Jorhat Institute of Science and Technology

5th Semester B.E (ETC & PEI)

AUTOMATIC CONTROL SYSTEMS

L-3 T-1 P-4

Theory : 100
Sessional : 50
Practical:50

1) **INTRODUCTION :** Concept of automatic control systems-classifications- open loop and closed loop systems, linear and non linear systems, continuous and discrete time systems, SISO and MIMO systems, time-invariant and time varying systems, servo systems and automatic regulating systems, adaptive control systems.
2) **MATHEMATICAL MODELLING OF PHYSICAL SYSTEMS:** Differential equations and transfer function - mathematical model of electrical- mechanical and electro mechanical systems-Analogous systems. Block diagram representation of physical systems- BD reduction techniques-Signal flow graph(SFG)- definition, terminology, SFG representation of physical systems, Mason's Gain formula-BD reduction using SFG techniques
3) **TIME RESPONSE:** Time response – Time domain specifications – Types of test input signals – Ist and IInd order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feed back control.
4) **FREQUENCY RESPONSE ANALYSIS:** Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Correlation between frequency domain and time domain specifications-Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart.
5) **STABILITY ANALYSIS:** Characteristics equation – Location of roots in S-plane for stability – Routh Hurwitz criterion – Root locus method – Angle and magnitude conditions, construction of complete root locus, stability analysis -Effect of addition of pole, zero – Relative Stability -Gain margin and phase margin – Nyquist stability criterion.
6) **COMPENSATOR DESIGN:** Performance criteria – Lag, lead and lag-lead networks – Compensator design using Root locus and Bode plots methods.
7) **STATE VARIABLE METHOD OF SYSTEM ANALYSIS**: Concept of state and state variables-State model-State-space representation of physical systems-BD representation-state transition matrix and its properties-Relation between state equation and transfer function-Solution of state equation-Characteristic equation-Eigen values & eigen vectors-Concept of controllability and observability of linear systems.
8) **CONTROL SYSTEM COMPONENTS**: Potentiometer, Synchros, DC and AC servomotors, Rotating amplifier, Stepper motor, Tachogenerators.

Text/ Ref. Books:

1) Ogata K-Modern Control Engineering (PHI).
2) Nagrath I J&Gopal M-Control System Engg.
3) Kuo B C-Automatic Control Systems (PHI).
4) Distefano-Feedback and Control Systems(Schaum Series) McGrow Hill
5) S. Ghosh –Control Systems (Pearson Education).
6) M.Gopal – Control Systems –Principles & Design (TMH)

COMPUTER ARCHITECTURE AND ORGANISATION

L-3 T-1 P-0

Theory : 100
Sessional : 50

UNIT 1: **Introduction:** Block Diagram of Computer System, Instruction Execution Model.

UNIT 2: **General System Architecture:** Store program control concept, Flynn's classification of computers (SISD, MISD, MIMD), Multilevel viewpoint of a machine: digital logic, micro architecture, ISA, operating system, high level language; structured organization; CPU, caches, main memory, secondary memory units and I/O, Performance metrices; MIPS, MFLOPS.

UNIT 3: **Instruction Set Architecture:** Instruction set based classification of processors (CISC and RISC architecture and their comparison); addressing modes; register, immediate, direct, indirect, indexed; Operations in instruction set; Arithmetic and Logical, Data Transfer, Control Flow; Instruction set formats (fixed, variable, hybrid); Language of the machine: 8085/8086; Assembly language programming (simulation using MSAM).

UNIT 4: **Basic non pipelined CPU Architecture:** CPU Architecture types (accumulator, register, stack, memory/register) detailed data path of a typical register based CPU, Fetch-Decode-Execution cycle (typically 3 to 5 stage); microinstruction sequencing, implementation of control unit, DMA, Interrupt and DMA mechanisms and controllers, Enhancing performance with pipelining.

UNIT 5: **Memory Hierarchy & I/O Techniques:** The need for a memory hierarchy (Locality of reference principle, Memory hierarchy in practice; Cache main and secondary memory. Memory parameters access/cycle time, cost per bit); Main Memory (Semiconductor RAM & ROM organization, memory expansion, Static & Dynamic memory types); Cache memory (Associative & direct mapped cache organizations, performance). Memory management unit (MMU), memory interleaving.

UNIT 6: **Introduction to parallelism:** Goals of parallelism (Exploitation of concurrency, throughput enhancement); Amdahl's law; instruction level parallelism (pipelining, super scaling-basic features); Processor level parallelism (Multiprocessor systems overview).

UNIT 7: **Computer Organizations: Processors Architectures:** Introduction to Vector processors, Array processors, Multiprocessors, Multiprocessors Architectures: Functional structures- loosely coupled and tightly coupled, multiprocessor interconnected networks, process definition, inter-process communication mechanisms, system deadlock and preventions, multiprocessor scheduling algorithms, parallel algorithms for multiprocessor- synchronous and asynchronous.

Text Books/ Reference:

1. Computer Organization and Design, by David A. Patterson and John L. Hennessy, Morgan 1997, Kauffmann.
2. Computer Architecture and Organization, 3rd Ed., by John P. Hayes, TMH.
1. Operating Systems Internals and Design Principles by William Stalling, Prentice Hall.
2. Computer Organization 5th Ed., by Carl Hamacher, Zvonko Vranesic, 2002, Safwat Zaky.
3. Mano M.M., Computer System Architecture, PHI (EEE).
4. Structured Computer Organization by A.S. Tanenbaum, 4th Ed., PHI.

COMMUNICATION ENGINEERING-I

L-3 T-1 P-2

Theory : 100
Practical: 25
Sessional : 50

1. **Introduction:** Review of Fourier series and transform, Power spectral density, random variables, random process,

2. **Amplitude Modulation:** Analog signal transmission (AM & FM diagram), Need for modulation, Equation for AM wave, modulation index and power relationships, Linear CW modulation schemes, Double Sideband Suppressed Carrier (DSB-SC), Single-Sideband (SSB), Vestigial Sideband (VSB), Generation and detection, AM broadcasting.

3. **Angle Modulation:** Phase Modulation (PM), Frequency Modulation (FM), Bessel functions and FM spectral analysis, Narrowband FM and Wideband FM, Frequency division multiplexing (FDM), Generation and detection of PM and FM (reactance modulator and indirect method, Stereophonic FM broadcasting.

4. **Radio Receivers:** Tunned radio frequency receivers, Superheterodyne receivers, Receiver sensitivity and selectivity, selection of IF

5. **Noise in Communication systems:** Sources and characteristics of different noise, Concept of white Gaussian noise, Thermal noise , Short noise, S/N ratio and noise equivalent bandwidth noise temperature and noise figure, Effect of noise on amplitude modulation systems, effect of noise on angle modulation, comparison of different analog communication systems, Threshold effect in FM, Pre-emphasis/de-emphasis filtering, Comparison of CW modulation systems.

6. **Pulse Modulation:** Review of sampling theorem and practical sampling of PAM, PWM and PPM signals. Generation and detection.

Text Books/references:

1. S. Haykin, *Communication Systems*, John Wiley & Sons
2. J.G. Proakis and M. Salehi, *Communication System Engineering*, Prentice Hall
3. B. Sklar, *Digital Communications: Fundamentals and Applications*, Prentice-Hall, 2001
4. G. Kennedy, “Electronics communication system”.
5. John. G. Proaki, “Fundamentals of communication Systems”, Pearson Education

ELECTRONIC INSTRUMENTS AND MEASUREMENT

Theory:100 Sessional : 50 Practical:25

L-3 T-1 P-2

1. **INTRODUCTION:** Concept of measurement, basic characteristics of measuring devices, error analysis, standards and calibration, performance characteristics of instrumentation system, system performance measurement, systems linearity and distortion.
2. **CATHOD RAY OSCILLOSCOPE:** Block diagram representation ; Cathode ray tube ; Vertical and Horizontal deflection systems ; Delay line ; Multiple trace ; CRO probe & transducers ; Measurement of voltage, current, phase & frequency by CRO ; Storage Oscilloscope.
3. **ELECTRONIC INSTRUMENTS:** (a) Electronic Voltmeters: Advantage & disadvantages of using electronic voltmeters ; Different stages in AC & DC electronic voltmeters ; Balanced bridge voltmeter ; Principle and circuit diagrams for average responding ; peak responding & RMS responding voltmeters.(b) Digital Voltmeters: Classification of digital voltmeters ; Principle, block diagram and signal wave form of ramp type, stair case ramp type and integrating type digital voltmeters. (c) Electronic and digital Multimeters, Q-meters.
4. **SIGNAL GENERATORS & ANALYZERS:** Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators; Signal Analyzers - Measurement Technique, Wave Analyzers, Harmonic distortion analyzer, Spectrum analyzer.
5. **RECORDERS:** Different types of recorders ; Construction, working principle and circuit diagrams of potentiometric Strip- chart recorder , X-Y recorder and dot-matrix recorder; Magnetic recorder and digital tape recording.
6. **TRANSDUCERS:** Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers- RTD, Thermocouples, Thermistors, LVDT, Strain Gauges, Bourdon Tubes, Bellows. Diaphragms, Seismic Accelerometers, Tachogenerators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.

Texts/References:

1. D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measuring Techniques. Prentice-Hall of India

2. E. Jones, Instrumentation, measurement, and Feedback. Tata McGraw-Hill

3. E. O. Deobelin, Measurement Systems – Applications and Design. McGraw-Hill

4. Kalsi H.S., "Electronic Instrumentation", Second Edition, Tata Mc Graw Hill Company

5. Sawhney A.K., "A course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai and sons, New Delhi

6. B. M. Oliver and J. M. Cage, Electronic Measurements and Instrumentation, McGraw-Hill

7. Gupta J.B., "A course in Electrical and Electronic Measurement and Instrumentation", Katson Publishing House

8. E.W. Golding & F.C Widdis – Electrical Measurement and Measuring Instruments.

ELECTROMAGNETIC FIELD THEORY

L-3 T-1 P-0

Theory : 100

Sessional : 50

1. **Vector Analysis :** Scalar & vector field; Vector algebra; Vector calculus – gradient, divergence and curl of a vector; Cartesian , Cylindrical and Spherical systems of vectors; Transformation between vectors; Line & surface integral; Divergence theorem; Stokes theorem and Green's theorem.
2. **Static Electric Fields:** Fundamental postulates of Electrostatics, Coulomb's Law, electric field & field intensity, electric flux & flux density, Gauss's law with application, boundary conditions, capacitance & capacitors, electrostatic energy, Laplace's & Poisson's equations, uniqueness of electrostatic solutions, method of images, solution of boundary value problems in different coordinate systems. Steady Electric Current: Current density and ohm's law, EMF and Kirchoff's voltage law, continuity equation and Kirchoff's current law, Power dissipation and Joule's law, Boundary conditions.
3. **Static Magnetic Fields**: Fundamental Postulates, Vector magnetic potential, Biot-Savart Law and Application; Ampere's circuital law; Magnetic dipole, Behavior of magnetic materials, Boundary conditions, Inductances and inductors, Energy in magnetic field..
4. **Time varying Fields & Maxwell's Equation**: Faraday's law of electromagnetic induction, Maxwell's equations, Eelectromagnetic boundary conditions, Wave equations and their solutions, Time harmonic fields.
5. **Electromagnetic Waves**: Plane wave in lossless media, Plane waves in lossy media, Poynting vector and power flow in electro magnetic field, Wave polarization, Retarded potential; Standing wave ratio; Plane wave reflection from a media interface.
6. **Antennas and Radiating systems**: Fundamentals of radiation, radiation field of an elemental dipole, antenna pattern and antenna parameters, thin linear wire antennas, loop antennas, basics of antenna arrays, aperture antennas.

Text/Reference Books :

1) Introduction to Electrodynamics - J. Griffiths (PHI)
2) Engineering Electromagnetics – W.H.Hayt (TMH)
3) Fields and Waves in Communication Electronics - S. Ramo, J. R. Whinnery and T. V. Duzer (John Wiley)
4) Elements of Electromagnetic Fields – S.P Seth (Dhan Pat Rai)
5) Electromagnetics – Joseph A Edminister (Schaum's Series)
6) Basic Electromagnetics with Applications – N.N.Rao (PHI)
7) Field and Wave Electromagnetics - David K. Cheng (Pearson)
8) Introduction to Electromagnetic Field and Waves – Dale Carson & Paul
9) Antennas- J. D. Kraus (McGraw-Hill)

MATHEMATICS-V

L-3 T-1 P-0

Theory : 100
Sessional : 50

Group A: Numerical Analysis (40 Marks)

1. **Interpolation**: Finite difference. Newton Grogory forwards and backward interpolation, Newton's and Lagranges formulae for unequal intervals, Stirling ande Bessels interpolation formulae.

2. **Numerical differentiation and Integration:** Numerical differentiation , Trapezoidal and Simpson's rule for Numerical Integration

3. **Solution of Ordinary differential equations**; Taylor's series, Range- Kuta (4^{th} Order) and Milne's predicator-corrector method.

4. **Solution of Transcendental and Polynomial Equations**: Bisection Jule-Fabi and Newton- Rap son's methods.

5. **Solution of simultaneous linear equations:** Gauss elimination and Gauss- Seidal Iterative method.

GROUP B: Linear Algebra and Complex Variables (60 Marks)

1. Definition and examples of vector space, Vector subspace, Basis and dimension of vector space, Theorems, Quotient space.
2. Linear transformation, Representation of Linear transformations by matrices, Kernel and image of Linear transformation, Linear functional, Rank and nullity of linear transformation, Linear operator, Eigen values and Eigen vectors of linear operator.
3. Normal linear space and Banch spaces, Continuous linear transformations, Inner product, Hilbert space, Orthogonal components, Orthogonal sets.
4. Functions of Complex Variables, Elementary functions, Analytic functions. Cauchy-Rieman equations. Harmonic functions and their applications to two dimensional problems.
5. Conformal transformation, complex line integral, Cauchy- Goursat theorem, Cauchy Integral formula, Liouville's theorem, Taylor's and Laurent's series, singularities, Residue theorem and applications.