B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : IV

Part : I

Teaching Schedule							Examination Scheme							
							Theory			Practical				
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final		Total	Remark
								Duaration hours	Marks		Duaration hours	Marks		
1	ME 708	Organization and Management	3	1		4	20	3	80				100	
2	EX 701	Energy Enviroment and Society	2			2	10	1.5	40				50	
3	CT 701	Project Management	3	1		4	20	3	80				100	
4	CT 702	Computer Network	3	1	1.5	5.5	20	3	80	50			150	
5	CT 703	Distributed System	3	1	1.5	5.5	20	3	80	25			125	
6	CT 704	Digital Signal Analysis and Processing	3	1	1.5	5.5	20	3	80	25			125	
7	CT 725	Elective I	3	1	1.5	5.5	20	3	80	25			125	
8	CT 707	Project (Part A)			3	3				50			50	
		Total	**20**	**6**	**9**	**35**	**130**	**19.5**	**520**	**175**			**825**	

ORGANIZATION AND MANAGEMENT

ME 708

Lecture : 3 **Year : IV**
Tutorial : 2 **Part : I**
Practical : 0

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 disadvantages
- 1.5.2 Functional Organization – Advantages and disadvantages
- 1.5.3 Line and Staff Organization – Advantages and disadvantages
- 1.5.4 Committee Organization – Advantages and disadvantages

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.

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

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"

PROJECT MANAGEMENT
CT 701

Lecture : 3 **Year : IV**
Tutorial : 1 **Part :I**
Practical : 0

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 assessment , 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",

COMPUTER NETWORKS
CT 702

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3

Course Objective:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Practical:

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

References:

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

DISTRIBUTED SYSTEMS
CT 703

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

Course Objective:

To be familiar with different aspect of the distributed system, middleware, system level support and different issues in designing distributed algorithms

1. Introduction **(4 hours)**

1.1 Introduction to Distributed Systems
1.2 Examples of Distributed Systems
1.3 Main Characteristics
1.4 Advantages and Disadvantages of Distributed System
1.5 Design Goals
1.6 Main Problems
1.7 Models of Distributed System
1.8 Resource Sharing and the Web Challenges
1.9 Types of Distributed System: Grid, Cluster, Cloud

2. Distributed Objects and File System **(7 hours)**

2.1 Introduction
2.2 Communication between distributed objects
2.3 Remote Procedure Call
2.4 Events And Notifications
2.5 Java RMI Case Study
2.6 Introduction to DFS
2.7 File Service Architecture
2.8 Sun Network File System
2.9 Introduction to Name Services
2.10 Name Services and DNS
2.11 Directory and Discovery Services
2.12 Comparison of Different Distributed File Systems

3. Operating System Support **(3 hours)**

3.1 The operating system layer
3.2 Protection
3.3 Process and threads
3.4 Communication and invocation
3.5 Operating system architecture

4. Distributed Heterogeneous Applications and CORBA **(3 hours)**

4.1 Heterogeneity in Distributed Systems
4.2 Middleware

4.3 Objects in Distributed Systems
4.4 The CORBA approach
4.5 CORBA services

5. Time and State in Distributed Systems **(5 hours)**

5.1 Time in Distributed Systems,
  5.1.1 Physical Clocks
  5.1.2 Logical Clocks
  5.1.3 Vector Clocks
  5.1.4 Clock Synchronization
5.2 Causal Ordering of Messages
5.3 Global State and State Recording
5.4 Distributed debugging

6. Coordination and Agreement **(4 hours)**

6.1 Mutual Exclusion in Distributed Systems
6.2 Algorithms for Mutual Exclusion
6.3 Distributed Elections
6.4 Multicast communication
6.5 Consensus

7. Replication **(4 hours)**

7.1 Reasons for Replication
7.2 Object Replication
7.3 Replication as Scaling Technique
7.4 Fault Tolerant Services
7.5 High Available Services
7.6 Transaction with Replicated Data

8. Transaction and Concurrency Control **(6 hours)**

8.1 Transactions
8.2 Nested Transaction
8.3 Locks
8.4 Optimistic Concurrency Control
8.5 Timestamp Ordering
8.6 Comparison of Methods For Concurrency Control
8.7 Introduction to Distributed Transactions
8.8 Flat and Nested Distributed Transactions
8.9 Atomic Commit Protocols
8.10 Concurrency Control in Distributed Transactions
8.11 Distributed Deadlocks
8.12 Transaction Recovery

9. Fault Tolerance **(4 hours)**

9.1 Introduction to Fault Tolerance
9.2 Process Resilience

9.3 Reliable Client Server Communication
9.4 Distributed Commit
9.5 Recovery

10. Case Studies **(5 hours)**

10.1 CORBA
10.2 Mach
10.3 JINI
10.4 TIB/Rendezvous

Practical:

1. Implementation of Election Algorithm.
2. Simulation for Clock Synchronization in Distributed System using Lamport's Algorithm.
3. Implementation of Banker's Algorithm for avoiding Deadlock
4. Experiment on DFS
5. Case Study – CORBA,JINI, Mach, TIB/Rendezvous

Reference:

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Third Edition, Pearson Education.
2. A.S. Tanenbaum, M. VanSteen, "Distributed Systems", Pearson Education.
3. MukeshSinghal, "Advanced Concepts in Operating Systems", McGraw-Hill Series in Computer Science.

DIGITAL SIGNAL ANALYSIS AND PROCESSING
CT 704

Lecture : 3 **year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To introduce digital signal processing techniques and algorithms

1. Discrete time signals and systems **(8 hours)**

1.1 Discrete time signal, basic signal types
1.2 Energy signal, power signal
1.3 Periodicity of discrete time signal
1.4 Transformation of independent variable
1.5 Discrete time Fourier series and properties
1.6 Discrete time Fourier transform and properties
1.7 Discrete time system properties
1.8 Linear time invariant (LTI) system convolution sum, properties of LTI system
1.9 Frequency response of LTI system
1.10 Sampling of continuous time signal, spectral properties of sampled signal.

2. Z-transform **(4 hours)**

2.1 Defintion, convergence of Z-transform and region of convergence
2.2 Properties of Z-transform (linearity, time shift, multiplication by exponential sequence, differentiation, time reversal, convolution, multiplication)
2.3 Inverse z-transform by long division and partial fraction expansion.

3. Analysis of LTI system in frequency domain **(6 hours)**

3.1 Frequency response of LTI system, response to complex exponential
3.2 Linear constant co-efficient difference equation and corresponding system function
3.3 Relationship of frequency response to pole-zero of system
3.4 Linear phase of LTI system and its relationship to causality.

4. Discrete filter structures **(8 hours)**

4.1 FIR filter, Structures for FIR filter (direct form, cascade, frequency sampling, lattice)
4.2 IIR filter, structures for IIR filter (direct form I, direct form II, cascade, lattice, lattice ladder)
4.3 Quantization effect (truncation, rounding), limit cycles and scaling.

5. FIR filter design **(6 hours)**

5.1 Filter design by window method, commonly used windows (rectangular

window, Hanning window, Hamming window)
5.2 Filter design by Kaiser window
5.3 Filter design by frequency sampling method
5.4 Filter design using optimum approximation, Remez exchange algorithm.

6. IIR filter design **(6 hours)**

6.1 Filter design by impulse invariance method
6.2 Filter design using bilinear transformation
6.3 Design of digital low pass Butterworth filter
6.4 Properties of Chebyshev filter, properties of elliptic filter, properties of Bessel filter, Spectral transformation.

7. Discrete Fourier transform **(7 hours)**

7.1 Discrete Fourier transform (DFT) representation, properties of DFT (linearity, time shift, frequency shift, conjugation and conjugate symmetry, duality, convolution, multiplication), circular convolution
7.2 Fast Fourier Transform (FFT) algorithm (decimation in time algorithm, decimation in frequency algorithm)
7.3 Computational complexity of FFT algorithm.

Practical:

1. Introduction to DSP tools.
2. Signal generation and manipulation
3. Convolution
4. Cascade of second order systems
5. IIR filter
6. FIR filter

References

1. Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, "Discrete-Time Signal Processing", Pearson Education.
2. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall.

PROJECT-I
CT 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 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

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

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

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

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. Castlemann. "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 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

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

Course Objective:

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

1. Introduction **(5 hours)**

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

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

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

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

- 3.1 Principles of Concurrency

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

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

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

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

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

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

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

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

7. Deadlock **(5 hours)**

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

8. Security **(4 hours)**

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

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

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

Practical:

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

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", PHI.
2. Stalling William, "Operating Systems", Pearson Education
3. SilbcrschatzA.,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 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

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 andPulse 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. MerrillI.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 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

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

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

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 Functional X-ray Machine
    - 5.2.1.1 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 Heamodialysis 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 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

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 NBD, Advantages of NBD, Limitations of NDB , Sitting 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, sitting 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, Sitting 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 NavigationSatellite 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)

RF AND MICROWAVE ENGINEERING

EX 725 05

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : I**
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.