

PROJECT MANAGEMENT

CT 701

Lecture : 3
 Tutorial : 1
 Practical : 0

Year : IV
 Part : I

Course objectives:

To make the students able to plan monitor and control project and project related activities

1. **Introduction** (2 hours)
 Definition of project and project management, Project objectives, classification of projects, project life cycle
2. **Project Management Body of Knowledge** (4 hours)
 Understanding of project environment, general management skill, effective and ineffective project managers, essential interpersonal and managerial skills, energized and initiator, communication, influencing, leadership, motivator, negotiation, problem solver, perspective nature, result oriented, global illiteracies, problem solving using problem trees.
3. **Portfolio and Project Management Institutes' (PMI) Framework** (2 hours)
 Portfolio, project management office, drivers of project success, inhibitors of project success
4. **Project Management** (4 hours)
 Advantages of project management, project management context as per PMI, Characteristics of project life cycles, representative project life cycles, IT Product Development Life Cycle, Product Life Cycle and Project Life Cycle, System Development methodologies, role and responsibilities of key project members
5. **Project and Organizational structure** (2 hours)
 System view of project management, functional organization, matrix organization, organizational structure influences on projects
6. **Project Management Process Groups** (2 hours)
 Project management processes, Overlaps of process groups in a phase, mapping of project management process groups to area of knowledge
7. **Project Integration Management** (4 hours)
 Develop project charters Develop preliminary project scope statement, Develop project management plan, Direct and manage project execution, monitor and control project work, Integrated change control, close project, project scope management, Create Work Break Down Structure, Scope

verification, Scope control.

- 8. Project Time Management (4 hours)**
Activity definition, decomposition of activities, activity attributes, Activity sequencing, precedence relationship, network diagram, precedence diagram method, arrow diagramming method, Activity resources estimating, determining resource requirements, Schedule development and control, principles of scheduling, milestones, forward pass, backward pass, critical path method, critical chain technique, gantt chart, schedule control.
- 9. Project Cost Management (4 hours)**
Cost and project, cost management, Cost estimating, types of cost estimates, estimating process and accuracy, enterprise environmental factors, organizational process assets, cost estimating tools, Cost budgeting, cost aggregation, deriving budget from activity cost, Cost control process, cost control methods, earned value management, EVM benefits, variance analysis.
- 10. Project quality management (3 hours)**
Quality theories, Quality planning, project quality requirements, cost of quality, quality management plan, Quality assurance, quality audit, approach to a quality audit, Quality control process, control chart, pareto charts, testing of IT system, the test life cycle.
- 11. Project Communication Management (3 hours)**
Importance of communication management, Communications planning process, communication requirement analysis, organizing and conducting effective meeting, Information distribution process, Performance reporting process, integrated reporting system
- 12. Project Risk Management (4 hours)**
Understanding Risk, project risk, Risk management planning process, risk management plan, Risk identification, risk identification techniques, Qualitative risk analysis process, Quantitative risk analysis process, modeling techniques, Risk response planning, resolution of risk, strategies for negative risks or threats, strategies for positive risks or opportunities, Risk monitoring and control process.
- 13. Project Procurement Management (3 hours)**
Procurement management process flow, Plan purchases and acquisition process, enterprise environmental factor, organizational process assets, Plan contracting process, standard forms, evaluation criteria, Request seller response process, Select seller process, Contract administration process, Contract closure process

14. Developing Custom Processes for IT projects (3 hours)

Developing it project management methodology, Moving forward with customized management processes, Certified associate in project management, Project management maturity, Promoting project Excellency through awards and assèssment , Certification process flow, Code of ethics, Future trends.

15. Balanced scorecard and ICT project management (1 hour)

References:

1. M. C. Christensen and R.H. Thayer, "The Project Manager's Guide to Software Engineering's Best Practices", IEEE computer Society
2. Clifford F. Gray, Erik W. Larson, "Project Management: The Management Process", McGraw Hill
3. Nick Jenkins, "A Project Management Primer",
4. Trevor L Young, "A handbook of Project Management", Kogan Page India Private Ltd.
5. M. Gentle, "Balance Supply and Demand", Compuware
6. Kelkar, " IT project Management",

ORGANIZATION AND MANAGEMENT

ME 708

Lecture : 3
 Tutorial : 2
 Practical : 0

Year : IV
 Part : I

Course Objective:

To give knowledge about organizational management and internal organization of companies required for managing an enterprise. Also to make familiar with personnel management, case study, management information system motivation and leadership for developing managerial skills.

- | | | |
|-----------|---|-------------------|
| 1. | Introduction | (20 hours) |
| 1.1 | Organization | (2 hours) |
| 1.1.1 | System approach applied to Organization | |
| 1.1.2 | Necessity of Organization | |
| 1.1.3 | Principles of Organization | |
| 1.1.4 | Formal and Informal Organizations | |
| 1.2 | Management | (4 hours) |
| 1.2.1 | Functions of Management | |
| 1.2.2 | Levels of Management | |
| 1.2.3 | Managerial Skills | |
| 1.2.4 | Importance of Management | |
| 1.2.5 | Models of Management | |
| 1.3 | Theory of Management | (6 hours) |
| 1.3.1 | Scientific Management Approach | |
| 1.3.2 | Administrative Management Approach | |
| 1.3.3 | Behavioral Management Approach | |
| 1.3.4 | Modern Management Theories | |
| 1.4 | Forms of Ownership | (2 hours) |
| 1.4.1 | Single Ownership – Advantages and limitations | |
| 1.4.2 | Partnership – Types of Partners – Advantages and limitations | |
| 1.4.3 | Joint Stock Company – Formation of Joint Stock Company – Advantages and limitations | |
| 1.4.4 | Co – operative Societies – Types of Co – operatives – Advantages and limitations | |
| 1.4.5 | Public Corporations – Advantages and limitations | |
| 1.5 | Organizational Structure | (2 hours) |
| 1.5.1 | Line Organization – Advantages and dis – advantages | |
| 1.5.2 | Functional Organization – Advantages and dis – advantages | |
| 1.5.3 | Line and Staff Organization – Advantages and dis – advantages | |
| 1.5.4 | Committee Organization – Advantages and dis – advantages | |
| 1.6 | Purchasing and Marketing Management | (4 hours) |
| 1.6.1 | Purchasing – Introduction | |

- 1.6.2 Functions of Purchasing Department
- 1.6.3 Methods of Purchasing
- 1.6.4 Marketing – Introduction
- 1.6.5 Functions of Marketing
- 1.6.6 Advertising.

2. Personal Management (8 hours)

- 2.1 Introduction
- 2.2 Functions of Personal Management
- 2.3 Development of Personal Policy
- 2.4 Manpower Planning
- 2.5 Recruitment and Selection of manpower – Scientific selection
- 2.6 Training and Development of manpower
- 2.7 Job Analysis, Job Evaluation and Merit Rating
- 2.8 Wages and Incentives

3. Motivation, Leadership and Entrepreneurship (10 hours)

- 3.1 Motivation (6 hours)
 - 3.1.1 Human needs
 - 3.1.2 Maslow's Hierarchy of needs
 - 3.1.3 Motivation – Introduction
 - 3.1.4 Types of Motivation
 - 3.1.5 Attitude Motivation; Group Motivation; Executive Motivation
 - 3.1.6 Techniques of Motivation
 - 3.1.7 Motivation Theories
 - 3.1.7.1 McGregor's Theory X - Y
 - 3.1.7.2 Fear and Punishment Theory
 - 3.1.7.3 Alderfer's ERG Theory
 - 3.1.7.4 MacClelland's Theory of learned needs
 - 3.1.7.5 Herzberg's Hygiene Maintenance Theory
 - 3.1.7.6 Vroom's Expectancy/ Valency Theory
- 3.2 Leadership - Introduction (2hours)
 - 3.2.1 Qualities of a good Leader
 - 3.2.2 Leadership Style
 - 3.2.3 Blakes and Mouton's Managerial Grid
 - 3.2.4 Leadership Approach
 - 3.2.5 Leadership Theories
- 3.3 Entrepreneurship – Introduction (2 hours)
 - 3.3.1 Entrepreneurship Development
 - 3.3.2 Entrepreneurial Characteristics
 - 3.3.3 Need for Promotion of Entrepreneurship
 - 3.3.4 Steps for establishing small scale unit

4. Case Studies (2 hours)

- 4.1 Introduction
- 4.2 Objectives of case study

- 4.3 Phases of case study
- 4.4 Steps of case study
- 4.5 Types of case studies

5. Management Information System (5 hours)

- 5.1 Data and Information
- 5.2 Need, function and Importance of MIS
- 5.3 Evolution of MIS
- 5.4 Organizational Structure and MIS
- 5.5 Computers and MIS
- 5.6 Classification of Information Systems
- 5.7 Information Support for functional areas of management
- 5.8 Organizing Information Systems

Note: Students have to submit a case study report after visiting an industrial organization outside or inside the Kathmandu valley.

Reference:

1. H. B. Maynard, "Industrial Engineering Handbook" , Editor – in – Chief, McGraw Hill.
2. E. S. Buffa and R. K. Sarin "Modern Production / Operations Management", 8th Edition, Wiley.
3. H. J. Arnold and D. C. Feldman "Organizational Behavior", McGraw – Hill.
4. J. A. Senn, "Information Systems in Management " , Wadsworth Inc.
5. P. Hershey and K. H. Blanchard, "Management of Organizational Behavior – Utilizing Human Resources " , Prentice – Hall Inc.
6. M. Mahajan, "Industrial Engineering and production Management" ,Dhanpat Rai and Co. (P) Ltd. , Delhi.
7. S. Sadagopan, "Management Information System", Prentice Hall of India Pvt Ltd.
8. C. B. Mamoria "Personnel Management", Himalaya Publishing House..
9. O. P. Khanna, "Industrial Engineering and Management", Dhanpat Rai Publications (P) Ltd.
10. S. K. Joshi, "Organization and Management", IOE, Pulchowk Campus.

ENERGY, ENVIRONMENT AND SOCIETY

EX 701

Lecture : 2
 Tutorial : 0
 Practical : 0

Year : IV
 Part : I

Course Objective:

To understand the various types of energy sources and their environmental impact.
 To know the role of engineers for creating better and responsible society.

- 1. Technology and Development (3 hours)**
 - 1.1 Introduction to Technology
 - 1.2 Appropriate Technology
 - 1.3 Role of Appropriate Technology in Transformation of Society
 - 1.4 Importance of Technology Transfer
 - 1.5 Impact of technology on Society

- 2. Energy Basics (4 hours)**
 - 2.1 Importance of Energy in achieving Maslow's hierarchy of Needs, Human Development Index and Energy Consumption
 - 2.2 Current Energy Trends, Demand and Supply of Energy in World and Nepal
 - 2.3 Introduction to Global warming, Clean Development Mechanism, and Sustainability Issues
 - 2.4 Conventional and Non-Conventional/Renewable Energy Sources
 - 2.5 Conventional Energy Sources: Fossil fuel, Nuclear Energy

- 3. Renewable Energy Sources (14 hours)**
 - 3.1 Solar Energy
 - 3.1.1 Solar radiation
 - 3.1.2 Solar thermal energy
 - 3.1.3 Solar Cell (Photovoltaic Technology)
 - 3.2 Hydropower
 - 3.2.1 Water sources and power.
 - 3.2.2 Water turbines and hydroelectric plants
 - 3.2.3 Hydro Power Plant Classification (pico, micro, small, medium, large)
 - 3.3 Wind Energy
 - 3.3.1 Availability of Wind Energy sources
 - 3.3.2 Wind turbines, wind parks and power control
 - 3.4 Geothermal Energy
 - 3.4.1 Sources of Geothermal Energy
 - 3.4.2 Uses of Geothermal Energy
 - 3.5 Bio-mass and Bio-energy
 - 3.5.1 Synthetic fuels from the biomass

- 3.5.2 Thermo-chemical, physio-chemical and bio-chemical conversion
- 3.5.3 Bio-fuel cells
- 3.6 Hydrogen Energy and Fuel Cell
 - 3.6.1 Basics of electrochemistry
 - 3.6.2 Polymer membrane electrolyte (PEM) fuel cells
 - 3.6.3 Solid oxide fuel cells (SOFCs)
 - 3.6.4 Hydrogen production and storage
 - 3.6.5 Coal-fired plants and integrated gassifier fuel cell (IGFC) systems
- 4. Environmental Impact of Energy sources (4 hours)**
 - 4.1 Emission hazard
 - 4.2 Battery hazard
 - 4.3 Nuclear hazard
- 5. Energy Storage (3 hours)**
 - 5.1 Forms of energy storage
 - 5.2 Hybrid vehicles
 - 5.3 Smart grid systems
 - 5.4 Batteries
 - 5.5 Super-capacitors
- 6. Relevant International/national case studies (2 hours)**

References:

1. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", Oxford University Press, latest edition
2. Aldo V. da Rosa, "Fundamentals of Renewable Energy Processes"

COMMUNICATION SYSTEMS II

EX 702

Lecture : 3
 Tutorial : 0
 Practical : 3/2

Year : IV
 Part : I

Course Objectives:

To introduce the student to the principles and building blocks of digital communication systems and effects of noise on the performance of communication systems.

- 1. Introduction (3 hours)**
 - 1.1 Digital communication sources, transmitters, transmission channels and receivers.
 - 1.2 Noise, distortion and interference. Fundamental limitations due to noise, distortion and interference
 - 1.3 Source coding, coding efficiency, Shannon-Fano and Huffman codes, coding of continuous time signals (A/D conversion)
- 2. Sampling Theory (4 hours)**
 - 2.1 Nyquist-Kotelnikov sampling theorem for strictly band-limited continuous time signals, time domain and frequency domain analysis, spectrum of sampled signal, reconstruction of sampled signal
 - 2.2 Ideal, flat-top and natural sampling processes, sampling of band-pass signals, sub-sampling theory
 - 2.3 Practical considerations: non-ideal sampling pulses (aperture effect), non-ideal reconstruction filter and time-limitness of the signal to be sampled (aliasing effects)
- 3. Pulse Modulation Systems (8 hours)**
 - 3.1 Pulse Amplitude Modulation (PAM), generation, bandwidth requirements, spectrum, reconstruction methods, time division multiplexing
 - 3.2 Pulse position and pulse width modulations, generation, bandwidth requirements
 - 3.3 Pulse code modulation as the result of analog to digital conversion, uniform quantization.
 - 3.4 Quantization noise, signal to quantization noise ratio in uniform quantization.
 - 3.5 Non uniform quantization, improvement in average SQNR for signals with high crest factor, companding techniques (μ and A law companding)
 - 3.6 Time Division Multiplexing with PCM, data rate and bandwidth of a PCM signal. The T1 and E1 TDM PCM telephone hierarchy
 - 3.7 Differential PCM, encoder, decoder
 - 3.8 Delta Modulation, encoder, decoder, noises in DM, SQNR. Comparison between PCM and DM
 - 3.9 Parametric speech coding, vocoders

- 4. Baseband Data Communication Systems (7 hours)**
- 4.1 Introduction to information theory, measure of information, entropy, symbol rates and data (bit) rates.
 - 4.2 Shannon Hartley Channel capacity theorem. Implications of the theorem and theoretical limits.
 - 4.3 Electrical representation of binary data (line codes), Unipolar NRZ, bipolar NRZ, unipolar RZ, bipolar RZ, Manchester (split phase), differential (binary RZ-alternate mark inversion) codes, properties, comparisons
 - 4.4 Baseband data communication systems, Inter-symbol interference (ISI), pulse shaping (Nyquist, Raised-cosine) and bandwidth considerations
 - 4.5 Correlative coding techniques, duobinary and modified duobinary encoders
 - 4.6 M-ary signaling, comparison with binary signaling
 - 4.7 The eye diagram.
- 5. Bandpass (modulated) data communication systems (4 hours)**
- 5.1 Binary digital modulations, ASK, FSK, PSK, DPSK, QPSK, GMPK, implementation, properties and comparisons
 - 5.2 M-ary data communication systems, quadrature amplitude modulation systems, four phase PSK systems
 - 5.3 Demodulation of binary digital modulated signals (coherent and non-coherent)
 - 5.4 Modems and its applications.
- 6. Random signals and noise in communication systems (7 hours)**
- 6.1 Random variables and processes, random signals, statistical and time averaged moments, interpretation of time averaged moments of a random process stationary process, ergodic process, psdf and AC function of an ergodic random process
 - 6.2 White noise, thermal noise, band-limited white noise, the psdf and AC function of white noise
 - 6.3 Passage of wide-sense stationary random signals through a LTI
 - 6.4 Ideal low-pass and RC filtering of white noise, noise equivalent bandwidth of a filter
 - 6.5 Optimum detection of a pulse in additive white noise, the matched filter. Realization of matched filters (time correlators). The matched filter for a rectangular pulse, ideal LPF and RC filters as matched filters
 - 6.6 Performance limitation of baseband data communications due to noise, error probabilities in binary and M-ary baseband data communication.
- 7. Noise performance of band-pass (modulated) communication systems (8 hours)**
- 7.1 Effect of noise in envelope and synchronous demodulation of DSB-FC AM, expression for gain parameter (ratio of output SNR to input SNR), threshold effect in non-linear demodulation of AM
 - 7.2 Gain parameter for demodulations of DSB-SC and SSB using synchronous demodulators

- 7.3 Effect of noise (gain parameter) for non-coherent (limiter-discriminator-envelop detector) demodulation of FM, threshold effect in FM. Use of pre-emphasis and de-emphasis circuits in FM.
- 7.4 Comparison of AM (DSB-FC, DSB-SC, SSB) and FM (Narrow and wide bands) in terms power efficiency, channel bandwidth and complexity.
- 7.5 Noise performance of modulated digital systems. Error probabilities for ASK, FSK, PSK, DPSK with coherent and non-coherent demodulation.
- 7.6 Comparison of modulated digital systems in terms of bandwidth efficiency, power efficiency and complexity.

8. Error control coding techniques (4 hours)

- 8.1 Basic principles of error control coding, types, basic definitions (hamming weight, hamming distance, minimum weight), hamming distance and error control capabilities
- 8.2 Linear block codes (systematic and non-systematic), generation, capabilities, syndrome calculation
- 8.3 Binary cyclic codes (systematic and non-systematic), generation, capabilities, syndrome calculation.
- 8.4 Convolutional codes, implementation, code tree, trellis and decoding algorithms.

Practical:

1. Study of line codes
2. Study of PCM
3. Study of DPCM
4. Study of DM
5. Study of ASK, FSK and PSK
6. Study of eye diagram

References:

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

TELECOMMUNICATION

EX 703

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

To continue the study of modern communication systems, their characteristics and design.

1. **Telecommunication Networks:** (4 hours)
 - 1.1 Evolution of telecommunications
 - 1.2 Classification of switching system
2. **Transmission Media:** (4 hours)
 - 2.1 Transmission media characteristics
 - 2.2 Transmission lines
 - 2.3 Hybrid Transformer and circuits
 - 2.4 Signal and noise measurement
3. **Signal Multiplexing:** (4 hours)
 - 3.1 Frequency division multiplex, Wavelength division multiplex
 - 3.2 Space division multiplex
 - 3.3 Time division multiplex; North American TDM system, The European E1
4. **Digital Switching:** (8 hours)
 - 4.1 Digital Telephone Exchange
 - 4.2 Space(S) Switch
 - 4.3 Time(T) Switch
 - 4.4 ST, TS, STS and TST switch
 - 4.5 Comparison between TST and STS switch
5. **Signaling System:** (4 hours)
 - 5.1 Classification of Signaling Systems: Channel Associated Signaling and Common Channel Signaling
 - 5.2 ITU Common Channel Signaling System # 7 (SS7)
6. **Telephone Traffic:** (9 hours)
 - 6.1 Network Traffic load and parameters
 - 6.2 Loss System: Grade of service (GOS) and Blocking probability
 - 6.3 Delay System: Queuing theory
 - 6.4 Routing
 - 6.5 Numbering Plans, Charging Plans

7. Telecommunication Regulation: (2 hours)

- 7.1. Purpose of ITU(International Telecommunications Union),
- 7.2. NTA(Nepal Telecommunications Authority)

8. Data Communication: (10 hours)

- 8.1 Switching Techniques in data Communication
- 8.2 IP Switching
- 8.3 Soft Switching
- 8.4 Routing and Flow control
- 8.5 ISDN
- 8.6 DSL

Practical: Six laboratory to illustrate course principles

References:

1. John C. Bellamy "Digital Telephony" John Wiley & Sons, Inc.
2. Roger L. Freeman "Telecommunication System Engg. " John Wiley & Sons, Inc.
3. A. S. Tanenbaum "Computer Networks" Prentice Hall.
4. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks",

FILTER DESIGN

EX 704

Lecture : 3

Tutorial : 1

Practical : 3/2

Year : IV

Part : I

Course Objective:

To familiarize student with the concept of analog filter design: passive filters, RC active filters and switched-capacitor filters

1. Introduction**(4 hours)**

- 1.1 Filter and its importance in communication
- 1.2 Kinds of filters in terms of frequency response
- 1.3 Ideal response and response of practical filters
- 1.4 Normalization and denormalization in filter design
- 1.5 Impedance (magnitude) scaling and frequency scaling
- 1.6 History of filter design and available filter technologies

2. Approximation Methods**(8 hours)**

- 2.1 Approximation and its importance in filter design
- 2.2 Lowpass approximations methods
- 2.3 Butterworth response, Butterworth pole locations, Butterworth filter design from specifications
- 2.4 Chebyshev and inverse Chebyshev characteristics, network functions and pole zero locations
- 2.5 Characteristics of Cauer (elliptic) response
- 2.6 Bessel-Thomson approximation of constant delay
- 2.7 Delay Equalization

3. Frequency transformation**(2 hours)**

- 3.1 Frequency transformation and its importance in filter design
- 3.2 Lowpass to highpass transformation
- 3.3 Lowpass to bandpass transformation and
- 3.4 Lowpass to bandstop transformation

4. Properties and Synthesis of Passive Networks**(7 hours)**

- 4.1 One-port passive circuits
 - 4.1.1 Properties of passive circuits, positive real functions
 - 4.1.2 Properties of lossless circuits
 - 4.1.3 Synthesis of LC one-port circuits, Foster and Cauer circuits
 - 4.1.4 Properties and synthesis of RC one-port circuits
- 4.2 Two-port Passive Circuits
 - 4.2.1 Properties of passive two-port circuits, residue condition, transmission zeros

4.2.2 Synthesis of two-port LC and RC ladder circuits based on zero-shifting by partial pole removal

- 5. Design of Resistively-Terminated Lossless Filter (4 hours)**
- 5.1 Properties of resistively-terminated lossless ladder circuits, transmission and reflection coefficients
 - 5.2 Synthesis of LC ladder circuits to realize all-pole lowpass functions
 - 5.3 Synthesis of LC ladder circuits to realize functions with finite transmission zeros
- 6. Active Filter (7 hours)**
- 6.1 Fundamentals of Active Filter Circuits
 - 6.1.1 Active filter and passive filter
 - 6.1.2 Ideal and real operational amplifiers, gain-bandwidth product
 - 6.1.3 Active building blocks: amplifiers, summers, integrators
 - 6.1.4 First order passive sections and active sections using inverting and non-inverting op-amp configuration
 - 6.2 Second order active sections (biquads)
 - 6.2.1 Tow-Thomas biquad circuit, design of active filter using Tow-Thomas biquad
 - 6.2.2 Sallen-Key biquad circuit and Multiple-feedback biquad (MFB) circuit
 - 6.2.3 Gain reduction and gain enhancement
 - 6.2.4 RC-CR transformation
- 7. Sensitivity (3 hours)**
- 7.1 Sensitivity and importance of sensitivity analysis
 - 7.2 Definition of single parameter sensitivity
 - 7.3 Centre frequency and Q-factor sensitivity
 - 7.4 Sensitivity properties of biquads
 - 7.5 Sensitivity of passive circuits
- 8. Design of High-Order Active Filters (6 hours)**
- 8.1 Cascade of biquads
 - 8.1.1 Sequencing of filter blocks, center frequency, Q-factor and gain
 - 8.2 Active simulation of passive filters
 - 8.2.1 Ladder design with simulated inductors
 - 8.2.2 Ladder design with frequency-dependent negative resistors (FDNR)
 - 8.2.3 Leapfrog simulation of ladders
- 9. Switched-Capacitor Filters (4 hours)**
- 9.1 The MOS switch and switched capacitor
 - 9.2 Simulation of resistor by switched capacitor

- 9.3 Switched-capacitor circuits for analog operations: addition, subtraction, multiplication and integration
- 9.4 First-order and second-order switched-capacitor circuits

Practical:

The laboratory experiments consist computer simulation as well hardware realization for analysis and design of passive and active filters which include.

- ▣ Analysis and design of passive & active filter circuits using computer simulation
- ▣ Design of active filters using biquad circuits
- ▣ Design of higher order active filters using inductor simulation
- ▣ Design of higher order active filters using functional simulation

References:

1. Rolf Schaumann, Mac E. Van Valkenburg, " Design of Analog Filters"
2. Wai-Kai Chen, " Passive and Active Filters (Theory and Implementations)",
3. Kendal L Su, "Analog Filter",

PROJECT-I
EX 707

Lecture : 0
Tutorial : 0
Practical : 3

Year : IV
Part : I

Course Objectives:

The objective of this project work is to develop hands-on experience of working in a project. During the course, students have to design and complete a functional project which should require integration of various course concepts. Students will develop various skills related to project management like team work, resource management, documentation and time management.

1. Group formation (Not exceeding 4 persons per group)
2. Project concept development (software engineering concept must include for computer engineering and hardware / software elements include electronics & communication engineering)
3. Proposal preparation (proposal content: title, objective, scope of project, methodology, expected outcome, hardware/software element, list of equipment, and historical background and reviewed should be clearly reflected)
4. Project documentation (follow the project documentation guideline)

Evaluation Scheme:

Project (Part A): Internal Evaluation is done on the basis of Project Proposal, Regular activities, Progress Report and Presentation.

ELECTIVE I

ADVANCED JAVA PROGRAMMING

CT 725 01

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : I

Course Objective:

To provide programming knowledge for both single system software distribution and across networks/devices and to focus on the advanced topics that a Java programmer will need to know so that they will be in a position to do commercial Java development both for single services and also for distributed processes across multiple devices. To provide an in depth coverage of object serialization, Java Beans, XML, Servlets, JSP's, networking, remote objects (RMI), distributed computing, and Java database Connectivity.

1. **Introduction** (2 hours)
 - 1.1 Overview
 - 1.2 Java Programming Review

2. **GUI Programming and Components** (4 hours)
 - 2.1 Swing Introduction
 - 2.2 Frame Creation/Positioning
 - 2.3 Working with Shape, Color, Text, Images
 - 2.4 Basics of Event Handling
 - 2.5 AWT Event Hierarchy
 - 2.6 Low Level Event Types
 - 2.7 User Interface Components
 - 2.8 Layout Management
 - 2.9 Text Input/Choice Components/Menu/Dialog Box

3. **Applets and Application Deployment** (4 hours)
 - 3.1 Applet Basics
 - 3.2 Applet HTML Tags & Attribute
 - 3.3 Multimedia, URL Encapsulation
 - 3.4 JAR files
 - 3.5 Application Packaging
 - 3.6 Storage of Application Preferences

4. **Streams and File Handling** (4 hours)
 - 4.1 Streams
 - 4.2 Text Input and Output
 - 4.3 Working with Binary Data
 - 4.4 Object Streams & Serialization
 - 4.5 File Management, Buffer , Lock etc.

- 5. XML Programming (3 hours)**
 - 5.1 Introducing XML
 - 5.2 Parsing an XML Documents
 - 5.3 Validating XML Documents
 - 5.4 XPath, SAX Parsers, XSL Transformations
- 6. Network Programming (4 hours)**
 - 6.1 Server Connection
 - 6.2 Implementing Servers
 - 6.3 Socket Timeouts / Interruptible Sockets
 - 6.4 Sending E-mail
 - 6.5 URL Connection Establishment
 - 6.6 Posting Form Data
- 7. Database Programming (6 hours)**
 - 7.1 The design of JDBC and types
 - 7.2 The Structured Query Language (SQL)
 - 7.3 JDBC Configuration
 - 7.4 Executing SQL Statements
 - 7.5 Query execution
 - 7.6 Scrollable and Updateable result sets
 - 7.7 Row sets /Cached row sets
 - 7.8 Metadata
 - 7.9 Transactions
 - 7.10 Enterprise Application and Connection management in Web
 - 7.11 LDAP / LDAP Server configuration and accessing LDAP
- 8. Distributed Objects (4 hours)**
 - 8.1 Client – Server model
 - 8.2 RMI Programming model
 - 8.3 Parameters and return values in remote methods
 - 8.4 Remote Object Activation
 - 8.5 Web services and JAX-WS
- 9. Advanced Swing and advanced AWT (5 hours)**
 - 9.1 Swing: Lists, Tables, Trees, Text Components
 - 9.2 Swing : Progress Indicators, Component Organizers, Split/tabbed Panes
 - 9.3 AWT : Rendering, Shapes, Areas, Strokes, Coordinate Transformations
 - 9.4 AWT : Clipping and Image manipulation, Printing, The Clipboard
- 10. Java Beans Components (5 hours)**
 - 10.1 Introducing Beans
 - 10.2 Using Beans in Application Building
 - 10.3 Packaging Beans in JAR files
 - 10.4 Naming Patterns for Beans

- 10.5 Bean property types
- 10.6 JavaBeans Persistence

11. Miscellaneous (4 hours)

- 11.1 Security : Bytecode verification, User Authentication, Encryption, Digital Signature
- 11.2 Scripting : Scripting Engine, Script Binding, Script compilation
- 11.3 Other recent trends

Practicals:

There should be substantial program design and implementation assignments related to every chapter of the syllabus content.

References:

1. Car S. Horstmann, "Core Java Volume I and II – Advanced Features", Prentice Hall.
2. Y. Daniel Liang, "Introduction to Java Programming", Pearson/ Prentice Hall.
3. H. Deitel, P. Deitel, "Java How To Program" , Prentice Hall.

DATA MINING

CT 725 02

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : I

Course Objective:

To introduce the fundamental principles, algorithms and applications of intelligent data processing and analysis and to provide an in depth understanding of various concepts and popular techniques used in the field of data mining

1. **Introduction** (2 hours)
 - 1.1 Data Mining Origin
 - 1.2 Data Mining & Data Warehousing basics
2. **Data Preprocessing** (6 hours)
 - 2.1 Data Types and Attributes
 - 2.2 Data Pre-processing
 - 2.3 OLAP & Multidimensional Data Analysis
 - 2.4 Various Similarity Measures
3. **Classification** (12 hours)
 - 3.1 Basics and Algorithms
 - 3.2 Decision Tree Classifier
 - 3.3 Rule Based Classifier
 - 3.4 Nearest Neighbor Classifier
 - 3.5 Bayesian Classifier
 - 3.6 Artificial Neural Network Classifier
 - 3.7 Issues : Overfitting, Validation, Model Comparison
4. **Association Analysis** (10 hours)
 - 4.1 Basics and Algorithms
 - 4.2 Frequent Itemset Pattern & *Apriori* Principle
 - 4.3 FP-Growth, FP-Tree
 - 4.4 Handling Categorical Attributes
 - 4.5 Sequential, Subgraph, and Infrequent Patterns
5. **Cluster Analysis** (9 hours)
 - 5.1 Basics and Algorithms
 - 5.2 K-means Clustering
 - 5.3 Hierarchical Clustering
 - 5.4 DBSCAN Clustering
 - 5.5 Issues : Evaluation, Scalability, Comparison

6. **Anomaly / Fraud Detection** (3 hours)

7. **Advanced Applications** (3 hours)

- 7.1 Mining Object and Multimedia
- 7.2 Web-mining
- 7.3 Time-series data mining

Practical:

Using either MATLAB or any other DataMining tools (such as WEKA), students should practice enough on real-world data intensive problems like IRIS or Wiki dataset.

References:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, 2005, Addison-Wesley.
2. Jiawei Han and Micheline Kamber, *Data Mining: Concepts and Techniques*, 2nd Edition, 2006, Morgan Kaufmann.

EMBEDDED SYSTEMS DESIGN USING ARM TECHNOLOGY CT 725 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

To provide fundamentals concepts and insights for understanding of the ARM based Processors architecture and programming embedded system based on ARM powered MCU for application in control, consumer, multimedia signal processing and mobile and wireless communications systems.

- 1. ARM Embedded Systems (3 hours)**
 - 1.1 Introduction to Embedded Systems
 - 1.2 The RISC Design Philosophy
 - 1.3 The ARM Design Philosophy
 - 1.4 Embedded System Hardware
 - 1.5 Embedded System Software

- 2. ARM Processor Fundamentals (3 hours)**
 - 2.1 The Acron RISC Machine
 - 2.2 The ARM programmer's model
 - 2.3 Current Program Status Register
 - 2.4 Exceptions, Interrupts, and the Vector Table
 - 2.5 ARM Processor Families

- 3. ARM Organization and Peripherals (6 hours)**
 - 3.1 3-stage pipeline ARM organization
 - 3.2 5-stage pipeline ARM organization
 - 3.3 ARM instruction execution
 - 3.4 Peripherals: GPIO, UART, I2C, SPI, ADC/DAC, Timers, Displays, Interrupts and DMA.

- 4. Efficient C Programming for ARM (3 hours)**
 - 4.1 Data types, Expressions and Conditional statements
 - 4.2 Loops, Functions and procedures
 - 4.3 Use of memory
 - 4.4 Pointer Aliasing
 - 4.5 Bit-Field

- 5. ARM Assembly Language Programming (3 hours)**
 - 5.1 Data processing instructions
 - 5.2 Data transfer instructions

- 5.3 Control flow instructions
- 5.4 Writing simple assembly language programs
- 6. ARM Instruction Set (6 hours)**
 - 6.1 Data Processing Instructions
 - 6.2 Branch Instructions
 - 6.3 Load-Store Instructions
 - 6.4 Software Interrupt Instruction
 - 6.5 Program Status Register Instructions
 - 6.6 Loading Constants
 - 6.7 Conditional Execution
- 7. Thumb Instruction Set (3 hours)**
 - 7.1 The Thumb bit in the CPSR
 - 7.2 The Thumb programmer's model
 - 7.3 Thumb branch instructions
 - 7.4 Thumb software interrupt instruction
 - 7.5 Thumb data processing instructions
 - 7.6 Thumb single register data transfer instructions
 - 7.7 Thumb multiple register data transfer instructions
 - 7.8 Thumb breakpoint instruction
 - 7.9 Thumb implementation
 - 7.10 Thumb applications
- 8. Architectural Support for System Development (6 hours)**
 - 8.1 The ARM memory interface
 - 8.2 The Advanced Microcontroller Bus Architecture (AMBA)
 - 8.3 The ARM reference peripheral specification
 - 8.4 Hardware system prototyping tools
 - 8.5 The ARMulator
 - 8.6 The JTAG boundary scan test architecture
 - 8.7 The ARM debug architecture
 - 8.8 Embedded Trace
- 9. Firmware and Embedded Operating Systems (6 hours)**
 - 9.1 Firmware and Bootloader
 - 9.2 Fundamental components of embedded operating systems
 - 9.3 Embedded Linux
 - 9.4 Android Operating Systems
- 10. Signal Processing and Communication Application using ARM Cortex Processors (6 hours)**
 - 10.1 ARM Cortex-M4 Processors for Multimedia Signal Processing
 - 10.2 Hardware and software development aspects for Cortex-M series applications

- 10.3 ARM Cortex-R processors for mobile and wireless communication
- 10.4 Hardware and software development aspects for Cortex-R series applications

Practicals:

1. Introduction to NXP LPC2148 MCU, Development Board and Development Tools
2. Programming in C & Assembly (KEIL and PROTEUS)
3. GPIO Programming (LED, LCD, Keypad, Buzzer)
4. Serial Protocols Programming (UART0, I2C0, SPI)
5. Timer Programming (Timer/Counter, PWM, WDT, RTC)
6. LPC2148 Interface for ADC/DAC

References:

1. Andrew N. Sloss, Dominic Symes, Chris Wright "ARM System Developer's Guide", Morgan Kaufmann.
2. Steve Furber, "ARM System-on-Chip Architecture," Second Edition, Addison Weley
3. Joseph Yiu, " The Definitive Guide to the ARM Cortex-M3," Newnes
4. William Hold, "ARM Assembly Language: Fundamentals and Techniques," CRC Press,
5. David Seal, "Free ARMv7-AR, ARMv7-M, ARMv6-M and ARMv5 Architecture Reference Manual Downloads," Addison-Wesley
6. Warwick A.Smith, "C Programming for Embedded Microcontrollers"

IMAGE PROCESSING AND PATTERN RECOGNITION

CT 725 04

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : I

Course Objectives:

To be familiar with processing of images, pattern recognition and their applications.

- 1. Introduction to digital image processing (4 hours)**
 - 1.1 Digital image representation
 - 1.2 Digital image processing: Problems and applications
 - 1.3 Elements of visual perception
 - 1.4 Sampling and quantization, relationships between pixels
- 2. Two-dimensional systems (5 hours)**
 - 2.1 Fourier transform and Fast Fourier Transform
 - 2.2 Other image transforms and their properties: Cosine transform, Sine transform, Hadamard transform, Haar transform
- 3. Image enhancement and restoration (8 hours)**
 - 3.1 Point operations, contrast stretching, clipping and thresholding, digital negative, intensity level slicing, bit extraction
 - 3.2 Histogram modeling: Equalization, Modification, Specification
 - 3.3 Spatial operations: Averaging, directional smoothing, median, filtering, spatial low pass, high pass and band pass filtering, magnification by replication and interpolation
- 4. Image coding and compression (4 hours)**
 - 4.1 Pixel coding: run length, bit plane coding, Huffman coding
 - 4.2 Predictive and inter-frame coding
- 5. Introduction to pattern recognition in images (3 hours)**
- 6. Recognition and classification (5 hours)**
 - 6.1 Recognition and classification
 - 6.2 Feature extraction
 - 6.3 Models
 - 6.4 Division of sample space
- 7. Grey level features edges and lines (6 hours)**
 - 7.1 Similarity and correlation
 - 7.2 Template matching
 - 7.3 Edge detection using templates
 - 7.4 Edge detection using gradient models, model fitting

7.5 Line detection, problems with feature detectors

8. Segmentation (3 hours)

8.1 Segmentation by thresholding

8.2 Regions based Segmentation, edges, line and curve detection

9. Frequency approach and transform domain (3 hours)

10. Advanced Topics (4 hours)

10.1 Neural networks and their application to pattern recognition

10.2 Hopfield nets

10.3 Hamming nets, perceptron

Practical:

Laboratory exercises using image processing and pattern recognition packages.

References:

1. R. C. Gonzalez and P. Wintz, "Digital Image Processing", Second Edition, Addison-Wesley Publishing.
2. K. Castleman. "Digital Image Processing", Prentice Hall of India Ltd.
3. A. K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India Pvt. Ltd..
4. Sing Tze Bow, M. Dekker, "Pattern Recognition and Image Processing",
5. M. James, "Pattern Recognition", BSP professional books.
6. P. Monique and M. Dekker, "Fundamentals of Pattern Recognition".

WEB TECHNOLOGIES AND APPLICATIONS

CT 725 05

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : I

Course Objectives:

To introduce the key foundations of the Web, essential technologies and knowledge needed for web application development, and to highlight the recent developments on the dynamic area of the Web.

- 1. Introduction (3 hours)**
 - 1.1 History
 - 1.2 Internet and the Web
 - 1.3 Client/server computing paradigm
- 2. Web basics (5 hours)**
 - 2.1 Web documents and browsers
 - 2.2 HTML, XHTML, forms, CSS
 - 2.3 Crawling and information retrieval on the web
- 3. Server-side programming (7 hours)**
 - 3.1 Server-side scripting languages- PHP, JSP, Java servlets, ASP.NET etc.
 - 3.2 Backend database programming
 - 3.3 Multi-tier architecture
- 4. Client-side scripting (4 hours)**
 - 4.1 JavaScript basics
 - 4.2 JavaScript DOM
- 5. Web applications (6 hours)**
 - 5.1 Content management systems
 - 5.2 Web application frameworks
 - 5.3 Online information systems and solutions
- 6. Web 2.0 (6 hours)**
 - 6.1 Introduction
 - 6.2 Blogs, wikis, social networking and collective intelligence
 - 6.3 Tagging - folksonomies
 - 6.4 AJAX
- 7. Information representation and sharing – XML (5 hours)**
 - 7.1 XML documents, DTD
 - 7.2 Stylesheets and transformation - XSLT
 - 7.3 Information syndication - RSS

8. Web services (4 hours)

- 8.1 Service-oriented architecture
- 8.2 SOAP, WSDL, REST

9. The Semantic Web (5 hours)

- 9.1 Introduction
- 9.2 RDF and Ontologies
- 9.3 Linked Open Data
- 9.4 Applications and Web 3.0

Practical:

Regular lab sessions can be conducted related to web design, server-side programming, client-side scripting, working with application frameworks and tools, etc.

A number of practical assignments can be given for hands-on experience on web application development.

References:

1. Slides and handouts
2. Jeffrey C. Jackson, "Web technologies: a computer science perspective",
3. P. J. Deitel and H. M. Deitel, "Internet and World Wide Web: How to Program",
4. G. McComb, "Web Programming Languages", John Wiley & Sons, Inc.
5. Marty Hall, "Core Web Programming", Prentice Hall PTR, Upper Saddle River, NJ 07458.

OPERATING SYSTEM

CT 725 06

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

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. Stallings William, "Operating Systems", Pearson Education
3. Silberschatz 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.

RADAR TECHNOLOGY

EX 725 01

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : I

Course Objectives:

- To enable the student to become familiar with Radar technology
- To get an overview of Radar and the Radar equation
- To study about different types of radars and their operations
- To study about Radar transmitters, receivers, duplexers, displays and antennas
- To get a knowledge about the detection of Radar signals in noise

1. **Introduction to Radar** (2 hours)
 - 1.1 Introduction
 - 1.2 Radar block diagram and operation
 - 1.3 Applications of Radar
 - 1.4 Radar frequencies
2. **The Radar equation** (8 hours)
 - 2.1 Simple form of Radar Equation
 - 2.2 Prediction of range performance
 - 2.3 Minimum detectable signal
 - 2.4 Receiver noise
 - 2.5 Signal to Noise ratio
 - 2.6 Integration of Radar Pulses
 - 2.7 Radar Cross Section of Targets (simple targets - sphere, cone-sphere)
 - 2.8 Transmitter Power
 - 2.9 Pulse repetition frequency and range ambiguities
 - 2.10 System losses
 - 2.11 Propagation effects
3. **CW and Frequency Modulated Radar** (4 hours)
 - 3.1 The Doppler effect
 - 3.2 CW Radar
 - 3.3 FM-CW Radar
 - 3.4 Multiple Frequency CW Radar
4. **MTI and Pulse Doppler Radar** (8 hours)
 - 4.1 Moving Target indicator Radar
 - 4.2 Delay Line and Cancellers
 - 4.3 Staggered Pulse Repetition Frequencies
 - 4.4 Range Gated Doppler Filters,
 - 4.5 Other MTI delay line,
 - 4.6 Limitations of MTI performance,

- 4.7 Non-Coherent MTI
- 4.8 Pulse Doppler Radar
- 4.9 MTI from a moving platform
- 4.10 Limitations of MTI performance
- 4.11 MTI versus Pulse Doppler Radar
- 5. Tracking Radar (6 hours)**
 - 5.1 Tracking with Radar
 - 5.2 Sequential Lobbing
 - 5.3 Conical Scan
 - 5.4 Monopulse Tracking Radar
 - 5.5 Tracking in range
 - 5.6 Acquisition
 - 5.7 Comparison of Trackers
- 6. Radar Transmitters, Receivers, Duplexers, Displays and Antennas (10 hours)**
 - 6.1 Radar Transmitters
 - 6.1.1 Introduction
 - 6.1.2 Solid state transmitters
 - 6.1.3 Introduction to Radar Modulators
 - 6.2 Radar Receivers
 - 6.2.1 Introduction
 - 6.2.2 Super Heterodyne Receiver
 - 6.2.3 Receiver Noise Figure
 - 6.3 Duplexers
 - 6.3.1 Introduction
 - 6.3.2 Branch type and Balanced type
 - 6.4 Displays
 - 6.4.1 Introduction and types
 - 6.5 Antennas
 - 6.6 Introduction
 - 6.7 Parameters of Radar Antenna
 - 6.8 Phased Array Antenna
 - 6.8.1 Basic Concepts
 - 6.8.2 Radiation Pattern
 - 6.8.3 Applications, Advantages and Limitations
- 7. Detection of Radar Signals in Noise (5 hours)**
 - 7.1 Introduction,
 - 7.2 Matched Filter Receiver
 - 7.2.1 Response Characteristics and Derivation
 - 7.3 Correlation Detection
 - 7.3.1 Correlation Function and Cross-correlation Receiver
- 8. Image Analysis and Applications (2 hours)**

Practical:

1. Field trip to Airport for the introduction of Air Traffic Control (ATC) Radar.
2. Radar Cross Section Simulation and Analysis
3. Case Study

References:

1. Merrill I. Skolnik, "Introduction to Radar Systems", MacGraw Hill
2. Merrill I. Skolnik, "Radar Handbook", McGraw Hill Publishers
3. J. C. Toomay and Paul J. Hannen, "Radar Principles for the Non-Specialist", by J. C. Toomay, Paul Hannen, SciTech Publishing
4. David Knox Barton, A. I. Leonov, Sergey A. Leonov, I. A. Morozov and Paul C. Hamilton, "Radar Technology Encyclopedia", Artech House.
5. Dr. Eli Brookner (Editor), "Radar Technology", Artech House.
6. M. R. Richards, J. A. Scheer, W. A. Holm, Editors "Principles of Modern Radar, Basic Principles", SciTech Publishing.

SATELLITE COMMUNICATION

EX 725 02

Lecture : 3**Tutorial : 1****Practical : 3/2****Year : IV****Part : I****Course Objectives:**

- To enable the student to become familiar with satellites and satellite services
- To get an overview of satellite systems in relation to other terrestrial systems
- To study about satellite orbits, launching, link design, multiple access techniques, propagation effects and their impact on satellite-earth links
- To study about VSAT systems, Satellite TV, radio and GPS

1. Overview of satellite communication (2 hours)

- 1.1 Introduction
- 1.2 Frequency Allocations for Satellite Services
- 1.3 Intelsat
- 1.4 U.S.Domsats
- 1.5 Polar Orbiting Satellites

2. Orbital mechanics and launchers (10 hours)

- 2.1 Kepler's laws
- 2.2 Newton's law
- 2.3 Orbital parameters
- 2.4 Orbital Mechanics
- 2.5 Look Angle Determination
- 2.6 Orbital perturbations
- 2.7 Orbit Control system
- 2.8 Geo stationary orbit
- 2.9 Telemetry, tracking, Command and monitoring
- 2.10 Power systems
- 2.11 Communication subsystems
- 2.12 Transponders
- 2.13 Satellite Antennas
- 2.14 Equipment reliability and space qualification.

3. Satellite link design (9 hours)

- 3.1 Basic transmission Theory,
- 3.2 System noise temperature and G/T ratio,
- 3.3 Design of downlinks,
- 3.4 Satellite systems using small earth stations Uplink design,
- 3.5 Design for C/N:Combining C/N and C/I values in satellite links,
- 3.6 System design examples

- 4. Multiple access techniques for satellite links (4 hours)**
 - 4.1 Multiple access
 - 4.2 Frequency Division Multiple Access
 - 4.3 Time Division Multiple Access
 - 4.4 On board processing
 - 4.5 Demand access Multiple Access
 - 4.6 Random access
 - 4.7 Code division Multiple Access
- 5. Propagation effects and their impact on satellite-earth links (3 hours)**
 - 5.1 Quantifying attenuation and depolarization
 - 5.2 Propagation effects that are not associated with hydrometers
 - 5.3 Rain and ice effects
 - 5.4 Prediction of rain attenuation
 - 5.5 Prediction of XPD
 - 5.6 Propagation impairment Countermeasures
- 6. VSAT systems (4 hours)**
 - 6.1 Network architectures
 - 6.2 Access control protocol
 - 6.3 Basic techniques
 - 6.4 SAT earth station engineering
 - 6.5 Calculation of link margins for VSAT star network
 - 6.6 System design procedures
- 7. Low Earth Orbit and Non-Geostationary Satellite systems (4 hours)**
 - 7.1 Orbit considerations
 - 7.2 Coverage and frequency considerations
 - 7.3 Delay and throughput considerations
 - 7.4 Operational NGSO constellation design
 - 7.5 Introduction to Satellite mobile network
 - 7.6 Meteorological Satellites System
- 8. Direct broadcast Satellite TV and radio (4 hours)**
 - 8.1 C-Band and Ku band home satellite TV
 - 8.2 Digital DBS-TV
 - 8.3 DBS-TV system design
 - 8.4 DBS-TV link budget
 - 8.5 Error control in digital DBS TV
 - 8.6 DBS-TV link budget
 - 8.7 Master control station and uplink
 - 8.8 Establishment of DBS-TV antennas Satellite radio broadcasting
- 9. Satellite Navigation and Global Positioning System: (5 hours)**
 - 9.1 Radio and Satellite navigation
 - 9.2 GPS position location principles

SATELLITE COMMUNICATION

EX 725 02

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : I

Course Objectives:

- To enable the student to become familiar with satellites and satellite services
- To get an overview of satellite systems in relation to other terrestrial systems
- To study about satellite orbits, launching, link design, multiple access techniques, propagation effects and their impact on satellite-earth links
- To study about VSAT systems, Satellite TV, radio and GPS

1. Overview of satellite communication (2 hours)

- 1.1 Introduction
- 1.2 Frequency Allocations for Satellite Services
- 1.3 Intelsat
- 1.4 U.S.Domsats
- 1.5 Polar Orbiting Satellites

2. Orbital mechanics and launchers (10 hours)

- 2.1 Kepler's laws
- 2.2 Newton's law
- 2.3 Orbital parameters
- 2.4 Orbital Mechanics
- 2.5 Look Angle Determination
- 2.6 Orbital perturbations
- 2.7 Orbit Control system
- 2.8 Geo stationary orbit
- 2.9 Telemetry, tracking, Command and monitoring
- 2.10 Power systems
- 2.11 Communication subsystems
- 2.12 Transponders
- 2.13 Satellite Antennas
- 2.14 Equipment reliability and space qualification.

3. Satellite link design (9 hours)

- 3.1 Basic transmission Theory,
- 3.2 System noise temperature and G/T ratio,
- 3.3 Design of downlinks,
- 3.4 Satellite systems using small earth stations Uplink design,
- 3.5 Design for C/N:Combining C/N and C/I values in satellite links,
- 3.6 System design examples

- 9.3 GPS receivers and Codes
- 9.4 Satellite signal acquisition
- 9.5 GPS navigation message
- 9.6 GPS signal levels
- 9.7 Timing accuracy
- 9.8 GPS receiver operation

Practical/ Field visits

Field visits to Satellite Stations.

References:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", John Willy & Sons (Asia) Pvt. Ltd.
2. Dennis Roddy, "Satellite Communications", McGraw-Hill Publication.
3. James Martyn, "Communication Satellite systems", Prentice Hall.
4. Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, "SatelliteCommunication Systems Engineering", Prentice Hall/Pearson.
5. M.Richharia, "SatelliteCommunicationSystems-DesignPrinciples", Macmillan.
6. Emanuel Fthenakis, "Manual of Satellite Communications", McGraw Hill Book Co.

BIOMEDICAL INSTRUMENTATION

EX 725 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

To provide specific engineering and instrumentation methods and principles to acquire basic knowledge of design, its application and maintenance of different biomedical instruments.

- 1. Fundamental of Medical Instrumentation: (4 hours)**
 - 1.1 Biomedical Engineering and Areas of Engineering Contribution
 - 1.2 Biometrics and Design Consideration Factors for Medical Instruments
 - 1.3 Man Instrument System and their Objectives
 - 1.4 Components of Man Instrument System
- 2. Bioelectric Signals and Electrodes: (4 hours)**
 - 2.1 Body System and Bioelectric Phenomenon
 - 2.2 Sources of Bioelectric Signals
 - 2.3 Resting and Action Potentials
 - 2.4 Electrode Theory and their Equivalent Circuits
 - 2.5 Types of Biopotential Electrodes
 - 2.6 Application of electrodes in medical instrumentation
- 3. Physiological Transducers: (4 hours)**
 - 3.1 Classification of Transducers
 - 3.2 Performance Characteristics of Transducers
 - 3.3 Active Transducers and their Application in Medical Instruments
 - 3.4 Passive Transducers and their Types used in Medical Instruments
- 4. Bioelectric Signals Measurement and Recording System (10 hours)**
 - 4.1 Aspects of Bioelectric Signals
 - 4.2 Electrocardiography (ECG)
 - 4.2.1 Normal Characteristics of Electrocardiogram
 - 4.2.2 ECG Lead Configuration and Recording Techniques
 - 4.2.3 Computer –Aided Electrocardiograph Analysis
 - 4.3 Electroencephalography (EEG)
 - 4.3.1 Electroencephalogram and Evoked Potential
 - 4.3.2 EEG Pre amplifier Design
 - 4.3.3 EEG Electrode Configuration and Recording Techniques
 - 4.3.4 Practical Details of EEG

- 4.4 Electromyography (EMG)
 - 4.4.1 Electromyography Recording Technique
 - 4.4.2 Applications of EMG
- 5. Non- Invasive Diagnostic Instruments (12 hours)**
 - 5.1 Blood Flow Measurement
 - 5.1.1 Magnetic Blood Flow meter
 - 5.1.2 Ultrasonic Blood Flow meter
 - 5.1.3 Blood Flow Measurement by Thermal Convection
 - 5.1.4 Blood Flow Measurement by Radiographic Method
 - 5.2 Diagnostic Medical Imaging System
 - 5.2.1 Radiographic Imaging System
 - 5.2.1.1 Principle of generation of X-rays and its medical properties
 - 5.2.1.1.1 Functional X-ray Machine
 - 5.2.1.1.2 Biological Effects of X-rays
 - 5.2.2 Ultrasonography Imaging System
 - 5.2.3 Computer Tomography (CT-Scan) System
 - 5.2.4 Magnetic Resonance Imaging System (MRI)
 - 5.2.5 Nuclear Medicine Machine
- 6. Therapeutic Instruments (4 hours)**
 - 6.1 Function of Kidneys
 - 6.2 Principle of Artificial Kidneys
 - 6.3 Hemodialysis Machine
 - 6.4 Types of Dialyzers
 - 6.5 Lithotripsy and its principle
 - 6.6 Lithotripter Machine
 - 6.7 Defibrillator Machine
- 7. Biomedical Telemetry and Telemedicine (3 hours)**
 - 7.1 Wireless Telemetry
 - 7.2 Single Channel Telemetry System
 - 7.3 Multi channel Telemetry
 - 7.4 Telemedicine Using Mobile Communication Equipments
- 8. Electrical Safety of Medical Equipment (4 hours)**
 - 8.1 Physiological Effects of Electricity
 - 8.2 Leakage Currents and Methods of Accident Prevention
 - 8.3 Micro shocks and Macro shocks Hazards
 - 8.4 Electrical Safety Codes and Standards
 - 8.5 Special Safety Measures for Electrical Susceptible Patients
 - 8.6 Power Distribution and Protection System of the Hospital

Practicals:

1. Three practical exercises based on availability of the portable medical and clinical based equipments.
2. Field Visit to Medical Institution
3. Field Visit Report and Viva Voce.

References:

1. Leslie Cromwell, et Al, " Biomedical Instrumentation and Measurements", Prentice Hall, India
2. R S Khandpur, "A Hand Book of Biomedical Instrumentation", Tata McGraw Hill

AERONAUTICAL TELECOMMUNICATION

EX725 04

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : I

Course Objectives:

To give the basic understanding of aviation related ground based electronics equipment used for Communication, Navigation and Surveillance and their theory of operation.

1. **Introduction to Aviation** **(4 hours)**
 History of Aviation, Aircraft, Airport, Airspace, Air Traffic Control and Air Traffic Management
2. **Aeronautical Communication** **(5 hours)**
 Aviation Band , ICAO and ITU , VHF Air to Ground communication, HF Ground to Ground communication, Interference, Data link, AFTN/ATN/AMHS
3. **Aeronautical Navigation** **(9 hours)**
 - 3.1 Introduction
 Introduction to Navigation, Piloting, Dead Reckoning, Radio Navigation, Ground Based Navigation System
 - 3.2 Non Directional Radio Beacon (NDB)
 NDB as a navigational aid, working principle, Uses of NDB, Advantages of NDB, Limitations of NDB , Siting Requirements, Antenna System, Types of Antennas, Factors affecting NDB Antenna, Role of Top, loading, Transmitting equipment, Monitoring and Calibration.
 - 3.3 VHF Omni Directional Radio Range (VOR)
 VOR as a navigational aid, Frequency band, general principal of operation, basic VOR transmission techniques, rotation of cardioids, VOR errors, siting requirements, Doppler VOR (DVOR), principal of operations of DVOR and its types, advantages of DVOR over conventional VOR, airborne VOR receiver, antenna system, conventional and Doppler VOR antenna, Transmitting techniques (i) conventional VOR (ii) Doppler VOR, monitoring and calibration.
4. **Aeronautical Equipment** **(9 hours)**
 - 4.1 Distance Measuring Equipment (DME)
 DME as a navigational aid, principal of operation, applications, Gaussian pulse, DME errors and echo suppression techniques, Airborne Interrogator, Siting requirements, antenna system, monitoring and calibrations

4.2 Instrument Landing System (ILS)

ILS as a landing aid, co-location of DME with ILS, coverage of an ILS, Marker Beacons, siting requirements, general transmitting techniques, generation of DDM, localizer and glide slope equipment and antenna system.

5. **Aeronautical Surveillance (8 hours)**

History of Radar, Types of Airport Surveillance Radar, Theory of Primary and Secondary Surveillance Radar, Monopulse SSR and Mode-S, Radar Data Processing System, Introduction to Automatic Dependence Surveillance and Multi Lateration system.

6. **Aeronautical Mobile Satellite System (AMSS) and Global Navigation Satellite system (GNSS) (4 hours)**

International maritime satellite System (Inmarsat), International Telecommunication Satellite System (Intelsat), Global Positioning System (GPS), Global Orbiting Navigation Satellite System (GLONASS).

7. **Basics of Aircraft Avionics Equipment (6 hours)**

Aircraft HF, VHF and Satellite Communication equipment, Radio compass, Radio Magnetic Indicator (RMI), Horizontal Situation Indicator, Automatic Direction Finder, SSR Tansponder, Flight Data and Voice Recorders.

Practical

1. Field visits to Avionics Communication Stations and Centers.
2. Reports writing on various Surveillance/Navigation/Other Instruments which are specific to avionics communication

References

1. H.V Sudarsan, "Seamless Sky", Ashgate Publishing limited, England
2. Donald J. Clausing, "Aviator's Guide to Navigation"
3. J.S. Chitode, "Principles of communication"
4. Dale Stacey, "Aeronautical Radio Communication system and Networks"
5. International Civil Aviation Organization, Global Air Navigation Plan for
6. CNS/ATM systems (Doc9750)

ENGINEERING PROFESSIONAL PRACTICE

CE 752

Lecture : 2
 Tutorial : 0
 Practical : 0

Year : IV
 Part : II

Course Objective:

To familiarize the students with their roles in the society, ethical and legal environment in which engineering is practiced, contract administration, regulatory environment and contemporary issues in Engineering.

1. **History of Engineering Practices** (3 hours)
 - 1.1 Man and Society
 - 1.2 Technology and Society
 - 1.3 History of Engineering Practice in Eastern Society
 - 1.4 History of Engineering Practice in Western society
 - 1.5 Engineering Practices in Nepal

2. **Profession and Ethics** (6 hours)
 - 2.1 Profession: Definition and Characteristics
 - 2.2 Professional Institutions
 - 2.3 Relation of an Engineer with Client, Contractor and Fellow Engineers
 - 2.4 Ethics, Code of Ethics and Engineering Ethics
 - 2.5 Moral Dilemma and Ethical Decision Making
 - 2.6 Detailed Duties of an Engineer and Architect
 - 2.7 Liability and Negligence

3. **Professional Practices in Nepal** (3 hours)
 - 3.1 Public Sector practices
 - 3.2 Private Sector Practices
 - 3.3 General Job Descriptions of Fresh Graduates in both Public and Private Sector

4. **Contract Management** (6 hours)
 - 4.1 Methods of work execution/contracting
 - 4.2 Types of Contracts
 - 4.3 Tendering Procedure
 - 4.4 Contract agreement

5. **Regulatory Environment** (5 hours)
 - 5.1 Nepal Engineering Council Act
 - 5.2 Labor Law
 - 5.3 Intellectual Property Right
 - 5.4 Building Codes and Bylaws
 - 5.5 Company Registration

6. Contemporary Issues in Engineering (3 hours)

- 6.1 Globalization and Cross Cultural Issues
- 6.2 Public Private Partnership
- 6.3 Safety, Risk and Benefit Analysis
- 6.4 Development and Environment
- 6.5 Conflict and Dispute Management

7. Case Studies based on Engineering Practices (4 hours)**References:**

1. Carson Morrison and Philip Hughes "Professional engineering Practice – Ethical Aspects", McGraw-Hill Ryerson Ltd. Toronto.
2. Dr Rajendra Adhikari, "Engineering Professional Practice – Nepalese and international Perspectives" Pashupati Publishing House, Kathmandu Nepal.
3. M. Govindarajan; S Natarajan and V.S. Senthikumar., " Engineering Ethics" – PHI Learning Pvt. Ltd. New Delhi.
4. Nepal Engineering Council Act
5. Contract Act
6. Labor Act
7. Company Act
8. Copyright Act
9. Public Procurement Act
10. Building By-Laws

WIRELESS COMMUNICATIONS

EX 751

Lecture : 3
 Tutorial : 0
 Practical : 0

Year : IV
 Part : II

Course Objectives:

To introduce the student to the principles and building blocks of wireless communications.

- 1. Introduction (2 hours)**
 - 1.1 Evolution of wireless (mobile) communications, worldwide market, examples
 - 1.2 Comparison of available wireless systems, trends
 - 1.3 Trends in cellular radio (2G, 2.5G, 3G, beyond 3G) and personal wireless communication systems
- 2. Cellular mobile communication concept (4 hours)**
 - 2.1 Frequency re-use and channel assignment strategies
 - 2.2 Handoff strategies, types, priorities, practical considerations
 - 2.3 Interference and system capacity, co-channel and adjacent channel interference, power control measures
 - 2.4 Grade of service, definition, standards
 - 2.5 Coverage and capacity enhancement in cellular network, cell splitting, sectoring, repeaters, microcells
- 3. Radio wave propagation in mobile network environment (12 hours)**
 - 3.1 Review Free space propagation model, radiated power and electric field
 - 3.2 Review Propagation mechanisms (large-scale path loss) - Reflection, ground reflection, diffraction and scattering
 - 3.3 Practical link budget design using path loss models.
 - 3.4 Outdoor propagation models (Longley-Rice, Okumura, Hata, Walfisch and Bertoni, microcell)
 - 3.5 Indoor propagation models (partition losses, long-distance path loss, multiple breakpoint, attenuation factor)
 - 3.6 Small scale fading and multipath (factors, Doppler shift), Impulse response model of multipath channel, multipath measurements, parameters of mobile multipath channel (time dispersion, coherence bandwidth, Doppler spread and coherence time)
 - 3.7 Types of small-scale fading (flat, frequency selective, fast, slow), Rayleigh and Ricean fading distribution
- 4. Modulation-Demodulation methods in mobile communications (4 hours)**
 - 4.1 Review of amplitude (DSB, SSB, VSB) and angle (frequency, phase) modulations and demodulation techniques

- 4.2 Review of line coding, digital linear (BPSK, DPSK, QPSKs) and constant envelope (BFSK, MSK, GMSK) modulation and demodulation techniques
 - 4.3 M-ary (MPSK, MFSK, QAM and OFDM) modulation and demodulation techniques
 - 4.4 Spread spectrum modulation techniques, PN sequences, direct sequence and frequency hopped spread spectrums
 - 4.5 Performance comparison of modulations techniques in various fading channels
- 5. Equalization and diversity techniques (4 hours)**
- 5.1 Basics of equalization. Equalization in communications receivers, linear equalizers
 - 5.2 Non-linear equalization, decision feedback and maximum likelihood sequence estimation equalizations
 - 5.3 Adaptive equalization algorithms, zero forcing, least mean square, recursive least squares algorithms, fractionally spaced equalizers
 - 5.4 Diversity methods, advantages of diversity, basic definitions
 - 5.5 Space diversity, reception methods (selection, feedback, maximum ratio and equal gain diversity)
 - 5.6 Polarization, frequency and time diversity
 - 5.7 RAKE receivers and interleaving
- 6. Speech and channel coding fundamentals (4 hours)**
- 6.1 Characteristics of speech signals, frequency domain coding of speech (sub-band and adaptive transform coding)
 - 6.2 Vocoders (channel, formant, cepstrum and voice-excited), Linear predictive coders (multipulse, code and residual excited LPCs), Codec for GSM mobile standard
 - 6.3 Review of block codes, Hamming, Hadamard, Golay, Cyclic, Bose-Chaudhary-Hocquenghem (BCH), Reed-Solomon (RS) codes
 - 6.4 Convolutional codes, encoders, coding gain, decoding algorithms (Viterbi and others)
 - 6.5 Trellis Code Modulation (TCM), Turbo codes
- 7. Multiple Access in Wireless communications (9 hours)**
- 7.1 Frequency Division Multiple Access (FDMA), principles and applications
 - 7.2 Time Division Multiple Access (TDMA), principles and applications
 - 7.3 Spread Spectrum Multiple Access, Frequency Hopped Multiple Access, Code Division Multiple Access, hybrid spread spectrum multiple access techniques
 - 7.4 Space Division Multiple Access
 - 7.5 Standards for Wireless Local Area Networks

8. Wireless systems and standards (6 hours)

- 8.1 Evolution of wireless telephone systems: AMPS, PHS, DECT, CT2, IS-94, PACS, IS-95, IS-136, IS-54 etc.
- 8.2 Global system for Mobile (GSM): Services and features, system architecture, radio sub-system, channel types (traffic and control), frame structure, signal processing, example of a GSM call
- 8.3 CDMA standards: Frequency and channel specifications, Forward and Reverse CDMA channels
- 8.4 WiFi, WiMax, UMB, UMTS, CDMA-EVDO, LTE, and recent trends
- 8.5 Regulatory issues (spectrum allocation, spectrum pricing, licensing, tariff regulation and interconnection issues)

Practicals:

1. Case study and field visit
2. Visit to mobile service operator, network service provider, internet service provider.

References:

1. K. Feher, Wireless Digital Communications
2. T. Rappaport, Wireless Communications
3. J. Schiller, Mobile Communications
4. Leon Couch, Digital and analog communication systems
5. B.P.Lathi, Analog and Digital communication systems
6. J. Proakis, Digital communication systems
7. D. Sharma, Course manual "Communication Systems II".

RF AND MICROWAVE ENGINEERING

EX 752

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To understand the fundamentals of Radio Frequency (RF) and Microwave (M/W) theory and applications, design and analysis practices, and measurement techniques.

- 1. Introduction (3 hours)**
 - 1.1 Standard frequency bands
 - 1.2 Behaviour of circuits at conventional and RF/microwave bands
 - 1.3 Microwave applications
- 2. RF and M/W Transmission Lines (6 hours)**
 - 2.1 Types of transmission lines
 - 2.2 Transmission line theory
 - 2.3 Smith Chart analysis
 - 2.4 Impedance transformations and matching analysis
- 3. RF and M/W Network Theory and Analysis (4 hours)**
 - 3.1 Scattering matrix and its properties
 - 3.2 S-Parameter derivation and analysis
- 4. RF/Microwave Components and Devices (8 hours)**
 - 4.1 Coupling probes
 - 4.2 Coupling loops
 - 4.3 Waveguide
 - 4.4 Termination, E-plane Tee, H-plane Tee, Magic Tee
 - 4.5 Phase-Shifter
 - 4.6 Attenuators
 - 4.7 Directional coupler
 - 4.8 Gunn diode
 - 4.9 Microwave transistor
 - 4.10 MASER
 - 4.11 Resonator and circulators
- 5. Microwave Generators (5 hours)**
 - 5.1 Transit-time effect
 - 5.2 Limitations of conventional tubes

- 5.3 Two-cavity and multi-cavity klystrons
- 5.4 Reflex klystron
- 5.5 TWT and magnetrons

6. RF Design Practices (10 hours)

- 6.1 RF Low pass filter
 - 6.1.1 Insertion loss
 - 6.1.2 Frequency scaling
 - 6.1.3 Microstrip implementation
- 6.2 RF Amplifier
 - 6.2.1 Amplifier theory
 - 6.2.2 Design and real world consideration
- 6.3 Oscillator and mixer
 - 6.3.1 Oscillator and super mixing theory
 - 6.3.2 Design and real world consideration

7. Microwave Antennas and Propagation (3 hours)

- 7.1 Antenna types
- 7.2 Propagation characteristics of microwave antennas
- 7.3 RF an M/W radiation, safety practices and standards

8. RF/Microwave Measurements (6 hours)

- 8.1 Power measurement
- 8.2 Calorimeter method
- 8.3 Bolometer bridge method
- 8.4 Thermocouples
- 8.5 Impedance measurement
- 8.6 RF frequency measurement and spectrum analysis
- 8.7 Measurement of unknown loads
- 8.8 Measurement of reflection coefficient
- 8.9 VSWR and Noise

Practicals:

1. Illustration of Smith Chart and load analysis
2. Introduction to RF and M/W signal and circuits, measuring techniques, instrumentations, and practices
3. Designing and analysis of simple strip-line and two-port circuits using network and spectrum analysers
4. Software-based (ADS-like) RF signal & circuit simulation practices

References:

1. Herbert J. Reich and et al., Van Nostard Reinhold, " Microwave Principles",
2. K.C. Gupta, "Microwave Electronics", Tata McGraw Hill.

3. A. K. Gautam, "Microwave Engineering" , S. K. Kataria & Sons.
4. D.C. Agrawal, "Microwave Techniques" , Tata McGraw Hill.
5. R. Chatterjee, "Elements of Microwave Engineering" ,Tata McGraw Hill.
6. Samuel Y. Liao, "Microwave Devices & Circuits", PHI.
7. David M. Pozar, "Microwave Engineering", John Wiley & Sons.
8. Newington "ARRL UHF/Microwave Experimenter's Manual", CT.
9. W. H. Hayt, "Engineering Electromagnetics" , McGraw-Hill Book Company.
10. A. Das, "Microwave Engineering", Tata McGraw Hill.
11. William Sinnema, "Electronic Transmission Technology: Lines, Waves, and Antennas", Prentice Hall.

DIGITAL SIGNAL PROCESSING

EX 753

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objectives:

To introduce digital signal processing techniques and applications, and to design and implement IIR and FIR digital filter.

- 1. Introduction (4 hours)**
 - 1.1 Basic elements of Digital Signal Processing,
 - 1.2 Need of Digital Signal Processing over Analog Signal Processing,
 - 1.3 A/D and D/A conversion,
 - 1.4 Sampling continuous signals and spectral properties of sampled signals
- 2. Discrete-time Signals and System (6 hours)**
 - 2.1 Elementary discrete-time signals,
 - 2.2 Linearity, Shift invariance, Causality of discrete systems,
 - 2.3 Recursive and Non-recursive discrete-time systems,
 - 2.4 Convolution sum and impulse response,
 - 2.5 Linear Time-invariant systems characterized by constant coefficient difference equations,
 - 2.6 Stability of LTI systems, Implementation of LTI system.
- 3. Z-Transform (6 hours)**
 - 3.1 Definition of the z-transform,
 - 3.2 One-side and two-side transforms, ROC, Left-side, Right-sided and two-sided sequences, Region of convergence, Relationship to causality,
 - 3.3 Inverse z-transform-by long division, by partial fraction expansion,
 - 3.4 Z-transform properties-delay advance, Convolution, Parseval's theorem,
 - 3.5 Z-transform function $H(z)$ -transient and steady state sinusoidal response, pole-zero relationship stability.
- 4. Discrete Fourier Transform (7 hours)**
 - 4.1 Definition and applications, Frequency domain sampling and for reconstruction, Forward and Reverse transforms, Relationship of the DFT to other transforms,
 - 4.2 Properties of the Discrete Fourier Transform: Periodicity, Linearity and Symmetry Properties, Multiplication of two DFTs and Circular Convolution, Time reversal, Circular time shift and Multiplication of two sequences circular frequency shift, Circular correlation and Parseval's Theorem,

- 4.3 Efficient computation of the DFT: Algorithm, applications, Applications of FFT Algorithms.

5. Implementation of Discrete-time System (8 hours)

- 5.1 Structures for FIR and IIR, Direct Form, Cascaded and parallel form, Lattice for FIR,
 5.2 Conversion between direct form and lattice and vice versa, Lattice and lattice-ladder for IIR,
 5.3 Frequency response,
 5.4 Digital filters, finite precision implementations of discrete filters,
 5.5 Representation of Numbers; fixed point and floating binary point, Effect of Rounding and truncation; Limit cycle oscillations effect,
 5.6 Quantization of filter coefficients and effects on location of poles, and zeros; pole perturbation, Overflow and underflow error, Scaling to prevent overflow and underflow.

6. IIR Filter Design (5 hours)

- 6.1 IIR Filter Design: IIR filter design by classical filter design using low pass approximations Butterworth, Chebychev, Inverse Chebyshev, Elliptic and Bessel-Thompson filters,
 6.2 IIR filter design by Impulse-invariant method, Bilinear Transformation Method, Matched z-transform method,
 6.3 IIR lowpass discrete filter design using bilinear transformation,
 6.4 Spectral transformations, Highpass, Bandpass and Notch filters.

7. FIR Filter Design (5 hours)

- 7.1 FIR filter design by Fourier approximation,
 7.2 Gibbs phenomena in FIR filter design, Design of Linear Phase FIR filters using window function, Applications of window functions to frequency response smoothing,
 7.3 Window functions, Rectangular, Hamming, Blackman and Kaiser windows,
 7.4 Design of linear phase FIR filter by the frequency sampling method,
 7.5 FIR filter design using the Remez exchange algorithm,
 7.6 Design of optimum equiripple linear-phase FIR filters.

8. Digital Filter Implementation (4 hours)

- 8.1 Implementations using special purpose DSP processors,
 8.2 Bit-serial arithmetic, pipelined implementations,
 8.3 Distributed arithmetic implementations.

Practical:

1. Study the behavior of a simple digital notch filter.
2. Response of a recursive digital.
3. Scaling, dynamic range and noise behavior of a recursive digital filter, observation of nonlinear finite precision effects.

4. Response of a non-recursive digital filter, Implementation in Impulse Invariant and Bilinear Transformation.
5. Band pass filters implemented using cascade second order sections and wave or ladder filters. Comparison of implementations.
6. Design of FIR filter using window method, Comparison of FIR filter for different windowing method.

References:

1. J.G. Proakis and D.G. Manolakis, "Digital Signal Processing", Prentice Hall of India.
2. A.V. Oppenheim, "Discrete-Time Signal Processing", Prentice Hall.
3. S.K. Mitra, "Digital Signal Processing, A Computer-based Approach", McGraw Hill.

PROJECT-II
EX755

Lecturer : 0
Tutorial : 0
Practical : 6

Year : IV
Part : II

Course Objectives:

The objective of this project work is to develop hands-on experience of working in a project. During the course, students have to design and complete a functional project which should require integration of various course concepts. Students will develop various skills related to project management like team work, resource management, documentation and time management.

1. Group formation (Not exceeding 4 persons per group)
2. Project concept development (software engineering concept must include for computer engineering and hardware / software elements include electronics & communication engineering)
3. Proposal preparation (proposal content: title, objective, scope of project, methodology, expected outcome, hardware/software element, list of equipment, and historical background and reviewed should be clearly reflected)
4. Project documentation (follow the project documentation guideline)

Evaluation Scheme:

Project (Part B): Internal and Final Evaluation is done on the basis of Regularity of the work, Completeness of project, Documentation, Progress Presentation and Final Presentation.

ELECTIVE II

AGILE SOFTWARE DEVELOPMENT

CT 765 02

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objectives:

- To deliver adaptable software iterations and releases based on Agile methodologies
- To minimize bugs and maximize productivity with Test-Driven Development and Unit Testing
- To Achieve quality design by adopting established coding principles
- To Provide an illustration on real life Agile Implementation through a case study in Extreme Programming
- To adopt best practices to successfully manage Agile projects

1. Review of Traditional Approaches (4 hours)

- 1.1 Overview of Waterfall Model
- 1.2 Overview of Spiral Model
- 1.3 Limitation of Traditional Approaches

2. Introduction to Agile Methodologies (4 hours)

- 2.1 Need of Agile Methodologies
- 2.2 Objectives of Agile Methodologies
- 2.3 Agile Implementations and Variants
- 2.4 Introduction to the Agile Manifesto

3. Planning an Agile Project (6 hours)

- 3.1 Establishing the Agile project
 - 3.1.1 Adopting the best practices of the Agile Manifesto
 - 3.1.2 Recognizing the structure of an Agile team
 - 3.1.3 Programmers
 - 3.1.4 Managers
 - 3.1.5 Customers
- 3.2 Developing a Foundation with User Stories
 - 3.2.1 Eliciting application requirements
 - 3.2.2 Writing user stories
- 3.3 Estimating and “The Planning Game”
 - 3.3.1 Defining an estimation unit
 - 3.3.2 Distinguishing between release and iteration

- 3.3.3 Prioritizing and selecting user stories with the customer
- 3.3.4 Projecting team velocity for releases and iterations

4. Agile Iterations (5 hours)

- 4.1 Breaking user stories into tasks
 - 4.1.1 Recognizing a program's main purpose
 - 4.1.2 Prioritizing tasks for a cohesive design
 - 4.1.3 The Agile coding process
 - 4.1.4 Write Test, Write Code, Refactor
 - 4.1.5 Allocating time for a spike

5. Test Driven Development (12 hours)

- 5.1 Design process with automated testing
 - 5.1.1 Introduction to Test Driven Development
 - 5.1.2 Writing a User Acceptance Test
 - 5.1.3 Compiling and Running tests
- 5.2 Integrating Unit Testing
 - 5.2.1 Distinguishing between user tests and unit tests
 - 5.2.2 Developing effective test suites
 - 5.2.3 Achieving "green lights" through continuous testing
- 5.3 Optimizing test-driven development
 - 5.3.1 Drafting a unit test that is simple, isolated and fast
 - 5.3.2 Isolating classes for effective testing
 - 5.3.3 Creating mock objects for testing
- 5.4 Refactoring
 - 5.4.1 Code Duplication
 - 5.4.2 Renaming fields and methods
 - 5.4.3 Extracting methods and base classes
 - 5.4.4 Programming by intention

6. Managing Agile Projects (4 hours)

- 6.1 Delivering the first release
- 6.2 Planning the next release
- 6.3 Adapting Agile to fit Development Methodology

7. Extreme Programming (10 hours)

- 7.1 Core Principles and Practices
- 7.2 Requirements and User Stories
- 7.3 Release Planning
- 7.4 Iteration Planning
- 7.5 Customer Tests
- 7.6 Small, Regular Releases

- 7.7 Pair Programming
- 7.8 Continuous Integration
- 7.9 Collective Code Ownership
- 7.10 Team Roles
- 7.11 Case Study

References

1. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall.
2. Andrew Hunt, David Thomas, "The Pragmatic Programmer: From Journeyman to Master", Addison-Wesley Professional.

NETWORKING WITH IPV6

CT 765 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objective:

To know the fundamental issues in network protocol design and implementation with the principles underlying TCP/IP protocol design; historical development of the Internet Protocol Version-6; IPv6 and QoS, IP network migrations and applications.

- 1. Internet and the Networking Protocols (3 hours)**
 - 1.1 Historical Development
 - 1.2 OSI Model
 - 1.3 Internet IP/UDP/TCP
 - 1.4 IPv4 Addressing Review
- 2. Next Generation Internet Protocol (14 hours)**
 - 2.1 Internet Protocol Version 6 (IPv6)
 - 2.1.1 History of IPv6
 - 2.1.2 IPv6 Header Format
 - 2.1.3 Problems with IPv4
 - 2.1.4 Features of IPv6
 - 2.1.5 IPv6 Addressing format and Types
 - 2.2 ICMPv6
 - 2.2.1 Features
 - 2.2.2 General Message Format
 - 2.2.3 ICMP Error & Informational Message types
 - 2.2.4 Neighbor Discovery
 - 2.2.5 Path MTU Discovery
- 3. Security and Quality of Service in IPv6 (5 hours)**
 - 3.1 Types of Threats
 - 3.2 Security Techniques
 - 3.3 IPSEC Framework
 - 3.4 QoS in IPv6 Protocols
- 4. Routing with IPv6 (6 hours)**
 - 4.1 Routing in the Internet and CIDR

- 4.2 Multicasting
 - 4.3 Unidirectional Link Routing
 - 4.4 RIPng
 - 4.5 OSPF for IPv6
 - 4.6 PIM-SM & DVMRP for IPv6
- 5. IPv4/IPv6 Transition Mechanisms (8 hours)**
- 5.1 Tunneling
 - 5.1.1 Automatic Tunneling
 - 5.1.2 Configured tunneling
 - 5.2 Dual Stack
 - 5.3 Translation
 - 5.4 Migration Strategies for Telcos and ISPs.
- 6. IPv6 Deployment (6 hours)**
- 6.1 Challenges and Risks
 - 6.2 IPv6 Deployment Plan
 - 6.3 IPv6 DNS (AAAA & A6 records)
 - 6.4 IPv6 enabled Proxy, Web & Mail Servers
- 7. Advanced Applications (3 hours)**
- 7.1 MPLS
 - 7.2 NGN

Practical:

For practical, one PC to one student either in virtual environment or real environment will be provided. Students will be divided into group which consists of 3 students. The working environment and machine connectivity will look like the following:

Tools Needed: TCPDUMP & WIRESHARK

1. Enable IPv6 in Windows/Linux
2. IPv6 Header Analysis
3. IPv6 Packet analysis (neighbor/router solicitation/discovery)
4. Unicast Routing Implementation using Zebra-OSPF & OSPF phase analysis
5. Multicast Routing Implementation using XORP-PIM/SM & PIM/SM phase analysis
6. IPv6 DNS/WEB/Proxy implementation & test
7. Case Study

Reference:

1. Joseph Davice, "Understanding IPv6"
2. Silvia Hagen, "IPv6 Essentials", O'reilly
3. S. A. Thomas, "IPng and the TCP/IP Protocols", Wiley.
4. O. Hersent, D. Gurle, J.-P. Petit, "IP Telephony", Addison-Wesley.

ADVANCED COMPUTER ARCHITECTURE

CT 765 04

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To provide advanced knowledge of computer architecture including parallel architectures, instruction-level parallel architectures, superscalar architectures, thread and process-level parallel architecture.

1. Computational models (5 hours)

- 1.1 computational model,
- 1.2 the von Neumann Computational model,
- 1.3 Evolution and interpretation of the concept of computer architecture,
- 1.4 Interpretation of the concept of the computer architectures at different levels of abstraction,
- 1.5 Multilevel hierarchical framework

2. Parallel Processing (8 hours)

- 2.1 Process, Thread, Processes and threads in languages,
- 2.2 Concurrent and parallel execution and programming languages,
- 2.3 Types of available parallelism,
- 2.4 Levels of available functional parallelism,
- 2.5 Utilization of functional parallelism,
- 2.6 Classification of parallel architectures,
- 2.7 Relationships between languages and parallel architectures

3. Pipelined Processors (8 hours)

- 3.1 Principle of pipelining,
- 3.2 Structure of pipelines,
- 3.3 Performance measures,
- 3.4 Application scenarios of pipelines,
- 3.5 Layout of a pipeline, Dependence resolution,
- 3.6 Design space,
- 3.7 pipelined processing of loads and stores

4. Superscalar Processors (8 hours)

- 4.1 The emergence and widespread adaption of superscalar processors,
- 4.2 Specific tasks of superscalar processing,
- 4.3 Parallel decoding,
- 4.4 superscalar instruction issue,
- 4.5 Scope of shelving,
- 4.6 Layout of shelving buffers,
- 4.7 Operand fetch policies,

- 4.8 Instruction dispatch schemes ,
- 4.9 Scope of register renaming with example

5. Processing of control transfer Instructions (6 hours)

- 5.1 Types of branches, Performance measures of branch processing ,
- 5.2 Branch handling ,
- 5.3 Delayed branching,
- 5.4 Branch processing,
- 5.5 Multiday branching

6. Thread and process-level parallel architectures (10 hours)

- 6.1 MIMD architectures
- 6.2 Distributed memory MIMD architectures,
- 6.3 Fine-grain and Medium-grain systems,
- 6.4 Coarse-grain multicomputer,
- 6.5 Cache coherence
- 6.6 Uniform memory access(UMA) machines,
- 6.7 Cache-coherent non-uniform memory access(CC-NUMA) machines,
- 6.8 Cache only memory architecture(COMA)

References:

1. Deszo Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures: a design space approach",
2. John P. Hayes, "Computer Architecture and organization",
3. David A. Patterson, John L. Hennessy, "Computer Organization and Design",

INFORMATION SYSTEMS

CT 765 05

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To introduce and apply the knowledge of computer based information systems. It also provides the concept to the student in designing and setting up complex information system.

- 1. Information system (3 hours)**
 - 1.1 Classification and evolution of IS
 - 1.2 IS in functional area.
 - 1.3 Information system architecture
 - 1.4 Qualities of information systems
 - 1.5 Managing Information System resources
 - 1.6 Balanced Scorecard – case studies
- 2. Control, Audit and Security of Information system (5 hours)**
 - 2.1 Control of information system
 - 2.2 Audit of information system
 - 2.3 Security of information system
 - 2.4 Consumer layered security strategy
 - 2.5 Enterprise layered security strategy
 - 2.6 Extended validation and SSL certificates
 - 2.7 Remote access authentication
 - 2.8 Content control and policy based encryption
 - 2.9 Example of security in e-commerce transaction
- 3. Enterprise Management Systems (4 hours)**
 - 3.1 Enterprise management systems (EMS)
 - 3.2 Enterprise Software: ERP/SCM/CRM
 - 3.3 Information Management and Technology of Enterprise Software
 - 3.4 Role of IS and IT in Enterprise Management
 - 3.5 Enterprise engineering, Electronic organism, Loose integration vs. full integration, Process alignment, Frame work to manage integrated change, future trends.
- 4. Decision support and Intelligent systems (7 hours)**
 - 4.1 DSS, operations research models
 - 4.2 Group decision support systems

- 4.3 Enterprise and executive decision support systems
- 4.4 Knowledge Management, Knowledge based Expert system
- 4.5 AI, Neural Networks, Virtual reality, Intelligent Agents
- 4.6 Data mining, Data ware Housing, OLAP, OLTP
- 4.7 Anomaly and fraud detection

5. Planning for IS (3 hours)

- 5.1 Strategic information system
- 5.2 Tactical information system
- 5.3 Operational information systems

6. Implementations of Information Systems (7 hours)

- 6.1 Change Management
- 6.2 Critical Success Factors
- 6.3 Next generation Balanced scorecard

7. Web based information system and navigation (8 hours)

- 7.1 The structure of the web
- 7.2 Link Analysis
- 7.3 Searching the web
- 7.4 Navigating the web
- 7.5 Web uses mining
- 7.6 Collaborative filtering
- 7.7 Recommender systems
- 7.8 Collective intelligence

8. Scalable and Emerging Information System techniques (8 hours)

- 8.1 Techniques for voluminous data
- 8.2 Cloud computing technologies and their types
- 8.3 MapReduce and Hadoop systems
- 8.4 Data management in the cloud
- 8.5 Information retrieval in the cloud
- 8.6 Link analysis in cloud setup
- 8.7 Case studies of voluminous data environment

Practicals:

The practical exercise shall include following three types of projects on designing of information system

1. E-commerce based information system for online transaction processing
2. web uses mining or collaborative filtering based processing system
3. scalable and emerging information system

References:

1. Leonard Jessup and Joseph Valacich , “Information Systems Today” , Prentice hall.
2. J.Kanter, “Managing With Information System”, PHI.
3. M. Levene, “An Introduction to Search Engines and Web Navigation”, Pearson Education,
4. Jimmy Lin and Chris Dyer, Morgan and Claypool, “ Data-Intensive Text Processing with Map Reduce”.
5. Jothy Rosenberg and Arthur Mateos , “The Cloud at Your Servic”, Manning.

BIG DATA TECHNOLOGIES

CT 765 07

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To introduce the current scenarios of big data and provide various facets of big data and to be familiar with the technologies playing key role in it and equips them with necessary knowledge to use them for solving various big data problems in different domains.

- 1. Introduction to Big Data (7 hours)**
 - 1.1 Big Data Overview
 - 1.2 Background of Data Analytics
 - 1.3 Role of Distributed System in Big Data
 - 1.4 Role of Data Scientist
 - 1.5 Current Trend in Big Data Analytics
- 2. Google File System (7 hours)**
 - 2.1 Architecture
 - 2.2 Availability
 - 2.3 Fault tolerance
 - 2.4 Optimization for large scale data
- 3. Map-Reduce Framework (10 hours)**
 - 3.1 Basics of functional programming
 - 3.2 Fundamentals of functional programming
 - 3.3 Real world problems modeling in functional style
 - 3.4 Map reduce fundamentals
 - 3.5 Data flow (Architecture)
 - 3.6 Real world problems
 - 3.7 Scalability goal
 - 3.8 Fault tolerance
 - 3.9 Optimization and data locality
 - 3.10 Parallel Efficiency of Map-Reduce
- 4. NoSQL (6 hours)**
 - 4.1 Structured and Unstructured Data
 - 4.2 Taxonomy of NoSQL Implementation
 - 4.3 Discussion of basic architecture of Hbase, Cassandra and MongoDB
- 5. Searching and Indexing Big Data (7 hours)**
 - 5.1 Full text Indexing and Searching
 - 5.2 Indexing with Lucene
 - 5.3 Distributed Searching with elasticsearch

6. Case Study: Hadoop**(8 hours)**

- 6.1 Introduction to Hadoop Environment
- 6.2 Data Flow
- 6.3 Hadoop I/O
- 6.4 Query languages for Hadoop
- 6.5 Hadoop and Amazon Cloud

Practical

Student will get opportunity to work in big data technologies using various dummy as well as real world problems that will cover all the aspects discussed in course. It will help them gain practical insights in knowing about problems faced and how to tackle them using knowledge of tools learned in course.

1. HDFS: Setup a hdfs in a single node to multi node cluster, perform basic file system operation on it using commands provided, monitor cluster performance
2. Map-Reduce: Write various MR programs dealing with different aspects of it as studied in course
3. Hbase: Setup of Hbase in single node and distributed mode, write program to write into hbase and query it
4. Elastic Search: Setup elastic search in single mode and distributed mode, Define template, Write data in it and finally query it
5. Final Assignment: A final assignment covering all aspect studied in order to demonstrate problem solving capability of students in big data scenario.

References

1. Jeffrey Dean, Sanjay Ghemawat, Map Reduce, "Simplified Data Processing on Large Clusters"
2. Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung, "The Google File System"
3. <http://wiki.apache.org/hadoop/>

OPTICAL FIBER COMMUNICATION SYSTEM

EX 765 01

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objective:

To introduce the concept of optical fiber communication

- 1. Introduction to Optical Fiber Communication (2 hours)**
 - 1.1 Evolution of optical fiber communication
 - 1.2 Optical fiber communication system
 - 1.3 Advantage of optical fiber communication
 - 1.4 Applications of optical fiber communication
- 2. Light Transmission in Optical Fiber (2 hours)**
 - 2.1 Introduction of optical fiber structure
 - 2.2 Total internal reflection
 - 2.3 Acceptance angle
 - 2.4 Numerical aperture
 - 2.5 Meridional and skew rays in optical wave guide
- 3. Electromagnetic Theory for Optical Propagation (2 hours)**
 - 3.1 Review of Maxwell's equation
 - 3.2 The wave equation for slab waveguide
 - 3.3 Wave equation for cylindrical waveguide
- 4. Mode Propagation in Optical Waveguide (3 hours)**
 - 4.1 Modes in a planar optical guide
 - 4.2 Phase and group velocity
 - 4.3 Evanescent field
 - 4.4 Modes in cylindrical optical waveguide
 - 4.5 Mode coupling
- 5. Optical Fibers (5 hours)**
 - 5.1 Introduction and types
 - 5.2 Modes in multimode fibers: step index and graded index
 - 5.3 Modes in step index and graded index single mode fiber
 - 5.4 Cutoff wavelength, mode-field diameter and spot size
 - 5.5 Transmission properties of optical fiber
 - 5.6 Fiber attenuation
 - 5.7 Fiber bend loss
 - 5.8 Fiber dispersion

Practicals:

1. Familiarization with optical fiber laboratory, safety and precaution.
Demonstration of the concept of light propagation in optical waveguide with the help of polymer rod and water spout
2. Determination of fiber numerical aperture and fiber attenuation
3. Plotting a power-current characteristic for LED
4. Determination of different optical fiber connector losses.
5. Determination of coupling efficiency/loss from source to fiber, fiber to fiber, and fiber to photodetector.
6. Digital optical transmission.

References:

1. John M. Senior, "Optical Fiber Communications – Principles and Practice", Prentice Hall.
2. William B. Jones. Jr. "Introduction to Optical Fiber Communication Systems", Holt, Rinheart and Winston, Inc.
3. Gerd Keiser, "Optical Fiber Communication", Second edition, McGraw Hill, Inc.
4. Roshan Raj Karmacharya, "Passive Optical Fiber LAN Design". M.Sc. Thesis, University of Calgary, Canada.

BROADCAST ENGINEERING

EX 765 03

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objectives:

- To make students familiar with the applications in different areas of broadcasting such as television, AM, FM, cable television, telecommunications, data communications, studio acoustics etc. through experiments and field researches
- To present a complete perspective of basic equipments or devices used for transmission of signals such as filters and oscillators, radio frequency power amplifiers and mixers, basic circuits of modulation and demodulation, transmitters and studio equipments
- To study and understand the basic concepts of broadcasting and obtain the knowledge of designing a simple AM/FM transmitter

1. Audio Principles (2 hours)

- 1.1 Decibel scale and units
- 1.2 Balanced lines
- 1.3 Principles and types of microphones
- 1.4 Basic audio measurements and test gear
- 1.5 Sampling theory and its application to audio signals
- 1.6 Audio data rate reduction systems for recording and transport of audio signals including an overview of psychoacoustic techniques

2. Television Principles (10 hours)

- 2.1 Concepts of Scanning
- 2.2 Video waveform signal bandwidth
- 2.3 Low frequency response and DC restoration
- 2.4 Sampling theory and its application to the digital studio standard
- 2.5 Effect of distortion and bit errors on picture
- 2.6 Generation of color component signals
- 2.7 International TV standards: Overview of different PAL standards, SECAM and NTSC, Problems of standards conversion

3. AM Transmitter (9 hours)

AM transmitter circuits and its modulation process

4. FM Transmitter (4 hours)

To know the basic FM transmitter circuits and its modulation process

5. AM Broadcasting (3 hours)

To know the actual set-up of devices/equipments used in AM broadcasting

6. **FM Broadcasting** (4 hours)
To know the actual set-up of devices/equipments used in FM broadcasting
7. **TV Broadcasting** (4 hours)
To know the actual set-up of devices/equipments used in TV broadcasting
8. **CATV Broadcasting** (4 hours)
To know the actual set-up of devices/equipments used in CATV broadcasting
9. **Satellite Navigation and Global Positioning System:** (5 hours)
 - 9.1 Radio and Satellite navigation
 - 9.2 GPS position location principles
 - 9.3 GPS receivers and Codes
 - 9.4 Satellite signal acquisition
 - 9.5 GPS navigation message
 - 9.6 GPS signal levels
 - 9.7 Timing accuracy
 - 9.8 GPS receiver operation

Practical:

1. Field visit to broadcasting stations
2. Field visit to VSAT stations.

References:

1. Roy Blake, "Comprehensive Electronic Communication". West Publishing Co.
2. B. Grob and Charles E. Herndon, "Basic Television and Video Systems", McGraw-Hill.

DATABASE MANAGEMENT SYSTEMS

EX 765 06

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

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

DATABASE MANAGEMENT SYSTEMS

EX 765 06

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

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 Object-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.

ELECTIVE III

MULTIMEDIA SYSTEM

CT 785 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To introduce the multimedia system: devices, systems and applications.

- 1. Introduction (5 hours)**
 - 1.1 Global structure of Multimedia
 - 1.2 Medium
 - 1.3 Multimedia system and properties
- 2. Sound / Audio System (6 hours)**
 - 2.1 Concepts of sound system
 - 2.2 Music and speech
 - 2.3 Speech Generation
 - 2.4 Speech Analysis
 - 2.5 Speech Transmission
- 3. Images and Graphics (5 hours)**
 - 3.1 Digital Image Representation
 - 3.2 Image and graphics Format
 - 3.3 Image Synthesis , analysis and Transmission
- 4. Video and Animation (6 hours)**
 - 4.1 Video signal representation
 - 4.2 Computer Video Format
 - 4.3 Computer- Based animation
 - 4.4 Animation Language
 - 4.5 Methods of controlling Animation
 - 4.6 Display of Animation
 - 4.7 Transmission of Animation
- 5. Data Compression (8 hours)**
 - 5.1 Storage Space
 - 5.2 Coding Requirements
 - 5.3 Source, Entropy and Hybrid Coding
 - 5.4 Lossy Sequential DCT- based Mode
 - 5.5 Expanded Lossy DCT-based Mode
 - 5.6 JPEG and MPEG
- 6. User Interfaces (5 hours)**
 - 6.1 Basic Design Issues

- 6.2 Video and Audio at the User Interface
- 6.3 User-friendliness as the Primary Goal

7. Abstractions for programming (5 hours)

- 7.1 Abstractions Levels
- 7.2 Libraries
- 7.3 System Software
- 7.4 Toolkits
- 7.5 Higher Programming Languages
- 7.6 Object-oriented approaches

8. Multimedia Application (5 hours)

- 8.1. Media preparation and composition
- 8.2. Media integration and communication
- 8.3. Media Entertainment

References:

1. Ralf Steinmetz and Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson Education Asia.
2. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Pearson Education Asia.
3. John F. Koegel Buford, "Multimedia Systems", Pearson Education Asia.

ENTERPRISE APPLICATION DESIGN AND DEVELOPMENT

CT 785 04

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objectives:

- To design and implementation of scalable enterprise applications.
- To introduce problem solving design patterns.
- To develop the service oriented solutions.
- To design and implement Rich Internet Applications

- | | |
|--|------------------|
| 1. Introduction | (3 hours) |
| 1.1 Enterprise Applications trends and Challenges | |
| 1.2 Application Architecture | |
| 1.3 Multi-tier Architecture | |
| 1.4 MVC Architecture | |
| 2. Design Pattern | (6 hours) |
| 2.1 Introduction | |
| 2.2 Creational Pattern | |
| 2.3 Structural Pattern | |
| 2.4 Behavioral Patterns | |
| 3. Database Concepts | (4 hours) |
| 3.1 Database Design | |
| 3.2 Enterprise Database (Oracle/DB2/MSSQL) | |
| 3.3 Database Connectivity (JDBC/ODBC) | |
| 3.4 Connection Pool | |
| 4. Service-Oriented Architecture | (5 hours) |
| 4.1 SOA Concepts and principles | |
| 4.2 XML/SOAP | |
| 4.3 Web services | |
| 5. Platform for Enterprise Solutions: Java EE5: | (9 hours) |
| 5.1 Java EE Platform Overview | |
| 5.2 Web Core Technologies: Servlets and JSP | |
| 6. Enterprise Java Bean | (6 hours) |
| 6.1 Enterprise JavaBean architecture | |
| 6.2 Developing EJB3.0 | |
| 6.3 Session and message-driven EJBs | |

7. Advanced Web Technology

(12 hours)

- 7.1 Web2.0 Introduction and Concepts
- 7.2 Rich Internet Application Development
- 7.3 AJAX
- 7.4 AJAX Frameworks(Prototype Library, DWR Java Ajax Framework)

Reference

1. Kevin Mukhar, "Beginning Java EE 5", Apress.
2. Markl Grand, "Patterns in Java", John Wiley & Sons.
3. Dana Moore, Raymond Budd, Edward Benson," Professional Rich Internet Application", John Wiley & Sons.

GEOGRAPHICAL INFORMATION SYSTEM

CT 785 07

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objective:

To provide the knowledge about basics of GIS with spatial data modelling and database design, capturing the real world, spatial analysis and visualization

1. **Introduction** (4 hours)
 - 1.1 Overview, History and concepts of GIS
 - 1.2 Scope and application areas of GIS
 - 1.3 Purpose and benefits of GIS
 - 1.4 Functional components of GIS
 - 1.5 Importance of GPS and remote sensing data in GIS

2. **Spatial data modeling and database design** (10 hours)
 - 2.1 Introduction to geographic phenomena
 - 2.2 Geographic fields and objects
 - 2.3 Geographic boundaries
 - 2.4 spatial relationships and topology
 - 2.5 scale and resolution
 - 2.6 vector, raster and digital terrain model
 - 2.7 Spatial database design with the concepts of geodatabase.

3. **Capturing the real world** (12 hours)
 - 3.1 Different methods of data capture
 - 3.2 Map elements, map layers, map scales and representation
 - 3.3 Coordinate system
 - 3.4 Spatial referencing: ITRS, ITRF
 - 3.5 Different classes of Map projections
 - 3.6 Datum and Datum Transformation
 - 3.7 GPS& Remote Sensing
 - 3.8 Data preparation, conversion and integration
 - 3.9 Quality aspects of spatial data

4. **Spatial analysis and visualization** (10 hours)
 - 4.1 Functional Components of GIS
 - 4.2 Analysis of spatial and attribute data
 - 4.3 Vector and Raster overlay operators
 - 4.4 Buffering
 - 4.5 Concepts of Spatial Data Mining
 - 4.6 Qualitative and Quantitative data visualization
 - 4.7 Map outputs and its basic elements

5. **Spatial data infrastructure** (5 hours)
- 5.1 SDI concepts and its current trend
 - 5.2 The concept of metadata and clearing house
 - 5.3 Critical factors around SDIs
6. **Open GIS** (4 hours)
- 6.1 Introduction of open concept in GIS
 - 6.2 Open source software for spatial data analysis
 - 6.3 Overview of OpenStreetMap
 - 6.4 Web Based GIS system

Practical

Lab: The lab should cover the chapters 3, 4, 5 and 6 by using the GIS tools like ArcView/ArchGIS

Lab 1&2: tutorial on ArchView/ArchGIS with real world map

Lab 3&4: Digitization and Map Layering practice

Lab 5&6: Linking to Databases, Data Analysis and Visualization

Lab 7&8: Building of your own GIS system.

Reference:

1. Rolf De By, Richard A. knippers, yuxian sun, " Principles of geographic information systems: An introductory textbook", international institute for Geo-information science and Earth observation, Netherlands
2. Andy Mitchell , "ESRI guide to GIS analysis", ESRI press, Red lands
3. GIS Cook BOOK

POWER ELECTRONICS

EE 785 07

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objectives:

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologies of Choppers.
- To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.
- To study simple applications

1. Power Semi-conductor Devices (9 hours)

- 1.1 Introduction
- 1.2 Power Diodes
- 1.3 Power BJT
- 1.4 Thyristor Characteristics
- 1.5 Two Transistor model of Thyristor
- 1.6 Series and Parallel operation of Thyristors
- 1.7 SCR, TRIAC, Power MOSFET, GTO, IGBT and SIT
 - 1.7.1 Device Structures and Characteristics
 - 1.7.2 Turn ON- Turn OFF methods and Circuits
 - 1.7.3 Protections, Ratings and applications
 - 1.7.4 Handling precautions and power dissipation

2. Controlled Rectifiers (8 hours)

- 2.1 Single Phase / Three Phase, Half wave / full wave, half controlled /fully controlled converters with R, RL and RLE loads
- 2.2 Continuous and discontinuous current operations
- 2.3 Evaluation of performance parameters
- 2.4 Effects of source inductance
- 2.5 Power factor improvement techniques
- 2.6 6-pulse and 12-pulse converters
- 2.7 Dual converters

3. Choppers (11 hours)

- 3.1 DC Choppers
 - 3.1.1 Introduction
 - 3.1.2 Principle of operation,
 - 3.1.3 Analysis with waveforms of Step-Down and Step-Up choppers
 - 3.1.4 Buck, boost and buck-boost Converter

- 3.2 AC Choppers:
 - 3.2.1 Operation of 1-phase voltage regulator with R, RL loads
 - 3.2.2 1-phase step up & step down cycloconverters

4. Inverters (9 hours)

- 4.1 Single phase and three phase (both 120° mode and 180° mode) inverters
- 4.2 PWM techniques: Sinusoidal PWM, modified sinusoidal PWM, multiple PWM
- 4.3 Introduction to space vector modulations
- 4.4 Voltage and harmonic control
- 4.5 Series resonant inverter
- 4.6 Current source inverter

5. Applications (8 hours)

- 5.1 Speed control of DC motor using rectifiers and choppers
- 5.2 Uninterruptible Power Supply (UPS)
- 5.3 Switched mode Power Supply (SMPS)
- 5.4 Battery Charger
- 5.5 Introduction to shunt and series compensators

Practical:

There should be experiments on

1. Basic characteristics of power transistors, diodes thyristors (SCRs)
2. Single phase, full wave and bridge rectifiers with resistive loads
3. Single phase SCR controller with UJT trigger
4. Three phase bridge rectifiers with diodes and with SCRs
5. Rectification for inductive loads
6. Various types of Choppers
7. Speed Control of DC Motor

References:

1. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education.
2. Philip T. Krein, "Elements of Power Electronics", Oxford University Press.
3. Jay P. Agarwal, "Power Electronic Systems – Theory and Design", Prentice Hall.
4. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics, Converters, Application and Design", John Wiley and Sons.
5. Cyril.W.Lander, "Power Electronics", McGraw – Hill.
6. M.D. Singh, K.B. Khanchandani, "Power Electronics", Tata McGraw – Hill.

REMOTE SENSING

CT 785 01

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objective:

To present an introduction to technological and scientific aspects of remote sensing (RS) of the Earth and its atmosphere

- 1. Introduction (7 hours)**
 - 1.1 General concepts of remote sensing
 - 1.2 History and basics of remote sensing of the Earth and its atmosphere
 - 1.3 Classifications
- 2. Physical Principles of Remote Sensing (10 hours)**
 - 2.1 Basic quantities
 - 2.2 Electromagnetic principles
 - 2.3 Emission/radiation theory
 - 2.4 Radar backscattering theory
- 3. Remote Sensing Technology (12 hours)**
 - 3.1 Passive remote sensing
 - 3.1.1 Visible and infrared techniques
 - 3.1.2 Microwave radiometry
 - 3.2 Active remote sensing
 - 3.2.1 Radar remote sensing
 - 3.2.2 Lidar remote sensing
 - 3.3 Basics of satellite remote sensing, and ground truths
- 4. Applications (10 hours)**
 - 4.1 Earth and its atmosphere
 - 4.1.1 Precipitation, winds, clouds and aerosols, temperature and trace gases
 - 4.1.2 Vegetation, forestry, ecology
 - 4.1.3 Urban and land use
 - 4.1.4 Water planet: meteorological, oceanographic and hydrologic RS
 - 4.1.5 Geological: Landforms, structure, topography, mine and resource exploration
 - 4.1.6 Geographic information system (GIS): GIS approach to decision making

4.2 Remote sensing into the 21st century: Outlook for the future RS

5. Remote Sensing Data (6 hours)

- 5.1 Processing and classification of remote sensing data
- 5.2 Data formats
- 5.3 Retrieval algorithms
- 5.4 Analysis and image interpretations

Practical:

1. Familiarization to remote sensing data available from department's capacity (via web and/or possible collaborations with national/international remote sensing agencies/institutions)
2. Data visualization/graphics
3. Data processing and pattern recognition
4. Computer simulations
5. Technical Writing

References:

1. Campbell, J.B., "Introduction to Remote Sensing," , The Guilford Press
2. Drury, S.A., "Image Interpretation in Geology", Chapman & Hall, 243 pp.
3. Drury, S.A., "Images of the Earth: A Guide to Remote Sensing", Oxford Press, 212 pp.
4. Kuehn, F. (Editor), "Introductory Remote Sensing Principles and Concepts", Routledge, 215 pp.
5. Lillesand, T.M. and Kiefer, R.W., "Remote Sensing and Image Interpretation", J. Wiley & Sons, 720 pp.
6. Sabins, Jr., F.F., "Remote Sensing: Principles and Interpretation", W.H. Freeman & Co., 496 pp.
7. Siegal, B.S. and Gillespie, A.R., "Remote Sensing in Geology", J. Wiley & Sons (especially Chapters 1 through 11)
8. Swain, P.H. and Davis, S.M., "Remote Sensing - the Quantitative Approach", McGraw-Hill Book Co.
9. Chen, H.S., "Space Remote Sensing Systems: An Introduction", Academic Press, Orlando
10. Jensen J. R., "Remote sensing of the environment: An Earth resource perspective" Academic Press, Orlando
11. Ulaby, F. T., R. K. Moore, and A. K. Fung, "Microwave Remote Sensing: Active and Passive", Artech House, Norwood, MA.
12. Periodicals devoted largely to remote sensing methods and applications:

13. IEEE Transactions on Geoscience and Remote Sensing.
14. IEEE Geoscience and Remote Sensing Letters
15. International Journal of Remote Sensing.
16. Photogrammetric Engineering and Remote Sensing.
17. Remote Sensing of the Environment
18. Canadian Journal of Remote Sensing
19. Journal of Remote Sensing Society of Japan

XML: FOUNDATIONS, TECHNIQUES AND APPLICATIONS

CT 785 05

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course objectives:

To provide knowledge of the Extensible Markup Language (XML), a standard for self-describing data, knowledge interchange, and information integration. Since representation, interchange and integration of information are fundamental to all information systems, there is a wide range of possible applications of XML.

- 1. XML Foundations (10 hours)**
 - 1.1 History and background
 - 1.2 XML syntax
 - 1.3 Document Type Definition (DTD)
 - 1.4 XML Schema
 - 1.5 XML Stylesheet Language Transformation (XSLT)
 - 1.6 XML document design
- 2. XML Models (4 hours)**
 - 2.1 XML conceptual models
 - 2.2 XML and logic
- 3. XML and Databases (10 hours)**
 - 3.1 XML as a database model
 - 3.2 XML query languages – Xpath, XSLT, XQuery
 - 3.3 XML native databases
- 4. XML and Semantics (6 hours)**
 - 4.1 RDF Resource Description Framework) syntax and semantics
 - 4.2 RDF schema
 - 4.3 Web Ontology Language (OWL)
 - 4.4 The Semantic Web
- 5. Web Services (8 hours)**
 - 5.1 SOAP
 - 5.2 WSDL
 - 5.3 UDDI
 - 5.4 Semantic Web Services
- 6. XML Applications (7 hours)**
 - 6.1 XBRL

6.2 Case studies of real XML applications

Practical:

A number of lab sessions can be conducted using XML Spy which is an XML editor and development environment.

References:

1. E.R. Harold, "XML Bible", IDG Books Worldwide.
2. S. Holzner and S. Holzner, "Real World XML", Peachpit Press.
3. S. Holzner, "Inside XML", New Riders Publishing.
4. S. Abiteboul, P. Buneman, and J. Gray, "Data on the Web: From Relations to Semistructured Data and XML", (Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann Publishers.
5. XML W3C Recommendation. <http://www.w3.org/TR/2008/REC-xml-20081126/>

ARTIFICIAL INTELLIGENCE

CT 785 06

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : II

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 hrs)**
- 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:

Practical 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.

SPEECH PROCESSING

CT 785 08

Lecture : 3
 Tutorial : 1
 Practical : 3/2

Year : IV
 Part : II

Course Objectives:

- To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression
- To introduce the models for speech production
- To develop time and frequency domain techniques for estimating speech parameters
- To introduce a predictive technique for speech compression
- To understand speech recognition, synthesis and speaker identification.

1. Nature of speech signal (8 hours)

- 1.1 Speech production: Mechanism of speech production
- 1.2 Acoustic phonetics
- 1.3 Digital models for speech signals
- 1.4 Representations of speech waveform
 - 1.4.1 Sampling speech signals
 - 1.4.2 Basics of quantization
 - 1.4.3 Delta modulation
 - 1.4.4 Differential PCM

2. Time domain methods for speech processing (8 hours)

- 2.1 Time domain parameters of Speech signal
- 2.2 Methods for extracting the parameters
 - 2.2.1 Short-time Energy
 - 2.2.2 Average Magnitude
 - 2.2.3 Short-time average Zero crossing Rate
- 2.3 Auditory perception: psychoacoustics.
- 2.4 Silence Discrimination using ZCR and energy
- 2.5 Short Time Auto Correlation Function
- 2.6 Pitch period estimation using AutoCorrelation Function

3. Frequency domain method for speech processing (10 hours)

- 3.1 Short Time Fourier analysis
 - 3.1.1 Fourier transform and linear filtering interpretations
 - 3.1.2 Sampling rates
- 3.2 Spectrographic displays
- 3.3 Pitch and formant extraction
- 3.4 Analysis by Synthesis
- 3.5 Analysis synthesis systems

- 3.5.1 Phase Vocoder
- 3.5.2 Channel Vocoder
- 3.6 Homomorphic speech analysis
 - 3.6.1 Cepstral analysis of Speech
 - 3.6.2 Formant and Pitch Estimation
 - 3.6.3 Homomorphic Vocoders

4. Linear predictive analysis of speech (10 hours)

- 4.1 Basic Principles of linear predictive analysis
- 4.2 Auto correlation method
- 4.3 Covariance method
- 4.4 Solution of LPC equations
- 4.5 Cholesky method
- 4.6 Durbin's Recursive algorithm
- 4.7 Application of LPC parameters
 - 4.7.1 Pitch detection using LPC parameters
 - 4.7.2 Formant analysis
 - 4.7.3 VELP
 - 4.7.4 CELP

5. Application of speech & audio signal processing (9 hours)

- 5.1 Algorithms:
 - 5.1.1 Dynamic time warping
 - 5.1.2 K-means clustering and Vector quantization
 - 5.1.3 Gaussian mixture modeling
 - 5.1.4 Hidden Markov modeling
- 5.2 Automatic Speech Recognition
 - 5.2.1 Feature Extraction for ASR
 - 5.2.2 Deterministic sequence recognition
 - 5.2.3 Statistical Sequence
 - 5.2.4 Recognition
 - 5.2.5 Language models
- 5.3 Speaker identification and verification
- 5.4 Voice response system
- 5.5 Speech synthesis
 - 5.5.1 Basis of articulation
 - 5.5.2 Source-filter
 - 5.5.3 Comparative synthesis

Practical:

There should be at least 4-6 experiments based on following topics

1. Spectral analysis
2. Time-Frequency analysis
3. Pitch extraction
4. Formant tracking

5. Speech enhancement
6. Audio coding
7. Speaker recognition

All these lab works may be performed in Matlab or similar softwares capable of processing speech signals. It can also be implemented in hardware if available.

References:

1. Thomas F. Quatieri, "Discrete-Time Speech Signal Processing", Prentice Hall /Pearson Education.
2. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc.
3. L.R.Rabiner and R.W.Schaffer, "Digital Processing of Speech signals", Prentice Hall
4. L.R. Rabiner and B. H. Juang, "Fundamentals of Speech Recognition", Prentice Hall.
5. J.R. Deller, J.H.L. Hansen and J.G. Proakis, "Discrete Time Processing of SpeechSignals", John Wiley, IEEE Press.
6. J.L Flanagan, "Speech Analysis Synthesis and Perception",Springer, Verlag.