S.E. Sem. III [ETRX]

Control System Engineering

SYLLABUS

Time : 3 Hrs. **Theory :** 100 Marks
Oral : 25 Marks **Term Work :** 25 Marks

1. **Introduction to control system analysis**
   Introduction, examples of control systems, open loop control systems, closed loop control systems, Transfer function. Types of feedback and feed back control system characteristics – noise rejection, gain, sensitivity, stability.

2. **Mathematical modeling of systems**
   Importance of a mathematical model, Block diagrams, signal flow graphs, Masan's gain formula and its application to block diagram reduction. State space method, solving time-invariant system, transfer matrix.

3. **Transient and Steady State – Response Analysis**
   3.1 Impulse response function, first order system, second order system, time domain specifications of systems, analysis of transient-response using second order model.
   3.2 Classification of control systems according to 'Type" of systems, steady – state errors, static error constants, steady-state analysis of different types of systems using step, ramp and parabolic input signals.

4. **Stability Analysis**
   Introduction to concept of stability, Stability analysis using Routh's stability criterion, Absolute stability, Relative stability. Root-Locus plots, summary of general rules for constructing Root-Locus, Root-Locus analysis of control systems. Compensation techniques-Log, Lead, log-lead.

5. **Frequency Response Analysis**
   Introduction, Frequency domain specification, resonance peak and peak resonating frequency, relationship between time and frequency domain specification of systems, Bode plots, Polar plots, Log-magnitude Vs phase plots, Nyquist stability criterion, stability analysis, Relative stability, gain margin, phase margin, stability analysis of system using Bode plots. Closed-loop frequency Response-Constant gain and phase loci, Nichol's chart and their use in stability study of systems.

6. **Control components and Controller**
   DC and AC servomotors, servoamplifier, potentiometer, synchro transmitters, synchro receivers, synchro control transformer, stepper motors. Discontinuous controller modes, continuous controller modes, composite controllers.

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S.E. Sem. III [ETRX]

Digital Systems Design - I

SYLLABUS

Time : 3 Hrs. **Theory :** 100 Marks
Practical : 50 Marks **Term Work :** 25 Marks
Oral : 25 Marks

1. **Introduction and Digital Codes**
   Analog Vs Digital Systems Digital Devices, Binary codes, Gray codes, Character codes, Codes for detecting and correcting errors.

2. **Logic Circuits**
   Boolean Algebra, theorems, combinational circuit analysis, combinational circuit synthesis, minimization, Karnaugh Map, Sum of Products, Product of Sums form and their minimization, Programmed minimization-Quine Mc-Cluskey minimization algorithm, timing hazards-static, Dynamic Hazards.

3. **Combinational MSI, LSI Devices**
   Combinational design using SSI, MSI devices, Decoders (74 × 139, 74 × 138), Encoders (74 × 148), Tri-state buffers (74 × 244, 74 × 245), Multiplexers (74 × 151), Parity circuits (74180), Comparators (7485), Adders (7483), Subtractors, BCD adders–subtractors, ALU (74181), Combinational Multipliers, Combinational PLDs.

4. **Logic families**
   Basics of TTL, CMOS, ECL Circuits for basic logic operations just Circuits and working of them in all above families. No Characteristics of families.

5. **Sequential Logic Practices**
   Basic Elements, Latches and Flip-Flops, S-R, D.T., J-K latches and Flip-Flops, Flip-Flop conversions, Applications of Latches and Flip-Flop in switch debouncing, bus holder circuits, Flip-Flop Timing Considerations and Metastability.

6. Counters – Asynchronous, Synchronous counters, UP-down counters, Mod counters, Ring counters, Shift Registers, Universal Shift register.

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S.E. Sem. III [ETRX]

Basic of Electronic Circuits

SYLLABUS

Time : 3 Hrs. **Theory :** 100 Marks
Practical : 50 marks **Term Work :** 25 Marks
Oral : 25 Marks

1. **Semiconductor Materials and Diodes**
   Review of Semiconductor Materials and Properties, The PN Junction, Introduction to Semiconductor Diode Theory. Diode Circuits : DC Analysis and models, AC Equivalent Circuits, Other Diode Types – Solar Cell, Photodiode, Light–Emitting Diode, Schottky Barrier Diode, Pin Diode, Zener Diode, Zener as voltage Regulator, Temperature Effects, Understanding Manufacturer's Specifications.
2. **Diode Circuits**
   Design of Rectifier Circuits : Full Wave Rectification with 'C', 'L-C' and 'pi' Filter, Ripple-Voltage and Diode Current, Voltage Doubler and Multiplier circuit, Zener Diode Circuits, Clipper and Clamper Circuits, Multiple-Diode Circuits. Photodiode and LED Circuits.
3. **The Bipolar Junction Transistor**
   Basic Bipolar Junction Transistor, PNP and NPN Transistor Structures Device Symbols, Current-Voltage Characteristics, Transistor Biasing – Single Base Resistor Biasing, Voltage Divider Biasing and Bias Stability, DC Analysis of Transistor Circuits in Common Emitter Common Base and Common Collector configurations, Forward-active Mode Operation Load Line considerations, Non-ideal Transistor Leakage Currents and Breakdown, Integrated Circuit Biasing, Multistage Circuits. Transistor Applications – As a Switch.
4. **Basic BJT Amplifiers**
   The BJT Linear Amplifier, Graphical Analysis and AC Equivalent Circuit, Small Signal Hybrid – π, ($g_m r_\pi$) Equivalent Circuit of the Bipolar Transistor, Hybrid – π ($g_m r_\pi$) Equivalent Circuit Including the early Effect, Expanded Hyrbid – π Equivalent Circuit, Other Small – Signal Parameters and Equivalent Circuits, Basic Transistor Amplifier Configurations, i.e., Common Emitter Common Base and Common Collector (Emitter Follower. AC Load Line Analysis, The Three Basic Amplifier configurations : Summary and Comparison, Design of Single Stage BJT Amplifier.
   Multistage Amplifier, Band-Width and Power Considerations, Thermal considerations in Transistor Amplifiers, Manufacturers' Specifications.
5. **The Field Effect Transistor**
   Junction Field-Effect Transistor, MOS Field-Effect Transistor, MOSFET, Self Biasing Mid-Point Biasing, Biasing for Zero Drain Current-Drift Potential Divider Biasing and DC Circuit Analysis, Basic MOSFET Applications : Switch, Digital Logic Gate and Amplifier. Temperature effects in MOSFETs, Input Protection in MOSFET. The Power FET (VMOS).
6. **Basic FET Amplifiers**
   Basic JFET Amplifier Configurations : Common Source Amplifier, The Source Follower (Common Drain) Amplifier, The Common Gate Configurations, Summary of the Three Basic Amplifier Configurations. AC circuit analysis of common source amplifier, The Source Follower (Common Drain) Amplifier, The Common Gate Amplifier Configurations. Design of Single Stage JFET Amplifier, MOSFET amplifier Biasing and DC Circuit Analysis. AC analysis of Single Stage MOSFET amplifier, single Stage Integrated Circuit MOSFET Amplifier, Multistage Amplifiers.

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S.E. Sem. III [ETRX]

Electrical Network Analysis and Synthesis

SYLLABUS

Time : 3 Hrs. **Theory :** 100 Marks

Term Work : 25 Marks

1. **Circuit Analysis (AC and DC)**
   Kirchoff's law, Loop variable analysis, Node variable analysis, Source transformations, Reference directions for current and voltage, Active element conventions, dot convention for coupled circuits. Linearity, Superposition, Thevenin's and Norton's, Maximum power for AC source and dependent source.

2. **Linear graphs**
   Introductory definitions, The incidence matrix A, the loop matrix B, relationship between sub-matrix of A and B, Cut-sets and cut-set matrix, Fundamental cut-sets and fundamental tie-sets, Planer graphs, A and B matrices, Loop, node, node pair equations, duality.

3. **Laplace Transforms**
   Properties of Laplace transforms, Basic Theorems, Laplace transform of gate function, impulse function and periodic functions, convolution integral, inverse Laplace transform, application of Laplace transforms to solution of Network problems.

4. **Transient and Frequency analysis**
   Transient response of R-L, R-C, R-L-C circuits (Series combinations only) for DC and sinusoidal excitations – Initial conditions – Solution using differential equation approach and Laplace transform methods of solutions. Transfer function. Concept of poles and zeros. Concept of Frequency response of a system.

5. **Two port networks**
   Concept of two port networks. Driving point and Transfer functions, Open circuit and short circuit parameters, transmission and inverse transmission parameters, hybrid parameters, inter-relationship of different parameters, inter-connection of two port networks, T and pi representation, terminated two port networks.

6. **Fundamentals of network synthesis**
   Realizability concept, Hurwitz property, positive realness, properties of positive real functions, testing positive real functions, Synthesis of R-L, R-C and L-C driving point functions – Foster and Cauer forms.

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S.E. Sem. III [ETRX]

Engineering Mathematics

SYLLABUS

Time : 3 Hrs. **Theory :** 100 Marks

Term Work : 25 Marks

1. Laplace Transform

1.1 Existence of Laplace Transform, Properties of L.T., 1st and 2nd shifting theorem, Change of scale properties, Unit step function, Heavi side, Dirac delta and Periodic function and their Laplace Transform.

1.2 Inverse Laplace Transform with partial fraction and Convolution theorem.

1.3 Applications to solve initial and boundary value problems involving ordinary differential equations.

2. Fourier Series

Dirichlet's conditions, Fourier series of periodic function with period 2π and $2l$. F.S. for even and odd functions. Half range sine and cosine and Parseval's identity.

3. 3.1 Complex form of Fourier Series.

3.2 Fourier Integral and Fourier Transform with properties in detail.

4. Matrices

4.1 Types of matrices, Adjoint, inverse and rank of a matrix. Normal form of a matrix.

4.2 System of Homogeneous and non-homogeneous equations and their consistency.

5. Complex Variables

5.1 Analytic function – R equation in Cartesian and polar form. Analytic function by Milne – Thompson method, Harmonic function.

5.2 Conformal mapping, Bilinear mapping and standard transforms.

6. Z-Transform and Vector analysis

6.1 Properties, change of scale, shifting, inverse of Z transform.

6.2 Initial value and final value.

6.3 Vector integration, scalar potential work down Greens Theorem, Divergence theorem, strokes theorem (without proof).

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S.E. Sem. III [ETRX/BIOM]

Presentation and Communication Techniques

SYLLABUS

Term Work : 50 Marks

1. **Communication in a business organization**

   Internal and external communication, Types of meetings, strategies for conducting successful business meetings, documentation (notice, agenda, minutes, resolution) of meetings. Introduction to modern communication techniques (e–mail, internet, video–conferencing, etc.) Legal and ethical issues in communication (Intellectual and property rights, patents, TRIPS, Geographical indications).

2. **Advanced technical writing**

   Report writing: Definition and importance of reports, qualities of reports, language and style in reports, types of reports, formats (letter, memo, project–reports). Methods of compiling data for preparing report.

   A computer–aided presentation of a technical project report based on a survey–based or reference based topic. The topics are to be assigned to a group of 8–10 students. The written report should not exceed 20 printed pages.

   Technical paper–writing.

   Writing business proposals.

3. **Interpersonal skills**

   Introduction to emotional intelligence, motivation, negotiation and conflict–resolution. Assertiveness, team–building, decision–making, time–management, persuasion.

4. **Presentation skills**

   Elements of an effective presentation, Structure of a presentation, Presentation tools, Audience analysis, Language : Articulation, Good Pronunciation, Voice quality, Modulation, Accent and Intonation.

5. **Career skills**

   Preparing resumes and cover letters. Types of Resumes, Interview techniques : Preparing for job interviews, Facing an interview, Verbal and non-verbal communication during interviews, Observation sessions and Role-play techniques to be used to demonstrate interview strategies (mock interviews).

6. **Group discussion**

   Group discussions as part of selection process. Structure of a group discussion, Dynamics of group behaviour, techniques for effective participation, Team work and use of body language.

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