

SPPU B.E./B.Tech CSE Sem 5 syllabus

Information Systems and Engineering Economics

310244: Information Systems and Engineering Economics

Credit 03

Unit I Basic of Management Theory & Practices

Role of Information Systems in Organizations, The Information System Manager and his challenges, Concepts of Information Systems, Information Systems and Management Strategy Case Studies - Information Systems in the Indian Railways, Information Systems in an e-Commerce Organization.

Unit II Management Information System (MIS)

Managing Information Systems, Ethical and Social Issues, Information Technology Infrastructure and Choices, Information Systems Security and Control, Case Studies - Information Technology Infrastructure in a Bank, Information Technology Infrastructure in a manufacturing / process industry.

Unit III Leveraging Information Systems

Information Systems Development and Project Management, Managing Data Resources, Business Process Integration and Enterprise Systems, ICT for Development and E-Governance, Case Studies - in-house or cloud based ERP implementation, UIDAI Unique Identification Authority of India.

Unit IV Money and Economic Value

Engineering Economic Decisions, Time Value of Money, Understanding Money Management, Case Studies- Economic decisions done in Multi-national companies.

Unit V Economics and Management

Equivalence Calculations under Inflation, Present-Worth Analysis,

Annual-Equivalence Analysis.

Case Studies -comparative analysis of software enterprises from relevant domains.

Unit VI Understanding Cash Flow and Taxes

Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis, Understanding Financial Statements, Case Studies - cash flow analysis done in start-up companies.

Books:

Text:

1. Rahul De, "MIS: Management Information Systems in Business, Government and Society", Wiley India, ISBN: 13: 978-81-265-2019-0.
2. Chan S. Park , "Fundamentals of Engineering Economics", 3rd Edition, Pearson Education, ISBN 13: 978-02-737-7291-0

References:

1. Turban and Wali, "Information Technology on Management", Willey India, ISBN:9788126558711
2. William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Engineering Economy, Pearson Education, ISBN13: 978-01-334-3927-4

Theory of Computation

Theory of Computation

Unit I: Formal Language Theory and Finite Automata

Finite Automata (FA): An informal picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language.

FA without output: Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA and inter-conversion. Minimization of DFAs.

FA with output: Moore and Mealy machines -Definition, models, inter-conversion.

Unit II: Regular Expressions (RE)

Introduction, Operators of RE, Precedence of operators, Algebraic laws for RE, Language to Regular Expressions, Equivalence of two REs. Conversions: RE to NFA, DFA, DFA to RE using Arden's theorem, Pumping Lemma for Regular languages, Closure and Decision properties of Regular languages. Myhill-Nerode theorem.

Unit III: Context Free Grammar (CFG) and Context Free Language(CFL)

Basic Elements of Grammar, Formal Definition of Context Free Grammar, Sentential form, Derivation and Derivation Tree/Parse Tree, Context Free Language (CFL), Ambiguous Grammar, writing grammar for language. Simplification of CFG: Eliminating ϵ -productions, unit productions, useless production, and useless symbols. Normal Forms: Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for CFG, Closure properties of CFL, Decision properties of CFL, Chomsky Hierarchy, Cock-Younger-Kasami Algorithm.

Unit IV: Pushdown Automata (PDA)

Introduction, Formal definition of PDA, Equivalence of Acceptance by Final State and Empty stack, Non-deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs CFLs. Deterministic CFLs.

Unit V: Turing Machines (TM)

Turing Machine Model, Formal definition of Turing Machines, Language Acceptability by Turing Machines, Design of TM, Description of TM, Techniques for TM Construction, Computing function with Turing Machine, Variants of Turing Machines, Halting Problem of TM, Halting vs Looping, A Turing-unrecognizable language, Reducibility, Recursion Theorem. The Model of Linear Bounded Automata.

Unit VI: Computability and Complexity Theory

Computability Theory: Decidable Problems and Un-decidable Problems, Church-Turing Thesis.

Reducibility: Undecidable Problems that is recursively enumerable, A Simple Un-decidable problem.

Complexity Classes: Time and Space Measures, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, P Problem Versus NP Problem, NP-completeness and NP-hard Problems.

Database Management Systems

Database Management Systems

Unit I: Introduction to Database Management Systems and ER Model

Introduction, Purpose of Database Systems, Database-System

Applications, View of Data, Database Languages, Database System Structure, Data Models. Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity-Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting ER and EER diagram into tables.

Unit II: SQL And PL/SQL

SQL: Characteristics and Advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators. Tables: Creating, Modifying, Deleting, Updating. SQL DML Queries: SELECT Query and clauses, Index and Sequence in SQL. Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries. PL/SQL: Concept of Stored Procedures and Functions, Cursors, Triggers, Assertions, Roles and Privileges.

Unit III: Relational Database Design

Relational Model: Basic concepts, Attributes and Domains, CODD's Rules. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints. Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF.

Unit IV: Database Transaction Management

Introduction to Database Transaction, Transaction states, ACID properties, Concept of Schedule, Serial Schedule. Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules. Concurrency Control: Lock-based, Time-stamp based Deadlock handling. Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints. Log-Based Recovery: Deferred Database Modifications and Immediate Database Modifications.

Unit V: NoSQL Databases

Introduction to Distributed Database System, Advantages, Disadvantages, CAP Theorem. Types of Data: Structured, Unstructured Data and Semi-Structured Data. NoSQL Database: Introduction, Need, Features. Types of NoSQL Databases: Key-value store, document store, graph, wide column stores, BASE Properties, Data Consistency model, ACID Vs BASE, Comparative study of RDBMS and NoSQL. MongoDB (with syntax

and usage): CRUD Operations, Indexing, Aggregation, MapReduce, Replication, Sharding.

Unit VI: Advances in Databases

Emerging Databases: Active and Deductive Databases, Main Memory Databases, Semantic Databases.

Complex Data Types: Semi-Structured Data, Features of Semi-Structured Data Models. Nested Data Types: JSON, XML. Object Orientation: Object-Relational Database System, Table Inheritance, Object-Relational Mapping. Spatial Data: Geographic Data, Geometric Data.

Computer Networks and Security

Computer Networks and Security

Unit I: Introduction To Computer Networks

Definition, Types of Networks: Local area networks (LAN), Metropolitan area networks (MAN), Wide area networks (WAN), Wireless networks, Networks Software, Protocol, Design issues for the Network layers. Network Models: The OSI Reference Model, TCP/IP Model, Network Topologies, Types of Transmission Medium. Network Architectures: Client-Server, Peer To Peer, Hybrid. Network Devices: Bridge, Switch, Router, Gateway, Access Point. Line Coding Schemes: Manchester and Differential Manchester Encodings, Frequency Hopping (FHSS) and Direct Sequence Spread Spectrum (DSSS).

Unit II: Data Link Layer

Introduction, functions. Design Issues: Services to Network Layer, Framing. ARQ strategies: Error detection and correction, Parity Bits, Hamming Codes (11/12-bits) and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol. WAN Connectivity: PPP and HDLC. MAC Sub layer: Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, CSMA/CD, CSMA/CA, Binary Exponential Back-off algorithm, Introduction to Ethernet IEEE 802.3, IEEE 802.11 a/b/g/n, IEEE 802.15 and IEEE 802.16 Standards.

Unit III: Network Layer

Introduction: Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. IP Protocol: Classes of IP (Network addressing), IPv4, IPv6, Network Address Translation, Sub-netting, CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP. Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP, MPLS. Routing in MANET: AODV, DSR, Mobile IP.

Unit IV: Transport Layer

Process to Process Delivery, Services, Socket Programming. Elements of Transport Layer Protocols: Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, Congestion Control. Transport Layer Protocols: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless networks.

Unit V: Application Layer

Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, DHCP, SNMP.

Unit VI: Security

Introduction, Security services, Need of Security, Key Principles of Security, Threats and Vulnerabilities, Types of Attacks, ITU-T X.800 Security Architecture for OSI, Security Policy and mechanisms, Operational Model of Network Security, Symmetric and Asymmetric Key Cryptography. Security in Network, Transport and Application: Introduction of IPSec, SSL, HTTPS, S/MIME, Overview of IDS and Firewalls.

Systems Programming and Operating System

Systems Programming and Operating System

Unit I: Introduction

Introduction to Systems Programming, Need of Systems Programming, Software Hierarchy, Types of software: system

software and application software, Machine structure.

Evolution of components of Systems Programming: Text Editors, Assembler, Macros, Compiler, Interpreter, Loader, Linker, Debugger, Device Drivers, Operating System. Elements of Assembly Language Programming: Assembly Language statements, Benefits of Assembly Language, A simple Assembly scheme, Pass Structure of Assembler. Design of two pass Assembler: Processing of declaration statements, Assembler Directives and imperative statements, Advanced Assembler Directives, Intermediate code forms, Pass I and Pass II of two pass Assembler.

Unit II: Macro Processor and Compilers

Introduction, Features of a Macro facility: Macro instruction arguments, Conditional Macro expansion, Macro calls within Macros, Macro instructions, Defining Macro, Design of two pass Macro processor, Concept of single pass Macro processor.

Introduction to Compilers: Phases of Compiler with one example, Comparison of Compiler and Interpreter.

Unit III: Linkers and Loaders

Introduction, Loader schemes: Compile and Go, General Loader Scheme, Absolute Loaders, Subroutine Linkages, Relocating Loaders, Direct linking Loaders, Overlay structure, Design of an Absolute Loader, Design of Direct linking Loader, Self-relocating programs, Static and Dynamic linking.

Unit IV: Operating System (OS)

Introduction: Evolution of OS, Operating System Services, Functions of Operating System.

Process Management: Process, Process States: 5 and 7 state model, Process control block, Threads, Thread lifecycle, Multithreading Model, Process control system calls.

Process Scheduling: Uni-processor Scheduling, Scheduling: Preemptive, Non-preemptive, Long-term, Medium-term, Short term scheduling.

Scheduling Algorithms: FCFS, SJF, RR, and Priority.

Unit V: Synchronization and Concurrency Control

Concurrency: Principle and issues with Concurrency, Mutual Exclusion, Hardware approach, Software approach, Semaphore, Mutex and monitor, Reader writer problem, Producer Consumer problem, Dining Philosopher problem.

Deadlocks: Principle of Deadlock, Deadlock prevention, Deadlock avoidance, Deadlock detection, Deadlock recovery.

Unit VI: Memory Management

Introduction: Memory Management concepts, Memory Management requirements.

Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy Systems Fragmentation, Paging, Segmentation, Address translation.

Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit.

Virtual Memory (VM): Concepts, Swapping, VM with Paging, Page Table Structure, Inverted Page Table, Translation Look aside Buffer, Page Size, VM with Segmentation, VM with Combined paging and segmentation.

Page Replacement Policies: First In First Out (FIFO), Last Recently Used(LRU), Optimal, Thrashing.