ST. XAVIER'S COLLEGE (AUTONOMOUS)

PALAYAMKOTTAI - 627 002

(Recognized as "College with Potential for Excellence" by UGC)
(Accredited by NAAC at "A^{++}" Grade with a CGPA of 3.66 in IV Cycle)
(Star College Programme by DBT, Govt. of India.)

Affiliated to Manonmaniam Sundaranar University
Tirunelveli

SYLLABUS

Preserve this copy of the syllabus until you complete the course, as it is an important document of your present course of study.

Name _____

MASTER OF COMPUTER APPLICATIONS

Choice Based Credit System (CBCS)

(w.e.f. June 2021 - 2022)

Programme Name : MCA

Programme Code : PCA

Programme Specific Outcomes

At the completion of MCA Programme the students will be able to

1. Adapt and utilize the Principles of Mathematics and Computing Techniques to analyze and solve complex problems.
2. Apply modern tools and techniques to design and develop Web and Mobile Applications.
3. Explore the knowledge acquired from Data Mining, Internet of Things and Data Science with Cloud Computing through research.
4. Analyze and apply the knowledge of Accounting and Financial Management, Organizational Structure and Human Resource Management and Mobile Commerce and develop entrepreneurship skills.
5. Apply their expertise in Green Computing, Human Machine Interaction and Machine Learning to find solutions for existing problems and bring out new innovative and ground breaking solutions.
6. Collaborate with team members in developing real-time projects.

COMPUTER APPLICATIONS (MCA) – Programme Structure

Sem.	Status	Course Code	Title of the Paper	Hours	Credits
I	Core	21PCA11	Mathematical Foundations of Computer Science	4	4
	Core	21PCA12	Object Oriented Programming with C++	4	4
	Core	21PCA13	Operating Systems	4	4
	Core	21PCA14	Database Systems	4	4
	Core	21PCAL15	**Practical:** Object Oriented Programming with C++	5	2
	Core	21PCAL16	**Practical:** Oracle and VB.NET	5	2
	Elective-I	21PCAE11	Computer Fundamentals and VB.NET / Green Computing / Human Machine Interaction	4	4
			Sub-Total	**30**	**24**
II	Core	21PCA21	Optimization Techniques	4	4
	Core	21PCA22	Advanced Java Programming	4	4
	Core	21PCA23	Web Technologies	4	4
	Core	21PCA24	Data Structures and Algorithms	4	4
	Core	21PCAL25	**Practical:** Advanced Java Programming	5	2
	Core	21PCAL26	**Practical:** Web Technologies	5	2
	Elective-II	21PCAE21	Accounting and Financial Management / E-Commerce / Organizational Structure and Human Resource Management	4	4
			Sub-Total	**30**	**24**

III	Core	21PCA31	Python Programming	4	4
	Core	21PCA32	Android Programming	4	4
	Core	21PCA33	Data Communication and Computer Networks	4	4
	Core	21PCA34	Data Science with Cloud Computing	4	4
	Core	21PCAL35	**Practical:** Python Programming	5	2
	Core	21PCAL36	**Practical:** Android Programming	5	2
	Elective-III	21PCAE31	Software Engineering / Internet of Things / Artificial Intelligence and Machine Learning	4	4
	Mini Project	21PCAR31	Mini Project	-	4
			Sub-Total	**30**	**28**
IV	Core	21PCA41	Project Work and Viva Voce	**Real Time Project**	**14**
			Sub-Total	**-**	
			STAND		**1**
			Grand Total	**90**	**91**

List of ECC/Value added courses

Self Study Papers :

Course Code	Title of the Paper
21PCAS01	Cyber Security
21PCAS02	Mobile Commerce
21PCAS03	Introduction to Blockchain Technology and Applications
21PCAS04	Introduction to Industry 4.0 and Industrial Internet of Things

ECC/Value Added Papers : (for MCA and Others)

Course Code	Title of the Paper	Duration
21PCAEC01	Aptitude and Reasoning Skills	30 hours
21PCAEC02	Communication and Presentation Skills	30 hours
21PCAEC03	Scripting Languages and AJAX	30 hours
21PCAEC04	Digital Forensics	30 hours

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Course Code : 21PCA11)

SEMESTER - I	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Define the notion of Tautologies and Predicate Calculus. **(K1)**
2. Interpret the concepts of Set Theory, Relations, Ordering and Functions. **(K2)**
3. Demonstrate the basic concepts of Groups. **(K3)**
4. Outline the properties of Graphs and related Discrete Structures, and be able to relate these to practical examples. **(K4)**
5. Compare the operations of graphs. **(K5)**
6. Develop Finite-State Machines to model computer operations. **(K6)**

UNIT I MATHEMATICAL LOGIC

Statement and Notations – Connectives – Negation – Conjunction – Disjunction – Conditional and Biconditional statement – Statement formulae and truth tables – Well Formed Formulae – Tautologies – Equivalences of Formula – Duality Law.

Predicate Calculus: Predicates – Statements functions – Variables – Quantifiers – Predicate formulae – Free and Bound variables.

UNIT II SET THEORY

Basic concepts of set theory: Notation – Inclusion of equality of sets – Power set – Operation on sets – Venn diagrams

Relations and ordering: Cartesian products - Relations – Properties of Binary Relation in a set – Relation matrix and graph – Equivalence relations – Composition of Binary Relations.

Functions: Definition and Introduction – Composition of functions – Inverse function.

UNIT III GROUPS

Definition and Examples – Subgroups – Homomorphism – Cosets – Normal subgroups.

UNIT IV GRAPH THEORY

Basic terminology: Different types of graphs – Directed and Undirected – Simple – Pseudo – Complete – Regular – Bipartite –Incidence and Degree – Pendant and Isolated Vertex – Null Graph – Isomorphism – Sub Graphs – Walk – Path and Circuit – Connected and Disconnected Graphs and Components – Operations on Graphs – Matrix representation of Graphs – Incidence and Adjacency Matrices.

UNIT V LANGUAGES, GRAMMARS, MACHINES

Introduction – Alphabets, Words, Languages – Regular Expressions, Regular Languages – Finite State Automata – Finite State Machines – Godel numbers – Grammars.

TEXT BOOKS

1. J.P Trembley, R. Manohar, "Discrete Mathematical structures with applications to Computer Science", Tata McGrawHill publications, 2017. (**Units I - IV)**
2. Seymour Lipschutz, Marc Lipson, "Discrete Mathematics", Revised Third Edition, Schaum's Outline Series, Tata McGraw Hill Publications, 2002.
   (Unit V)
   Note: Excluding algorithms and theorems.

REFERENCE BOOK

S. Santha, "Discrete Mathematics with Combinatory and Graph Theory", Third Edition, Cengage Publications, 2015.

OBJECT ORIENTED PROGRAMMING WITH C++

(Course Code : 21PCA12)

SEMESTER - I	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES

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

1. Describe the benefits of implementing OOPs concepts in Programming. **(K1)**
2. Interpret the concepts of Constructors and Destructors. **(K2)**
3. Experiment the concepts of Polymorphism and Inheritance. **(K3)**
4. Analyse Exception Handling techniques. **(K4)**
5. Implement Files concept. **(K5)**
6. Integrate Object-Oriented techniques to solve bigger real world problems. **(K6)**

UNIT I PRINCIPLES OF OOP, CLASSES AND OBJECTS

Programming paradigms – Basic concepts – Benefits of OOP – Applications of OOP – Introduction to C++: History of C++ – Structure of C++ – Basic data types – Type casting and Type modifiers – Operators and Control structures – Input and output statements – Classes and objects – Class specification – Member function specification – Scope resolution operator – Access qualifiers – Instance creation .

UNIT II FUNCTIONS AND POINTERS

Function prototyping – Function components – Passing parameters – Call by reference – Return by reference – Inline functions – Default arguments –Overloaded function – Pointers: Array of objects – Pointers to objects – This pointer – Dynamic allocation operators – Dynamic objects.

UNIT III CONSTRUCTORS AND OVERLOADING CONCEPT

Constructors – Parameterized constructors – Overloaded constructors – Constructors with default arguments – Copy constructors – Static class members and static objects – Operator Overloading: Overloading unary and binary operator – Overloading the operator using friend function – Stream Operator overloading and data conversion.

UNIT IV INHERITANCE AND VIRTUAL FUNCTIONS

Defining derived classes – Single inheritance – Protected data with private inheritance – Multiple inheritance – Multi-level inheritance – Hierarchical inheritance – Hybrid inheritance – Multi path inheritance – Constructors in derived and base class – Abstract classes – Friend and Virtual function – Dynamic Polymorphism – Virtual Destructor.

UNIT V EXCEPTION HANDLING AND TEMPLATES

Principles of Exception handling – Exception handling mechanism – Multiple Catch – Nested Try – Rethrowing the Exception – Streams in C++: Stream classes – Formatted and Unformatted data – Manipulators – User defined manipulators – File Streams – File Pointer Manipulation – File Open and Close – Templates: Template functions and Template classes.

TEXT BOOK

Herbert Schildt, "The Complete Reference – C++", Fourth Edition, Tata McGraw Hill, 2020.

REFERENCE BOOKS

1. E. Balagurusamy, "Object Oriented Programming with C++", Fourth Edition, Tata McGraw Hill, 2016.
2. Robert Lafore, "Object Oriented Programming with C++", Fourth Edition, Galgotia Publications, 2013.
3. D. Ravichandran, "Programming with C++", Second Edition, Tata McGraw Hill, 2003.

OPERATING SYSTEMS

(Course Code : 21PCA13)

SEMESTER - I	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES

1. Describe the Operating System Operations, Structures and Processes. **(K1)**
2. Interpret the various types of threads and CPU scheduling algorithms. **(K2)**
3. Demonstrate Critical Section Problem, Semaphores and Monitors. **(K3)**
4. Analyze Main Memory and Virtual Memory. **(K4)**
5. Classify Disk Scheduling, RAID structure, Distributed Systems and Network-Based Operating Systems. **(K4)**
6. Summarize the methods for handling deadlock. **(K5)**

UNIT I INTRODUCTION AND PROCESSES

Introduction to Operating system – Computer System Organization – Computer System Architecture – Operating System Operations – Process Management – Memory Management – Storage Management – Protection and Security – Open Source Operating Systems. Operating System Structures: Operating System Services – User and Operating System Interface – Operating System Structure.

Processes: Process Concept – Process Scheduling – Operations on Processes – Interprocess Communication – Communication in Client-Server Systems.

UNIT II THREADS, SCHEDULING AND DEADLOCKS

Threads : Overview – Multithreading Models – Threading Issues – CPU Scheduling : Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiprocessor Scheduling – Real Time CPU Scheduling – Deadlocks : Deadlock Characterization – Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock.

UNIT III SYNCHRONIZATION

Process Synchronization : Background – The Critical Section Problem – Peterson's Solution – Synchronization Hardware – Semaphores – Classical Problems of Synchronization – Monitors – Alternative Approaches.

UNIT IV MEMORY MANAGEMENT

Main Memory : Background – Swapping – Contiguous Memory Allocation – Segmentation – Paging – Structure of the Page Table – Virtual Memory: Background – Demand Paging – Copy-on-Write – Page Replacement – Allocation of Frames – Thrashing.

UNIT V STORAGE MANAGEMENT AND DISTRIBUTED SYSTEMS

Mass-Storage Structure : Overview – Disk Structure – Disk Attachment – Disk Scheduling – RAID Structure – File-System Implementation : File-System Structure – Allocation Methods – Distributed Systems : Advantages of Distributed Systems – Types of Network-based Operating Systems – Network Structure – Communication structure.

TEXT BOOK

Silberschatz, Galvin and Gagne, "Operating System Concepts", Ninth Edition, John Wiley and Sons Inc. Publications, 2013.

REFERENCE BOOKS

1. Archer Harris. J, "Operating Systems - Schaum's Outlines", First Edition, McGraw Hill Education, 2020.
2. Mukesh Singhal, Niranjan Shivaratri, "Advanced Concepts in Operating Systems", First Edition, McGraw Hill Education, 2017.
3. Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", Fourth Edition, Pearson Education India, 2016.

DATABASE SYSTEMS

(Course Code : 21PCA14)

SEMESTER - I	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe the concepts of the Database and Data Models. **(K1)**
2. Interpret SQL. **(K2)**
3. Model database applications using normalization. **(K3)**
4. Analyze different special purpose databases and to critique how they differ from traditional database systems.**(K4)**
5. Evaluate query and monitor the performance of the DBMS.**(K5)**
6. Design database using ER diagrams and map ER into Relations and normalize the relations. **(K6)**

UNIT I INTRODUCTION

Database System Applications – Purpose of Database Systems – View of Data – Database Languages – Relational Databases – Database Design – Database and Application Architecture – Database Users and Administrators – History of Database Systems – Introduction to the Relational Model –Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Operations.

UNIT II SQL

Introduction to SQL –Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries – Additional Basic Operations – Set Operations – Null Values – Aggregate Functions – Intermediate SQL –Join Expressions – Views – Transactions – Integrity Constraints – SQL Data Types and Schemas – Index Definition in SQL – Authorization.

UNIT III ER MODEL AND RELATIONAL DATABASE DESIGN

Overview of the Design Process – The Entity Relationship Model – Complex Attributes – Mapping Cardinalities – Primary Key – Removing Redundant Attributes in Entity Sets – Reducing E-R Diagrams to Relational Schemas Entity-Relationship Diagrams – Relational Database Design –Features of Good Relational Designs – Decomposition Using Functional Dependencies – Normal Forms – Decomposition using Multivalued Dependencies – More Normal Forms.

UNIT IV STORAGE MANAGEMENT & INDEXING

Overview of Physical Storage Media – Storage Interfaces – Magnetic Disks – Flash Memory – RAID – Disk Block Access – Database Storage Architecture – File Organization – Organization of Records in Files – Data-Dictionary Storage – Database Buffer – Column-Oriented Storage –Indexing – Basic Concepts – Ordered Indices – B+-Tree Index Files – B+-Tree Extensions – Hash Indices – Multiple Key Access – Creation of Indices - Bitmap Indices – Indexing of Spatial and Temporal Data.

UNIT V TRANSACTIONS, CONCURRENCY CONTROL & RECOVERY SYSTEM

Transaction Concept – A simple Transaction Model – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Concurrency Control –Lock-Based Protocols – Deadlock Handling – Multiple Granularity – Timestamp–Based – Protocols – Validation-Based Protocols –Multiversion Schemes – Recovery System –Failure Classification – Storage – Recovery and Atomicity – Recovery Algorithm – Buffer Management – Failure with Loss of Non-volatile Storage.

TEXT BOOK

Abraham Silberschatz, Henry F. Korth and S. Sudharsan, “Database System Concepts”, Seventh Edition, Tata McGraw Hill, 2019.

REFERENCE BOOKS

1. Elmasri Ramez and Navathe Shamkant, “Fundamentals of Database System", Seventh Edition, Pearson Education, 2017.
2. G. K. Gupta, “Database Management Systems", First Edition, McGraw Hill Education, 2018.
3. Thomas Connolly, Carolyn Begg, “Database Systems", Sixth Edition, Pearson Education, 2019.

PRACTICALS: OBJECT ORIENTED PROGRAMMING WITH C++

(Course Code : 21PCAL15)

SEMESTER - I	CORE	HOURS - 5	CREDITS - 2

1. Programs using control structures.
2. Programs using classes and objects.
3. Program using functions.
4. Program using call by reference.
5. Program using default arguments.
6. Program using function overloading.
7. Program using pointers.
8. Program using constructors and destructors.
9. Program implementing binary operator overloading using friend function.
10. Program using the types of Inheritance.
11. Program using constructors in derived and base classes.
12. Program using virtual function.
13. Program using exceptional handling.
14. Programs on file handling using classes.
15. Program using templates.

PRACTICALS: ORACLE AND VB.NET

(Course Code : 21PCAL16)

SEMESTER - I	CORE	HOURS - 5	CREDITS - 2

ORACLE

1. Working with DDL and DML commands.
2. Queries Using Relational, Logical and Special Operators.
3. Queries using Character, Number and Date functions.
4. Queries using Group Functions.
5. Queries using Order By and Group BY Clause.
6. Queries using Joins and Sub Queries.
7. PL/SQL program using Control Structures.
8. PL/SQL program using Cursors.
9. PL/SQL program using Exception Handling.
10. PL/SQL program using Stored Procedures.

VISUAL BASIC.NET

1. Program using Controls. (Textbox, Listbox, Combobox, Checkbox, Option Button)
2. Program using Tree view.
3. Program using List view.
4. Designing Menus.
5. Design and Develop VB.Net application with Database.

COMPUTER FUNDAMENTALS AND VB .NET

(Course Code : 21PCAE11)

SEMESTER - I	ELECTIVE - I	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Identify and analyze computer hardware, software, and components.**(K1)**
2. Describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE). **(K2)**
3. Demonstrate knowledge of object-oriented concepts Design user experience and functional requirements VB.NET application. **(K3)**
4. Classify control structures such as If, Do While and For. **(K4)**
5. Perform tests, resolve defects, and revise existing code. **(K5)**
6. Design and Implement database connectivity using ADO.NET in window based application. **(K6)**

UNIT I INTRODUCTION TO COMPUTERS

Five Generations of Modern Computers – Classification of Digital Computer Systems – Anatomy of a Digital Computer – Computer Architecture – The Number System Central Processing Unit (CPU) and Memory – Secondary (Auxiliary) – Storage Devices – Input Devices – Output Devices – Introduction to Computer Software – Introduction to Software Development – Programming Languages – Operating Systems – General Software Features and Trends.

UNIT II VB.NET INTRODUCTION

Visual Basic.NET IDE – Creating a Simple Application – Variables – Comments and Whitespace – Data Types – Storing Variables – Methods – Debugging Your Programs. Microsoft.NET Framework – Common Language Infrastructure CLI – Common Language Runtime CLR – Common Type System CTS – Intermediate Language (IL) and Just-In-Time (JIT) Compilation – Metadata.

UNIT III CONTROLLING THE FLOW

Making Decisions – If Statement - Else Statement – Allowing Multiple Alternatives with ElseIf – Nested If Statements – Single-Line If Statement – Comparison Operators – Numeric Operators – And and Or Operators – String Comparison – Select Case – Different Data Types with Select Case – Loops – The For-Next Loop – For Each-Next Loop – DoUntil Loop – Do-While Loop – Arrays – Defining and Using Arrays – Using For Each-Next – Passing Arrays as Parameters – Sorting Arrays.

UNIT IV VB.NET CONTROLS

Menus – Overview – Creating Menus – Context Menus – Visual Basic.Net Controls – Text Box – Label – Button – Checkbox – Radio Button– List Box and Combo Box – Picture Box – DateTime Picker – Tree view – List view – Dialog boxes – Msgbox – open Dialog – Save Dialog – Print Dialog.

UNIT V ERROR HANDLING AND DATABASE

Debugging and Error Handling – Major Error Types – Debugging – Error Handling – Accessing Databases – What Is a Database – SQL SELECT Statement – Queries in Access – Data Access Components – Data Binding – ADO.NET – The ADO.NET Classes in Action – Data Binding.

TEXT BOOKS

1. Alexis Leon and Mathew Leon, "Fundamentals of Information Technology", Second Edition, Vikas Publishing, 2009. (Unit I)
2. Richard Blaire, Jonathan Crossland, Mathew Reynolds, "Beginning VB.Net", Second Edition, Wrox Press, 2008. (Unit II to V)

REFERENCE BOOKS

1. Peter Norton, "Introduction to Computers", Fifth Edition, Tata McGraw Hill.
2. Dave Grundgeiger, "Programming Visual Basic.NET", First Edition, O'Reilly Publisher, 2002.
3. Steven Holzner , "Visual Basic.NET Black Book", Coriolis Publisher, 2002.
4. Michael Halvorson, "Microsoft Visual Basic.NET Step by Step", Microsoft Press, 2002.
5. https://www.tutorialspoint.com/vb.net.

GREEN COMPUTING

(Course Code : 21PCAE11)

SEMESTER - I	ELECTIVE - I	HOURS - 4	CREDITS - 4

COURSE OUTCOMES

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

1. Define Green IT with its different Dimensions and Strategies. **(K1)**
2. Describe Green Devices and Hardware along with its Green Software Methodologies. **(K2)**
3. Illustrate the various Green Enterprise Activities and Issues. **(K3)**
4. Analyze the Concepts of how to Manage and Regulate the Green IT. **(K4)**
5. Evaluate the various Standards and Green IT trends. **(K5)**
6. Develop a Software with Minimal or no Impact to the Environment. **(K6)**

UNIT I GREEN IT: AN OVERVIEW

Introduction – Environmental Concerns and Sustainable Development – Environmental Impacts of IT – Holistic Approach to Greening IT – Applying IT for enhancing Environmental Sustainability – Green IT Standards and Eco-Labeling of IT – Enterprise Green IT Strategy.

UNIT II GREEN DEVICES AND HARDWARE WITH GREEN SOFTWARE

Green Devices and Hardware: Introduction – Life Cycle of a device or hardware – Reuse – Recycle and Dispose – **Green Software:** Introduction – Energy-saving – Software Techniques – Evaluating and Measuring Software Impact to Platform Power.

UNIT III GREEN ENTERPRISES AND THE ROLE OF IT

Introduction – Organization and Enterprise Greening – Information Systems in Greening Enterprises – Greening Enterprise: IT Usage and Hardware – Inter-Organizational Enterprise Activities and Green Issues – Enablers and making the case for IT and Green Enterprise.

UNIT IV MANAGING AND REGULATING GREEN IT

Introduction – Strategizing Green Initiatives – Implementation of Green IT – Information Assurance – Communication and Social Media – Regulatory Environment and IT Manufacturers – Non-Regulatory Government Initiatives.

UNIT V GREEN IT: AN OUTLOOK

Green Building Standards – Green Data Centers – Social Movements and Greenpeace – **An Outlook:** Awareness to Implementations – Greening by IT – Green IT: A Megatrend? – A seven-step approach to creating Green IT Strategy – Research and Development Directions.

TEXT BOOK

San Murugesan, G. R. Gangadharan, "Harnessing Green IT Principles and Practices", Wiley Publication, 2018.

REFERENCE BOOKS

1. Gerardus Blokdyk, "Green Computing A Complete Guide - 2020", First Edition, 5starcooks, 2019.
2. Bud E. Smith, "Green Computing – Tools and Techniques for saving Energy, Money and Resources", CRC Press, 2017.

HUMAN MACHINE INTERACTION

(Course Code : 21PCAE11)

SEMESTER - I	ELECTIVE – I	HOURS - 4	CREDITS - 4

COURSE OUTCOMES

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

1. Identify the issues and challenges of User-Centric Design. **(K1)**
2. Describe User-Centric Computing Models. **(K2)**
3. Examine Contemporary Interfaces and Interactions. **(K3)**
4. Analyze Formal Models in User-Centric Computing. **(K4)**
5. Gradethe existing User-Centric Models. **(K5)**
6. Formulate the User Centric Computing Challenges. **(K6)**

UNIT I INTRODUCTION

Introduction – User-Centric Design – Genesis of the field – Issues and Challenges – Research Trends – User-Centric: An Engineering Perspective: Introduction – Engineering a Software System – Introduction to Usability – User-Centric Design.

UNIT II COMPUTATIONAL PERSPECTIVE AND CLASSICAL MODELS

User-Centric: A Computational Perspective: Introduction – A framework for User-Centric Computing – User-Centric Models – Models for User-Centric Computing – Broad Taxonomy of User-Centric Computing Models – Computational Models of Users – Classical Models: The GOMS Model – Models of specific User Behaviour – The Models and the Computational Framework.

UNIT III CONTEMPORARY INTERFACES AND INTERACTION

Computational Models of Users – Contemporary Interfaces and Interaction: WIMP Interactions – 2D Pointing and Scaling – Constrained Navigation on Interfaces – Mobile Typing – Touch Interaction – Computational Models of Users – Design Implications and Present State – Design Case Study: Virtual Keyboard.

UNIT IV FORMAL MODELS IN USER-CENTRIC COMPUTING

Models for Non-Traditional Interactions – Learning based Models – Emerging Trend in Interactive Systems–Formal Models in User-Centric Computing: Introduction – Use of formal Models and Issues – Formal Modeling of Dialog.

UNIT V USER-CENTRIC COMPUTING FOR EVALUATION

User-Centric Computing for Evaluation: Introduction – Evaluation with Experts – Evaluation with Users – Model-Based Evaluation – User-Centric Computing beyond GUI: Ubiquitous Systems – Introduction – Recent Trends: GUI and beyond – User-Centric Issues and Challenges – User-Centric Computing Challenges.

TEXT BOOK

Samit Bhattacharya, "Human Computer Interaction - User-Centric Computing for Design", First Edition, McGraw Hill Education, 2020.

REFERENCE BOOKS

1. Benjamin Weiss, "Talker Quality in Human and Machine Interaction", Springer, 2019.
2. Paul R. Daugherty, H. James Wilson, "Human + Machine", First Edition, Harvard Business Review Press, 2018.
3. Yogesh Karunakar, Mahesh Mali, "Human Machine Interaction", First Edition, Tech-Max Publications, 2017.

OPTIMIZATION TECHNIQUES

(Course Code : 21PCA21)

SEMESTER - II	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Identify the formulation and solving techniques of Linear Programming Problem. **(K1)**
2. Interpret the Two Phase method effectively. **(K2)**
3. Solve Integer Programming Problem. **(K3)**
4. Analyze the Assignment and Transportation Problems. **(K4)**
5. Evaluate the Sequencing Problems and Queueing Models. **(K5)**
6. Design the optimal solution using PERT and CPM techniques. **(K6)**

UNIT I INTRODUCTION, LINEAR PROGRAMMING PROBLEM

The Nature and Meaning of OR – Management – Applications of OR – Modeling in OR – General methods for solving OR models – Scope of OR .

Linear Programming Problem: Formulation of LP problems – Graphical solution of LP problems – General formulation of LPP – Slack and Surplus variables – Standard form of LPP – Some important forms of LPP – Simplex Method and its special cases.

UNIT II ARIFICIAL VARIABLE TECHNIQUES AND IPP

Artificial Variable Techniques: Two Phase method and special cases.

Integer Programming Problem: Importance – Definitions – Gromory's Pure Integer Programming Problem – Mixed Integer Programming Problem.

UNIT III ASSIGNMENT AND TRANSPORTATION PROBLEMS

Assignment Problem: Mathematical formulation – Hungarian method – Unbalanced assignment problem – Various types.

Transportation Model: Mathematical formulation – Matrix form – Methods for finding Initial Basic Feasible solution and Optimal solution – Degeneracy in Transportation Problems – Unbalanced Transportation Problem.

UNIT IV SEQUENCING PROBLEMS AND QUEUING MODELS

Sequencing Problems: Assumptions – Solutions to Sequencing Problems: Processing n jobs through 2 machines – Processing n jobs through 3 machines – Processing n jobs on m machines.

Queuing Models: Queuing System – Transient and Steady States – Kendal's Notation for representing Queuing Models – Various Models in Queuing System – Birth and Death Model.

UNIT V PERT AND CPM TECHNIQUES

PERT and CPM Techniques: Basic Steps – Network Diagram representation – Rules for drawing Network Diagram – Labeling Fulkerson's I-J Rule – Time Estimates and Critical Path in Network Analysis – Examples on optimum duration and minimum duration cost – PERT.

TEXT BOOK

S.D. Sharma, "Operations Research", Tenth Edition, Pearson, 2017.

REFERENCE BOOKS

1. Hamdy Taha, "Operations Research", Ninth Edition, Pearson, 2016.
2. V. Sundaresan, K.S. Ganapathy Subramanian, K. Ganesan, "Resource Management Techniques", Ninth Edition, A.R. Publications, 2015.

ADVANCED JAVA PROGRAMMING

(Course Code : 21PCA22)

SEMESTER - II	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe the History and Fundamentals of Java. **(K1)**
2. Explain about Inheritance, Package and Exception Handling. **(K2)**
3. Demonstrate the Multithreaded Programming. **(K3)**
4. Design the Applet using various Events and AWT controls**.(K6)**
5. Create Database Related Applications using JDBC**. (K6)**
6. Develop Servlet programs and JSP applications. **(K6)**

UNIT I INTRODUCTION TO JAVA

The History and Evolution of Java – Java buzz words – An overview of Java – Data types – Variables and Arrays – Operators – Control Statements – Introducing Classes – A Closer Look at Methods and Classes.

UNIT II INHERITANCE, PACKAGE, EXCEPTION HANDLING

Inheritance – Overriding methods – Abstract classes – Packages and Interfaces – Exception Handling.

UNIT III MULTITHREADING, STRING HANDLING

Multithreaded Programming – Java Thread Model – Synchronization – Messaging – Runnable Interface – Inter-thread Communication – Deadlock – Suspension – Resuming and Stopping threads – Multithreading – The Java Library – String Handling – String Buffer.

UNIT IV APPLET, EVENT HANDLING, AWT

Applet basics – Architecture – Applet Skeleton – Using status window – HTML Applet tags – Passing parameters to Applets – Methods available in Applets – Event handling: Event classes – Event Listener interfaces – Using the Delegation Event Model – Introducing the AWT: Working with Windows, Graphics, and Text – Using AWT Controls, Layout Managers, and Menus.

UNIT V JDBC, SERVLETS, JSP

JDBC: Types of drivers – Steps to establish connectivity – Example of connectivity. Java Servlets: Benefits of using a Servlet – A simple Java Servlet. Reading Data from a client – Sending Data to a client – Working with Cookies – Tracking Sessions. JSP: JSP Tags – Variable and Objects – Methods – Control Statements – Loops – Session Objects.

TEXT BOOKS

1. Herbert Schildt, "Java The Complete Reference**",** Eleventh Edition, Tata McGraw Hill, 2019.
2. Dr. K. Somasundaram, **"**Programming in Java2", Jaico Publishing House, 2005. **(JDBC)**
3. Jim Keogh, "The Complete Reference J2EE", First Edition, Tata McGraw Hill, 2017. (**Unit V**)

REFERENCE BOOKS

1. E.Balaguruswamy, "Programming with JAVA", Sixth Edition, McGraw Hill Education, 2019.
2. Rashmi Kanta Das, "J2EE Made Easy", First Edition, Vikas Publishing House, 2014.

WEB TECHNOLOGIES

(Course Code : 21PCA23)

SEMESTER - II	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Recall the basics of Web Technology. **(K1)**
2. Describe HTML, XML and DTD. **(K2)**
3. Experiment Element, Attribute and Entity **(K3)**
4. Infer the usage of Laravel framework along with PHP.**(K4)**
5. Evaluate PHP applications using Exception Handling. **(K5)**
6. Develop PHP applications using Database Connectivity. **(K6)**

UNIT I HTML AND CSS

Basic – Formatting tags – Links– Images – Frames – Lists – Tables – Forms – Entities – Cascading Style Sheets – Types – Properties: Background – Text – Border – Table – List.

UNIT II XML

Basic – Elements – Attributes – XML Namespace – Cascading Style Sheets – XSLT elements – XPath, XSL Formatting Objects – XLinks. Document type Definitions – Internal and External DTD declaration – DTD Elements declaration – DTD Attributes: Types and declaration – PCDATA –CDATA – Entities.

UNIT III BASICS OF LARAVEL

Introduction – Usage of Framework – Special about Laravel – How it works – Why Laravel – Setting up Laravel Development Environment – System requirements – composer – Local development environments – Creating a new Laravel project – Laravel's directory structure – Configuration – Up and running – Routing and Controllers – MVC – HTTP verbs – REST – Route definitions – Route groups – Views – Controllers.

UNIT IV BASICS IN PHP

Echoing data – PHP Syntax and Variables – Control Structures – Conditionals – Loops – Functions – PHP String Handling functions – PHP Number Handling functions – PHP Arrays – Cookies – Cookies in Laravel – Accessing the Cookie tool – Sessions – Accessing the session – Methods available on session instances – Flash session storage.

UNIT V DATABASE

Database Connections – Configuration – Query builder – Select – Insert – Update – Delete – Validation – Validation on the request object – Manual validation – Display Validation Error Messages – Handling Exceptions.

TEXT BOOKS

1. Thomas Powell, "The Complete Reference: HTML AND XHTML", Fifth Edition, Tata McGraw Hill Publication, 2010. **(Unit: I)**
2. Heather Williamson, "The Complete Reference: XML", First Edition, Tata McGraw Hill Publication, 2001**(Unit: II)**
3. Matt Stauffer, "Laravel: Up & Running: A Framework for Building Modern PHP Apps", Second Edition, O′Reilly Publishing, 2019. **(Unit: III - V)**

REFERENCE BOOKS

1. Julie C. Meloni, Michael Morrison, "Sams: Teach Yourself HTML and CSS in 24 Hours", Eighth Edition, Sams Publishing, 2010.
2. Sanjib Sinha, "Beginning Laravel Build Websites with Laravel 5.8", Second Edition, Apress, 2019
3. Jon Duckett, "PHP & MySQL Server-side Web Development", Wiley, 2021.

DATA STRUCTURES AND ALGORITHMS

(Course Code : 21PCA24)

SEMESTER - II	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. List the Data Structures. **(K1)**
2. Discuss basic knowledge about Dynamic Programming. **(K2)**
3. Examine the concepts of all the data structures. **(K3)**
4. Analyze to select appropriate data structures for the problem definition. **(K4)**
5. Evaluate the efficiency and Limitations of Algorithms. **(K5)**
6. Build programs for the operations on the data structures. **(K6)**

UNIT I INTRODUCTION

Introduction to Data Structures – Performance analysis – Space Complexity – Time Complexity – Asymptotic notations – Performance measurement – Arrays – Dynamically Allocated Arrays – Sparse Matrices – Abstract data type – Sparse matrix representation – Transposing a matrix.

UNIT II STACKS, QUEUES AND LINKED LIST

Stacks – Stacks using Dynamic Arrays – Queues – Circular Queues using Dynamic Arrays – Evaluation of Expressions – Evaluating Postfix Expression – Infix to Postfix – Singly Linked List and Chains – Linked Stacks and Queues.

UNIT III TREES

Introduction – Binary Trees –The ADT – Properties of Binary Trees–Binary Tree Representations – Binary Tree Traversals – In-Order Traversal – Preorder Traversal – Postorder Traversal – Binary Search Trees – Definition – Searching a Binary Search Tree.

UNIT IV DIVIDE-AND-CONQUER METHOD

Divide-And-Conquer Method: General Method – Binary Search – Finding the Maximum and Minimum – Merge Sort – Quick Sort. Greedy Method: General Method – Knapsack Problem – Tree Vertex Splitting – Job Sequencing with Deadlines – Minimum Cost Spanning Trees – Single Source Shortest Path Problem.

UNIT V DYNAMIC PROGRAMMING

Dynamic Programming: General Method – Multi Stage Graph – All Pair Shortest Path Problem – Single Source Shortest Path Problem – 0/1 Knapsack Problem – Reliability Design – Travelling Sales Man Problem – Flow Shop Scheduling.

TEXT BOOKS

1. Ellis Horowitz, Sartaj Sahani, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press (India) Private Limited, Hyderabad. **(Units : I, II & III)**
2. Ellis Horowitz and Sartaj Sahani, "Fundamentals of Computer Algorithms", Computer Science Press Inc., Galgotia Book Sources Publications, New Delhi, 2014. **(Units : IV & V)**

REFERENCE BOOKS

1. Seymour Lipschutz, "Data Structures", Special India Edition, McGraw Hill Education (India) Pvt. Ltd., 2013.
2. G. A. Vijayalakshmi Pai, "Data Structures and Algorithms Concepts, Techniques and Applications", Tata McGraw Hill Publishing Company Limited, New Delhi 2008.
3. A.Chitra, P.T.Rajan, "Data Structures", Second Edition, Vijay Nicole Imprints Private Limited, 2016.

PRACTICALS: ADVANCED JAVA PROGRAMMING

(Course Code : 21PCAL25)

SEMESTER - II	CORE	HOURS - 5	CREDITS - 2

1. Program using simple Java Classes.
2. Program using Constructor.
3. Program using Method Overloading.
4. Program using Inheritance. (Single, Multilevel)
5. Program using Interface.
6. Program using Exception Handling.
7. Program using Package.
8. Program using Multithreading.
9. Design a Simple Calculator using Applet.
10. Program using AWT Controls (Text, Button, Checkbox, Radio Button).
11. Program using JDBC (Insert, Update and Delete Records in the Database).
12. Servlet Life Cycle Program.
13. Implementing Cookies using Servlet.
14. Implementing Session Tracking using JSP
15. Accessing Database with JSP using JDBC.

PRACTICALS: WEB TECHNOLOGIES

(Course Code : 21PCAL26)

SEMESTER - II	CORE	HOURS - 5	CREDITS - 2

1. Design a web page in HTML using frames.
2. Design a web page in HTML using tables.
3. Design a web page in HTML using forms.
4. Design a web site using INLINE and INTERNAL CSS.
5. Design a web site with navigation menus with EXTERNAL CSS
6. Design a web page in XML using CSS.
7. Design a web page in XML using XSLT.
8. Design a web page in XML using INTERNAL DTD.
9. Design a web page in XML using EXTERNAL DTD.
10. Design a web site in PHP using string functions.
11. Design a web site in PHP using Numeric functions.
12. Design a web site in PHP using forms.
13. Design a web site in PHP using cookies.
14. Design a web site in PHP using session.
15. Design a web site in PHP using database.

ACCOUNTING AND FINANCIAL MANAGEMENT

(Course Code : 21PCAE21)

SEMESTER - II	ELECTIVE - II	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe about general aspects of business operations in financial transactions**.(K1)**
2. Explain about the Financial Statements (Balance Sheet, Fund Flow Statement). **(K2)**
3. Apply cost accounting methods to evaluate and project business performance. **(K3)**
4. Outline the ethical issues related to the accounting profession. **(K4)**
5. Evaluate Operating as well as Working Capital Management. **(K5)**
6. Create Financial Statements in accordance with Generally Accepted Accounting Principles. **(K6)**

UNIT I ACCOUNTING

Accounting Principles – Concepts – Conventions – Accounting as a System for Decision-Making – Financial Accounting – and Cost Accounting – Management Accounting.

UNIT II FINANCIAL STATEMENTS

Preparation of Financial Statement: Balance Sheet – Income Statement – Statement of Changes in Financial Position – Fund Flow Statement and Cash Flow Statement.

UNIT III FINANCIAL ANALYSIS

Financial Ratio Analysis – Liquidity Ratios – Activity Ratios – Solvency Ratios and Profitability Ratios. Analysis and Interpretation of Financial Statements (With Simple Problems)

UNIT IV COST ANALYSIS

Techniques of Cost Analysis – Cost Classifications: Preparation of a Cost Sheet – Methods of Costing – Output Costing – Job Order Costing – Batch Costing – Operating Costing – Marginal Costing – CVP Analysis for Profit Planning (With Simple Problems).

UNIT V COST CONTROL

Techniques – Standard Costing – Analysis of Variances – Material Cost Variance – Labour Cost Variance – Overheads Variance – Sales Variance (Simple Problems).

TEXT BOOKS

1. S.P. Jain, K L Narang, “Cost Accounting: Principle & Practice”, Kalyani Publishers, 2014.
2. I.M. Pandey, “Financial Management”, Eleventh Edition, Vikas Publishing House, 2016.
3. Ambrish Gupta, “Financial Accounting for Management”, Fifth Edition, Pearson Publishers, 2016.

REFERENCE BOOKS

1. Prasanna Chandra,” Financial Management, Theory and Practice”, Tenth Edition, McGraw Hill, 2019.
2. M.Y. Khan, P.K Jain, “Financial Management”, Third Edition, McGraw Hill Education, 2017.

E-COMMERCE

(Course Code : 21PCAE21)

SEMESTER - II	ELECTIVE - II	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe the foundations and importance of E-Commerce. **(K1)**
2. Summarize various business models of E-Commerce. **(K2)**
3. Demonstrate the impact of E-Commerce on the existing Business Models and Strategy. **(K3)**
4. Analyze the E-Commerce Security Environment. **(K4)**
5. Evaluate the present marketing concepts. **(K5)**
6. Integrate the Social networks for the development of E-Commerce. **(K6)**

UNIT I INTRODUCTION

Introduction to E-Commerce: The revolution is just beginning – E-Commerce: A Brief History – Understanding E-Commerce: Organizing Themes.

UNIT II E-COMMERCE BUSINESS MODELS

E-Commerce Business Models and Concepts – The Internet and World Wide Web: E-Commerce infrastructure: E-Commerce Business Models – Major Business-to-Consumer (B2C) Business Models – Major Business- to-Business (B2B) Business Models – Business Models in emerging E-commerce areas – How the Internet and the Web change business: Strategy – Structure and process – The Internet: Technology Background – The Internet Today – Internet II – The Future Infrastructure – The World Wide Web – The Internet and the Web: Features.

UNIT III SECURITY THREATS AND PAYMENT SYSTEM

Building an E-Commerce Web Site – Security and Payment: Building an E-Commerce Web Site: A Systematic Approach – The E-Commerce Security Environment – Security threats in the E-Commerce Environment – Technology solution – Management Policies – Business procedures – Public Laws – Payment System – E-Commerce Payment System – Electronic Billing Presentment and Payment.

UNIT IV E-COMMERCE MARKETING CONCEPTS

E-Commerce Marketing Concepts – Online Retailing and Services: Consumer Online: The Internet Audience and Consumer Behaviour – Basic Marketing Concepts – Internet Marketing Technologies – B2C and B2B E-Commerce Marketing and Business Strategies – The Retail Sector – Analyzing the viability of Online Firms – E-Commerce in action: E-tailing Business Models – Common Themes in Online Retailing – The Service Sector: Offline and Online – Online Financial Services – Online Travel Services – Online Career Services.

UNIT V SOCIAL NETWORKS AND E-COMMERCE PORTALS

Social networks – Auctions – Portals: Social Networks and Online Communities – Online Auctions – E-Commerce Portals.

TEXT BOOK

Kenneth C. Laudon, E-Commerce: Business, Technology, Society, Tenth Edition, Pearson, 2016.

REFERENCE BOOKS

1. David Whiteley, "E-Commerce – Strategy, Technologies and Applications", Indian Edition, McGraw Hill Education, 2017.
2. S. J. Joseph, "E-Commerce: an Indian Perspective", Sixth Edition, PHI, 2019.

ORGANIZATIONAL STRUCTURE AND HUMAN RESOURCE MANAGEMENT

(Course Code : 21PCAE21)

SEMESTER - II	ELECTIVE - II	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe the principles and dynamics of Organizational Structure. **(K1)**
2. Interpret the Group Dynamics and Leadership. **(K2)**
3. Predict the challenges of Human Resources Management. **(K3)**
4. Analyze the Performance Evaluation of the Human Resources. **(K4)**
5. Evaluate Human Resource Planning and Communication. **(K5)**
6. Create Human Resource Motivation. **(K6)**

UNIT I ORGANIZATIONAL STRUCTURE

Organization: Meaning – Function –Types – Formal and Informal Structures of Organization – Principles of an Organization – Tall and flat Organization – Organizational Authority – Life and Staff Organization –Departmentation: Meaning – Importance – Types.

UNIT II INDIVIDUAL DIFFERENCES –GROUP DYNAMICS

Personality – Types – Traits – Individual Differences – Factors influencing – Individual's behavior and differences -Definition and Importance of Group Dynamics – Types of groups – Group Formation – Group Cohesiveness – Group Development – Decision making in groups – Conflict Management – Principle – Central approach to team development – Leadership: Meaning – Styles and Theories – Quality of an effective leader.

UNIT III HUMAN RESOURCES MANAGEMENT

Concepts – Evolution – Objectives and Functions of HR Management – HR Management as a profession – Challenges for the HR Executives of today – HR Management in India.

UNIT IV HUMAN RESOURCES PLANNING

Human Resources Planning – Job analysis – Selection – Orientation and Placement – Training and Development – Communication : Definition – Characteristic – Process and barriers.

UNIT V HUMAN RESOURCES MOTIVATION

Motivation: Meaning – Process and theories need hierarchy – XY and two factor theories – Performance Evaluation: Meaning – Objective and Methods.

TEXT BOOKS

1. L.M. Prasad, "Principles of Management", Sultan Chand & Sons, 2007. **(Unit-I)**
2. J. Jayasankar, "Organisational Behaviour", Margham Publication, 2012.**(Unit-II)**
3. C.B. Momoria, "Human Resource Management", Margham Publication, 2017. **(Units: III - V)**

REFERENCE BOOKS

1. Koontz and O'Donol, "Principles of Management".
2. Dr. K. Aswathappa, "Organizational Behaviour", Himalaya Publishing Hall, 2019.
3. Dessler, Varkkey, "Human Resource Management", Eleventh Edition, Pearson Education India, 2015.

PYTHON PROGRAMMING

(Course Code : 21PCA31)

SEMESTER - III	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES

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

1. Describe the types of Operators, Input/Output and Control Statements. **(K1)**
2. Interpret Arrays, Lists and Tuples. **(K2)**
3. Demonstrate the various operations on Strings. **(K3)**
4. Illustrate Database Connectivity and Data Visualization. **(K4)**
5. Evaluate Dictionaries and Object Oriented Programming concepts in Python. **(K5)**
6. Design Stacks and Queues and integrate various GUI tools. **(K6)**

UNIT I INTRODUCTION

Introduction to Python: Features of Python – Writing the First Python Program – Executing a Python Program – Data types in Python – Literals – Operators – Input and Output – Control Statements.

UNIT II ARRAYS, STRINGS, FUNCTIONS AND TUPLES

Creating an Array – Indexing and Slicing on Arrays – Types of Arrays – Working with arrays using numpy - Slicing and Indexing in numpy Arrays – Working with Multi-dimensional Arrays – Indexing and Slicing the Multi-dimensional Arrays – Creating Strings – Indexing, Slicing and Comparing Strings – Finding and Counting Substrings – Splitting and Joining Strings – Defining and Calling a Function – Pass by Object Reference – Anonymous Functions or Lambdas – Lists – Creating and Updating the Elements of a List – Methods to Process Lists – Creating Tuples – Functions to process Tuples – Inserting, Modifying and Deleting Elements from a Tuple.

UNIT III DICTIONARIES AND INTRODUCTION TO OOPS

Operations on Dictionaries – Dictionary Methods – Creating a Class – Types of Variables – Types of Methods – Constructors in Inheritance – Types of Inheritance – Operator Overloading – Method Overloading and Overriding – Interfaces in Python – Regular Expressions in Python.

UNIT IV DATA STUCTURES AND GRAPHICAL USER INTERFACE

Linked Lists – Stacks – Queues – **Graphical User Interface:** The Root Window – Working with Containers – Canvas – Frame – Widgets – Button Widget – Label Widget – Message Widget – Text Widget – Scrollbar Widget – Checkbutton Widget – Radiobutton Widget – Entry Widget – Listbox Widget – Menu Widget – Creating Tables – Sending a Simple Mail.

UNIT V DATABASE CONNECTIVITY AND DATA SCIENCE USING PYTHON

Database Connectivity: Types of Databases used with Python – Using MySQL from Python – Retrieving all rows from a Table – Inserting, Deleting and Updating rows in a Table – Creating Database Tables using Python – **Data Science using Python:** Data Frame and Data Visualization.

TEXT BOOK

Dr. R. Nageswara Rao, "Core Python Programming", Second Edition, Dreamtech Press, 2019.

REFERENCE BOOKS

1. Martin C. Brown, "The Complete Reference Python", Indian Edition, McGraw Hill Education, 2018.
2. Yashavant Kanetkar, Aditya Kanetkar, "Let us Python", Second Edition, BPB Publications, 2019.

ANDROID PROGRAMMING

(Course Code : 21PCA32)

SEMESTER - III	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Tabulate the Activity Life cycle and different types of Layouts. **(K1)**
2. Differentiate the Widgets, Menus and Fragments. **(K2)**
3. Experiment Database Connectivity using SQLite, Alerts and Notification. **(K3)**
4. Analyse the Sensor Data and apply transition to the animation. **(K4)**
5. Verify playing audio with mediaplayer. **(K5)**
6 Compose and receive SMS and getting the device location. **(K6)**

UNIT I ACTIVITIES AND LAYOUTS

Activities: Introduction – Declaring an Activity – Starting a new Activity with an intent object – Switching between Activities – Passing data to another Activity – Storing persistent Activity Data – Understanding the Activity Life cycle – **Layouts:** Defining and inflating a Layout – Using Relative and Linear Layout – Creating Tables – TableLayout and GridLayout – RecyclerView – Changing Layout properties during runtime.

UNIT II VIEWS, WIDGETS, MENUS AND FRAGMENTS

Views, Widgets and Styles: Inserting a Widget into a Layout – Using graphics to show button state – Creating a Widget at runtime – Applying a Style to a View – **Menus and Action Mode:** Creating an options menu – Modifying Menus and Menu items during runtime – Enabling Contextual Action Mode for a View – Creating a Pop-up Menu – **Fragments:** Creating and Using a Fragment – Adding and Removing Fragments during runtime.

UNIT III USING SQLite DATABASE, ALERTS AND NOTIFICATIONS

Home Screen Widget and the System UI: Creating a Homescreen Widget – Adding Search to the Action Bar – **Data Storage:** Creating and using an SQLite Database – Accessing data in the background using a Loader – **Alerts and Notifications:** Creating a Toast with a custom layout – Displaying a Messagebox with AlertDialog – Displaying a Progress Dialog – Creating a MediaPlayer Notification.

UNIT IV SENSORS, GRAPHICS AND ANIMATION

Using the Touchscreen and the Sensors: Listening for click and long-press events – Recognizing tap and other common gestures – Listing available sensors – An introduction to the Android Sensor Framework – Reading Sensor Data – Using Android Sensor Framework events – **Graphics and Animation:** Scaling down large images to avoid Out of Memory Exceptions – A transition animation – Defining scenes and applying a transition – Creating a Compass using sensor data and RotateAnimation – Creating a Slideshow with ViewPager.

UNIT V USING CAMERA AND SENDING SMS

Multimedia: Playing Audio with MediaPlayer – Taking a Photo with the default camera – **Telephony, Networks and the Web:** How to send SMS (text) messages – Receiving SMS messages – Displaying a web page in your application – Location and Using Geofencing: How to get the device location – Creating and Monitoring a Geofence.

TEXT BOOK

Rick Boyer, "Android 9 Development Cookbook", Third Edition, Packt Publishing Limited, 2018.

REFERENCE BOOKS

1. Dawn Griffiths and David Griffiths, "Head First Android Development", Second Edition, Shroff/O'Reilly, 2018.
2. John Horton, "Android Programming for Beginners", Second Edition, Packt Publishing Limited, 2018.
3. M. M. Sharma, Rashmi Aggarwal, "Android Programming for Beginners", First Edition, BPB Publications, 2018.

DATA COMMUNICATION AND COMPUTER NETWORKS

(Course Code : 21PCA33)

SEMESTER - III	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe how computer networks are organized with the concept of layered approach. **(K1)**
2. Describe how packets in the Internet are delivered. **(K2)**
3. Implement a simple LAN with hubs, bridges and switches. **(K3)**
4. Analyze the contents in a given Data Link layer packet, based on the layer concept. **(K4)**
5. Decide routing entries given a simple example of network topology. **(K5)**
6. Design logical sub-address blocks with a given address block. **(K6)**

UNIT I INTRODUCTION, BASIC CONCEPTS, REFERENCE MODEL, MEDIA

Introduction: Data Communications – Networks - Network Types – Internet History – Standards and Administration, **Networks Models**: Protocol Layering – TCP/IP Protocol suite – The OSI model – **Basic Concepts**: Line Configuration – Topology – Transmission modes.

UNIT II ERRORS, DATA LINK CONTROL, LAN, MAN

Error Detection and Correction: Types of Errors – Detection – VRC – LRC – CRC – Checksum – Error Correction – **Data Link Control**: Line Discipline – Flow Control – Error Control **– LAN**: Project 802 – Ethernet – Token Bus – Token Ring – FDDI – **MAN**: IEEE 802.6 – SMDS.

UNIT III PPP, ISDN, X.25, FRAME RELAY, SWITCHING

PPP: Transmission States – Layers – LCP – Authentication – NCP – **ISDN**: Services – History – Layers – B-ISDN – Future – X.25: Layers – other X.25 protocols – **Frame Relay**: Introduction – Operation – Layers – Congestion control – Leaky Bucket. **Bandwidth Utilization**: Multiplexing and Spread Spectrum. **Switching**: Introduction – Circuit Switched Networks and Packet switching.

UNIT IV ATM, NETWORK DEVICES, TRANSPORT LAYER

ATM: Design Goals – Architecture – Layers – Applications – **Network Devices**: Repeaters – Bridges – Routers – Gateways – Other Devices – Routing Algorithms – Distance Vector – Link State – **Transport Layer**: Duties – Connection – OSI Transport Protocol.

UNIT V UPPER OSI LAYERS, TCP/IP-PART-I, TCP/IP-PART-II

Upper OSI Layers: Session Layer – Presentation Layer – Application Layer – **TCP/IP Protocol Suite-Part-I**: Overview – Network Layer – Addressing – Sub netting – Transport Layer - **TCP/IP Protocol Suite-Part-II**: C/S Model – BOOTP, DHCP – DNS – Telnet – FTP, TFTP – SMTP – SNMP – HTTP – WWW. **Network layer Protocols**: Internet Protocol - ICMPv4 - Mobile IP.

TEXT BOOK

Behrouz A. Forouzan, "Data communications and Networking", Fourth Edition, Tata McGrawHill, 2017.

REFERENCE BOOKS

1. Andrew S. Tanenbaum, "Computer Networks", Fifth Edition Illustrated, PHI, 2013.
2. William Stallings, "Data and Computer Communication", Tenth Edition, Pearson Education, 2014.

DATA SCIENCE WITH CLOUD COMPUTING

(Course Code : 21PCA34)

SEMESTER - III	CORE	HOURS - 4	CREDITS - 4

COURSE OUTCOMES

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

1. Describe Data Pre-processing methods and Data Warehouse. **(K1)**
2. Discuss Cloud Security and Standards. **(K2)**
3. Demonstrate Cloud Infrastructure and Cloud Accessing. **(K3)**
4. Analyze the Frequent Itemset Mining Methods and Association Rules. **(K4)**
5. Assess Cloud-Based Services. **(K5)**
6. Develop Cloud-Based Applications. **(K6)**

UNIT I INTRODUCTION AND DATA PRE-PROCESSING

Data Mining: Introduction – Data Mining: On what kind of data – Data Mining Functionalities– What kind of patterns to be mined – Classification of Data Mining Systems – Data Mining task primitives – Integration of a Data Mining Systems with a Database or Data Warehouse Systems –Major issues in Data Mining.

Data Pre-processing: Descriptive Data Summarization – Data Cleaning –Data Integration and Transformation – Data Reduction –Data Discretization and Concept Hierarchy Generation.

UNIT II DATA WAREHOUSE AND ASSOCIATION RULES

Data Warehouse and OLAP technology: What is Data Warehouse? – A Multidimensional Data Model – Data Warehouse Architecture – Data Warehouse implementation –Development of Data Cube Technology – Multi dimensional Data Analysis in Cube Space.

Basic concepts – Efficient and Scalable Frequent Itemset Mining Methods – Mining Various Kinds of Association Rules - From Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT III CLOUD COMPUTING – IAAS, PAAS, SAAS

The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization – Communication as a Service – Infrastructure as a Service – Monitoring as a Service – Platform as a Service – Software as a Service.

Building Cloud Networks – Evolution from MSP to cloud – The Cloud Data Center – Service Oriented Architectures – Basic Approach to Data Centered SOA.

UNIT IV SECURITY AND COMMON STANDARDS

Security in the Cloud – Challenges – Security Governance – Risk Management – Security Awareness – Security Monitoring and Incident Response – Security Architecture Design – Data Privacy – Governance – Security.

Common Standards in Cloud Computing – Standards for Application Developers – Standards for Messaging.

UNIT V CLOUD BASED SERVICES AND APPLICATIONS

Cloud Based Services and Applications – Cloud Services and Platforms – Compute Services – Storage Services – Database Services – Application Services – Content Delivery Services – Analytic & Deployment Services.

Hadoop & MapReduce – Job Execution – Schedulers – Cluster Setup – Cloud Application Development using Python.

TEXT BOOKS

1. Jiawei Han, MichelineKamberJian Pei, "Data Mining: Concepts and Techniques", Third Edition, Morgan Kauffman Publishers, 2012. **(Unit : I& II)**
2. John W. Rittinghouse, James F. Ransome "Cloud Computing – Implementation, Management and Security, Second Edition, CRC Press, 2017. **(Unit : III & IV)**
3. ArshdeepBahga, Vijay Madisetti, "Cloud Computing – A Hands-on Approach", Universities Press, 2018. **(Unit : V)**

REFERENCE BOOKS

1. Mohammed J.Zaki, Wagner Meira JR, "Data Mining and Analysis", First Edition, Cambridge University Press, 2014.
2. Charu C. Aggarwal, "Data Mining", First Edition, Springer, 2015
3. Anthony . T. Velte, Toby J. Velte, Robert Elsen Peter, " Cloud Computing A Practical Approach", McGraw Hill, 2014.
4. Michael Miller, "Cloud Computing: Web Based Applications that change the way you work and collaborate online", Eighth Impression, Pearson Education, 2013.
5. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall, 2013.

PRACTICAL: PYTHON PROGRAMMING

(Course Code : 21PCAL35)

SEMESTER - III	CORE	HOURS - 5	CREDITS - 2

1. Program using Control Structures.
2. Program using Arrays.
3. Program using Strings.
4. Program using Lists.
5. Program using Tuples.
6. Program using Dictionaries.
7. Program using Inheritance.
8. Program using Interfaces.
9. Program using Regular Expressions.
10. Program to perform Stack Operations.
11. Program to perform Queue Operations.
12. Working with Widgets.
13. Program to perform Insert, Delete and Update operations using Database.
14. Program to create and perform operations using Data Frames.
15. Program to implement Data Visualization.

PRACTICAL: ANDROID PROGRAMMING

(Course. Code : 21PCAL36)

SEMESTER - III	CORE	HOURS - 5	CREDITS - 2

1. Program to implement Activity Life cycle.
2. Program to illustrate different layouts using simple controls.
3. Program using Views and Styles.
4. Program using Menus and Pop-up Menus.
5. Program using Fragments.
6. Program to perform Insert, Delete and Update operations in a Database using SQLite.
7. Program to create Toasts.
8. Program using AlertDialog messagebox.
9. Program using ProgressDialog.
10. Program using Notification.
11. Program using Android Sensor Framework events.
12. Program using Widgets.
13. Program to send and receive SMS.
14. Program to display a web page in an application.
15. Program to get the device location.

SOFTWARE ENGINEERING

(Course Code : 21PCAE31)

SEMESTER - III	ELECTIVE - III	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe the Professional Software Development & Software Process Models. **(K1)**
2. Summarize the Software Functional & Non Functional Requirements. **(K2)**
3. Illustrate Different Software Testing Methodologies **(K3)**
4. Analyze the System Dependability & Security. **(K4)**
5. Decide the Benefits and Problems of Reusing Software When Developing New Systems. **(K5)**
6. Design the Basic Project Management Practices in Real Life Projects. **(K6)**

UNIT I INTRODUCTION TO SOFTWARE ENGINEERING

Introduction: Professional Software Development – Software Engineering Ethics - **Software Process:** Software Process Models – Process Activities – Copying with change. **Agile Software Development:** Agile methods – Agile development techniques - Agile project management.

UNIT II REQUIREMENT ENGINEERING & SOFTWARE TESTING

Functional and Non-functional Requirements – Requirement Engineering Processes- Elicitation – Specification – Validation - Change. System Modeling: Context Models – Interaction Models. Architectural Design: Architectural Patterns – Application Architectures. Software Testing: Development Testing – Test Driven Development – Release Testing – User Testing.

UNIT III SYSTEM DEPENDABILITY & SECURITY

Dependable Systems: Dependability Properties – Dependable processes – Formal methods and system dependability. Reliability Engineering: Reliability and availability – Reliability requirements – Reliability testing. Safety Engineering: Safety-critical systems – Safety requirements – Safety engineering processes. Security Engineering: Security and dependability – Security and organizations – Security requirements – Security testing and assurance.

UNIT IV ADVANCED SOFTWARE ENGINEERING

Component Based Software Engineering: Component and Component Models – CBSE Processes – Component Composition. Distributed Software Engineering: Distributed Systems – Client Server Computing – Architectural Patterns for Distributed Systems. Real-time Software Engineering: Embedded Systems Design – Architectural Patterns for real-time systems – Real-time operating systems.

UNIT V SOFTWARE MANAGEMENT

Project Management: Risk Management – Managing People. Project Planning: Software Pricing – Project Scheduling – Estimation Techniques. Quality management: Software quality – Software standards – Reviews and inspections. Configuration Management: Version management – System building – Change management - Release management.

TEXT BOOK

Ian Sommerville, "Software Engineering", Tenth Edition, Pearson Publication, 2016.

Chapters: 1-6, 8, 9, 10, 11, 12, 13, 16, 17, 21, 22, 23, 25

REFERENCE BOOKS

1. Rajib Mall, "Fundamentals of Software Engineering", Fifth Edition, PHI Learning Private Ltd., 2018.
2. Roger Pressman S., "Software Engineering: A Practitioner's Approach", Eighth Edition, McGraw Hill, 2019.

INTERNET OF THINGS

(Course Code : 21PCAE31)

SEMESTER - III	ELECTIVE - III	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Describe the characteristics, physical and logical design of IoT. **(K1)**
2. Differentiate IoT and M2M. **(K2)**
3. Examine various Amazon web services for IoT. **(K3)**
4. Illustrate IoT using various case studies. **(K4)**
5. Develop applications using Raspberry Pi with Python. **(K6)**
6. Perform data analysis using Mapreduce Programming Model. **(K6)**

UNIT I INTRODUCTION AND DOMAIN SPECIFIC IOTS

Introduction – Definition and Characteristics of IoT – Physical design of IoT – Logical Design of IoT – IoT enabling technologies – Domain Specific IoTs: Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Lifestyle.

UNIT II IOT SYSTEM MANAGEMENT AND DESIGN METHODOLOGY

IoT and M2M: Introduction – M2M – Difference between IoT and M2M – SDN and NFV for IoT – Software Defined Networking – Need for IoT System Management SNMP – Network operator requirements – NETCONF – YANG – IoT System Management with NETCONF-YANG – IoT Design methodology.

UNIT III IoT SYSTEMS LOGICAL DESIGN AND PHYSICAL DEVICES

IoT Systems – Logical Design using Python – Python data types and data structures – Control flow – Functions – Modules – Packages – File Handling – Date/Time operations – Classes – Python packages for IoT – IoT Physical devices and endpoints: Basic building blocks of IoT devices – Exemplary device: Raspberry Pi – Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming Raspberry Pi with Python.

UNIT IV IOT PHYSICAL SERVERS, WEB SERVICES AND CASE STUDIES

Introduction to Cloud storage models and Communication APIs – WAMP – Python Web Application Framework - DJANGO – Amazon Web Services for IoT – Amazon EC2 – Amazon Autoscaling – Amazon S3 – AmazonRDS – Case studies illustrating IoT – Smart Lighting – Home Intrusion System – Forest Fire Detection – Smart Irrigation – IoT printer.

UNIT V DATA ANALYTICS AND TOOLS FOR IOT

Introduction – Apache Hadoop – Mapreduce Programming Model – Hadoop Mapreduce Job Execution – Mapreduce Job Execution Workflow – Hadoop Cluster Setup – Tools for IoT – Chef – Setting up Chef – Chef Case studies – Puppet – Puppet case study.

TEXT BOOK

Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", First Edition, Universities Press, 2016.

REFERENCE BOOKS

1. Anand Tamboli, "Build your own IoT Platform", First Edition, APress, 2019.
2. Yashavant Kanetkar, Shrirang Korde, "21 IOT Experiments", BPB Publications, 2018.
3. Raj Kamal, "Internet of Things Architecture and Design Principles", First Edition, Mc Graw Hill Education, 2017.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(Course Code: 21PCAE31)

SEMESTER - III	ELECTIVE - III	HOURS - 4	CREDITS - 4

COURSE OUTCOMES:

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

1. Define the Artificial Intelligence Concepts and Components. **(K1)**
2. Interpret the Types of Heuristic Search Techniques. **(K3)**
3. Examine the Knowledge Engineering Techniques, Principles and Methodologies. **(K4)**
4. Analyze the Advanced Knowledge Representation Techniques. **(K5)**
5. Evaluate the Natural Language Processing Parsing Techniques. **(K6)**
6. Design Hybrid Machine Learning Model. **(K6)**

UNIT 1 AI INTRODUCTION

Artificial Intelligence: Concept & Definition – History of AI – Related Concepts about AI – Physical Symbol System Hypothesis – Comparison of Human and Computer Skills – Practical Systems Based on AI – The Development of Logic – Components of AI – Parallel and Distributed AI – **PROBLEM SOLVING THROUGH AI :** Introduction - Representation the AI Problems – Production System – Examples of AI Problems – Nature of AI Problems – Search Techniques.

UNIT II SEARCH TECHNIQUES

Heuristic Search – Introduction – Concept of Heuristic Knowledge – Designing of Heuristic Function – Types of Heuristic Search Techniques – **INTRODUCTION TO KNOWLEDGE:** Types of Knowledge - Knowledge Representation – Knowledge Store – Knowledge Acquisition – Knowledge Organization and Management – Basic Concepts of Knowledge Engineering - Knowledge Engineering Techniques - Knowledge Engineering Principles - Knowledge Engineering Methodologies.

UNIT III ADVANCED KNOWLEDGE REPRESENTATION TECHNIQUES

Introduction – Frames – Semantic Network – Conceptual Graphs – Conceptual Dependencies – Script – Object Oriented Representation – Object – Message – Method – Class and Hierarchies – Object Oriented Languages – **PROGRAMMING LANGUAGES :** Introduction – Prolog – Lisp – Declarative vs. Procedural Language – Programming in Prolog – Programming in Lisp – Small Talk – POP 11.

UNIT IV REASONING WITH UNCERTAINTY

Introduction – Representing Uncertain Knowledge – Reasoning with Uncertain Knowledge – Probabilistic Reasoning – Default Reasoning – **NATURAL LANGUAGE PROCESSING:** Brief History of NLP – Early NLP Systems – Role of Knowledge in NLP – English Grammar – Phases of Natural Language Processing – Parsing Techniques – Human Parsing – Approaches to Semantic Analysis – Computational Grammar – Natural Language Generation – Speech Recognition.

UNIT V EXPERT SYSTEMS

Learning: An Introduction – Types of Learning – Genetic Algorithm – Planning – Understanding – Applications of AI – Neural Networks – Pattern Recognition – Computer Vision – **EXPERT SYSTEMS:** Introduction – Expert and Expert Systems – Successive Development of Expert Systems – Human Experts vs. Expert Systems – Characteristics of an Expert Systems – Expert System Architecture – Inference Engine – Knowledge Base Editor – Knowledge Acquisition Facilities – Design of Expert Systems – Types of Expert Systems – Domain Exploration – Expert System Shell.

TEXT BOOK

Ela Kumar, "Artificial Intelligence", Dreamtech Press, 2020

REFERENCE BOOK

1. Tom M. Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2017.
2. Kevin Knight Elaine Rich, "Artificial Intelligence", Third Edition, McGraw Hill Education, 2017.

MINI PROJECT

(Course Code : 21PCAR31)

SEMESTER - III	CREDITS - 4

Every student is required to carry out Mini Project work during the II Semester summer vacation under the supervision of a project guide provided by the Head of the Department of Computer Applications. The project guide shall monitor progress of the student continuously. Two reviews and Viva-Voce will be conducted during the III semester.

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

- Utilize the application of knowledge and techniques in theoretical classes for developing the software for real problems.
- Gain deeper understanding in specific functional areas.
- Explore career opportunities in their areas of interest.

The course MCA Mini Project is one that involves Requirement Analysis, Feasibility Analysis, Database Design, Coding, Testing, Implementation and Maintenance.

PROJECT WORK AND VIVA VOCE

(Course Code : 21PCA41)

SEMESTER - IV	CREDITS - 14

MCA students are required to complete a Major Project in the IV semester. This project is basically for the implementation of the various technologies learned during all the three semesters in the real life scenario. The training would impart practical exposure to all the students in the industry. The students will be doing projects related to the different specialization areas.

OBJECTIVE OF MAJOR PROJECT

The primary objective of Major Project is to develop an application using practical experience and understanding of the theoretical principles learnt in previous semesters of MCA. Major Project is oriented towards developing the skills, knowledge and attitude needed to make an effective start as a member of the computer/IT profession.

Some of the expected advantages of Major Project to be gained by an MCA graduate:

- Systematic introduction to the ways of industry and developing talent and attitude, so that he/she can enjoy fully, a career in IT industry (as a Software Developer/ Trainee/ Software Engineer/Database Administrator etc.)
- Recognizing his/her responsibilities as a professional of the future.
- Understanding real life situations in industrial organizations and their related environments and accelerating the learning process of how his/her knowledge could be used in a realistic way.
- Understanding the formal and informal relationship in an industrial organization so as to promote favorable human relations and teamwork.
- Appreciating that IT is an expanding field and that learning has no limitations.
- Understanding that the problems encountered in the industry have unique solution and gaining experience to select the optional solution from the many alternatives available.

SELF STUDY PAPERS

CYBER SECURITY

(Course Code : 21PCAS01)

SEMESTER - I	SELF STUDY	CREDITS - 3

COURSE OUTCOMES:

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

1. Examine the types of information systems and security. **(K1)**
2. Describe about types of threats and attacks. **(K2)**
3. Demonstrate encryption and digital signatures. **(K3)**
4. Analyze firewalls and virtual private networks. **(K4)**
5. Measure the Network Security and Firewall. **(K5)**
6. Design Copyright Act and Intellectual Property Law. **(K6)**

UNIT I INTRODUCTION

Introduction to Information Systems – Elements of Information Systems – Introduction to Security issues and techniques: Information Security – Computer Security – Network Security – Application Security – Need for Information Security – Information Assurance and Security Risk Analysis.

UNIT II TYPES OF THREATS AND ATTACKS

Introduction to Threats and Threat Vectors – Threat Sources and Targets – Types of Threats: Viruses – Worms – Trojans – Advanced Persistent Threats (APT's) – Steganography – Types of Attacks: Manual – Physical – Network and Application Layer Attacks; Electronic Payment System – e-Cash – Credit/Debit Cards.

UNIT III DATA/INFORMATION SECURITY

Data/Information Security: Introduction to Structured and Unstructured Data – Approaches to Securing Unstructured Data – Data Loss Prevention (DLP) – Overview of Information Rights Management (IRM); Introduction to Encryption: Symmetric Key Cryptography – Public Key Infrastructure – Digital Signatures.

UNIT IV FIREWALLS, VIRTUAL PRIVATE NETWORK

Network Security: Overview of Firewalls – Types of Firewalls – Functions of Firewall – Overview of Virtual Private Networks – Types of VPNs – Basics of VPN Protocols – Overview of Intrusion Detection Systems (IDS) – Types and Features of IDS.

UNIT V INFORMATION SECURITY, COPY RIGHT LAW

Overview of ISO Standard for Computer and Information Security – IT Act 2000 and subsequent amendments – Copyright Act – Patent Law; Intellectual Property Law: Copy Right Law – Software License – Semiconductor Law and Patent Law.

TEXT BOOK

1. Rhodes-Ousley, Mark, "Information Security: The Complete Reference", Second Edition, McGraw Hill, 2013.

REFERENCE BOOKS

1. V.K. Pachghare, "Cryptography and information Security", Second Edition, PHI Learning Pvt. Ltd., 2015.
2. Surya Prakash Tripathi, Ritendra Goel, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Laws", First Edition, Wiley Dreamtech Press, 2014.
3. Chander, Harish, "Cyber Laws and IT Protection", First Edition, PHI Learning Private Ltd., 2012.

MOBILE COMMERCE

(Course Code : 21PCAS02)

SEMESTER - II	SELF STUDY	CREDITS - 3

COURSE OUTCOMES:

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

1. List the M-Commerce principles and Business Models. **(K1)**
2. Describe the Key Players of M-Commerce. **(K2)**
3. Illustrate the current technological advancements in M-Commerce. **(K3)**
4. Analyze the theory and applications of M-Commerce in business domain. **(K4)**
5. Recommend M-Commerce Technology to various business domains. **(K5)**
6. Create research motivation in mobile commerce. **(K6)**

UNIT I INTRODUCTION

Mobile Commerce – Wireless Communication Technology – Applications of M-Commerce – Principles of Mobile Commerce – Benefits of Mobile Commerce – Limitations of Mobile Commerce – Mobile Commerce Framework – Mobile Commerce Business Models – Mobile Banking – Mobile Payments – Impact of M-Commerce – Mobile Commerce Applications.

UNIT II MOBILE COMMERCE TECHNOLOGY

Wireless and Mobile Communication – Communication Systems – Analog Communication Systems – Digital Communication Systems – Wireless Communication – Wireless Services – Spectrum Allocation – Satellite Communication – Categories of Satellites – Global Satellite Communication – Mobile Communication Systems – Broadband Technology – Wireless Broadband Internet – Wireless Application Protocol.

UNIT III KEY PLAYERS

Mobile Devices – Types of Mobile Devices – Mobile Computers – Laptops – Mobile Internet Device – Personal Navigation Device – Research in Motion – Mobile Service Providers – Mobile Network Operators – Mobile Virtual Network Operators – Mobile Commerce Service Providers.

UNIT IV MOBILE PRODUCTS

Mobile Banking – Mobile Banking Business Models – Mobile Banking Technologies – Mobile Banking Services – Advantages of Mobile Banking – Challenges of Mobile Banking – Mobile Banking Applications – Tickets on Mobile – Mobile Ticketing – Advantages of Mobile Tickets – Value-Added Services – Mobile Ticketing Apps – Mobile Ticket Providers.

UNIT V MOBILE PAYMENT

Characteristics of Mobile Payment Systems – Mobile Payment Models – Types of Mobile Payments – Mobile Payment Service Providers – Mobile Computing – Applications of Mobile Computing – Challenges of Mobile Computing – Mobile Computing Software Platforms – Business Applications of Mobile Computing – Future of Mobile Computing.

TEXT BOOK

Karabi Bandyopadhyay, "Mobile Commerce", Kindle Edition, Prentice Hall India Learning Private Limited, 2013.

REFERENCE BOOKS

1. Daniel Rowles, "Mobile Marketing: How Mobile Technology is Revolutionizing Marketing, Communications and Advertising", Second Edition, Kogan Page, 2017.
2. Esther Swilley, "Mobile Commerce: How it Contrasts, Challenges, and Enhances Electronic Commerce", First Edition, Business Expert Press, 2015.
3. M. Suman, "Advanced E-commerce and Mobile Commerce", First Edition, Himalaya Publishing House, 2015.

INTRODUCTION TO BLOCKCHAIN TECHNOLOGY AND APPLICATIONS

(Course Code : 21PCAS03)

SEMESTER - III	SELF STUDY	CREDITS - 3

COURSE OUTCOMES:

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

1. Describe about the Bitcoin Blockchain. **(K1)**
2. Interpret Ethereum and Smart Contracts. **(K2)**
3. Discuss about Hyperledger. **(K2)**
4. Examine the basic ideas of Private vs. Public Blockchain. **(K3)**
5. Analyze Byzantine Generals Problem and Consensus. **(K4)**
6. Evaluate Permissioned Blockchain and its Use Cases. **(K5)**

UNIT I INTRODUCTION

Introduction – Basic ideas behind Blockchain – How it is changing the landscape of Digitalization – Introduction to Cryptographic Concepts required – Hashing – Public key cryptosystems – Private vs. Public Blockchain and use cases – Hash Puzzles.

UNIT II BITCOIN BLOCKCHAIN AND SCRIPTS

Introduction to Bitcoin Blockchain – Bitcoin Blockchain and scripts – Use cases of Bitcoin Blockchain – Scripting **language** in micropayment, escrow, etc. – Downside of Bitcoin – Mining.

UNIT III ALTERNATIVE COINS

Alternative coins – Ethereum and Smart Contracts – Next Generation of Distributed Ledger Technology – IOTA

UNIT IV CONSENSUS AND HYPERLEDGER

The real need for mining – Consensus – Byzantine Generals Problem – Consensus as a distributed coordination problem – Coming to Private or Permissioned Blockchains – Introduction to Hyperledger.

UNIT V APPLICATIONS OF BLOCKCHAIN

Permissioned Blockchain and Use Cases – Hyperledger – Corda – Uses of Blockchain in E-Governance – Uses of Blockchain in Land Registration – Uses of Blockchain in Medical Information Systems and others.

REFERENCE

SWAYAM/NPTEL Online Course Videos by Dr. Sandeep Shukla, IIT, Kanpur.

INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS

(Course Code : 21PCAS04)

SEMESTER - IV	SELF STUDY	CREDITS - 3

COURSE OUTCOMES:

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

1. Describe the basic ideas of Industry 4.0. **(K1)**
2. Discuss the IIot Business Models and Reference Architectures. **(K2)**
3. Examine the IIoT Layers and IIoT Analytics. **(K3)**
4. Analyze the Real Case Studies in IIoT. **(K4)**
5. Classify the various Application Domains. **(K4)**
6. Evaluate Security and Fog Computing in IIoT. **(K5)**

UNIT I INTRODUCTION TO INDUSTRY 4.0

Introduction: Sensing & actuation – Communication-Part I & II – Networking-Part I, Part II – Industry 4.0: Globalization and Emerging Issues – The Fourth Revolution – LEAN Production Systems – Smart and Connected Business Perspective – Smart Factories – Industry 4.0: Cyber Physical Systems and Next Generation Sensors – Collaborative Platform and Product Lifecycle Management – Augmented Reality and Virtual Reality – Artificial Intelligence – Big Data and Advanced Analysis.

UNIT II INTRODUCTION TO INDUSTRIAL IoT

Cyber security in Industry 4.0 – Basics of Industrial IoT: Industrial Processes-Part I, Part II – Industrial Sensing & Actuation – Industrial Internet Systems – IIoT-Introduction – Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I & II – IIoT Reference Architecture-Part I, Part II – Industrial IoT-Layers: IIoT Sensing-Part I & II – IIoT Processing-Part I & II – IIoT Communication-Part I.

UNIT III IoT LAYERS AND IIoT ANALYTICS

Industrial IoT- Layers: IIoT Communication-Part II & III, IIoT Networking-Part I, Part II & III – Big Data Analytics and Software Defined Networks: IIoT Analytics – Introduction – Machine Learning and Data Science - Part I & II – R and Julia Programming – Data Management with Hadoop.

UNIT IV INDUSTRIAL IoT-APPLICATION DOMAINS

SDN in IIoT-Part I, Part II – Data Center Networks – Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II – Fog Computing in IIoT – Security in IIoT-Part I, Part II – Industrial IoT-Application Domains: Factories and Assembly Line – Food Industry.

UNIT V REAL CASE STUDIES OF IIoT

Industrial IoT- Application Domains: Healthcare – Power Plants – Inventory Management & Quality Control – Plant Safety and Security (Including AR and VR safety applications) – Facility Management – Oil, Chemical and Pharmaceutical Industry – Applications of UAVs in Industries – Real case studies : Case study - I : Milk Processing and Packaging Industries – Case study - II: Manufacturing Industries - Part I – Case study - III : Manufacturing Industries - Part II – Case study - IV: Student Projects - Part I – Case study - V: Student Projects - Part II – Case study - VI : Virtual Reality Lab – Case study - VII : Steel Technology Lab.

REFERENCES

SWAYAM/NPTEL Online **Course Videos by Prof. Sudip Misra, IIT, Kharagpur.**

ECC/VALUE ADDED PAPERS

APTITUDE AND REASONING SKILLS

(Course Code : 21PCAEC01)

SEMESTER - I	**ECC**	**CREDITS - 3**

COURSE OUTCOMES:

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

1. Identify basic skills in Analogy. **(K1)**
2. Interpret Analytical Reasoning and Verbal Reasoning. Problems. **(K2)**
3. Solve the problems with Simplifications and Average. **(K3)**
4. Analyze problems on Percentage and Partnership.**(K4)**
5. Assess Time and Work related problems. **(K5)**
6. Derive solution for the problems with Trains, Boats and Simple Interest. **(K6)**

UNIT I ANALOGY, SERIES, CODING

Analogy: Verbal Analogy – Alphabet Analogy – Number Analogy

Series: Letter Series – Number Series

Coding: Letter Coding – Number Coding

Verbal Classification (Odd Man Out) – Dissimilarity.

UNIT II ANALYTICAL REASONING

Analytical Reasoning: Direction – Family – Relation – Symmetric Relation – Ordering – Logical Diagram. Verbal Reasoning: Analogies – Series – Classification.

UNIT III PROBLEMS

Problems on Numbers – Simplification – Average.

UNIT IV PROBLEMS

Percentage – Ratio and Proportion – Partnership – Profit and Loss – Time and Distance – Time and Work – Problems on Ages.

UNIT V PROBLEMS

Problems on Trains – Boats and Streams – Simple Interest – Compound Interest.

REFERENCE BOOKS

1. Dr. R.S.Agarwal, “Reasoning”, S.Chand & Co. Ltd. Publications.
2. Dr. R.S.Agarwal, “Quantitative Aptitude”, S. Chand & Co. Ltd. Publications.
3. Deepak Agarwal, D.P. Gupta, “Quantitative Aptitude for Competitive Exams”, Disha Experts.

COMMUNICATION AND PRESENTATION SKILLS

(Course Code : 21PCAEC02)

SEMESTER - II	ECC	CREDITS - 3

COURSE OUTCOMES:

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

1. Understand the basics of English Grammar. **(K1)**
2. Differentiate the methods to speak English fluently. **(K2)**
3. Apply the Presentation and Communication theories. **(K3)**
4. Outline the principles of Effective Communication. **(K4)**
5. Assess the various styles in Public Speaking. **(K5)**
6. Develop the skills for Group Discussion and presenting in Seminars. **(K6)**

UNIT I BASICS OF COMMUNICATION

Understanding English Grammar – How to write and speak correctly? – Speaking and writing with style – Word Choice.

UNIT II ENGLISH FLUENCY

Methods for speaking English fluently – English pronunciation – Common mistakes speakers repeat – Use of slang – Body Language – Developing the skills.

UNIT III COMMUNICATION & PRESENTATION THEORIES

Verbal, Non-Verbal Communication – Making Presentations – Listening Skills – How to be a good communicator?

UNIT IV THE ART OF EFFECTIVE COMMUNICATION

Significance of communication – Roadmap to Effective Communication – Principles for Effective Communication – The art and skill of good communication.

UNIT V PUBLIC SPEAKING AND PRESENTATION

What is Public Speaking? – The art of Public Speaking – Language and Proficiency in Public Speaking – Group Discussions and Seminars.

REFERENCE BOOKS

1. S. K. Mandal, “Effective communication & Public Speaking”, Jaico Publishing House, 2016.
2. Reena Gupta, “How to write and speak correct English”, Lotus Press and Publishers, 2012.
3. Namrata Palta, “The art of effective communication”, Lotus Press and Publishers, 2015.
4. Prem P. Bhalla, “7 steps to effective communication”, Goodwill publishing house, 2014.

SCRIPTING LANGUAGES AND AJAX

(Course Code : 21PCAEC03)

SEMESTER - III	ECC	CREDITS - 3

COURSE OUTCOMES

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

1. Define the Importance of Scripting Languages and Batch files. **(K1)**
2. Describe the basic concepts of VB Script. **(K2)**
3. Demonstrate the arrays and VB Script Operators. **(K3)**
4. Illustrate the Linked Scripts and Java Script Entities. **(K4)**
5. Evaluate the functions and regular expressions in Java Script. **(K5)**
6. Create fast and dynamic web pages using AJAX. **(K6)**

UNIT I INTRODUCTION TO SCRIPTING

Scripting and Script – Difference between Scripting and Programming - Importance of Scripting – Batch file – Importance of Batch Files – Argument of a Batch File – Pipelining of Commands – Command line Redirecting.

UNIT II VB SCRIPT ARRAYS AND OPERATORS

Variables – Subtypes – Constants – Variables Deformed – Declaring Variables – Naming Variables Variants and Subtype – Data Subtypes Conversion – Numeric and Literal Constants – Arrays Groups of Similar Variables – One Dimensional Arrays – Multi Dimensional Arrays – VB Script Operators Logic Operators – Arithmetic Operator Precedence – Comparison Operators Logic Operators – String Concatenation.

UNIT III JAVA SCRIPT

Introduction to JavaScript: Adding JavaScript to HTML Documents – Event Handlers – Linked Scripts – JavaScript Pseudo-URL – JavaScript Entities – JavaScript Applications – History of JavaScript.

UNIT IV JAVASCRIPT CORE FEATURES

Overview: Basic Definitions – Language Characteristics – Variables – Basic Data Types – Composite Types – Flow Control Statements – Loops – Functions – Input and Output in JavaScript – Regular Expressions – Comments Line.

UNIT V AJAX

Introduction to Ajax – XMLHttpRequest Object – Data Formats.

REFERENCE BOOKS

1. Shiv Kiran, “SMART Scripting”, Swadhyay Books, 2019.
2. Jusanner Clark and Team, “VB Script Programmer Reference”, Shroff Publications and Distributors Pvt. Ltd., 2000.
3. Adrian Kingsley-Hughes, Kathie Kingsley-Hughes, Daniel Read, "VBScript Programmer’s Reference", Third Edition, Wiley Publishing.
4. Thomas Powell and Fritz Schneider, "JavaScript 2.0 The Complete Reference", Second Edition, McGraw-Hill.
5. Yehuda Shiran and Tomer Shirar, “Learn Advanced Java Script Programming”, BPB Publications, New Delhi
6. Thomas Powell, "Ajax: The Complete Reference", McGraw-Hill.
7. Ronald Huereca, "WordPress and Ajax - An in-depth guide on using Ajax with WordPress", Second Edition.

DIGITAL FORENSICS

(Course. Code : 21PCAEC04)

SEMESTER - IV	ECC	CREDITS - 3

COURSE OUTCOMES

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

1. Describe the rules and characteristics of Digital Evidences. **(K1)**
2. Interpret the Computer Forensic Tools. **(K2)**
3. Examine the types of Intrusion Detection Systems. **(K3)**
4. Analyze the Live Data Collection Techniques. **(K4)**
5. Evaluate Digital Evidence using Forensic Tools. **(K5)**
6. Formulate Ethical Hacking. **(K6)**

UNIT I INTRODUCTION

Definition of Hacker, Crackers and Phreakers – Ethical Hacking – Difference between Hacking and Ethical Hacking – Steps of Ethical Hacking – Exploring some tools for Ethical Hacking – Introduction to Digital Forensic–Types of Digital Forensics – Ethical Issues – Digital Forensic Investigations – Introduction to Digital Evidences – Rules – Characteristics – Types of Evidences – Challenges in Evidence Handling.

UNIT II INCIDENT RESPONSE PROCESS AND LIVE DATA COLLECTION

People involve in Incident Response Process – Incident Response Process – Incident Response Methodology – Activities in Initial Response – Phases after Detection of an Incident – Live Data Collection: People involved in Data Collection Techniques – Live Data Collection from Windows System – Live Data Collection from UNIX System.

UNIT III FORENSIC DUPLICATION

Forensic Duplication: Rules – Necessity – Important terms – Forensic Image Formats – Traditional Duplication – Live System Duplication – Forensic Duplication Tool Requirements – Creating a Forensic Duplicate of a Hard Drive – Disk and File System Analysis.

UNIT IV DATA ANALYSIS AND NETWORK FORENSIC

Data Analysis: Preparation Steps for Forensic Analysis – Investigating Windows Systems – Investigating UNIX Systems and Applications – Malware Handling – **Network Forensic:** Understanding Password Cracking – Understanding Technical Exploits – Types of Intrusion Detection System.

UNIT V COMPUTER FORENSIC TOOLS

Network Forensic: Understanding Network Intrusions and Attacks – Collecting Network-Based Evidence – Investigating Routers – Handling Router Table Manipulation Incidents – Using Routers as Response Tools – Report Writing – Layout and Guidelines for writing a report – Sample for writing a report – Computer Forensic Tools.

TEXT BOOK

Dr. Nilakshi Jain, Dr. Dhananjay R. Kalbande, "Digital Forensic", First Edition, Wiley India Pvt. Ltd., 2019.

REFERENCE BOOKS

1. Joakim Kavrecstad, "Fundamentals of Digital Forensics Theory, Methods and Real-Life Applications", Springer, 2020.
2. Dr. Sangita Chaudhari, Dr. Madhumita Chatterjee, "Digital Forensics", First Edition, Star EduSolutions India Pvt. Ltd., 2019.