WEEK 2: SOFTWARE AND SOFTWARE ENGINEERING

Software is:

- Instructions (computer programs) that provide desired features, function, and performance.
- Data structures enabling programs to manipulate information.
- Descriptive information (hard copy/virtual) about the program's operation and use.

Software Characteristics

- Software is developed, not manufactured.
- Software does not wear out.
- Most software continues to be custom-built.

Software Application Domains

- System Software
- Application Software
- Engineering/Scientific Software
- Embedded Software
- Product-Line Software
- Web Applications
- Artificial Intelligence Software

Software Engineering

- An engineering approach to software development.
- Systematic application of analysis, design, construction, and testing.
- IEEE Definition: Systematic, disciplined, quantifiable approach to development, operation, and maintenance of software.

The Software Process

- Five Generic Activities:
  - Communication
  - Planning
  - Modeling
  - Construction
  - Deployment
- Umbrella Activities:
  - Project tracking and control
  - Risk management
  - Software quality assurance
  - Technical reviews
  - Measurement
  - Software configuration management
  - Reusability management

Software Engineering Ethics

- Ethical behavior involves more than legal compliance.
- Responsibilities:
  - Confidentiality
  - Competence
  - Intellectual property rights
  - Computer misuse.

WEEK 3-4: THE SOFTWARE PROCESS

Software Process: A collection of work activities, actions, and tasks performed to create a work product.

Process Flow: Organizes framework activities and their sequence in time.

Process Patterns:

- **Stage Pattern** (e.g., Establishing Communication)
- **Task Pattern** (e.g., Requirements Gathering)
- **Phase Pattern** (e.g., Spiral Model, Prototyping)

Process Assessment and Improvement Approaches:

- SCAMPI (Standard CMMI Assessment Method for Process Improvement)
- CBA IPI (CMM-Based Appraisal for Internal Process Improvement)
- SPICE (ISO/IEC 15504)
- ISO 9001:2000 for Software

Prescriptive Process Models:

- Waterfall Model
- V-Model
- Incremental Model
- Evolutionary Model (Prototyping, Spiral Model)
- Concurrent Model

Unified Process (UP) Phases:

- Inception
- Elaboration
- Construction
- Transition
- Production

Personal & Team Process Models:

- **PSP (Personal Software Process):**
  - Planning
  - High-level design
  - High-level design review
  - Development
  - Postmortem
- **TSP (Team Software Process):**
  - Project launch
  - High-level design
  - Implementation
  - Integration and test
  - Postmortem

WEEK 5-6: MANAGING SOFTWARE PROJECTS

Software Project Management:

- Planning, scheduling, resource allocation, execution, tracking, and delivery of software projects.
- Topics Covered:
    - Project Management Concepts
    - Process and Project Metrics
    - Estimation and Scheduling
    - Risk Management
    - Maintenance and Reengineering

Project Roles & Responsibilities:

- **Project Manager:** Develop project plan, recruit staff, lead team, determine methodology, set schedule, assign tasks, report to management.
- **Functional Manager:** Assign project tasks, evaluate work performance, set career goals.
- **Operational Manager:** Coordination, supervision, financial and HR management.
- **Other Roles:**
    - Analyst (requirement documentation)
    - Change Manager (accepts project changes)
    - Database Administrator (manages databases)
    - Developer (builds solution)
    - Tester (ensures error-free product)
    - Client (beneficiary of the project)
    - User (uses deliverables)

Project Planning:

- Define scope
- Verification and control
- Divide project into manageable parts

Project Estimation Techniques:

- **Decomposition Technique** (breaking project into smaller components)
- **Line of Code Estimation**
- **Function Points Estimation**
- **Empirical Techniques:**
    - Putnam Model
    - COCOMO (Cost Estimation)

Project Scheduling Activities:

- Task breakdown
- Correlate tasks
- Estimate time and resources
- Assign work units
- Calculate total project duration

Risk Management:

- **Common Risks:**
    - Staff turnover
    - Requirement changes
    - Underestimated time/resources
    - Business competition
- **Risk Management Process:**
    - Identification
    - Categorization
    - Management
    - Monitoring

Project Management Tools:

- **Gantt Chart** (time-based schedule representation)
- **PERT/CPM Chart** (network diagram showing task dependencies)
- **Resource Histogram** (graphical staff planning tool)

Maintenance & Reengineering:

- Software Maintenance: Fixes defects, adapts to environment, enhances functionality.
- Reengineering: Process of improving software quality and maintainability through:
    - Inventory analysis
    - Document restructuring
    - Reverse engineering
    - Forward engineering