B.E. Sem.VIII – [ETRX]

Advanced Digital Signal Processing

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. Discrete – Time random processes

2. Spectral Factorization
- Minimum phase signals & systems
- Partial energy & minimum delay
- Minimum phase and Minimum delay property
- Spectral factorization theorem

3. Spectral estimation by Classical Methods
- The periodogram
- The modified periodogram
- Barlett, Welch & Blackman – Tuckey approach

4. Signal Modeling
- The Least–Squares method
- The Pade Approximation

5. Linear prediction
- Levinson Recursion
- Schur Algorithm
- Lattice realization

6. Spectral estimation by Parametric techniques

7. Wiener filtering
- FIR wiener filters

References :

1. Statistical Digital Signal processing and Modeling, (*Hayes*), John Wiley
2. Advanced Digital Signal Processing, (*Proakis, Rader, Ling & Nikias*) Maxwell Macmillan International, 1992.
3. Modern Spectral Estimation, (*S.M.Kay*), Prentice Hall, 1988
4. Optimum Signal Processing : An Introduction (*S.J. Orfanidis*), 2nd edition – McGraw–Hill, International, 1990.

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B.E. Sem.VIII – [ETRX]

Biomedical Instrumentation

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. **Study of Human Body**
   Anatomy and physiology of the human body, Body system – Skeletal, Muscular, Circulatory, Respiratory, Digestive, Excretory, Nervous, Endocrine, Reproductive.

2. **Study of the Human Cell**
   Average Human Cell, Transport across the cell membrane and membrane potential – N+ and K+ transport, Action Potential, Electrical equivalent circuit of a cell.

3. **Bio Electrodes, transducers and amplifiers :**
   Electrode – Electrode Interface, different electrode types, stimulating electrodes, biomedical amplifiers, transducers for measurement of physiological events.

4. **Electrocardiogram**
   Origin of the heart beat and the electrical activity of the heart, the ECG and its analysis, the Einthoven Triangle, Bipolar leads, Unipolar leads, Vector cardiography, Measurement of cardiac output, ECG electrodes, ECG Amplifiers, Cardiac Arrhythmias.

5. **Bioelectric Signals**
   Study of characteristics of various bioelectric signals such as EEG, EMG, ERG, EOG and their recording.

Signal Measurement

- Measurement of blood pressure, blood flow and cardiac output
- Impedance Plethysmography.
- Measurement in the respiratory system

Biomedical Instruments

Stimulators, Defibrillators, Pacemakers, Respirators, Bedside Monitor, Audiometer and hearing aids. Oximetry, Ear Oximeter, Pulse Oximeter, Blood Gas Analyzer, Spirometry, Pulmonary Function Analyzers.

Prosthesis

Introduction to Prosthesis.

Electrical safety

Electrical safety of patient and medical equipment.

References :

1. Biomedical Instrumental and measurements, (*Cromwell L. Weibell & Pfeiffer*), Prentice Hall of India.
2. Handbook of Biomedical Instrumentation, (*Khandpur R.S.*), Tata McGraw Hill, 2nd edition.
3. Review of Medical Physiology, (Ganong W.F.), Prentice Hall Inc., USA, 1995.
4. Medical Instrumentation (*Webster J.G.*) – Application and Design, Wiley and Sons Inc., 3rd edition.
5. Introduction to biomedical equipment technology, (*Carr and Brown*), 4th edition, Pearson press.

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B.E. Sem.VIII – [ETRX]

Data Communication and Networking

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. **Introduction**
   Network , Protocols and standards, Line configuration, Topology, Transmission modes, categories of networks, Internetworks, Transmission media, Transmission Impairments, Performance of Transmission media, The OSI model, TCP/IP, DTE – DCE interface.

2. **Multiplexing**
   FDM, Synchronous TDM, Statistical TDM, Asymmetric Digital subscriber lines, XDSL.

3. **Data Link Control**
   Flow control, Error detection – two dimensional Parity checks, Internet checksum, CRC.
   Error control, Transmission efficiency of ARQ protocols, HDLC, point to point protocol.

4. **Circuit switching**
   Circuit switching networks, circuit switches – space division switches, Time – division switches, Time – space – time switches, Routing in circuit switching Networks, control signaling, SS7.

5. **Packet Switching Networks**
   Network services and internal network operation, packet network topology, Datagram and Virtual circuits, Routing in packet networks, shortest path algorithms – The Bellman – Ford algorithm, Dijkstra's algorithm, other Routing approaches, congestion control.

6. **ATM and Frame Relay**
   ATM protocol Architecture, Logical connections, ATM cells, Transmission of ATM cells, ATM Adaptation Layer, Frame Relay, Frame Relay protocol Architecture.

7. **Local Area Network**
   LAN Applications, LAN architecture, Bus LANs, Ring LANs, Star LANs, Wireless LAN, LAN Bridges, IEEE 802.3 Medium Access control for 10 Mbps and 100 Mbps LAN, Token Ring and FDDI.

8. **ISDN**
   Architecture, ISDN channels, User Access, ISDN Protocols, Broadband ISDN

References :

1. Data and computer communication, (*William Stallings*), Pearson Education, 6th Edition
2. Communication Networks, (*Leon Garcia and Widjaja*), Tata McGraw Hill, 2nd Edition
3. Data Communication and Networking, (*Forouzan*), Tata McGraw Hill, 3rd Edition
4. Understanding Data Communication and Networks, (*William A Shay*) – Thomson Learning
5. Computer Networks, (*Andrew Tenenbaum*), Prentice Hall of India

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B.E. Sem.VIII – [ETRX]

Embedded Systems and Real Time Programming

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. **Introduction to Embedded Systems**
   Software embedded into a system.

2. **Processor and Memory Organization**
   Structural units in a processor, processor selection for an embedded system, memory devices, memory selection for an embedded system, allocation of memory to program segments and blocks and memory map of a system, direct memory access, interfacing processor, memories and I/O devices.

3. **Devices and buses for device networks**
   I/O devices, timer and counting devices, serial communication using the 'I2C', 'CAN' and advanced I/O buses between networked multiple devices, Host system or computer parallel communication between the networked I/O multiple devices using the PCI, PCI-X and advanced buses.

4. **Device Drivers and Interrupts Servicing Mechanism**
   Device drivers, parallel port device drivers in a system, serial port device drivers in a system, device drivers for internal programmable timing devices, interrupt servicing (Handling) Mechanism, Context and the periods of context–switching, deadline and interrupt latency.

5. **Programming concepts and embedded programming in C and C++**
   Software programming in assembly language (ALP) and in high level language 'C', 'C' program elements; header source files and preprocessor directives, program elements : Macros and functions, program elements : data types, data structures, Modifiers, statements , loops and pointers, Queues, Stacks, lists and ordered lists, embedded programming in C++, 'C' program compiler and cross–compiler, source code engineering tools for embedded C/C++, optimization of memory needs.

6. **Program modeling concepts for software–development Process**
   Modeling processes for software analysis before software implementation, programming models for event controlled or response time constrained real time programs.

7. **Software Engineering Practices in the embedded software development process**
   Software algorithm complexity, software development process life cycle and its models, software analysis, software design, software implementation, software testing, validating and debugging, real time programming issues during the software development process, software project management, software maintenance, unified modeling language (UML).

8. **Inter–process communication and synchronization of processes, tasks and threads**
   Multiple processes in an application, problem of sharing data by multiple tasks and routines, inter process communication.

9. **Real time operating system**
   Operating system services, I/O subsystems, network operating systems, real–time and embedded system operating systems, interrupt routines in RTOS environment:

Handling of interrupt source call by the RTOSs, RTOS tasks scheduling models, Interrupt Latency and Response times of the tasks as performance metrics, performance metric in scheduling models for periodic, sporadic and aperiodic tasks, IEEE standard POSIX 1003.1b functions for standardization of RTOS and inter–tasks communication functions, list of basic actions in a preemtige scheduler and expected times taken at a processor, fifteen–point strategy for synchronization between the processes, ISRs, OS functions and tasks and for resource management.

10. Hardware–software co–design in an embedded system

Embedded system project management, embedded system design and co–design issues in system development process, design cycle in the development phase for an embedded system, uses of target system or its emulator and in–circuit emulator (ICE), uses of software tools for development of an embedded system, use of software tools for development of an embedded system. The software build process for embedded systems – preprocessing, compiling/cross compiling, linking, locating, loading on the target, uses of oscilloscopes and logic analyzers for system hardware tests, issues in embedded system design.

References :

1. Embedded systems – Architecture, programming and design (*Rajkamal*), Tata.McGraw Hill, 1st edition.
2. Embedded Realtime System Programming (*Sriram Iyer and Pankaj Gupta*), Tata.McGraw Hill, 1st edition.
3. Real–time Concepts for Embedded System (*Qing Li and Caroline Yao*), Cmpbooks Press, 1st edition.

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B.E. Sem.VIII – [ETRX]

Mechatronics

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. **Introduction to Mechatronics**
   Mechatronics key elements, Mechatronics design process, approaches in Mechatronics

2. **Modeling and Simulation of Physical System**
   Simulation and Block Diagrams, Analogies and Impedance Diagrams, Electrical Systems, Mechanical Translation Systems, Mechanical rotational System , Electromechanical Coupling, Fluid Systems.

3. **Sensors and Transducers**
   Introduction to Sensors and Transducers, Sensors for Motion and Position Measurement , Force, Torque, and Tactile Sensors, Flow Sensors , Temperature – Sensing Devices , Ultrasonic Sensors, Range sensors, Active Vibration Control Using Magnetostrictive Transducers, Fiber Optic Devices in Mechatronics

4. **Actuating Devices**
   Direct Current Motor, Permanent Magnet Stepper Motor, Fluid Power Actuation, Fluid Power Design Elements, Piezoelectric Actuators.

5. **Hardware Components for Mechatronics**
   Transducer Signal Conditioning and Devices for Data Conversion, Programmable Controllers.

6. **Signals, Systems and Controls**
   Introduction to Signals, Systems, and Controls, System Representation, Linearization of Nonlinear Systems, Time delays, Measures of System Performance, Root Locus and Bode Plots.

7. **Real – Time Interfacing**
   Introduction, Elements of a Data Acquisition and Control System, Overview of the I/O Process, Installation of the I/O Card and Software, Installation of the Application Software, Examples of interfacing.

8. **Closed Loop Controllers**
   Continuous and discrete processes , control modes, two step mode, proportional mode, derivative control, integral control, PID controller, Digital controllers, Control system performance, Controller tuning, Velocity Control and Adaptive control.

9. **Advanced Applications in Mechatronics**
   Sensors for Condition Monitoring , Mechatronic Control in Automated Manufacturing, Artificial Intelligence in Mechatronics , Fuzzy Logic Applications in Mechatronics, Fuzzy Logic Applications in Mechatronics, Microsensors in Mechatronics.

References :

1. Mechatronics System Design, (*Devdas Shetty and Richard A. Kolk*), Thomson Asia Pte Ltd., 2nd Reprint.
2. Mechatronics, (*W.Bolton*), Perason Education Asia, 3rd Indian Reprint.
3. Introduction to Mechatronics and Measurement Systems, (*David G. Alciatore & Michael B. Histand*), Tata McGraw Hill, 2nd Edition.

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B.E. Sem.VIII – [ETRX]

Power Electronics

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

Power Devices

Construction, ratings, characteristics : (including SOA Rating) Power transistors , SCR, TRIAC , GTO – SCR, IGBT, MCT.

Drive Circuits

Using BJT, UJT, DIAC. Isolation circuits using an optocoupler and transformer.

Protection Circuits

Snubbers , MOVs , di / dt inductor, semiconductor fuses .

Cooling of Semiconductor Devices

Basic theory - thermal resistance, simple heat sink calculations.
Types of cooling : (a) natural convection (b) forced air cooling (c) liquid cooling (d) vapour phase cooling.

Half wave and Full wave Uncontrolled and Controlled Rectifier Circuits

With resistive load and R-L load. Output average and RMS voltages. Effect of freewheeling diode

A.C. Phase Control Circuits

Using BJT, OP-Amps, Special IC's such as TCA 785. Firing scheme for 3 phase supply.

Power Inverters

Series, parallel and bridge inverter (single phase) working, important waveforms, control circuits and applications.

Choppers

Principle of operation, Jones chopper (working, important waveforms, control circuit and applications).

Motor Controllers

A.C. motor controllers: Induction squirrel cage motor control – voltage control, V / F control, torque – speed characteristics. Control of wound rotor motor. Slip power recovery.
D.C. motor controllers: armature voltage control of separately exited DC shunt motor. IR compensation. Field current control, torque – speed characteristics.
Micro controller based control circuit for motor control. (Block diagram and working.)

Reference :

1. Power Electronics (*M Rashid*), Prentice Hall of India Publication
2. Ned Mohan (*Undeland*), Robins, Power Electronics, John Wiley Publication
3. Power Electronics, (*Landers*), McGraw Hill
4. Electrical Drives, (*Dubey G.K.*), Narosa Press
5. General Electric, SCR Manual
6. Power Electronics, (*M.D.Singh & K.B. Khanchandani*), Tata McGraw Hill, 1st edition
7. Modern Power Electronics, (*P.C. Sen*), Wheeler Publication

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B.E. Sem.VIII – [CMPN/ETRX/ELEC]

Robotics

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. **Robotic Manipulation :**
   Automation and Robots, Classification, Application, Specification, Notations.

2. **Direct Kinematics :**
   Dot and cross products, Co-ordinate frames, Rotations, Homogeneous, Co-ordinates, Link co-ordination arm equation, (Five-axis robot, Four axis robot, Six axis robot).

3. **Inverse Kinematics :**
   General properties of solutions tool configuration five axis robots, Three-Four axis, Six axis robot (Inverse kinematics).

   Workspace analysis and trajectory planning work envelop and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

4. **Robot Vision :**
   Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation (Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured Illumination, Camera calibration).

5. **Task Planning :**
   Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp planning, Fine-motion Planning, Simulation of planer motion, Source and goal scenes, Task planner simulation.

6. **Moments of Inertia.**

7. **Principles of NC and CNC Machines.**

References :

1. Fundamentals of Robotics –Analysis & Control (*Robert Shilling*), Prentice Hall of India
2. Robotics (*Fu, Gonzales & Lee*), McGraw Hill
3. Introduction to Robotics (*J. J. Craig*), McGraw Hill
4. Robotics and AI, (*Staughard*), Prentice Hall of India
5. Industrial Robotics, (*Grover, Wiess, Nagel, Oderey*), McGraw Hill
6. Walfram Stdder, (*Robotics and Mechatronics*).
7. Introduction to Robotics, (*Niku*), Pearson Education.
8. Robot Engineering, (*Klafter, Chmielewski, Negin*), Prentice Hall of India
9. Robotics and Control, (*Mittal, Nagrath*), Tata McGraw Hill Publications

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B.E. Sem. VIII – [ETRX]

Telecommunication Network Management

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. **Foundations**
   Network management standards, network management model, organization model, information mode abstract syntax notation I (ASN, 1), encoding structure, macros, functional model.

2. **Network management application functional requirements**
   Configuration management, fault management, performance management, error correlation technology, security management, accounting management, common management, report management, polity based management, service level management, management service, community definitions, capturing the requirements, simple and formal approaches, semi formal and formal notations.

3. **Telecommunication management network (TMN) architecture :**
   Terminology, functional architecture, information architecture, physical architecture, TNN cube, TMN and OSI.

4. **Common management information service element (CMISE)**
   CMISE model, service definitions, errors, scooping and filtering features, synchronization, functional units, association services, common management information protocol (CMIP) specification.

5. **Information Modeling for TMN**
   Rationale for Information Modeling, management information model, object oriented modeling paradigm, structure of management information, managed object class definition, management information base (MIB).

6. **Simple network management protocol (SNMP) :**
   SNMPv1 : managed networks, SNMP models, organization model, information model,
   SNMPv2 : communication model, functional model, major changes in SNMPv2, structure of management information (SMI), MIB, SNMPv2 protocol, compatibility with SNMPv1, SNMPv3: architecture, applications, MIB security, remote monitoring (RMON) SMI and MIB, RMON1 and RMON2.

7. **Network management examples :**
   ATM integrated local management interface, ATM, MIB, M1, M2, M3, M4, interfaces, ATM digital exchange interface management, digital subscriber loop (DSL) and asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management.

8. **Network management tools :**
   Network statistics management, network management system, management platform case studies : OPENVIEW, ALMAP.

References :

1. Network Management : Principles and Practice (Mani Subramanian), Addison Wesley, Pearson Education Asia publication.
2. Fundamentals of Telecommunication Network Management (*Lakshmi Raman*), IEEE Communication Society, Prentice Hall of India.
3. Telecommunication Network Management : Technologies and Implementations (Airdarous Salah, Plevyak Thomos), Prentice Hall of India.
4. Telecommunication Network Management (*Haojin Wang, Henry Haojin Wang, Haijiang Haojin Wang*).

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B.E. Sem.VIII – [ETRX]

VLSI Design

SYLLABUS

Time : 3 Hrs.

Theory : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Practical : 2 Hrs.

1. **Circuit characterization and performance estimation**
   Resistance and capacitance estimation, switching characteristics, CMOS gate transistor sizing, power dissipation, sizing routing conductors, charge sharing designing margining yield and reliability.

2. **System Specification using Verilog HDL**
   Basic concepts, structural gate level modeling, switch level modeling, design hierarchies, behavioral and RTL modeling.

3. **Arithmetic Circuit in CMOS VLSI**
   Bit adder circuits, Ripple carry adders, carry look ahead adders, high speed adders, multipliers.

4. **Design of memories and programmable logic**
   The static RAM, SRAM, Dynamic RAM, ROM, Arrays, Logic ARRAYS.

5. **System Level Physical Design**
   Large scale physical design, interconnected delay modeling, crosstalk, interconnected scaling, floor planning & rolling, I/P and O/P circuit, power dissipation and consumption, low power design considerations.

6. **VLSI clocking and system design**
   Clocked flipflop, CMOS clock styles, Pipelined systems, Clock generation and distribution, System design considerations.

7. **CMOS Testing**
   The need for testing, manufacturing test principles, design strategies for test, chip level test techniques, system level test techniques, layout design for improved testability.

References :

1. Principles of CMOS VLSI Design : A system perspective (*Neil H.E. Weste Kamran E. Shraghian*), Addison Wesley publication.
2. Introduction to VLSI Circuits and systems (*John P. Vyemura*), John Wiley & Sons.
3. Verilog HDL, A guide to Digital Design and Synthesis (*Samir Palnitkar*), Pearson Education.

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