Computer Networks (3 – 0 - 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:
This course provides the overall communication infrastructure including wired and wireless media for computer networking, models of network. It also highlights the operation of layer-wise network communication, different addressing mechanisms, routing algorithms, security in the computer network and overview of server configuration for complete networking systems.

Course Contents:

1. Introduction to Computer Network **3 hrs**
- 1.1. Definition, merits, Demerits
- 1.2. Network Models
  - 1.2.1. PAN, LAN, Campus Area Network (CAN), MAN, Country Area Network (CAN*), WAN, GAN.
  - 1.2.2. Topological Models (star, bus, distributed bus, mesh, tree, hybrid, ring)
  - 1.2.3. Client/Server, Peer-to-Peer & Active Network Model

2. Reference Model **4 hrs**
- 2.1. Protocols and Standards
- 2.2. Interfaces and Services
- 2.3. OSI Layers
- 2.4. TCP/IP layers
- 2.5. Comparison of OSI & TCP/IP
- 2.6. Networking hardware: NIC, Hub, Repeater, Switches, Bridge, Router

3. Physical Layer **4 hrs**
- 3.1. Guided Media: Copper, Fiber cabling and its capacity standards
- 3.2. Unguided Media: Bluetooth, Wi-Fi/Wireless-LAN, Satellite Communication Basics (Micro waves, Radio waves)
- 3.3. Circuit/packet/message switching
- 3.4. ISDN Signaling & Architecture
- 3.5. Network Performance: Bandwidth, Throughput, Latency, Bandwidth-Delay Product, Jitter

4. Data Link Layer **8 hrs**
- 4.1. LLC and MAC sub-layer overview
- 4.2. Physical (MAC) addressing overview
- 4.3. Framing
- 4.4. Flow control (stop and wait, go-back-N, selective-repeat-request)
- 4.5. Error Control Mechanisms
  - 4.5.1. Error Detection: Parity Check, CRC

4.5.2. Error Correction: Hamming code
4.6. Channel Access
4.6.1. ALOHA Systems
4.6.2. CSMA, CSMA/CD
4.7. 802.3 Ethernet, Fast Ethernet, Gigabit Ethernet
4.8. 802.4 Token Bus, 802.5 Token Ring
4.9. Virtual Circuit Switching: Frame Relay, ATM & X.25

5. Network/Internet Layer Protocols and Addressing **8 hrs**

5.1. Logical addressing
5.1.1. IPv4 addressing, subnetting, supernetting, CIDR, VLSM
5.1.2. IPv6 addressing overview
5.1.3. IPv4 and IPv6 header protocol format
5.1.4. IPv4 & IPv6 feature comparison
5.2. Routing Algorithm overview
5.2.1. Classful and Classless Routing
5.2.2. Adaptive and non-adaptive routing
5.2.3. Distance vector and link-state routing
5.2.4. Interior and exterior routing
5.2.5. Unicast & multicast routing
5.2.6. Routing Algorithms: RIP, OSPF, BGP

6. Transport Layer and protocols **4 hrs**

6.1. Port addressing overview
6.2. Process to process delivery: multiplexing and de-multiplexing
6.3. TCP services, features, segment headers, well known ports & Handshaking
6.4. UDP Services, features, segment Headers, well known ports
6.5. Concept of Socket programming: TCP & UDP socket

7. Congestion Control & Quality of services **3 hrs**

7.1. Congestion Control: Open loop and Closed Loop
7.2. Traffic Shaping (leaky bucket and token bucket)
7.3. TCP congestion control

8. Application Layer, Servers & Protocols **5 hrs**

8.1. Domain addressing, DNS server & Queries
8.2. HTTP, FTP & proxy server overview.
8.3. DHCP principles.
8.4. E-mail server Protocol: SMTP, POP, IMAP

9. Network management and Security **6 hrs**

9.1. Introduction to Network management.
9.2. SNMP
9.3. Principles of cryptography (Symmetric key: DES, Asymmetric key: RSA)
9.4. Key Exchange Protocols (Diffie-Hallman, Kerberos)
9.5. VPN
9.6. Overview of IPSEC
9.7. Firewall & its types

Laboratory Work:

1. Network commands testing: ping-pong, netstat, nslookup, ipconfig/ifconfig, tracert/traceroute…
2. Setting up Client/Server network system in Microsoft and Linux environment
3. UTP CAT6 cabling: Straight and Cross wiring, testing and verification
4. Internet Packet header analysis using TCPDUMP/WIRESHAK
5. Router Configuration, use of packet tracer or other simulator software
6. OSPF configuration & practices
7. Web, Proxy, FTP server configuration
8. Implementation of Router ACL, Proxy Firewall, IPTables.
9. Case Study: Network Design Standards (eg: building Network design with servers including NCR)

Text Book:

Behrouz A. Forouzen, "Data Communication and Networking", 4th Edition, Tata McGgaw Hill.

References:

1. A.S. Tanenbaum, "Computer Networks", 3rd Edition, Prentice Hall India, 1997.
2. W. Stallings, "Data and Computer Communication", Macmillan Press, 1989.
3. Kurose Ross : Computer Networking: A top down approach, 2nd Edition, Pearson Education

पाठ्यक्रम विकास केन्द्र

Engineering Economics (3 – 2 - 0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

After completing this course, students will be able to

- understand and describe the basic concept of economics, engineering economics, cost accounting and time value of money.
- assist in the valuation of engineering projects in the public and private sectors in order to take investment decisions
- analyze the project risk and relate the concept of ecological limit and economic development.
- calculate depreciation, taxation and its application in analysis
- identify different financing options and use, to a limited extent, general accounting procedures.

Course Contents:

1. **Basics of Engineering Economics** **3 hrs**
   - 1.1. Definition of Economics, Demand, the Law of Demand, Law of Diminishing Utility, Marginal Utility, Supply, Law of Supply, Law of Supply and Demand,
   - 1.2. Engineering Economics, Principles of Engineering Economy and its application

2. **Cost Concept and Fundamentals of Cost Accounting** **3 hrs**
   - 2.1 Cost Terminology: Manufacturing Cost and Non-Manufacturing Cost
   - 2.2 Cost for Business Decision: Differential Cost and Revenue; Opportunity Cost,Sunk Cost and Marginal Cost

3. **Time Value of Money** **4 hrs**
   - 3.1 Interest, Simple Interest, Compound Interest, Nominal Rate of Interest, Effective Rate of Interest
   - 3.2 Economic Equivalence: Present Worth, Future Worth and Annual Worth
   - 3.3 Development of Formulas for Equivalence Calculation

4. **Basic Methods of Engineering Economic Studies** **7 hrs**
   - 4.1 Minimum Attractive Rate of Return - MARR
   - 4.2 Payback Period Method – Simple and Discounted
   - 4.3 Equivalent Worth Methods; Present Worth Method, Future Worth Method and Annual Worth Method.
   - 4.4 Rate of Return Methods: Internal Rate of Return (IRR) Method and External/Modified Rate of Return (ERR/MIRR) Method
   - 4.5 Benefit Cost Ratio Method.

5. Comparative Analysis of Alternatives **6 hrs**

5.1 Comparing Mutually Exclusive Alternatives having same useful life byPayback Period Method, Equivalent Worth Method; Rate of Return Methods and Benefit Cost Ratio Method

5.2 Comparing Mutually Exclusive Alternatives having different useful lives by Repeatability Assumption, Co-terminated Assumption, Capitalized Worth Method

5.3 Comparing Mutually Exclusive, Contingent and Independent Projects in Combination.

6. Risk Analysis **4 hrs**

6.1 Origin/Sources of Project Risks.

6.2 Methods of Describing Project Risks; Sensitivity Analysis, Breakeven Analysis, Scenario Analysis

7. Ecological Limits and Economic Development **3 hrs**

7.1 Economic Theory and Ecological Limit,

7.2 Concept of sustainable development,

7.3 Ecological Footprint and

7.4 Overcoming Ecological Limits

8. Depreciation and Corporate Income Taxes **5 hrs**

8.1. Depreciation and its causes, Asset Depreciation and Accounting Depreciation,

8.2. Basic Methods of Depreciation; Straight line method, Declining Balance Method, Sinking Fund Method, Sum of the Year Digit Method, Unit of Production Method, Modified Accelerated Cost Recovery System (MACRS)

8.3. Introduction to Corporate Income Tax.Taxation Law, Depreciation Rates Personal Tax, Corporate Tax, VAT

8.4. After Tax Cash flow Estimate, General Procedure for Making After Tax Economic Analysis

9. Enterprise Financing and Capital Investment **4 hrs**

9.1 Method of Financing: Equity Financing, Debt Financing and Capital Structure

9.2 Cost of Capital: Cost of Equity, Cost of Debt and calculating cost of capital

9.3 Project Funding Mechanism: Government budget, Public Private Partnership and Private Investment

9.4 FIRR, EIRR and Return on Equity

10. Basic Accounting Procedure **6 hrs**

10.1 Accounting Terminologies; Asset and liabilities: Fundamental equation of accounting,

10.2 Financial statements: The Balance Sheet, Income Statement and Cashflow Statements

10.3 Using Ratios to make Decisions: Debt Ratio, Current Ratio, Quick Ratio – Acid Test Ratio, Inventory Turnover Ratio, Total Asset Turnover, Profit Margin on Sales, Return on Total Assets, Price Earnings Ratio and Book Value per Share.

Tutorials:

2 assignments and 1 case study.

Text Book:

Chan S. Park. *Contemporary Engineering Economics.* PHI Learning Private Limited

References:

1. E. Paul De Garmo, William G. Sullivan and James A. Bontadelli, *Engineering Economy,* MC Milan Publishing Company.
2. James L. Riggs, David D. Bedworth and Sabah U. Randhawa, *Engineering Economics,* Tata McGraw Hill Education Private Limited.
3. N. N. Borish and S. Kaplan, *Economic Analysis for Engineering and Managerial Decision Making,* MCGran Hill Publishing Company.
4. Adhikari, D, *Principle's of Engineering Economic Analysis,* Global Publication, Nepal.
5. SenGupta, Ramprasad, *Ecological Limits and Economic Development,* Oxford University Press.

Multimedia Systems (3 – 0 - 3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:
To introduce the technologies, concepts and techniques associated with the development of multimedia systems.

Course Contents:

1. **Multimedia** **4 hrs**
   - 1.1 Introduction: Overview of multimedia, Multimedia building blocks, Digital representation, Interaction techniques and devices.
   - 1.2 The Medium aspect
   - 1.3 Main Properties of Multimedia System
   - 1.4 Definition of Multimedia Systems
   - 1.5 Media Combination and Independence
   - 1.6 Traditional Data Stream Characteristics
   - 1.7 Information Units.

2. **Sound and Audio** **4 hrs**
   - 2.1 Basic Sound Concepts: Representation and Formats
   - 2.2 Basic Music (MIDI) Concepts: Devices, Messages, Standards and Software
   - 2.3 Speech: Generation, Analysis and Transmission.

3. **Images and Graphics** **4 hrs**
   - 3.1 Basic Image Concepts: Representation and Format
   - 3.2 Image Processing Fundamentals: Synthesis, Analysis and Transmission.
   - 3.3 Image Enhancement: Enhancement by point processing, Spatial filtering, Color image processing

4. **Video and Animation** **5 hrs**
   - 4.1 Basic Video Concepts: Representation and Format
   - 4.2 Television
   - 4.3 Basic Concepts of Animation
   - 4.4 Types of animation
   - 4.5 Principles of animation
   - 4.6 Techniques of animation
   - 4.7 Creating animation
   - 4.8 Animation Language, Control and Transmission.

5. Data Compression **8 hrs**

5.1 Data Compression and Coding Fundamentals
- 5.1.1. Storage Space
- 5.1.2. Coding Requirements
- 5.1.3. Source, Entropy and Hybrid Coding

5.2 Basic Data Compression Techniques

5.3 Data Compression and Coding Standards:
- 5.3.1. JPEG
- 5.3.2. H.261 (px64)
- 5.3.3. MPEG
- 5.3.4. DVI.

6. Optical Storage Media **5 hrs**

6.1 Basic Technology
6.2 Video Disk Fundamentals
6.3 CD Audio
6.4 CD-ROM and Extended Architecture
6.5 Principles of CD-Write Once and CD-Magneto Optical
6.6 Other Storage Media: DVD, Flash Drive, HD Cards, USB

7. Computer Technology and Multimedia Operating Systems (MOS) **5 hrs**

7.1 Communication Architecture: Hybrid and Digital Systems
7.2 Multimedia Workstation
7.3 Introduction to MOS
7.4 Function of MOS
7.5 Multimedia Real Time System

8. Documentation, Hypertext and MHEG **5 hrs**

8.1 Document Architecture and Multimedia Integration
8.2 Hypertext, Hypermedia and Multimedia
8.3 Hypermedia System: Architecture, Nodes and Pointers
8.4 Document Architecture: SGML and ODA
8.5 MHEG.

9. Multimedia Communication Systems **5 hrs**

9.1 Definition of Multimedia Communication
9.2 Application Subsystem
9.3 Transport Subsystem: Requirements, Transport Layer, Network Layer
9.4 Quality of Service and Resource Management

Laboratory Exercises:

Laboratory Exercise includes integration of multimedia (Audio: Speech and Music, Video: Static and Movie, Animation Programming, etc), with application programs through high-level language programming, such as C++ or Java.

Text Book:

Steinmetz, R., Nahrstedt, K., *Multimedia: Computing, Communications and Applications*, Pearson Education Asia, 2001, ISBN: 81-7808-319-1

References:

1 Andleigh, P., Thakrar, *Multimedia Systems Design*, Prentice Hall, NJ, 1996
2 Gibbs S.J., Tsichritzis, D.C., *Multimedia Programming: Objects, Environments and Frameworks*, Addison-Wesley, 1995
3 Koegel-Buford, J.F., Multimedia Systems, Addison-Wesley, 1994
4 K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson, 2002
5 Ranjan Parekh, Principle of Multimedia, Tata McGraw-Hill Education, 2006

Object Oriented Software Development (3 – 0 – 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

This course enables students to convert the information gained about object oriented Software Engineering into knowledge. This course provides general overview of design and architectural patterns and practical approaches to Software Engineering Process.

Course Contents:

1. Introduction **4 hrs**

1.1 Review of Object Oriented Analysis and Design
1.2 Review of UML

2. Iterative and Incremental Development **14 hrs**

2.1. Phases(inception, elaboration, construction and transition)
2.2. Unified Software Development Process disciplines, iterations and activity
  2.2.1. Business modeling
  2.2.2. Requirement analysis
  2.2.3. Design
  2.2.4. Implementation
  2.2.5. Test
  2.2.6. Deployment
  2.2.7. Configuration and change management
  2.2.8. Project management
  2.2.9. Environment
2.3. Models evolution through the iterations
  2.3.1. Use case model
  2.3.2. Analysis model
  2.3.3. Design model
  2.3.4. Deployment model
  2.3.5. Implementation model
  2.3.6. Test model
  2.3.7. Use Case Driven Process/ Use Case Realization
  2.3.8 Role and responsibilities of people through the iterations

3. Design Patterns **15 hrs**

3.1. Introduction to Design Patterns
3.2. Programming paradigm versus Design patterns
3.3. Importance of Design Pattern

3.4. Classification of Design patterns
  3.4.1 Creational patterns
  3.4.2 Structural Patterns
  3.4.3 Behavioral Patterns
  3.4.4 Other Patterns - Concurrency Patterns, Data Access Patterns, Enterprise Patterns, Real-Time Patterns
3.5. Documenting and Describing Patterns
3.6. Criticism

4. Software Architecture **12 hrs**

4.1. Introduction to Software Architecture
4.2. Architecture centric process
4.3. Architectural tactics and patterns
  4.3.1 The Multi-Layer architectural pattern
  4.3.2 The Client/Server and other distributed architectural patterns
  4.3.3 The Model/View/Controller (MVC) architectural pattern
  4.3.4 The Service-Oriented architectural (SOA) pattern
  4.3.5 The Message-Oriented architectural pattern

Laboratory:
The laboratory work shall focus on the implementation aspect of the concepts covered in the lecture class .These include implementation of UML, Design, Architecture Patterns and using Unified Software Development Process. Students shall develop a project using above mentioned concepts.

References:

1. Lethbridge, T. C., & Laganiere, R. (2004). *Object-Oriented Software Engineering: Practical Software Development Using UML and Java.* Mc Graw Hill.
2. Larman, C. (2008). *Applying UML and Patterns.* Pearson Education.
3. Jacobson, I., Christerson, M., Jonsson, P., & Overgaard, G. (2009). *Object Oriented software Engineering.* Pearson Education.
4. Jacobson, I., Booch, G., & Rumbaugh, J. (2003). *The Unified Software Development Process.* Pearson Education.

Project II (0 – 0 - 4)
(BE Computer / Software / IT)

Evaluation:

	Theory	Practical	Total
Sessional	-	100	100
Final	-	-	-
Total	-	100	100

Objectives:

1. To provide the practical knowledge of project undertaking by focusing on planning, requirements elicitation, design, development and implementation of a project.
2. To provide the knowledge of Programming tools currently used in the market by carrying out a project.
3. To teach students to work and solve problem in a team environment
4. To provide the knowledge to formulate project documentation and oral presentation for his/her project.

Procedures:
The project course requires students to get themselves involved in a group consisting of generally 3-4 members and work jointly in a team, on a proposed task under the direct supervision of the faculty members of their respective department. The project may be selected in consultation with the industries and they shall be software and or electronic hardware based. The project may be done using any programming language or any platform and it may be any type of application e.g. Scientific Applications, Information Systems, Web Applications, Games, Simulations etc but it must find its practical usage in daily life and it should be relevant, as possible, to the local industry environment and its demands.

The project must be started at the beginning of the semester, span throughout the semester and finished by the end of that very semester. The project should be undertaken preferably by group of 3-4 students who will jointly work and implement the project. Term work will be jointly assessed by a panel of examiners as appointed by head of the institution. Oral examination will be conducted by internal and external examiners as appointed by the college.

Project Work Phases:
The entire project work shall be divided in to three phases and evaluation shall be done accordingly:

First Phase:
The students are required to form a team comprised of 3-4 team members and come up with a conceptual framework for their project work which must be documented in the form of a Proposal and presented in front of an examiner in a formal presentation lasting for about 10 minutes, on the date prescribed by the college or concerned department.
30% of the marks shall be based on the following criteria:

Evaluation Criteria:
Task Accomplished (20%)

- Feasibility Study
- Requirements Analysis and Specification

- Project plan
- Creativity, Innovativeness and Usefulness of the Idea

Documentation (10%)
- Proposal Report
- Estimations
- Time Line

Second Phase:
The students are required to show the progress of their work and the work done so far must be justifiable. They must have finished the design phase including the overall system/architectural design and validation scheme. 50% of total mark shall be based on the following criteria:

Evaluation Criteria:
Task Accomplished (40%)
- System/Architectural Design
- Depth of Project work
- Progress
- Level of achievement
- Group/Team Effort
- Ability to propose solutions

Documentation (10%)
- Report organization
- Completeness and consistency of the report
- Validation Criteria
- Organization and analysis of data and results

Third Phase (20%):
All students must have finished all phases of their project work including requirements analysis, design, coding, testing on time by the time they come for the Final Project Presentation.
Students must come up with a visible output of the product that they have developed and perform an oral defense of their work in the presence of an external examiner (external to the department or from industries). The final presentation should be conducted on the last week of final semester term as far as practicable.

Evaluation (20%):
- Presentation
- Completeness, Consistency and Final Output of the Project
- Viva
- Final Project Report

Principles of Programming Languages (3 – 0 – 1)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:
The objective of this course is to provide a student with adequate knowledge on fundamentals and necessary theoretical backgrounds of various programming languages and their pragmatic structure.

Course Contents:

1. **Evolution of Programming Languages** **5 hrs**
   - 1.1 Importance of Study
   - 1.2 History and Motivation
   - 1.3 Characteristics of a good language
   - 1.4 Design of a pseudo code, implementation
   - 1.5 Phenomenology of Programming Languages

2. **Emphasis on Efficiency - *FORTRAN*** **10 hrs**
   - 2.1 History and Motivation
   - 2.2 Structural Organization
   - 2.3 Control Structure
   - 2.4 Data Structure
   - 2.5 Name Structure
   - 2.6 Syntactic structure.

3. **Generality and Hierarchy - *ALGOL-60*** **10 hrs**
   - 3.1 History and Motivation
   - 3.2 Structural Organization
   - 3.3 Control Structure
   - 3.4 Data Structure
   - 3.5 Name Structure
   - 3.6 Syntactic structure
   - 3.7 Descriptive tools(BNF)
   - 3.8 Elegance.

4. **List Processing and Functional Programming - *LISP*** **10 hrs**
   - 4.1 History and Motivation
   - 4.2 Structural Organization
   - 4.3 Control Structure
   - 4.4 Data Structure

4.5 Name Structure
4.6 Syntactic structure
4.7 Recursive Interpreters
4.8 Storage Reclamation.

5. **Object Oriented Programming - *Small Talk*** **10 hrs**
   5.1 History and Motivation
   5.2 Structural Organization
   5.3 Classes and Subclasses
   5.4 Objects and Message Sending
   5.5 Classes and Objects
   5.6 Object oriented Extensions.

Laboratory Works:
The laboratory works consists of compiling and running programs in different programming languages like FORTRAN, LISP etc., designing and implementing different data structures and understanding the evolution of those constructs, comparing different programs developed in multiple languages and compare the time and space complexity.

Text Book:
Maclennan J. Bruce, *Principles of Programming Languages*, 3rd Edition, Oxford University Press, 1999, ISBN 0-19-511306-3

References:

1. Appleby, D., Vandekpllle, J. J., *Programming Languages*, 2E, McGraw -Hills, International Edition, 1997, ISBN 0-070005315-4.
2. Friedman P. Daniel, et all, *Essentials of Programming Languages*, PHI, 1998, ISBN-81-203-1355-0

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