamal, " Internet And Web Technologies", TMH, New Delhi, ISBN:9780070472969

Semester	Course Code	Title of the Course									Hours	Credits
II	**20MCA2ACC3**	**WEB DESIGN (HTML 5, Java Script &CSS)**									-	5
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	4	5	3	5	4	3	3	4	3	3	3.7	
CO-2	3	4	3	3	4	4	4	4	3	3	3.5	
CO-3	4	3	2	3	4	4	4	3	3	2	3.2	
CO-4	5	4	4	3	4	4	4	4	4	3	3.9	
CO-5	5	4	3	4	3	4	3	4	4	3	3.7	
										Mean Overall Score	3.6	
										Result	High	

Semester II   **Hours/Week: -**
20MCA2ACC4   **Credits: 5**

WEB DESIGN (HTML 5, Java Script &CSS) Lab

Course Outcomes:
Upon successful completion of this course, students will

1. Have the ability to design simple web pages with basic HTML tags
2. Be well-equipped to use CSS with web pages
3. Have the skill set to design web pages using Java Script.
4. Have mastered the art of event driven programming
5. Be in a state of designing web applications for any organization.

Exercises
1. Web Page with Headings and Formatting Tags
2. Web Page with Ordered and Unordered Lists
3. HTML file to demonstrate Tables
4. HTML file to demonstrate Forms
5. HTML file to demonstrate Frames
6. CSS Background and Text Styles
7. CSS Id and Class
8. Java Script Loops
9. Java Script Functions
10. Java Script Form Validation

Semester III   **Hours/Week: -**
20MCA2ACC5   **Credits: 5**

Web Graphics

Course Outcomes:
On completion of the course, the student will be able to

1. Familiar with the existing Multimedia Products
2. Able to work with GIMP
3. Able to learn how to design using basic Synfig tools
4. To use advanced technologies in Synfig
5. To develop presentation package using multimedia tool Inkscape

Unit-I:
Introduction to Multimedia Definition – Components of Multimedia – Multimedia and Hypermedia – World Wide Web – Various overview of Multimedia software Tools - Multimedia Authoring and Tools: Multimedia Authoring – VRML – Popular File Formats.

Unit-II:
GIMP environment – Layers and work path – Image editing – channels, masks and actions - filters – rollovers and animations.

Unit-III:
Synfig: Introduction – drawing and coloring tools.

Unit-IV:
Synfig: Animation – tweening – interactive elements.

Unit-V:
Inkscape: Interface – working with shapes – layers – blend, path and mask.

Books for Study
1. Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia", 2004 by Pearson Education, Inc.
2. Phillip Whitt "Beginning Photo Retouching & Restoration Using GIMP", Apress/2014. ISBN-13: 978-1-484204-04-7.
3. Http://wiki.synfig.org/category - Manual. 21-Jun-2016.
4. Bethany Hiitola, Packt Publishing Limited, "Inkscape Starter", ISBN- 10.1849517568,

ISBN-13.978-1849517560

Books for Reference:

1. Fred Halsall**,** "Multimedia Communications: Applications, Networks, Protocols, and Standards", by Pearson Education, Inc.2001.
2. Jason Van Gumster and Robert Shimonski, "GIMP Bible", Wiley, 2010.
3. Jesse Russell, Ronald Cohn, "Synfig", Book on Demand, 2012.
4. Bethany Hiitola,"Inkscape Beginner's Guide", Packt Publishing,2012.

Unit-I Chapter 1:(Page no. 3-23), Chapter 3:(page no. 69-80)
Unit-II Chapter 7,8,9,10,11
Unit-III, IV Manual
Unit-V Chapter 1,2,4,5,6

Semester	Course Code	Title of the Course									Hours	Credits
III	**20MCA3ACC5**	**Web Graphics**									-	5
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					**Mean Scores of Cos**	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	3	4	2	4	4	3	3	3	3	3	3.2	
CO-2	3	4	3	3	4	4	4	4	3	3	3.5	
CO-3	4	3	2	3	4	3	4	3	3	2	3.1	
CO-4	5	4	2	3	4	4	4	4	3	3	3.6	
CO-5	5	3	3	4	3	4	3	3	4	3	3.5	
										Mean Overall Score	3.38	
										Result	High	

Semester III   **Hours/Week: -**
20MCA2ACC6   **Credits: 5**
                       Web Graphics Lab

Course Outcomes:

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

1. Knowledge about editing images

2. Familiarisation with the modern GIMP workspace

3. Experience with image Resolution and Retouching

4. Creativity to design a project

5. Skill in cutout animation using bitmap images

Practical Exercises

1. Design ID card, Pamphlets and Advertisement using GIMP.
2. Design an invitation for a seminar or conference.
3. Design a greeting card
4. Create text effects using text tools
5. Apply various Layer Effects to Images.
6. Apply Filter effects on images.
7. Develop a slide show of Photos with transition.
8. Design brushed outlines for an image using Synfig
9. Create an Animation for bouncing ball.
10. Using Time line Adapt motion tweening Animation.
11. Creating logo using Inkscape.
12. Creating Calligraphic text effects using inkscape.