B.E. DEGREE
IN
ELECTRONICS & COMMUNICATION ENGINEERING

Year : IV

Part : II

Teaching Schedule							Examination Scheme							
							Theory			Practical				
								Final			Final			
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Duaration hours	Marks	Assesment Marks	Duaration hours	Marks	Total	Remark
1	CE 752	Professional Practice	2			2	10	1.5	40				50	
2	EX 751	Wireless Communication	3	1		4	20	3	80				100	
3	EX 752	RF and Microwave Engineering	3	1	1.5	5.5	20		80	25			125	
3	EX 753	Digital Signal Processing	3	1	1.5	5.5	20	3	80	25			125	
4	EX 7650..	Elective II	3	1	1.5	5.5	20	3	80	25			125	
5	EX 7850..	Elective III	3	1	1.5	5.5	20	3	80	25			125	
6	EX 755	Project (Part B)			6	6				50		50	100	
		Total	**17**	**5**	**12**	**34**	**110**	**13.5**	**440**	**150**		**50**	**750**	

ENGINEERING PROFESSIONAL PRACTICE
CE 752

Lecture : 2 **Year : IV**
Tutorial : 0 **Part : II**
Practical : 0

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 **Year : IV**
Tutorial : 0 **Part : II**
Practical : 0

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 ReviewFree space propagation model, radiated power and electric field
3.2 ReviewPropagation 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 envelop (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, Bosh-Chaudhary- Hocquenghgem (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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 an 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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 verse, 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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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-gain and Medium-gain 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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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

6. Optical Source for Optical Fiber Communication **(4 hours)**

6.1 Introduction, types and requirements
6.2 Light emitting diode (LED)
6.3 Laser diode (LD)
6.4 Properties of optical sources

7. Optical Detectors **(4 hours)**

7.1 Introduction
7.2 Semiconductor photodiode
7.3 PIN photodiode
7.4 Avalanche photodiode
7.5 Comparison of different photodiodes
7.6 Properties of photodiodes

8. Optical Modulation **(3 hours)**

8.1 Introduction and types
8.2 Analog modulation
8.3 Digital modulation

9. Connectors and Couplers **(6 hours)**

9.1 Introduction to optical connections
9.2 Optical fiber connectors: Principle and types
9.3 Characteristic losses in connectors
9.4 Optical fiber splices: Principle and types
9.5 Comparison of different types of splices
9.6 Comparison between splice and connector
9.7 Introduction to optical couplers and their types
9.8 Fused biconical taper (bus) coupler
9.9 Fused star coupler
9.10 Characteristic properties of optical couplers
9.11 Fully bidirectional four port optical coupler
9.12 Asymmetrical bidirectional three port optical coupler (ABC)
9.13 Comparison between four port full bidirectional coupler made with traditional three port coupler and ABC

10. Fiber Amplifiers and Integrated Optics **(4 hours)**

10.1 Introduction
10.2 Rare earth doped fiber amplifier
10.3 Raman and Brillouin fiber amplifier
10.4 Integrated optics
10.5 Optical switch

11. Optical Fiber Network **(10 hours)**

11.1 Introduction to analog and digital fiber optic transmission
11.2 Optical fiber local area networks
11.3 Design of passive digital fiber optic networks

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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 presenta 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 it's 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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

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

1. Introduction **(3 hours)**

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

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

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

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

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

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

4.1 Integrity Constraints and Domain Constraints
4.2 Assertions and Triggering
4.3 Functional Dependencies

4.4 Multi-valued and Joined Dependencies
4.5 Different Normal Forms (1st, 2nd, 3rd, BCNF, DKNF)

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

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

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

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

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

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

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

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

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

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

Practical:

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

***8*:** Practice of Procedure/Trigger and DB Administration & other DBs (MySQL, PG-SQL, DB2.)
9, 10, 11: Group Project Development.
12: Project Presentation and Viva

References

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

ELECTIVE III

MULTIMEDIA SYSTEM

CT 785 03

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

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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 ArchView/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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 sinusoidalPWM, 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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 Lider 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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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

Course Objectives:

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

1. Introduction **(4 hours)**

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

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

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

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

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

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

4.1 Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well- formed-formula,
4.2 Propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses,
4.3 Rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system,

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

5. Structured knowledge representation **(4 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 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

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 Digitalmodels for speech signals
1.4 Representations of speech waveform
  1.4.1 Sampling speechsignals
  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 Auditoryperception: 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 bySynthesis
3.5 Analysis synthesis systems