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.

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 Thread
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

COMPUTER NETWORKS
CT 657

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

Course Objective:

To understand the concepts of computer networking, functions of different layers and protocols, and know the idea of IPV6 and security

1. Introduction to Computer Network **(5 hours)**

1.1 Uses of Computer Network
1.2 Networking model client/server, p2p, active network
1.3 Protocols and Standards
1.4 OSI model and TCP/IP model
1.5 Comparison of OSI and TCP/IP model
1.6 Example network: The Internet, X.25, Frame Relay, Ethernet, VoIP, NGN and MPLS, xDSL.

2. Physical Layer **(5 hours)**

2.1 Network monitoring: delay, latency, throughput
2.2 Transmission media: Twisted pair, Coaxial, Fiber optic, Line-of-site, Satellite
2.3 Multiplexing, Circuit switching, Packet switching, VC Switching, Telecommunication switching system (Networking of Telephone exchanges)
2.4 ISDN: Architecture, Interface, and Signaling

3. Data Link Layer **(5 hours)**

3.1 Functions of Data link layer
3.2 Framing
3.3 Error Detection and Corrections,
3.4 Flow Control
3.5 Examples of Data Link Protocol, HDLC, PPP
3.6 The Medium Access Sub-layer
3.7 The channel allocation problem
3.8 Multiple Access Protocols
3.9 Ethernet,
3.10 Networks: FDDI, ALOHA, VLAN, CSMA/CD, IEEE 802.3, 802.4, 802.5, and 802.11.

4. Network Layer **(9 hours)**

4.1 Internetworking &devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway
4.2 Addressing: Internet address, classful address

4.3 Subnetting
4.4 Routing: techniques, static vs. dynamic routing , routing table for classful address
4.5 Routing Protocols: RIP, OSPF, BGP, Unicast and multicast routing protocols
4.6 Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP

5. Transport Layer **(5 hours)**

5.1 The transport service: Services provided to the upper layers
5.2 Transport protocols: UDP, TCP
5.3 Port and Socket
5.4 Connection establishment, Connection release
5.5 Flow control & buffering
5.6 Multiplexing & de-multiplexing
5.7 Congestion control algorithm: Token Bucket and Leaky Bucket

6. Application Layer **(5 hours)**

6.1 Web: HTTP & HTTPS
6.2 File Transfer: FTP, PuTTY, WinSCP
6.3 Electronic Mail: SMTP, POP3, IMAP
6.4 DNS
6.5 P2PApplications
6.6 Socket Programming
6.7 Application server concept: proxy caching, Web/Mail/DNS server optimization
6.8 Concept of traffic analyzer: MRTG, PRTG, SNMP, Packet tracer, Wireshark.

7. Introduction to IPV6 **(4 hours)**

7.1 IPv6- Advantages
7.2 Packet formats
7.3 Extension headers
7.4 Transition from IPv4 to IPv6: Dual stack, Tunneling, Header Translation
7.5 Multicasting

8. Network Security **(7 hours)**

8.1 Properties of secure communication
8.2 Principles of cryptography: Symmetric Key and Public Key
8.3 RSA Algorithm,
8.4 Digital Signatures
8.5 Securing e-mail (PGP)
8.6 Securing TCP connections (SSL)
8.7 Network layer security (IPsec, VPN)
8.8 Securing wireless LANs (WEP)
8.9 Firewalls: Application Gateway and Packet Filtering, and IDS

Practical:

1. Network wiring and LAN setup
2. Router Basic Configuration
3. Static and Dynamic Routing
4. Creating VLAN
5. Router access-list configuration
6. Basic Network setup on Linux
7. Setup of Web Server
8. DNS Server setup
9. Setup of DHCP Server
10. Virtualizations

References:

1. A.S. Tanenbaum, "Computer Networks", Prentice Hall India
2. W. Stallings, "Data and Computer Communication", Macmillan Press
3. Kurose Ross, "Computer Networking: A top down approach", Pearson Education
4. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers

SIGNAL ANALYSIS
EX 651

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

Course Objectives:

To provide understanding of basic concepts in signals and systems.

1. Signal **(4 hours)**

Signal definition, continuous time signal, discrete time signal, basic signal types, energy signal, power signal, periodicity of continuous time signal, periodicity of discrete time signal, transformation of independent variable.

2. Fourier series **(9 hours)**

Continuous time Fourier series representation, properties of continuous time Fourier series (linearity, time shift, frequency shift, time reversal, time scaling, conjugation conjugate symmetry, multiplication, convolution), Parsevals relation. Discrete time Fourier series representation, Properties of discrete time Fourier series (linearity, time shift, frequency shift, time reversal, conjugation and conjugate symmetry, multiplication, convolution), parseval's relation.

3. Fourier transform **(12 hours)**

Continuous time Fourier transform representation, properties of continuous time Fourier transform (linearity, time shift, frequency shift, time reversal, time scaling, duality, conjugation and conjugate symmetry, multiplication, convolution), Parseval's relation, Fourier transform of square wave function, impulse function, unit step function, rectangular function, signum function, cosine function, periodic function etc, energy spectral density, power spectral density. Discrete time Fourier transform representation, properties of discrete time Fourier transform (linearity, time shift, frequency shift, time reversal, conjugation and conjugate symmetry, multiplication, convolution), Parseval's relation, Fourier transform of rectangular sequence, unit sample sequence, periodic sequence etc, discrete Fourier transform, properties of discrete Fourier transform.

4. Sampling **(2 hours)**

Ideal sampling, practical considerations in sampling, reconstruction of signal from its samples, aliasing.

5. Continuous time system **(9 hours)**

System definition, properties of system, Linear time invariant (LTI) system, convolution integral, properties of LTI system, frequency response of LTI system, bode plot, conditions for distortion less transmission, ideal low pass

filter, impulse response and step response of ideal low pass filter, impulse response and frequency response of first order system and second order system.

6. Discrete time system **(9 hours)**

System definition, properties of system, Linear time invariant (LTI) system, convolution sum, properties of LTI system, difference equation, transfer function, frequency response of LTI system, bode plot, conditions for distortion less transmission, impulse response and frequency response of first order system and second order system.

References

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid "Signals and Systems", Prentice Hall
2. B. P. Lathi, "Linear systems and signals", Oxford University Press.

COMUNICATION SYSTEM I

EX 652

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

Course Objectives:

To introduce the student to the principles and building blocks of analog communication systems.

1. Introduction **(4 hours)**

1.1 Analog and Digital communication sources, transmitters, transmission channels and receivers.
1.2 Noise, distortion and interference. Fundamental limitations due to noise, distortion and interference.
1.3 Types and reasons for modulation.

2. Representation of signals and systems in communication **(4 hours)**

2.1 Review of signals (types, mathematical representation and applications)
2.2 Linear/non-linear, time variant/invariant systems. Impulse response and transfer function of a system. Properties of LTI systems.
2.3 Low pass and band pass signals and systems, bandwidth of the system, distortionless transmission, the Hilbert transform and its properties.
2.4 Complex envelops rectangular (in-phase and quadrature components) and polar representation of band pass band limited signals.

3. Spectral Analysis **(4 hours)**

3.1 Review of Fourier series and transform, energy and power, Parseval's theorem
3.2 Energy Density Spectrum, periodogram, power spectral density function (psdf)
3.3 Power spectral density functions of harmonic signal and white noise
3.4 The autocorrelation (AC) function, relationship between psdf and AC function.

4. Amplitude Modulation **(12 hours)**

4.1 Time domain expressions, frequency domain representation, modulation index, signal bandwidth
4.2 AM for a single tone message, carrier and side-band components, powers in carrier and side-band components, bandwidth and power efficiency
4.3 Generation of DSB-FC AM

4.4 Double Side Band Suppressed Carrier AM (DSB-AM), time and frequency domain expressions, powers in side-bands, bandwidth and power efficiency
4.5 Generation of DSB-AM (balanced, ring modulators)
4.6 Single Side Band Modulation, time and frequency domain expressions, powers
4.7 Generation of SSB (SSB filters and indirect method)
4.8 Vestigial Side Bands (VSB), Independent Side Bands (ISB) and Quadrature Amplitude Modulations (QAM)

5. Demodulation of AM signals (6 hours)

5.1 Demodulation of DSB-FC, DSB-SC and SSB using synchronous detection
5.2 Square law and envelop detection of DSB-FC
5.3 Demodulation of SSB using carrier reinsertion , carrier recovery circuits
5.4 Phase Locked Loop (PLL), basic concept, definitions, equations and applications, demodulation of AM using PLL

6. Frequency Modulation (FM) and Phase Modulation (PM) (12 hours)

6.1 Basic definitions, time domain expressions for FM and PM
6.2 Time domain expression for single tone modulated FM signals, spectral representation, Bessel's functions
6.3 Bandwidth of FM , Carson's rule, narrow and wideband FM
6.4 Generation of FM (direct and Armstrong's methods)
6.5 Demodulation of FM and PM signals, synchronous (PLL) and non-synchronous (limiter-discriminator) demodulation
6.6 Stereo FM, spectral details, encoder and decoder
6.7 Pre-emphasis and de-emphasis networks
6.8 The superheterodyne radio receivers for AM and FM

7. Frequency Division Multiplexing (FDM) (3 hours)

7.1 Principle of frequency division multiplexing, FDM in telephony, hierarchy
7.2 Frequency Division Multiple Access (FDMA) systems- SCPC, DAMA, SPADE etc.
7.3 Filter and oscillator requirements in FDM.

Practical

1. Demonstration of power spectrum of various signals using LF spectrum analyzer
2. Generation of DSB-SC, DSB-FC and SSB signals
3. Demodulation of AM signals (synchronous and non-synchronous methods)
4. Generation of FM signals

5. Demodulation of FM signal (limiter-discriminator)
6. Operation of PLL, PLL as demodulator of AM and FM signals.

References:

1. S. Haykin, Analog and Digital communication systems
2. Leon Couch, Digital and analog communication systems
3. B.P.Lathi, Analog and Digital communication systems
4. J. Proakis, Analog and Digital communication systems
5. D. Sharma, Course manual "Communication Systems I".

PROPAGATION AND ANTENNA
EX 653

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

Course Objectives:

To provide the student with an understanding of antennas, EM wave propagation and optical fibre communications.

1. Radiation and Antenna Fundamentals **(5 hours)**

1.1 Retarded Potentials: EM wave generation with a conduction current, the short uniformcurrent dipole, the radiated electric and magnetic fields.

1.2 Radiation patterns and input impedance of the short uniform current dipole, the short Dipole and long dipole.

1.3 Antenna theorems: reciprocity, superposition, Thevenin, minimum power transfer, Compensation, equality of directional patterns, equivalence of receiving and Transmitting impedances.

2. Antenna Parameters and Arrays: **(5 hours)**

2.1 Basic antenna parameters

2.2 Pattern multiplication: Linear and two-dimensional antenna arrays, end fire and Broadside arrays.

3. Antennas classification: **(10 hours)**

3.1 Isotropic antenna

3.2 Omni directional antenna; Dipole

3.3 Directional antennas;

3.4 Travelling wave antennas – single wire, V and RhombusReflector antennas – large plane sheet, small plane sheet, linear, corner, parabolic,elliptical, hyperbolic and circular reflector.Aperture antenna - horn Array antennas – Yagi-Uda, Log PeriodicOther antennas – Monopole, Loop, Helical, Microstrip.

4. Propagation and Radio Frequency Spectrum **(7 hours)**

4.1 Ground or surface wave

4.2 Space wave; direct and ground reflected wave, duct propagation

4.3 Ionospheric or sky wave; critical frequency, MUF, Skip distance

4.4 Tropospheric wave

4.5 Radio frequency spectrum and its propagation characteristics

5. Propagation between Antennas: **(7 hours)**

5.1 Free space propagation: power density of the receiving antenna, path loss

5.2 Plane earth propagation: the ground reflection, effective antenna heights, the two ray
5.3 propagation model, path loss
5.4 Fresnel Zones and Knife edge diffraction

6. Optical fibres(Introductory) (11 hours)

6.1 Optical fibre communication system and its advantages and disadvantages overMetalled wire communication system
6.2 Types of optical fibre and its structural difference
6.3 Light propagation characteristics and Numerical Aperture (NA) in optical fibre
6.4 Losses
6.5 Light source and photo detector

Practical:

1. Two Experiments in properties of EM waves: refraction, diffraction, polarization
2. Two Experiments in radiation patters of various types of antennas
3. Two Experiments in measurements on optical fibre transmission systems

References:

1. J. D. Kraus, "Antenna" McGraw Hill
2. C. A. Balanis, " Antenna Theory Analysis and Design" John Wiley & Sons, Inc.
3. Collins, R. E., "Antenna and Radio Wave Propagation" McGraw Hill.
4. Gerd Kaiser "Optical Fibre Communications" McGraw Hill.
5. John Gowar" Optical Communication Systems" PHI Publications.

MINOR PROJECT
EX 654

Practical : 4 **Year : III**
Tutorial : 0 **Part : II**
Practical : 4

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)**