**MCA-109 Software Engineering**

**UNIT-I** **Software Engineering Fundamentals:** Definition of Software, Software characteristics, Software Applications. Software Process: Software Process Models - Waterfall model, prototyping model, spiral model, incremental model, concurrent development model. Project management Concepts: The Management Spectrum - The People, The Product The Process, The Project.

**UNIT-II Software Process and Project Metrics :** Measures , Metrics and Indicators , Software measurement Size -Oriented Metrics , Function - Oriented Metrics , Extended Function point metrics Software Project Planning : Project Planning Objectives , Software Project Estimation , Decomposition Techniques - Problem Based Estimation Process Based Estimation ,Empirical Estimation Models- The COCOMO Model Risk Analysis and Management: Software risks, Risk identification, Risk Projection, Risk Refinement, Risk Mitigation , Monitoring and Management.

**UNIT-III Software Quality Assurance:** Basic concepts- Quality, Quality Control, Quality Assurance, Cost of Quality , Software Quality Assurance (SQA) , Formal Technical Review Software Configuration Management: Baselines , Software Configuration Items, The SCM Process, Version Control, Change Control, Configuration Audit, Status Reporting. Analysis Concepts and Principles: Requirements Elicitation for Software, Analysis Principles. The Information Domain, Modeling, Partitioning, Essential and Implementation Views, Specification: Specification Principles, Representation, The Software Requirement Specification (SRS)

**UNIT-IV Design Concepts and Principles:** Design Principles, Design Concepts — Abstraction, Refinement, Modularity, Software Architecture, Control Hierarchy, Structural Partitioning, Data Structure. Software Procedure, Structure, Information Hiding, Effective Modular Design- Cohesion, Coupling Software Testing: Testing Objectives & principles, Unit Testing, Integration Testing (Top Down Integration , Bottom. Up Integration, Regression Testing, Smoke Testing), Validation Testing (Alpha and Beta Testing), System Testing (Recovery Testing, Security Testing, Stress Testing, Performance Testing).

**UNIT-V Reengineering:** Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering CASE Tools: What is CASE, Building Blocks of CASE, A Taxonomy of CASE Tools, Integrated CASE Environments, The integration Architecture, The CASE Repository.

**MCA-119 Data Base Management System**

**Unit 1: Introduction:** Database Management System, Examples, Characteristics of the Database Approach, Advantage of using a Database Approach. Database System concepts and Architecture, Data Models, Schemes and Instances, DBMS Architecture and Data independence, Database Languages, Procedural and Non-procedural languages and Interfaces. Database System Environment, Classification of Database Management Systems.

**Unit 2: ER Model:** Database Modeling using the ER Model., Using High-Level conceptual Data Models for Database design, An example Database Application, Entity types, Entity Sets, Attributes and keys, Relationships, Relationship types, roles and Structural Constraints., Week Entity types, Refining the ER Design for the Company Database, ER Diagrams, naming conventions and design Issues, Conversion of ER Diagram to tables.

**Unit 3: Relational Model:** The Relational Data Model, Relational constraints. the Relational Algebra: Relational Model Concepts, Relational concepts and Relational Database Schemes, Update Operation and Dealing with Constraints Violations, Relational Database Design, Using ER-to-Relational Mapping.

**Unit 4: Structured Query language:** Data definition, Constraints and Schema changes in SQL 2, Basic Quires in SQL, More Complex SQL Quires, Insert, Delete and Update Statements in SQL, views(Virtual Tables) in SQL, Specifying general constraints as Assertion features of SQL. Integrity constrains, Triggers, Functional dependencies.

**Unit 5: Normalization:** Functional Dependencies and Normalization for Relational Database, Informal Design Guidelines for Schemes, Functional Dependencies, Normal Forms based on Primary keys, General Definitions of Second and Third Normal forms, Boyce Codd Normal form, Relational Database Design Algorithms and Further Dependencies, Algorithms for Relational Database Schema Design, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.

**Unit 6: Transaction Processing Concepts**: Introduction to Transaction Processing, Transaction and System Concept, Desirable properties of Transactions, Scheduling and Recoverability, Serializability of Scheduling, Transaction Support in SQL, Concurrency control techniques, Concurrency techniques for concurrency control, concurrency control based on timestamp based protocol, validation based protocol, deadlock handling, Database Recovery Techniques based on Immediate Update, Failure classification, Shadow Paging, Log based recovery, failure with loss of Nonvolatile Storage.

## Unit 7: Emerging Trends in DBMS

Introduction to object oriented Database Management System, Introduction to client/Server Database, Introduction to Distributed Database, Introduction to Knowledge Databases.

**MCA-120 Theory of Computation**

**Block 1:Introduction to Finite Automata**

**Unit-1: Alphabet, Strings and Languages**

Set, Relations, Alphabet,Strings,Languages,Finite Representation of Languages, Chomasky Hierarchy

**Unit-2: Finite Automata**

Finite State Systems, Basic Definitions Non-Deterministic finite automata (NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA, Finite automata with epsilon transitions, Removal of epsilon transitions.

**Unit-3: Introduction to Machines**

Concept of basic Machine, Properties and limitations of FSM. Moore and mealy Machines, Equivalence of Moore and Mealy machines. Minimization of DFA.

**Block 2: Regular Expressions and Languages**

**Unit-4: Regular Expressions**

Regular Expressions-Definition, Algebraic Laws of RE, Finite Automata and Regular expressions, Conversion from RE to FA, Conversion from FA to RE, Arden’s Theorem.

**Unit-5: Properties of Regular Language**

The Pumping Lemma for Regular Sets, Applications of the pumping lemma, Closure properties of regular sets.

**Block 3: Context Free Grammar**

**Unit-6: Context Free Grammar**

Context Free Grammar (CFG)-Formal definition, sentential forms, leftmost and rightmost derivations, the language of CFG.

**Unit-7: Normal Forms**

Simplifications of CFG’s- Removal of Useless Symbols, Removal of epsilon and Unit Production, Normal Forms-CNF and GNF.

**Unit-8: Context Free Languages (CFL)**

Closure Properties of CFL, Decision Properties of CFL, Application of CFG, Pumping Lemma for CFL.

**Block 4: Pushdown Automata and Turing Machine**

**Unit-9: Push Down Automata**

Formal Definition of Pushdown Automata, Pushdown Automata accepted by final state and empty state, Equivalence between CFG and PDA.

**Unit-10: Turing Machine**

Turing Machine (TM) –Formal Definition and behavior, Transition diagram, Instantaneous Description, Language of a TM, Variants of TM, Universal Turing Machine, Halting Problem, Church Thesis.

**Unit-11: Undecidability**

Recursive enumerable, Undecidable Problem About Turing Machines, Unsolvable Problems.

**PGDCA-103 C Programming**

**Block 1:** **Introduction to algorithms and program design**

**Unit 1:** **Introduction to** **Algorithms**

Problem solving techniques, Algorithm

**Unit 2:** **Pseudo-codes and Flowcharts**

Tools of Algorithm, Pseudo codes, Flowchart

**Unit 3**: **Program design principles**

Introduction to computer programming, Program design principles, Programming techniques, Program Errors

**Block 2:** **Introduction to the ‘C’ programming language**

**Unit 1: Introduction**

History of C Language, Structure of a ‘C’ program, Creating and Executing a ‘C’ program,

**Unit 2:Data Types in ‘C’**

Character Set of ‘C’ language, Trigraph characters, Tokens, Identifiers, Keywords, Constants, Data types, Variables

**Unit 3:Storage Classes**

Scope and lifetime of variable, Storage classes, Automatic storage class, Register storage class, Static storage class, External storage class

**Unit 4:Input and Output Functions**

Reading a single character, Writing a single character, Formatted Input-Output, Formatted Input, Formatted Output

**Block 2:** **Operator and Control Structures**

**Unit 1: Operators and Expressions**

Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and decrement operators, Conditional operators, Bitwise operators, Special operators, Operator Precedence and Associativity, lvalue and rvalue, Type casting: Promotion and Demotion of variable types

**Unit 2: Decision Structures in ‘C’**

if statement, if else statement, nested if … else statement, switch statement, goto statment

**Unit 3: Loop Structures in ‘C’**

for statement, while statement, do while statement, break statement, continue statement

**Unit 4: Arrays**

One dimensional array, Two dimensional array, Multidimensional arrays, Strings, String handling functions, Character functions

**Block 3: Advanced Features of C**

**Unit 1: Pointers**

Pointers and Address (&) operator, Pointer declaration and Initialization , Indirection operator, Pointer Arithmetic, Arrays and Pointers, Character strings and Pointers, Array of Pointers, Pointer to Pointer

**Unit 2: Functions**

Functions, user-defined functions, categories of function, returning non-integer values, function arguments, recursion, arrays as function arguments

**Unit 3: Structures, Unions, enum and typedef**

Structure definition, Structures within structures, Structures as function arguments, Pointers to structures, Unions, Enumerated data type, Type definition

**Unit 4: File and Memory Management in ‘C’**

Files, File Pointer Variable, Opening a file, Reading and writing to files, File Status Functions, Random Access to files, Command Line Arguments, Memory management

**Unit 5: Preprocessor Directives and Error reporting**

Macro directives, Conditional directives, Control directives, Error reporting

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**Course Content**

**Paper I - RESEARCH METHODOLOGY AND PUBLICATION ETHICS**

**(Common Syllabus for all Ph.D. Scholars)**

**Course Code: PCWRM-01 Credits: 8**

**UNIT 1 BASICS OF RESEARCH**

Knowledge and the Approaches of Acquiring knowledge

* (deductive, inductive and scientific)

Meaning of Research

Objectives of Research

Motivation in Research

Significance of Research

Importance of knowing How Research is Done

Criteria of Good Research

**UNIT 2: APPROACHES OF RESEARCH**

Types of Research

Research Approaches

Research Methods versus Methodology

Research and Scientific Method

Research Process

**UNIT 3 DEFINING THE RESEARCH PROBLEM**

What is a Research Problem?

Selecting the Problem

Necessity of Defining the Problem

Technique involved in Defining a Problem

**UNIT 4 RESEARCH DESIGN**

Meaning of Research Design

Need for Research Design

Features of Good Design

Important Concepts Relating to Research Design

Different Research Design

Basic Principles of Experimental Designs

**UNIT 5: REVIEW OF LITERATURE**

Meaning and importance of Review of Literature

Types of research literature

Applications/uses of review of literature

Presentation of references/ bibliography

**UNIT 6 SAMPLING DESIGN**

Census and Sample Survey

Implications of a Sample Design

Steps in Sampling Design

Criteria of Selection of Sampling Procedure

Characteristics of a Good Sample Design

Different Types of Sample Designs

**UNIT 7 TYPES AND METHODS OF DATA COLLECTION**

Meaning and concept of data

Types of data- primary and secondary

Introduction of data collection

Sources of data collection

Collection of Primary Data

**UNIT 8: TOOLS AND TECHNIQUES OF DATA COLLECTION**

Tools of Primary data collection

-Observation

-Interview

-Questionnaire

-Schedules

-Checklist

Collection of secondary data

**UNIT 9 DATA CLASSIFICATION AND TABULATION**

Introduction

Classification of Data

Basis of Classification

Frequency Distribution

Tabulation of Data

Objectives of Tabulation

**UNIT 10: DATA PRESENTATION**

Graphical Presentation of Data

Functions of a Graph

Advantages and Limitations of Diagrams (Graph)

General and Summary Tables

Types of Diagrams

One Dimensional Diagrams

Two Dimensional Diagrams

Three-Dimensional Diagrams

**UNIT 11 PROCESSING AND ANALYSIS OF DATA**

Processing Operations

Some Problems in Processing

Elements/Types of Analysis

Statistics in Research

Measures of Central Tendency

Measures of Dispersion

Measures of Asymmetry (Skewness)

Measures of Relationship

**UNIT 12 FUNDAMENTALS IN INFERENTIAL RESEARCH**

Research Hypothesis- Meaning, types and characteristics

Formulation of hypothesis

Concept of hypothesis testing

Measuring the power of hypothesis testing

Types of errors in hypothesis testing

**UNIT 13: ICT APPLICATION IN RESEARCH**

Role of computer in knowledge management

Open Education Resource and Research

Using word processing software- MS Word/Latex/others, data analysis, drawing graphs and diagrams through computer

Know how of power point presentation and MS-Excel

**Unit 14 PHILOSOPHY AND ETHICS**

Introduction to philosophy: definition, nature and scope, concept, branches

Ethics: definition, moral philosophy, nature of moral judgements and reactions

**Unit15 SCIENTIFIC CONDUCT**

Ethics with respect to science and research

Intellectual honesty and research integrity

Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)

Redundant publications: duplicate and overlapping publications, salami slicing

Selective reporting and misrepresentation of data

**Unit 16 PUBLICATION ETHICS**

Publication ethics: definition, introduction and importance

Best practices / standards setting initiatives and guidelines. COPE, WAME, etc.

Conflicts of interest

Publication misconduct: definition, concept. problems that lead to unethical behaviour and vice versa, types

Violation of publication ethics, authorship and contributor ship

Identification of publication misconduct, complaints and appeals

Predatory publishers and journals