SEMESTER – VII

LINUX PROGRAMMING & SYSTEM ADMINISTRATION (CS 8120)

Introduction to Linux operating system (3L)
Installation Linux O.S (12L)
Linux file system fundamentals and architecture (5L)
Linux commands (4L)
Manage directories and files in Linux O.S (3L)
Manage user, group and permission (4L)
Editing text file using vi editor (4L)
Navigation and Linux shell (3L)
Shell processing and scripting (5L)
Process and job control in Linux (4L)
File compression, communication commands and networking commands (3L)
Backup and utilities (2L)

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM (CS 7111)

Introduction :Overview of AI, Problems of AI, AI techniques;
Problem Solving – (5L)
Problem space and search, Defining the problem as state space search, Problem
characteristics; Tic-Tac-Toe problem.
AI languages Basic knowledge of programming languages like Prolog and Lisp.
Basic Search Techniques :Solving problems by searching; Uniform search strategies:
breadth first search, depth first search, depth limited search, bidirectional search, comparing
search strategies in terms of complexity. (5L)
Special Search Techniques : Heuristic Search- greedy best-first search, A* search; Hill
climbing search, Simulated annealing search; Genetic algorithms; Constraint satisfaction
problems; Adversarial search - Games, Optimal decisions and strategies in games, Minimax
search, Alpha-beta pruning. (5L)
Symbolic Logic :Syntax and semantics for propositional logic, Syntax and semantics of FOPL, Properties of WFF, Clausal form, Unification, Resolution. (6L)
Reasoning Under Inconsistencies and Uncertainties :Non-monotonic reasoning, Truth maintenance systems, Default reasoning & closed world assumption, Predicate completion and circumscription, Fuzzy logic.
(4L)
Probabilistic Reasoning :Bayesian probabilistic inference, Representation of knowledge (3L)
in uncertain domain, Semantics of Bayesian networks, Dempster-Shafer theory.
Structured Knowledge :Associative networks, Conceptual graphs, Frame structures. (4L)
Expert Systems :Rule based systems, Nonproduction systems: decision tree architectures, blackboard system architectures, neural network architectures.(4L)
Learning :Types of learning, general learning model, Learning by induction: generalization, specialization; example of inductive learner.(4L)

DATA WAREHOUSING AND DATA MINING (CS 7115)

Introduction : Data warehousing – definitions and characteristics, Multi-dimensional
data model, Warehouse schema. (5L)
Data Marts : Data marts, types of data marts, loading a data mart, metadata, data model,
maintenance, nature of data, software components; external data, reference data, performance
issues, monitoring requirements and security in a data mart. (3L)
Online Analytical Processing : OLTP and OLAP systems, Data Modeling, LAP tools,
State of the market, Arbor Essbase web, Microstrategy DSS web, Brio Technology, star
schema for multi dimensional view, snowflake schema; OLAP tools.
(5L)
Developing a Data Warehousing : Building of a Data Warehousing, Architectural
strategies & organizational issues, design considerations, data content, distribution of data,
Tools for Data Warehousing (4L)
Data Mining : Definitions; KDD(Knowledge Discovery database) versus Data Mining;
DBMS versus Data Mining, Data Mining Techniques; Issues and challenges; Applications of
Data Warehousing & Data mining in Government. (4L)
Association Rules : A priori algorithm, Partition algorithm, Dynamic inset counting
algorithm, FP – tree growth algorithm; Generalized association rule.(5L)
Clustering Techniques : Clustering paradigm, Partition algorithms, CLARA,
CLARANS; Hierarchical clustering, DBSCAN, BIRCH, CURE; Categorical clustering,
STIRR, ROCK, CACTUS. (5L)
Decision Trees : Tree construction principle, Best split, Splitting indices, Splitting
criteria, Decision tree construction with presorting. (3L)
Web Mining : Web content Mining, Web structure Mining, Web usage Mining, Text
Mining. (4L)

Temporal and Spatial Data Mining : Basic concepts of temporal data Mining, The GSP
algorithm, SPADE, SPIRIT, WUM. (5L)

COMPUTER GRAPHICS (CS 6110)

Introduction to Computer Graphics & Graphics Systems
Overview of CG, definitions of CG, types of CG, storage tubes displays, CRT technologies -
Raster Scan Display, Computer graphics software. (2L)
Scan Conversion
Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle
generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm,
boundary fill algorithm, flood fill algorithm. (8L)
2D Transformation
Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous
coordinates, transformations between coordinate systems; reflection shear; Transformation of
points, lines, parallel lines, intersecting lines.
Viewing
Viewing pipeline, Window to Viewport co-ordinate transformation, clipping operations,
point clipping, line clipping, clipping circles, polygons & ellipse.(10L)
3D Transformation & Viewing
3D transformations: translation, rotation, scaling & other transformations. Rotation about an
arbitrary axis in space; reflection through an arbitrary plane; general parallel projection
transformation; clipping, Viewport clipping, 3D viewing, perspectives & Depth Cueing. (10L)
Curves and Fractals
Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for
periodic B-spline curves, rational B-spline curves. (4L)
Hidden Surfaces
Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's
algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry. (4L)
Color & Shading Models

Introduction, Modeling Light Intensities and Sources, Diffuse Reflection, Lambert's Cosine
Law, Specular Reflection, Halftoning, Color Models - RGB Color, CMY Color. (4L)

NETWORK SECURITY & CRYPTOGRAPHY(IT 8116)

Introduction
Attacks, Services, Mechanisms, Security Attacks, Security Services, Model for Network
Security (6L)
Conventional Encryption and Message Confidentiality
Conventional Encryption Principles, Conventional Encryption Algorithms, Location of
Encryption Devices, Key Distribution (8L)
Public Key Cryptography and Message Authentication
Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles,
RSA, Digital Signatures, Key Management (10L)
Network Security Applications
Kerberos Motivation, Kerberos Version 4, PGP Notation, PGP Operational Description (6L)
IP Security
IP Security Overview, IP Security Architecture, Authentication Header (5L)
Web Security
Web Security Threats, Web Traffic Security Approaches, Overview of Secure Socket Layer
and Transport Layer Security, Overview of Secure Electronic Transaction (6L)
Intruders and Viruses
Intruders, Intrusion Techniques, Password Protection, Password Selection Strategies,
Intrusion Detection, Malicious Programs, Nature of Viruses, Types of Viruses, Macro
Viruses, Antivirus Approaches (4L)
Firewalls
Firewall Characteristics, Types of Firewalls, Firewall Configuration(2L)

VLSI DESIGN (EC 7111)

Analog VLSI Circuit Design: -
i) Review of MOSFET characteristics, scaling and small-geometry effects, MOSFET
capacitances.

ii) MOS resistor, MOS current source, current mirror circuits. MOS voltage source
Linear voltage and current converters.

iii) CMOS operational amplifier (OPAMP) design: - Differential amplifier, level shifter,
source follower, output stage voltage and power amplifiers. Cascode OPAMP.
Compensation techniques.

iv) Analog Filters: - Switched capacitor (SC) fundamentals, first order SC circuits,
second-order SC circuits and cascade design.

v) Analog to digital and digital to analog converters, speed of conversion and over
sampling issues.

vi) VLSI Interconnects: - distributed RC model, transmission line model. Future inter
connect technologies.

Digital VLSI Circuit Design: -
i) MOS inverters, CMOS inverter, state characteristics, switching characteristics, power
dissipation issues.

ii) CMOS logic gates: NAND, NOR, XOR, CMOS logic design of half and full adders.
CMOS transmission gates, pseudo-nMOS, domino logic gates.

iii) Sequential MOS Logic Circuits: The SR latch circuit, clocked latch and flip-flop,
CMOS D-latch and edge-triggered circuits, Schmitt trigger circuit, Comparator.

iv) Dynamic Logic Circuits: Pass transistor logic, synchronous dynamic circuit
techniques.

v) Semiconductor Memories: ROM circuits, SRAM circuits, DRAM circuits, drivers and
buffers, Buffer scaling and design issues.

WEB TECHNOLOGY (CS 7112)

Static Web Pages

Web Pages - types and issues, tiers; comparisons of Microsoft and java technologies, WWW-Basic concepts, web client and web server, http protocol (frame format), universal resource locator (url), HTML- different tags, sections, image & pictures, listings, tables, frame, frameset, form.

Dynamic Web Pages

The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation.

Active Web Pages

Need of active web pages; java applet life cycle.

Java Script

Data types, variables, operators, conditional statements, array object, date object, string object.

Java Servlet

Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

JSP

JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

J2EE

An overview of J2EE web services, basics of Enterprise Java Beans, EJB vs.
Java Beans, basics of RMI, JNI.

XML

Extensible Markup Language (XML), basics of XML, elements and attributes, document
type definition, XML parsers, sequential and tree approach.

ELECTIVES I & II

PARALLEL PROGRAMMING (CS 7114)

Processes and processors. Shared memory. Fork. Join constructs. Basic parallel programming
techniques- loop splitting, spin locks, contention barriers and row conditions.
Variations in splitting, self and indirect scheduling. Data dependency- forward and backward
block scheduling. Linear recurrence relations. Backward dependency. Performance tuning
overhead with number of processes, effective use of cache.
Parallel programming examples: Average, mean squared deviation, curve fitting, numerical
integration, travelling salesman problem, Gaussian elimination. Discrete event time
simulation.
Parallel Programming constructs in HPF, FORTRAN 95. Parallel programming under Unix.

ROBOTICS (EC 7114)

Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem.Arm Dynamics,D
Alembert Equations of Motion, Synthesis of elements with movalulity constraints,manipulations-trajectory planning,joint interpolated trajectories.

Control of Robot Manipulation-computed torque technique sequencing & adaptive control,
resolved motion control Moluie Robots.
Robot sensing-Range & Proximity & Higher-Level vision, illumination techniques,Imaging
Geometry, Segmentation Recognition & Interpretation.
Robot Programming Language Characteristics of Robot Level & Task Level
languages.Robot intelligence-State Space search, Robot learning,Robot Task
Planning,Knowledge Engineering.

DIGITAL IMAGE PROCESSING (EC 7115)

Digital image fundamentals: - Image digitization
Sampling & quantisation
Image resolution
Colour perception & processing
Image processing: - Pixel based transformation
Geometric transformation
Local processing: - Edge detection, subpixel location estimation
Restoration: - Degradation, inverse fitting, Wiener filtering

Binary image processing: - Thresholding, run length encoding
Distance transforms, Medial axis transforms
Morphological operations
Region segmentation & Representation: - Split & merge algorithm
Region growing
Image filtering: - Histogram modification
Linear & Gaussian filters
Contours: - Digital curves
Poly line splitting
Hop along algorithm
Conic & Splines Hough transform
Fourier description
Textures: - Statistical syntactic & model based methods
Image transforms: - Fourier, Hadamard, Discrete Cosine
Wavelets & other orthogonal transforms
Compression of image: - Predictive compression methods, vector quantisation,
hierarchical & progressive methods, JPEG, MPEG

Case studies

DIGITAL SIGNAL PROCESSING (EC 7110)

Introduction, Overview of digital signal processing.

Discrete – Time linear system, Sequences, arbitrary sequences, linear time invariant
system, causality, stability. Difference equation, relation between continuous and
discrete system. Classifications of sequence, recursive and non-recursive system.

Mathematical operations on sequences: Convolution, graphical and analytical techniques,
overlap and add methods, matrix method, some examples and solutions of LTI systems,
MATLAB examples (Tutorial)

Z-transform: Definition, relation between Z transform and Fourier transform of a
sequence, properties of Z transform, mapping between S-plane and Z-plane. Unit circle,
convergence and ROC, Inverse z-transform, solution of difference equation using the one
sided Z-transform MATLAB examples (Tutorial).

Discrete Fourier transform: Definition, inverse discrete Fourier transform (IDFT)
Twiddle factor, linear transformation, basic properties, circular convolution,
multiplication of DFT, linear filtering using DFT, filtering of long data sequences,
overlap add and save method. Computation of DFT, Fast Fourier transform (FFT), FFT
algorithm, Radix 2 algorithm. Decimation-in-time and decimation-in-frequency

algorithm, signal flow graph, butterflies, Chirp z-transform algorithm, MATLAB
examples (Tutorial).

Digital filter realization: Principle of digital filter realization, structures of All-zero
filters. Design of FIR (Finite impulse response) filters, linear phase, windows-rectangular,
Berlitt, Hanning, Hamming and Blackman. Design of infinite impulse response filters
(IIR) from analog filters. Bilinear transformation, Butterworth, Chebyshev, Elliptic
filters. Optimisation method of IIR filters. Some example of practical filter design.
Computer aided filter design, MATLAB examples (Tutorial).

BIOMEDICAL ELECTRONICS (EC 7116)

Origin of bio-potential:

- Electric activity of excitable cells, resting potential, action potential, Nerst equation,
propagation of action potential.
- Surface map of bio-potential- concept.

Biomedical electrodes:

- Electrode theory.
- Working principle & application of different bio-potential electrodes & biochemical
transducers○
Microelectrodes, surface electrodes, needle electrodes
  - Reference electrode, pH electrode, blood gas electrode
  - Ion electrode.

Cardiovascular measurements:

- Brief description of cardiovascular system.
- Electrocardiography○
Sources of cardiac bio-potentials,
  - Methodology & principle of measurement
  - Electrocardiograms & their inferences
- Vector cardiography- concept
- Principles of direct & indirect measurement of blood pressure
- Principles of measurement of blood flow/cardiac rate
- PH & blood gas analyzer

Electroencephalography (EEG):

- Sources of action potentials
- Methodology & principle of measurement
- Electroencephalograms & their inferences

Electromyography:

- Sources of action potentials
- Methodology & principle of measurement
- Electromyograms & their inferences

Respiratory system measurement:

- Respiratory mechanism, parameters of respiratory system
- Principle of measurement of various parameters, impedance pneumograph, Spiro meter.

Medical imaging systems:

- Working principles of medical X-ray, CT scan, CAT scan, Ultrasound scanning, MRI

Therapeutic & prosthetic devices:
Pacemakers, Defibrillators, ventilators, respirators, heamodialysis machine

Medical application of LASER including safety aspects
Fiber optic application in imaging internal organs
Effect of mm wave and microwave on human body
Electrical safety:
Physiological effect of electricity, micro shock & macro shock hazards, electrical safety standards for human body, basic approaches to shock protection.

OPERATIONS RESEARCH AND OPTIMIZATION TECHNIQUES (EC 7117)

Introduction
Introduction to OR modeling approach and various real life situations
Linear programming problems
Basic LPP and applications, Various components of LP problem formulation
Solving Linear Programming problem
Solving LPP using

simultaneous equations and Graphical Method

Simplex Method and extensions.

Sensitivity analysis , Duality theory

Revised Simplex, Transportation and assignment problems.

Network Analysis
Shortest paths, Maximal flow including PERT-CPM
Integer programming
Basic concepts, formulation, solution and applications
Dynamic programming
Modeling, Optimization, Replacement
Game theory
Introduction, Decisions under risk, Decisions under uncertainty
Queuing Theory
Introduction, basic definitions and notations, axiomatic derivation of the arrival & departure
distributions for Poission Queue, Poission Queuing Model, M/M/1 queues in series,
application

GEOGRAPHICAL INFORMATION SYSTEM (CS 7116)

Introduction and Overview of Geographic Information Systems
Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS
as an Information System; GIS and cartography; contributing and allied disciplines; GIS data
feeds; historical development of GIS.
GIS and Maps, Map Projections and Coordinate Systems
Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography
versus GIS; map projections; coordinate systems; precision and error.
Data Sources, Data Input , Data Quality and Database Concepts
Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial
data; locating and evaluating data; data formats; data quality; metadata.
Database concepts
and components; flat files; relational database systems; data modeling; views of the database;
normalization; databases and GIS.
Spatial Analysis
Questions a GIS can answer; GIS analytical functions; vector analysis including topological
overlay; raster analysis; statistics; integrated spatial analysis.
Making Maps
Parts of a map; map functions in GIS; map design and map elements; choosing a map type;
producing a map formats, plotters and media; online and CD-ROM distribution; interactive
maps and the Web.
Implementing a GIS
Planning a GIS; requirements; pilot projects; case studies; data management; personnel and
skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop
GIS; embedded GIS; public domain and low-cost packages.
Technology & Instruments involved in GIS & Remote Sensing
GIS applications; GIS application areas and user segments; creating custom GIS software

applications; user interfaces; case studies. Future data; future hardware; future software;
Object-oriented concepts and GIS; future issues – data ownership, privacy, education; GIS
career options and how to pursue them.

Remote Sensing

Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote
sensing of Vegetation, Remote sensing of water, urban landscape