ENGINEERING ECONOMICS
CE 655

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 0

Course Objectives:

To provide concept and knowledge of economic studies that will be useful for the evaluation engineering projects and make decisions related to investment.

1. Introduction **(3 hours)**

- 1.1 Origin of Engineering Economy
- 1.2 Principles of Engineering Economy
- 1.3 Role of Engineers in Decision Making
- 1.4 Cash Flow Diagram

2. Interest and Time Value of Money **(6 hours)**

- 2.1 Introduction to Time Value of Money
- 2.2 Simple Interest
- 2.3 Compound Interest
  - 2.3.1 Nominal Interest Rate
  - 2.3.2 Effective Interest Rate
  - 2.3.3 Continuous Compounding
- 2.4 Economic Equivalence
- 2.5 Development of Interest Formulas
  - 2.5.1 The Five Types of Cash Flows
  - 2.5.2 Single Cash Flow Formulas
  - 2.5.3 Uneven Payment Series
  - 2.5.4 Equal Payment Series
  - 2.5.5 Linear Gradient Series.
  - 2.5.6 Geometric Gradient Series.

3. Basic Methodologies of Engineering Economic Analysis **(8 hours)**

- 3.1 Determining Minimum Attractive (Acceptable) Rate of Return (MARR).
- 3.2 Payback Period Method
- 3.3 Equivalent Worth Methods
  - 3.3.1 Present Worth Method
  - 3.3.2 Future Worth Method
  - 3.3.3 Annual Worth Method
- 3.4 Rate of Return Methods
  - 3.4.1 Internal Rate of Return Method.
  - 3.4.2 External/Modified Rate of Return Method
- 3.5 Public Sector Economic Analysis (Benefit Cost Ratio Method)
- 3.6 Introduction to Lifecycle Costing

3.7 Introduction to Financial and Economic Analysis

4. Comparative Analysis of Alternatives **(6 hours)**

4.1 Comparing Mutually Exclusive Alternatives having Same Useful Life by
- 4.1.1 Payback Period Method and Equivalent Worth Method
- 4.1.2 Rate of Return Methods and Benefit Cost Ratio Method

4.2 Comparing Mutually Exclusive Alternatives having Different Useful Lives by
- 4.2.1 Repeatability Assumption
- 4.2.2 Co-terminated Assumption
- 4.2.3 Capitalized Worth Method

4.3 Comparing Mutually Exclusive, Contingent and Independent Projects in Combination

5. Replacement Analysis **(6 hours)**

5.1 Fundamentals of Replacement Analysis
- 5.1.1 Basic Concepts and Terminology
- 5.1.2 Approaches for Comparing Defender and Challenger

5.2 Economic Service Life of Challenger and Defender

5.3 Replacement Analysis When Required Service Life is Long
- 5.3.1 Required Assumptions and Decision Framework
- 5.3.2 Replacement Analysis under the Infinite Planning Horizon
- 5.3.3 Replacement Analysis under the Finite Planning Horizon

6. Risk Analysis **(6 hours)**

6.1 Origin/Sources of Project Risks

6.2 Methods of Describing Project Risks
- 6.2.1 Sensitivity Analysis
- 6.2.2 Breakeven Analysis
- 6.2.3 Scenario Analysis

6.3 Probability Concept of Economic Analysis

6.4 Decision Tree and Sequential Investment Decisions

7. Depreciation and Corporate Income Taxes **(6 hours)**

7.1 Concept and Terminology of Depreciation

7.2 Basic Methods of Depreciation
- 7.2.1 Straight line method
- 7.2.2 Declining Balance Method
- 7.2.3 Sinking Fund Method
- 7.2.4 Sum of the Year Digit Method
- 7.2.5 Modified Accelerated Cost Recovery System (MACRS)

7.3 Introduction to Corporate Income Tax

7.4 After Tax Cash Flow Estimate

7.5 General Procedure for Making after Tax Economic Analysis

8. Inflation and its Impact on Project Cash Flows **(4 hours)**

8.1 Concept of Inflation
8.2 Measuring Inflation
8.3 Equivalence Calculation Under Inflation
8.4 Impact of Inflation on Economic Evaluation

Tutorial:

1. Assignments
2. Quizzes and Case study

References:

1. Chan S.Park,"Contemporary Engineering Economics",,Prentice Hall, Inc.
2. E. Paul De Garmo, William G. Sullivan and James A. Bontadelli, "Engineering Economy", Mc Milan Publishing Company.
3. James L. Riggs, David D. Bedworth and Sabah U. Randhawa, "Engineering Economics", Tata McGraw Hill Education Private Limited.

OBJECT ORIENTED ANALYSIS AND DESIGN

CT 651

Lecture : 3 **Year : III**
Tutorial : **Part : II**
Practical : 3/2

Course Objectives:

To introduce basic concepts of object-oriented analysis and design and to study the main features of the software development process in an object-oriented framework. To provide exposure to Visual Object Oriented Modeling languages, specifically Unified Modeling Language (UML)

1. Object Oriented Fundamentals **(10 hours)**

1.1 Introduction,
1.2 Object Oriented Analysis and Design,
1.3 Defining Models,
1.4 Case Study,
1.5 Requirement Process,
1.6 Use Cases,
1.7 Object Oriented Development Cycle,
1.8 Overview of the Unified Modeling Language: UML Fundamentals and Notations.

2. Object Oriented Analysis **(8 hours)**

2.1 Building Conceptual Model,
2.2 Adding Associations and Attributes,
2.3 Representation of System Behavior.

3. Object Oriented Design **(12 hours)**

3.1 Analysis to Design,
3.2 Describing and Elaborating Use Cases,
3.3 Collaboration Diagram,
3.4 Objects and Patterns,
3.5 Determining Visibility,
3.6 Class Diagram.

4. Implementation **(15 hours)**

4.1 Programming and Development Process,
4.2 Mapping Design to Code,
4.3 Creating Class Definitions from Design Class Diagrams,
4.4 Creating Methods from Collaboration Diagram,
4.5 Updating Class Definitions,
4.6 Classes in Code,
4.7 Exception and Error Handling.

Practical:

Laboratory Exercise will include handling a object oriented design and modeling activity in a ACSE Environment. UML pattern design and modeling will be taken up with the help of *UML Software*.

Reference Books:

1. Larman, C., Applying UML and Patterns, Pearson Education Asia.
2. Stevens, P., Pooley, R., Using UML: Software Engineering with Objects and Components, Addision-Wesley.
3. Fowler, M., Scott, K., UML Distilled: Applying the Standard Object Modeling Language, Addison-Wesley.
4. Booch, G., Jacobson, I., Rumbaugh, J., The Unified Software Development Process, Addison-Wesely.
5. Booch, G., Jacobson, I., Rumbaugh, J., The Unified Modeling Language User Guide, Addison-Wesely.
6. Jacobson I., Object-Oriented Software Engineering – A Use Case Driven Approach, Addison-Wesely.

DATABASE MANAGEMENT SYSTEMS

CT 652

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3

Course Objectives:

To provide fundamental concept, theory and practices in design and implementation of Database Management System

1. Introduction **(3 hours)**

1.1 Concepts and Applications
1.2 Objective and Evolution
1.3 Data Abstraction and Data Independence
1.4 Schema and Instances
1.5 Concepts of DDL, DML and DCL

2. Data Models **(7 hours)**

2.1 Logical, Physical and Conceptual
2.2 E-R Model
2.3 Entities and Entities sets
2.4 Relationship and Relationship sets
2.5 Strong and Weak Entity Sets
2.6 Attributes and Keys
2.7 E-R Diagram
2.8 Alternate Data Model (hierarchical, network, graph)

3. Relational Languages and Relational Model **(7 hours)**

3.1 Introduction to SQL
3.2 Features of SQL
3.3 Queries and Sub-Queries
3.4 Set Operations
3.5 Relations (Joined, Derived)
3.6 Queries under DDL and DML Commands
3.7 Embedded SQL
3.8 Views
3.9 Relational Algebra
3.10 Database Modification
3.11 QBE and domain relational calculus

4. Database Constraints and Normalization **(6 hours)**

4.1 Integrity Constraints and Domain Constraints
4.2 Assertions and Triggering
4.3 Functional Dependencies
4.4 Multi-valued and Joined Dependencies

4.5 Different Normal Forms (1st, 2nd, 3rd, BCNF, DKNF)

5. Query Processing and Optimization **(4 hours)**

5.1 Query Cost Estimation
5.2 Query Operations
5.3 Evaluation of Expressions
5.4 Query Optimization
5.5 Query Decomposition
5.6 Performance Tuning

6. File Structure and Hashing **(4 hours)**

6.1 Records Organizations
6.2 Disks and Storage
6.3 Remote Backup System
6.4 Hashing Concepts, Static and Dynamic Hashing
6.5 Order Indices
6.6 B+ tree index

7. Transactions processing and Concurrency Control **(6 hours)**

7.1 ACID properties
7.2 Concurrent Executions
7.3 Serializability Concept
7.4 Lock based Protocols
7.5 Deadlock handling and Prevention

8. Crash Recovery **(4 hours)**

8.1 Failure Classification
8.2 Recovery and Atomicity
8.3 Log-based Recovery
8.4 Shadow paging
8.5 Advanced Recovery Techniques

9. Advanced database Concepts **(4 hours)**

9.1 Concept of Objet-Oriented and Distributed Database Model
9.2 Properties of Parallel and Distributed Databases
9.3 Concept of Data warehouse Database
9.4 Concept of Spatial Database

Practical:

1: Introduction and operations of MS-Access or MySQL or any suitable DBMS
2: Database Server Installation and Configuration (MS-SQLServer, Oracle)
3: DB Client Installation and Connection to DB Server. Introduction and practice with SELECT Command with the existing DB.
4, 5: Further Practice with DML Commands
6, 7: Practice with DDL Commands. (Create Database and Tables).
8: Practice of Procedure/Trigger and DB Administration & other DBs (MySQL,

PG-SQL, DB2.)
9, 10, 11: Group Project Development.
12: Project Presentation and Viva

References

1. H. F. Korth and A. Silberschatz, "*Database system concepts*", McGraw Hill.
2. A. K. Majumdar and P. Bhattacharaya, "*Database Management Systems*", Tata McGraw Hill, India.

ARTIFICIAL INTELLIGENCE

CT 653

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

- To provide basic knowledge of Artificial Intelligence
- To familiarize students with different search techniques
- To acquaint students with the fields related to AI and the applications of AI

1. Introduction **(4 hours)**

1.1 Definition of Artificial Intelligence
1.2 Importance of Artificial Intelligence
1.3 AI and related fields
1.4 Brief history of Artificial Intelligence
1.5 Applications of Artificial Intelligence
1.6 Definition and importance of Knowledge, and learning.

2. Problem solving **(4 hours)**

2.1 Defining problems as a state space search,
2.2 Problem formulation
2.3 Problem types, Well- defined problems, Constraint satisfaction problem,
2.4 Game playing, Production systems.

3. Search techniques **(5 hours)**

3.1 Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison,
3.2 Informed search techniques-hill climbing, best first search, greedy search, A* search Adversarial search techniques-minimax procedure, alpha beta procedure

4. Knowledge representation, inference and reasoning **(8 hours)**

4.1 Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well-formed-formula,
4.2 Propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses,

4.3 Rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system,

4.4 Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

5. Structured knowledge representation **(4 hours)**

5.1 Representations and Mappings,

5.2 Approaches to Knowledge Representation,

5.3 Issues in Knowledge Representation,

5.4 Semantic nets, frames,

5.5 Conceptual dependencies and scripts

6. Machine learning **(6 hours)**

6.1 Concepts of learning,

6.2 Learning by analogy, Inductive learning, Explanation based learning

6.3 Neural networks,

6.4 Genetic algorithm

6.5 Fuzzy learning

6.6 Boltzmann Machines

7. Applications of AI **(14 hours)**

7.1 Neural networks

- 7.1.1 Network structure
- 7.1.2 Adaline network
- 7.1.3 Perceptron
- 7.1.4 Multilayer Perceptron, Back Propagation
- 7.1.5 Hopfield network
- 7.1.6 Kohonen network

7.2 Expert System

- 7.2.1 Architecture of an expert system
- 7.2.2 Knowledge acquisition, induction
- 7.2.3 Knowledge representation, Declarative knowledge, Procedural knowledge
- 7.2.4 Development of expert systems

7.3 Natural Language Processing and Machine Vision

- 7.3.1 Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic
- 7.3.2 Introduction to Machine Vision

Practical:

Laboratory exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

References:

1. E. Rich and Knight, "Artificial Intelligence", McGraw Hill.
2. D. W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall.
3. P. H. Winston, "Artificial Intelligence", Addison Wesley.
4. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson.

EMBEDDED SYSTEM

CT 655

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objective:
To introduce students to understand and familiarization on applied computing principles in emerging technologies and applications for embedded systems

1. Introduction to Embedded System **(3 Hours)**

1.1 Embedded Systems overview
1.2 Classification of Embedded Systems
1.3 Hardware and Software in a system
1.4 Purpose and Application of Embedded Systems

2. Hardware Design Issues **(4 Hours)**

2.1 Combination Logic
2.2 Sequential Logic
2.3 Custom Single-Purpose Processor Design
2.4 Optimizing Custom Single-Purpose Processors

3. Software Design Issues **(6 Hours)**

3.1 Basic Architecture
3.2 Operation
3.3 Programmer's View
3.4 Development Environment
3.5 Application-Specific Instruction-Set Processors
3.6 Selecting a Microprocessor
3.7 General-Purpose Processor Design

4. Memory **(5 Hours)**

4.1 Memory Write Ability and Storage Permanence
4.2 Types of Memory
4.3 Composing Memory
4.4 Memory Hierarchy and Cache

5. Interfacing **(6 Hours)**

5.1 Communication Basics
5.2 Microprocessor Interfacing: I/O Addressing, Interrupts, DMA
5.3 Arbitration
5.4 Multilevel Bus Architectures
5.5 Advanced Communication Principles

6. Real-Time Operating System (RTOS) **(8 Hours)**

6.1 Operating System Basics

6.2 Task, Process, and Threads
6.3 Multiprocessing and Multitasking
6.4 Task Scheduling
6.5 Task Synchronization
6.6 Device Drivers

7. Control System **(3 Hours)**

7.1 Open-loop and Close-Loop control System overview
7.2 Control System and PID Controllers
7.3 Software coding of a PID Controller
7.4 PID Tuning

8. IC Technology **(3 Hours)**

8.1 Full-Custom (VLSI) IC Technology
8.2 Semi-Custom (ASIC) IC Technology
8.3 Programming Logic Device (PLD) IC Technology

9. Microcontrollers in Embedded Systems **(3 Hours)**

9.1 Intel 8051 microcontroller family, its architecture and instruction sets
9.2 Programming in Assembly Language
9.3 A simple interfacing example with 7 segment display

10. VHDL **(4 Hours)**

10.1 VHDL overview
10.2 Finite state machine design with VHDL

Practical:

Student should be complete lab works and project work in practical classes.

Reference Books:

1. David E. Simon, "An Embedded Software Primer", Addison-Wesley
2. Muhammad Ali Mazidi, "8051 Microcontroller and Embedded Systems", Prentice Hall
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons
4. Douglas L. Perry, "VHDL Programming by example", McGraw Hill

OPERATING SYSTEM

CT 656

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objective:

To be familiar with the different aspects of operating system and use the idea in designing operating system

1. Introduction **(5 hours)**

- 1.1 Operating System and Function
- 1.2 Evolution of Operating System
- 1.3 Type of Operating System: Batch, Interactive, Multiprocessing, Time Sharing and Real Time System
- 1.4 Operating System Components
- 1.5 Operating System Structure: Monolithic, Layered, Micro-Kernel, Client-Server, Virtual Machine
- 1.6 Operating System Services
  - 1.6.1 System calls
  - 1.6.2 Shell commands
  - 1.6.3 Shell programming
- 1.7 Examples of O. S.: UNIX, Linux, MS-Windows, Handheld OS.

2. Process Management **(6 hours)**

- 2.1 Introduction to Process
  - 2.1.1 Process description
  - 2.1.2 Process states
  - 2.1.3 Process control
- 2.2 Threads
- 2.3 Processes and Threads
- 2.4 Scheduling
  - 2.4.1 Types of scheduling
  - 2.4.2 Scheduling in batch system
  - 2.4.3 Scheduling in Interactive System
  - 2.4.4 Scheduling in Real Time System
  - 2.4.5 Thread Scheduling
- 2.5 Multiprocessor Scheduling concept

3. Process Communication and Synchronization **(5 hours)**

- 3.1 Principles of Concurrency

3.2 Critical Region
3.3 Race Condition
3.4 Mutual Exclusion
3.5 Semaphores and Mutex
3.6 Message Passing
3.7 Monitors
3.8 Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem

4. Memory Management **(6 hours)**

4.1 Memory address, Swapping and Managing Free Memory Space
4.2 Resident Monitor
4.3 Multiprogramming with Fixed Partition
4.4 Multiprogramming With Variable Partition
4.5 Multiple Base Register
4.6 Virtual Memory Management
  4.6.1 Paging
  4.6.2 Segmentation
  4.6.3 Paged Segmentation
4.7 Demand Paging
4.8 Performance
4.9 Page Replacement Algorithms
4.10 Allocation of Frames
4.11 Thrashing

5. File Systems **(6 hours)**

5.1 File: Name, Structure, Types, Access, Attribute, Operations
5.2 Directory and File Paths
5.3 File System Implementation
  5.3.1 Selecting Block Size
  5.3.2 Impact of Block Size Selection
  5.3.3 Implementing File: Contiguous Allocation, Link List Allocation, Link List Allocation with Table, Inode
  5.3.4 Implementing Directory
5.4 Impact of Allocation Policy on Fragmentation
5.5 Mapping File Blocks on The Disk Platter
5.6 File System Performance
5.7 Example File Systems: CD ROM file system, MS-DOS file system, Unix File system

6. I/O Management & Disk Scheduling **(4 hours)**

6.1 Principles of I/O Hardware
6.2 Principles of I/O software

6.3 I/O software Layer
6.4 Disk
6.4.1 Hardware
6.4.2 Formatting
6.4.3 Arm scheduling
6.4.4 Error handling
6.4.5 Stable Storage

7. Deadlock **(5 hours)**

7.1 Principles of deadlock
7.2 Deadlock Prevention
7.3 Deadlock Avoidance
7.4 Deadlock Detection
7.5 Recovery from deadlock
7.6 An Integrated Deadlock Strategies
7.7 Other Issues: Two phase locking, Communication Deadlock, Livelock, Starvation

8. Security **(4 hours)**

8.1 Security breaches
8.2 Types of Attacks
8.3 Security Policy and Access Control
8.4 Basics of Cryptography
8.5 Protection Mechanisms
8.6 Authentication
8.7 OS Design Considerations For Security
8.8 Access Control Lists And OS Support

9. System administration **(4 hours)**

9.1 Administration Tasks
9.2 User Account Management
9.3 Start And Shutdown Procedures
9.4 Setting up Operational Environment for a New User
9.5 AWK tool, Search, Sort tools, Shell scripts, Make tool

Practical:

1. Shell commands, shell programming: write simple functions, basic tests, loops, patterns, expansions, substitutions
2. Programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Programs using the I/O system calls of UNIX operating system
4. Implement the Producer – Consumer problem using semaphores.
5. Implement some memory management schemes

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", PHI
2. Stalling William, "Operating Systems", Pearson Education
3. Silbcrschatz A.,Galvin P., Gagne G., "Operating System Concepts", John Wiley and Sons,
4. Milan Milenkovic, "Operating Systems Concepts and Design", TMGH
5. Das Sumitabha, "Unix Concepts and Applications", Tata McGraw Hill.
6. M. J. Bach, "The Design of The Unix Operating System", PHI.
7. Charles Crowley, "Operating Systems: A Design-oriented Approach", TMH.

MINOR PROJECT
CT 654

Lecture : 0
Tutorial : 0
Practical : 4

Year : III
Part : II

Objectives:

To carry out a small scale project to develop hands-on experience of working in a project. During the course, the student will also develop knowledge of application development platforms and tools (Java /C# dotnet / Visual C++/PHP or any platform of current trend). The students will learn working as a team and basic collaboration and project management skills. The student will also learn about formulating project documentations.

1. Project ideas and proposal guidance **(4 hours)**

2. Application development **(10 hours)**

- 2.1 Visual programming (object oriented)
  - 2.1.1 Language basics
  - 2.1.2 Frameworks and APIs
- 2.2 Programming basics and design patterns

3. Project management, team work and collaboration **(8 hours)**

- 3.1 Project management techniques
- 3.2 Collaborative development environment

4. Project guidance **(5 hours)**

5. Project work **(30 hours)**

6. Project documentation guidance **(3 hours)**

ENGINEERING ECONOMICS
CE 655

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 0

Course Objectives:

To provide concept and knowledge of economic studies that will be useful for the evaluation engineering projects and make decisions related to investment.

1. Introduction **(3 hours)**

- 1.1 Origin of Engineering Economy
- 1.2 Principles of Engineering Economy
- 1.3 Role of Engineers in Decision Making
- 1.4 Cash Flow Diagram

2. Interest and Time Value of Money **(6 hours)**

- 2.1 Introduction to Time Value of Money
- 2.2 Simple Interest
- 2.3 Compound Interest
  - 2.3.1 Nominal Interest Rate
  - 2.3.2 Effective Interest Rate
  - 2.3.3 Continuous Compounding
- 2.4 Economic Equivalence
- 2.5 Development of Interest Formulas
  - 2.5.1 The Five Types of Cash Flows
  - 2.5.2 Single Cash Flow Formulas
  - 2.5.3 Uneven Payment Series
  - 2.5.4 Equal Payment Series
  - 2.5.5 Linear Gradient Series.
  - 2.5.6 Geometric Gradient Series.

3. Basic Methodologies of Engineering Economic Analysis **(8 hours)**

- 3.1 Determining Minimum Attractive (Acceptable) Rate of Return (MARR).
- 3.2 Payback Period Method
- 3.3 Equivalent Worth Methods
  - 3.3.1 Present Worth Method
  - 3.3.2 Future Worth Method
  - 3.3.3 Annual Worth Method
- 3.4 Rate of Return Methods
  - 3.4.1 Internal Rate of Return Method.
  - 3.4.2 External/Modified Rate of Return Method
- 3.5 Public Sector Economic Analysis (Benefit Cost Ratio Method)
- 3.6 Introduction to Lifecycle Costing

3.7 Introduction to Financial and Economic Analysis

4. Comparative Analysis of Alternatives **(6 hours)**

4.1 Comparing Mutually Exclusive Alternatives having Same Useful Life by
- 4.1.1 Payback Period Method and Equivalent Worth Method
- 4.1.2 Rate of Return Methods and Benefit Cost Ratio Method

4.2 Comparing Mutually Exclusive Alternatives having Different Useful Lives by
- 4.2.1 Repeatability Assumption
- 4.2.2 Co-terminated Assumption
- 4.2.3 Capitalized Worth Method

4.3 Comparing Mutually Exclusive, Contingent and Independent Projects in Combination

5. Replacement Analysis **(6 hours)**

5.1 Fundamentals of Replacement Analysis
- 5.1.1 Basic Concepts and Terminology
- 5.1.2 Approaches for Comparing Defender and Challenger

5.2 Economic Service Life of Challenger and Defender

5.3 Replacement Analysis When Required Service Life is Long
- 5.3.1 Required Assumptions and Decision Framework
- 5.3.2 Replacement Analysis under the Infinite Planning Horizon
- 5.3.3 Replacement Analysis under the Finite Planning Horizon

6. Risk Analysis **(6 hours)**

6.1 Origin/Sources of Project Risks

6.2 Methods of Describing Project Risks
- 6.2.1 Sensitivity Analysis
- 6.2.2 Breakeven Analysis
- 6.2.3 Scenario Analysis

6.3 Probability Concept of Economic Analysis

6.4 Decision Tree and Sequential Investment Decisions

7. Depreciation and Corporate Income Taxes **(6 hours)**

7.1 Concept and Terminology of Depreciation

7.2 Basic Methods of Depreciation
- 7.2.1 Straight line method
- 7.2.2 Declining Balance Method
- 7.2.3 Sinking Fund Method
- 7.2.4 Sum of the Year Digit Method
- 7.2.5 Modified Accelerated Cost Recovery System (MACRS)

7.3 Introduction to Corporate Income Tax

7.4 After Tax Cash Flow Estimate

7.5 General Procedure for Making after Tax Economic Analysis

8. Inflation and its Impact on Project Cash Flows **(4 hours)**

8.1 Concept of Inflation
8.2 Measuring Inflation
8.3 Equivalence Calculation Under Inflation
8.4 Impact of Inflation on Economic Evaluation

Tutorial:

1. Assignments
2. Quizzes and Case study

References:

1. Chan S.Park,"Contemporary Engineering Economics",,Prentice Hall, Inc.
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3. James L. Riggs, David D. Bedworth and Sabah U. Randhawa, "Engineering Economics", Tata McGraw Hill Education Private Limited.

OBJECT ORIENTED ANALYSIS AND DESIGN

CT 651

Lecture : 3 **Year : III**
Tutorial : **Part : II**
Practical : 3/2

Course Objectives:

To introduce basic concepts of object-oriented analysis and design and to study the main features of the software development process in an object-oriented framework. To provide exposure to Visual Object Oriented Modeling languages, specifically Unified Modeling Language (UML)

1. Object Oriented Fundamentals **(10 hours)**

1.1 Introduction,
1.2 Object Oriented Analysis and Design,
1.3 Defining Models,
1.4 Case Study,
1.5 Requirement Process,
1.6 Use Cases,
1.7 Object Oriented Development Cycle,
1.8 Overview of the Unified Modeling Language: UML Fundamentals and Notations.

2. Object Oriented Analysis **(8 hours)**

2.1 Building Conceptual Model,
2.2 Adding Associations and Attributes,
2.3 Representation of System Behavior.

3. Object Oriented Design **(12 hours)**

3.1 Analysis to Design,
3.2 Describing and Elaborating Use Cases,
3.3 Collaboration Diagram,
3.4 Objects and Patterns,
3.5 Determining Visibility,
3.6 Class Diagram.

4. Implementation **(15 hours)**

4.1 Programming and Development Process,
4.2 Mapping Design to Code,
4.3 Creating Class Definitions from Design Class Diagrams,
4.4 Creating Methods from Collaboration Diagram,
4.5 Updating Class Definitions,
4.6 Classes in Code,
4.7 Exception and Error Handling.

Practical:

Laboratory Exercise will include handling a object oriented design and modeling activity in a ACSE Environment. UML pattern design and modeling will be taken up with the help of *UML Software*.

Reference Books:

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5. Booch, G., Jacobson, I., Rumbaugh, J., The Unified Modeling Language User Guide, Addison-Wesely.
6. Jacobson I., Object-Oriented Software Engineering – A Use Case Driven Approach, Addison-Wesely.

DATABASE MANAGEMENT SYSTEMS

CT 652

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3

Course Objectives:

To provide fundamental concept, theory and practices in design and implementation of Database Management System

1. Introduction **(3 hours)**

1.1 Concepts and Applications
1.2 Objective and Evolution
1.3 Data Abstraction and Data Independence
1.4 Schema and Instances
1.5 Concepts of DDL, DML and DCL

2. Data Models **(7 hours)**

2.1 Logical, Physical and Conceptual
2.2 E-R Model
2.3 Entities and Entities sets
2.4 Relationship and Relationship sets
2.5 Strong and Weak Entity Sets
2.6 Attributes and Keys
2.7 E-R Diagram
2.8 Alternate Data Model (hierarchical, network, graph)

3. Relational Languages and Relational Model **(7 hours)**

3.1 Introduction to SQL
3.2 Features of SQL
3.3 Queries and Sub-Queries
3.4 Set Operations
3.5 Relations (Joined, Derived)
3.6 Queries under DDL and DML Commands
3.7 Embedded SQL
3.8 Views
3.9 Relational Algebra
3.10 Database Modification
3.11 QBE and domain relational calculus

4. Database Constraints and Normalization **(6 hours)**

4.1 Integrity Constraints and Domain Constraints
4.2 Assertions and Triggering
4.3 Functional Dependencies
4.4 Multi-valued and Joined Dependencies

4.5 Different Normal Forms (1st, 2nd, 3rd, BCNF, DKNF)

5. Query Processing and Optimization **(4 hours)**

5.1 Query Cost Estimation
5.2 Query Operations
5.3 Evaluation of Expressions
5.4 Query Optimization
5.5 Query Decomposition
5.6 Performance Tuning

6. File Structure and Hashing **(4 hours)**

6.1 Records Organizations
6.2 Disks and Storage
6.3 Remote Backup System
6.4 Hashing Concepts, Static and Dynamic Hashing
6.5 Order Indices
6.6 B+ tree index

7. Transactions processing and Concurrency Control **(6 hours)**

7.1 ACID properties
7.2 Concurrent Executions
7.3 Serializability Concept
7.4 Lock based Protocols
7.5 Deadlock handling and Prevention

8. Crash Recovery **(4 hours)**

8.1 Failure Classification
8.2 Recovery and Atomicity
8.3 Log-based Recovery
8.4 Shadow paging
8.5 Advanced Recovery Techniques

9. Advanced database Concepts **(4 hours)**

9.1 Concept of Objet-Oriented and Distributed Database Model
9.2 Properties of Parallel and Distributed Databases
9.3 Concept of Data warehouse Database
9.4 Concept of Spatial Database

Practical:

1: Introduction and operations of MS-Access or MySQL or any suitable DBMS
2: Database Server Installation and Configuration (MS-SQLServer, Oracle)
3: DB Client Installation and Connection to DB Server. Introduction and practice with SELECT Command with the existing DB.
4, 5: Further Practice with DML Commands
6, 7: Practice with DDL Commands. (Create Database and Tables).
8: Practice of Procedure/Trigger and DB Administration & other DBs (MySQL,

PG-SQL, DB2.)
9, 10, 11: Group Project Development.
12: Project Presentation and Viva

References

1. H. F. Korth and A. Silberschatz, "*Database system concepts*", McGraw Hill.
2. A. K. Majumdar and P. Bhattacharaya, "*Database Management Systems*", Tata McGraw Hill, India.

ARTIFICIAL INTELLIGENCE

CT 653

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

- To provide basic knowledge of Artificial Intelligence
- To familiarize students with different search techniques
- To acquaint students with the fields related to AI and the applications of AI

1. Introduction **(4 hours)**

1.1 Definition of Artificial Intelligence
1.2 Importance of Artificial Intelligence
1.3 AI and related fields
1.4 Brief history of Artificial Intelligence
1.5 Applications of Artificial Intelligence
1.6 Definition and importance of Knowledge, and learning.

2. Problem solving **(4 hours)**

2.1 Defining problems as a state space search,
2.2 Problem formulation
2.3 Problem types, Well- defined problems, Constraint satisfaction problem,
2.4 Game playing, Production systems.

3. Search techniques **(5 hours)**

3.1 Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison,
3.2 Informed search techniques-hill climbing, best first search, greedy search, A* search Adversarial search techniques-minimax procedure, alpha beta procedure

4. Knowledge representation, inference and reasoning **(8 hours)**

4.1 Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well-formed-formula,
4.2 Propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses,

4.3 Rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system,

4.4 Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

5. Structured knowledge representation **(4 hours)**

5.1 Representations and Mappings,

5.2 Approaches to Knowledge Representation,

5.3 Issues in Knowledge Representation,

5.4 Semantic nets, frames,

5.5 Conceptual dependencies and scripts

6. Machine learning **(6 hours)**

6.1 Concepts of learning,

6.2 Learning by analogy, Inductive learning, Explanation based learning

6.3 Neural networks,

6.4 Genetic algorithm

6.5 Fuzzy learning

6.6 Boltzmann Machines

7. Applications of AI **(14 hours)**

7.1 Neural networks

- 7.1.1 Network structure
- 7.1.2 Adaline network
- 7.1.3 Perceptron
- 7.1.4 Multilayer Perceptron, Back Propagation
- 7.1.5 Hopfield network
- 7.1.6 Kohonen network

7.2 Expert System

- 7.2.1 Architecture of an expert system
- 7.2.2 Knowledge acquisition, induction
- 7.2.3 Knowledge representation, Declarative knowledge, Procedural knowledge
- 7.2.4 Development of expert systems

7.3 Natural Language Processing and Machine Vision

- 7.3.1 Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic
- 7.3.2 Introduction to Machine Vision

Practical:

Laboratory exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

References:

1. E. Rich and Knight, "Artificial Intelligence", McGraw Hill.
2. D. W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall.
3. P. H. Winston, "Artificial Intelligence", Addison Wesley.
4. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson.

EMBEDDED SYSTEM

CT 655

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objective:
To introduce students to understand and familiarization on applied computing principles in emerging technologies and applications for embedded systems

1. Introduction to Embedded System **(3 Hours)**

1.1 Embedded Systems overview
1.2 Classification of Embedded Systems
1.3 Hardware and Software in a system
1.4 Purpose and Application of Embedded Systems

2. Hardware Design Issues **(4 Hours)**

2.1 Combination Logic
2.2 Sequential Logic
2.3 Custom Single-Purpose Processor Design
2.4 Optimizing Custom Single-Purpose Processors

3. Software Design Issues **(6 Hours)**

3.1 Basic Architecture
3.2 Operation
3.3 Programmer's View
3.4 Development Environment
3.5 Application-Specific Instruction-Set Processors
3.6 Selecting a Microprocessor
3.7 General-Purpose Processor Design

4. Memory **(5 Hours)**

4.1 Memory Write Ability and Storage Permanence
4.2 Types of Memory
4.3 Composing Memory
4.4 Memory Hierarchy and Cache

5. Interfacing **(6 Hours)**

5.1 Communication Basics
5.2 Microprocessor Interfacing: I/O Addressing, Interrupts, DMA
5.3 Arbitration
5.4 Multilevel Bus Architectures
5.5 Advanced Communication Principles

6. Real-Time Operating System (RTOS) **(8 Hours)**

6.1 Operating System Basics

6.2 Task, Process, and Threads
6.3 Multiprocessing and Multitasking
6.4 Task Scheduling
6.5 Task Synchronization
6.6 Device Drivers

7. Control System **(3 Hours)**

7.1 Open-loop and Close-Loop control System overview
7.2 Control System and PID Controllers
7.3 Software coding of a PID Controller
7.4 PID Tuning

8. IC Technology **(3 Hours)**

8.1 Full-Custom (VLSI) IC Technology
8.2 Semi-Custom (ASIC) IC Technology
8.3 Programming Logic Device (PLD) IC Technology

9. Microcontrollers in Embedded Systems **(3 Hours)**

9.1 Intel 8051 microcontroller family, its architecture and instruction sets
9.2 Programming in Assembly Language
9.3 A simple interfacing example with 7 segment display

10. VHDL **(4 Hours)**

10.1 VHDL overview
10.2 Finite state machine design with VHDL

Practical:

Student should be complete lab works and project work in practical classes.

Reference Books:

1. David E. Simon, "An Embedded Software Primer", Addison-Wesley
2. Muhammad Ali Mazidi, "8051 Microcontroller and Embedded Systems", Prentice Hall
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons
4. Douglas L. Perry, "VHDL Programming by example", McGraw Hill

OPERATING SYSTEM

CT 656

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objective:

To be familiar with the different aspects of operating system and use the idea in designing operating system

1. Introduction **(5 hours)**

- 1.1 Operating System and Function
- 1.2 Evolution of Operating System
- 1.3 Type of Operating System: Batch, Interactive, Multiprocessing, Time Sharing and Real Time System
- 1.4 Operating System Components
- 1.5 Operating System Structure: Monolithic, Layered, Micro-Kernel, Client-Server, Virtual Machine
- 1.6 Operating System Services
  - 1.6.1 System calls
  - 1.6.2 Shell commands
  - 1.6.3 Shell programming
- 1.7 Examples of O. S.: UNIX, Linux, MS-Windows, Handheld OS.

2. Process Management **(6 hours)**

- 2.1 Introduction to Process
  - 2.1.1 Process description
  - 2.1.2 Process states
  - 2.1.3 Process control
- 2.2 Threads
- 2.3 Processes and Threads
- 2.4 Scheduling
  - 2.4.1 Types of scheduling
  - 2.4.2 Scheduling in batch system
  - 2.4.3 Scheduling in Interactive System
  - 2.4.4 Scheduling in Real Time System
  - 2.4.5 Thread Scheduling
- 2.5 Multiprocessor Scheduling concept

3. Process Communication and Synchronization **(5 hours)**

- 3.1 Principles of Concurrency

3.2 Critical Region
3.3 Race Condition
3.4 Mutual Exclusion
3.5 Semaphores and Mutex
3.6 Message Passing
3.7 Monitors
3.8 Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem

4. Memory Management **(6 hours)**

4.1 Memory address, Swapping and Managing Free Memory Space
4.2 Resident Monitor
4.3 Multiprogramming with Fixed Partition
4.4 Multiprogramming With Variable Partition
4.5 Multiple Base Register
4.6 Virtual Memory Management
  4.6.1 Paging
  4.6.2 Segmentation
  4.6.3 Paged Segmentation
4.7 Demand Paging
4.8 Performance
4.9 Page Replacement Algorithms
4.10 Allocation of Frames
4.11 Thrashing

5. File Systems **(6 hours)**

5.1 File: Name, Structure, Types, Access, Attribute, Operations
5.2 Directory and File Paths
5.3 File System Implementation
  5.3.1 Selecting Block Size
  5.3.2 Impact of Block Size Selection
  5.3.3 Implementing File: Contiguous Allocation, Link List Allocation, Link List Allocation with Table, Inode
  5.3.4 Implementing Directory
5.4 Impact of Allocation Policy on Fragmentation
5.5 Mapping File Blocks on The Disk Platter
5.6 File System Performance
5.7 Example File Systems: CD ROM file system, MS-DOS file system, Unix File system

6. I/O Management & Disk Scheduling **(4 hours)**

6.1 Principles of I/O Hardware
6.2 Principles of I/O software

6.3 I/O software Layer
6.4 Disk
6.4.1 Hardware
6.4.2 Formatting
6.4.3 Arm scheduling
6.4.4 Error handling
6.4.5 Stable Storage

7. Deadlock **(5 hours)**

7.1 Principles of deadlock
7.2 Deadlock Prevention
7.3 Deadlock Avoidance
7.4 Deadlock Detection
7.5 Recovery from deadlock
7.6 An Integrated Deadlock Strategies
7.7 Other Issues: Two phase locking, Communication Deadlock, Livelock, Starvation

8. Security **(4 hours)**

8.1 Security breaches
8.2 Types of Attacks
8.3 Security Policy and Access Control
8.4 Basics of Cryptography
8.5 Protection Mechanisms
8.6 Authentication
8.7 OS Design Considerations For Security
8.8 Access Control Lists And OS Support

9. System administration **(4 hours)**

9.1 Administration Tasks
9.2 User Account Management
9.3 Start And Shutdown Procedures
9.4 Setting up Operational Environment for a New User
9.5 AWK tool, Search, Sort tools, Shell scripts, Make tool

Practical:

1. Shell commands, shell programming: write simple functions, basic tests, loops, patterns, expansions, substitutions
2. Programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Programs using the I/O system calls of UNIX operating system
4. Implement the Producer – Consumer problem using semaphores.
5. Implement some memory management schemes

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", PHI
2. Stalling William, "Operating Systems", Pearson Education
3. Silbcrschatz A.,Galvin P., Gagne G., "Operating System Concepts", John Wiley and Sons,
4. Milan Milenkovic, "Operating Systems Concepts and Design", TMGH
5. Das Sumitabha, "Unix Concepts and Applications", Tata McGraw Hill.
6. M. J. Bach, "The Design of The Unix Operating System", PHI.
7. Charles Crowley, "Operating Systems: A Design-oriented Approach", TMH.

MINOR PROJECT
CT 654

Lecture : 0
Tutorial : 0
Practical : 4

Year : III
Part : II

Objectives:

To carry out a small scale project to develop hands-on experience of working in a project. During the course, the student will also develop knowledge of application development platforms and tools (Java /C# dotnet / Visual C++/PHP or any platform of current trend). The students will learn working as a team and basic collaboration and project management skills. The student will also learn about formulating project documentations.

1. Project ideas and proposal guidance **(4 hours)**

2. Application development **(10 hours)**

- 2.1 Visual programming (object oriented)
  - 2.1.1 Language basics
  - 2.1.2 Frameworks and APIs
- 2.2 Programming basics and design patterns

3. Project management, team work and collaboration **(8 hours)**

- 3.1 Project management techniques
- 3.2 Collaborative development environment

4. Project guidance **(5 hours)**

5. Project work **(30 hours)**

6. Project documentation guidance **(3 hours)**