Fourth Semester

BTEE 402 Linear Control Systems

Unit I Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems, Block diagrams, some illustrative examples.

Unit II Modeling: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Unit III Time Domain Analysis: Typical test – input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion.

Unit IV Root Locus Technique: The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot.

Unit V Frequency Domain Analysis: Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

Unit VI Compensation: Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation.

Unit VII Control Components: Error detectors – potentiometers and synchros, servo motors, a.c. and d.c. techno generators, Magnetic amplifiers.

Suggested Readings / Books

- Dorf Richard C. and Bishop Robert H., *Modern Control System*, Addison –Wesley, Pearson New Delhi
- Ogata K., *Modern Control Engineering*", Prentice Hall,
- Kuo B. C., *Automatic Control System*", Prentice Hall
- Nagrath I.J. and Gopal M., *Control System Engineering*, Wiley Eastern Ltd.
- Singh / Janardhanan, Modern Control Engineering, Cengage Learning
- Kilian, Modern Control Technology: Components and Systems, Cengage Learning

BTEC 401 Analog Communication Systems

Unit I Base Band Signals and Systems: Introduction, Elements of communication system, Noise & its types; Noise Figure & noise factor, Noise equivalent temperature. Modulation & Demodulation, Mixing; Linear & Nonlinear, need of modulation, types of modulation systems, basic transmission signals, Frequency multiplexing technique.

Unit II Analog Modulation Techniques: Introduction, theory of amplitude modulation; AM power calculations, AM current calculations, AM modulation with a complex wave, theory of frequency modulation;

mathematical analysis of FM, spectra of FM signals, narrow band of FM, Wide band FM, Theory of phasemodulation, phase modulation obtained from frequency modulation, comparison of AM & FM, Comparison of PM & FM.

Unit III AM Transmission: Introduction, generation of Amplitude Modulation, Low level and high level modulation, basic principle of AM generation; square law modulation, Amplitude modulation in amplifier circuits, suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.

Unit IV AM Reception: Receiver Parameters; Selectivity, Sensitivity, Fidelity, Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver; Basic elements of AM super heterodyne Receiver; RF Amplifier, Neutralization of RF Amplifiers, Class of operation of RF Amplifiers, High power RF Amplifiers, Image Frequency Rejection, Cascade RF Amplifier, methods of increasing Bandwidth, frequency Conversion and Mixers; Additive Mixing, Bipolar Transistor Additive Mixer, self exicted Additive Mixers, multiplicative mixing, Multiplicative Mixer using dual gate MOSFET, Tracking & Alignment, IF Amplifier, AM detector; square law detector, Envelope or Diode detector, AM detector with AGC, Distortion in diode detectors, AM detector Circuit using Transistor, Double hetro-dyne receiver, AM receiver using a phase locked loop (PLL), AM receiver characteristics.

Unit V FM Transmission: FM allocation standards, generation of FM by direct method, varactor diode Modulator, Cross by Direct FM Transmitter, Phase-Locked-Loop Direct FM Transmitter, Indirect generation of FM; Armstrong method, RC phase shift method, Frequency stabilised reactance FM transmitter.

Unit VI FM Reception: Frequency demodulators, Tuned circuit frequency discriminators; Slope Detector, Balance Slope Detector, Foster Seeley discriminator, Ratio Detector, FM detection using PLL, Zero crossing detector as a Frequency Demodulator, quadrature FM demodulator, pre emphasis and de emphasis, limiter circuits, FM Capture effect, FM receiver, FM stereo transmission and reception, Two way FM Radio Transmitter and Receiver.

Unit VII SSB Transmission: Introduction, Single Side band systems, AM-SSB; Full carrier, Suppressed carrier , reduced carrier, Independent side band, and Vestigial side band, Comparison of SSB Transmission to conventional AM, Generation of SSB; Filter method, Phase Shift Method, Third Method.

Unit VIII SSB Reception: SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Single Side band receivers; Single side band BFO Receivers, Coherent Single side band BFO Receivers, Single Side band Envelop detection receiver, Multi Channel Pilot Carrier SSB Receiver.

Unit IX Pulse Modulation Transmissions and Reception: Introduction, Sampling Theorem Pulse Amplitude Modulation (PAM), Natural PAM Frequency Spectra for PAM , Flat-top PAM, Sample and hold circuits, Time division Multiplexing, PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM); Pulse Width Modulation(PWM), Pulse Position Modulation (PPM), PPM Demodulator.

Suggested / Recommended Books:

- Electronic communication Systems by Kennedy & Davis, Tata Mcgraw Hill.
- Analog Communication Systems by Manoj Kumar & Manisha, Satya Prakashan, New Delhi, 2nd Edition.
- Electronic Communication System, Tomasi, Pearson Education.
- Electronic Communication, Roddy, Pearson Education.
- Analog Communication Systems by Symon Hykens, John Wiley & Sons .
- Principles of Communication System, Taub & Schilling, Tata Mc-Graw Hill.

BTEC402 Signals & Systems

Unit I Classification of Signals and Systems: Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic & aperiodic, random &deterministic signals, Even& Odd Signals, Energy & Power Signals, Description of continuous time and discrete time systems.

Unit II Analysis of Continuous Time Signals: Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and its properties in Signal Analysis, Power Spectral Density and Energy spectral density.

Unit III Linear Time Invariant –Continuous Time Systems: Linear Time invariant Systems and their properties. Differential equation & Block diagram representation, Impulse response, Convolution integral, Frequency response (Transfer Function), Fourier transforms analysis.

Unit IV Analysis of Discrete Time Signals: Sampling of CT signals and aliasing, DTFT and its properties, Z-transform and properties of Z-transform.

Unit V Linear Time Invariant - Discrete Time System: Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms.

Unit VI Random Signal Theory: Introduction to probabilities, Definition, probability of Random events, Joint and conditional probability, probability Mass function statistical averages. Probability density functions and statistical averages. Examples of P.D. function, transformation of random variables random processes, stationary, True averages and Ergodic.

Suggested Readings / Books:

- Signals and Systems by Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Pearson Education.
- Fundamentals of Signals and Systems by Edward W Kamen & Bonnie's Heck, Pearson Education.
- Communication Signals & System by Simon Haykins, John Wiley & Sons.
- Signals and Systems by H P Hsu, Rakesh Ranjan, Schaum's Outlines, Tata McGraw Hill.
- Digital Signal Processing by S Salivahanan, A. Vallavaraj, C. Gnanapriya, McGraw Hill International.
- Signals and Systems by Simon Haykins and Barry Van Veen, John Wiley & sons, Inc.
- Signal, System & Transforms, Phillips, Pearson Education.
- Roberts, Signals & Linear Systems, by Robert A. Gabel and Richard A., John Wiley.
- Signals & systems, by Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin. Pearson Education.

BTEC403 Electromagnetics & Antennas

Unit I Electromagnetic Waves: Maxwell's equations in differential and integral forms Wave equation and its solution in different media, polarization. Plane wave propagation in a dielectric medium, Reflection and transmission of an EM waves. Surface impedance, Poynting theorem.

Unit II Waveguides and Transmission Lines: Waves between parallel planes. TE, TM and TEM Waves, velocities of propagation, Attenuation in parallel plane guides, wave impedance. Circuit representation of parallel plane transmission lines. Low loss transmission lines. Distortion less condition. Smith charts. Rectangular and circular wave guides. Wave impedance and characteristics impedances. Transmission line analogy for wave guides.

Unit III Antennas: introduction, concept of radiation in single wire, two wire, and dipole, Antenna parameters, Retarded potential, infinitesimal dipole. Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole.

Unit IV Antenna Arrays: Array of two point sources, Array factor, Array configurations, Hansen-woodyard end fire array, n-element linear array with uniform amplitude and spacing, n-element linear array with non-uniform spacing, Analysis of Binomial and Dolph-Tschebysceff array, Scanning Array, Super directive array.

Unit V Aperture Antennas: Field Equivalence principle, Rectangular and circular aperture antennas, Horn antenna, Babinet's Principle, Slot Antenna, Reflector antenna.

Unit VI Wave Propagation: Free space equation, Reflection from earth's surface, Surface and Space wave propagation, Range of space wave propagation, Effective earth's radius, Duct propagation, Troposphere propagation. Structure of ionosphere, propagation of radio waves through ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

Suggested Readings / Books:

- Electromagnetics and radiating systems, Jordan E.C., PHI.
- Antenna Theory, Balanis C.A, John Wiley & sons.
- Antenna and wave propagation, R.L.Yadava, PHI
- Problem and solutions in electromagneics, W H Hayt and J A buck, Tata McGraw Hill
- Antenna Theory, Krauss J.D., McGraw Hill.
- Shen/Kong/Patnaik, Engineering Electromagnetics, Cengage Learning.

BTEC-404 Electronics Measurements and Instrumentation

Unit I Fundamentals: Generalized instrumentation system – Units and Standards, Calibration Methods, Standards of measurements, Classification of errors, error analysis. Static Characteristics- Accuracy, Precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effects etc. Dynamic Characteristics.

Unit II Electronic Meters: Electronic Analog voltmeter: DC voltmeters-Choppers type-DC amplifier, solid state voltmeter, Differential voltmeter, peak responding voltmeter, True RMS voltmeter, calibration of DC voltmeters. Digital Voltmeter:- Introduction, Ramp Techniques, dual slope, integrating type DVM, Successive approximation type DVM, Resolution and sensitivity of digital meters, general specification of a DVM. CRO's

study of various stages in brief, measurement of voltage, current phase and frequency, special purpose oscilloscope.

Unit III Measuring Instruments: Principle of operation of galvanometer, PMMC, Moving Iron instruments, Resistance measurements using Wheatstone bridge, Kelvin Double Bridge, Ohm meter, AC bridges: Maxwell bridge, Maxwell wein bridge, Hey's Bridge, Schering Bridge, Anderson Bridge, Campbell Bridge.

Unit IV Instrumentation for Generation and Analysis of Waveforms: Signal generators: Fixed and variable AF oscillators, AF sine and square wave generator, Function generator: Square and pulse generator, Sweep generator, wave analyzer, harmonic distortion analyzer, spectrum analyzer, spectrum analysis.

Unit V Storage and Display Devices: Necessity of recorders, recording requirements, graphic recorders, strip chart recorders, magnetic tape recorders, digital tape recorders. Electronic indicating instruments, seven segment display, fourteen segmental display Nixie tube.

Unit VI Transducers and DATA Acquisition Systems: Strain gauge, LVDT, thermocouple, piezoelectric, crystal and photoelectric transducers and their applications. Data acquisition systems.

Unit VII Telemetry: Introduction, method of data transmission, types of telemetry systems and applications.

Suggested Readings / Books:

- Electrical and Electronic Measurements and Instrumentation, by K. SAWHNEY.
- Electronic Instrumentation and Measurement Techniques, by D Cooper.
- Electronic Instrumentation, by H.S. Kalsi, Tata McGraw Hill
- Applied Electronics Instrumentation and measurement, David Buchla, Wayne Melachlan:
- Electronics Measurement and Instrumentation,Oliver by B.H and Cag J.M. McGrawHill.
- Element of Electronic Instrumentation & Measurment, by Carr, Pearson Education.
- Electronic Measurments & Instrumentation, by Kishore, Pearson Education.
- Process Control Systems and Instrumentation, Bartelt, Cengage Learning

BTEC405 Pulse Wave Shaping and Switching

Unit I Introduction to Basic Elements and Waveforms: Passive and Active circuit elements, AC through inductor and capacitor, AC through Resistor-inductor and resistor-capacitor in series, Series and parallel resonance circuit, Different input signals, Average and RMS value.

Unit II Bistable Multivibrators: Role of feedback in electronic circuits, Fixed bias and self-bias bistable multivibrator, Speed-up Capacitors, unsymmetrical and symmetrical triggering, Application of Trigger input at the base of OFF Transistor, Application of Trigger input at the base of ON Transistor, Bisatble multivibrator as T Flip-Flop, Schmitt trigger circuit, Calculation of Upper Tripping Point and Lower Tripping Point.

Unit III Monostable and Astable Multivibrators: Collector Couple and Emitter Coupled Monostable multivibrator, Expression for Gate width, Astable Collector coupled and emitter coupled multivibrator, complementary Transistor Astable multivibrator.

Unit IV Switching Characteristics of Devices: Diode and transistor as electronic switch, Breakdown mechanism in diode, Effect of temperature on diode, Charge storage phenomena, Switching times in diode and transistor, Delay time, Rise time, Storage time and fall time, Use of Schotkey diode for reducing storage time.

Unit V Linear Wave Shaping: Low pass RC Network, Response to standard waveforms circuits, Integrator High Pass RC circuits, Response to standard waveforms, Differentiator, Double differentiation, Attenuator.

Unit VI NON- Linear Wave Shaping: Clipping circuits (diode & transistor), Diode comparators, Transistor differential comparator, Operational amplifier comparator, clamping circuits, Practical clamping circuit, clamping circuit theorem.

Suggested Readings / Books:

- Pulse and Digital Switching Circuits by Milliman, Taub; Tata Mcgraw Hill
- Pulse and Digital Circuits by Mothiki S. Prakash Rao; Tata Mcgraw Hill
- Pulse & Digital Circuits, by Rao K, Pearson Education.
- Switching Theory & Logic Design, by Rao , Pearson Education.
- Wave Generation and Shaping by Strauss McGraw Hill.
- Pulse and Switching Circuits by Sanjeev Kumar; Dhanpat Rai & Company

BTEC406 LAB Analog Communication Systems

- Generation of DSB & DSB-SC AM signal using balanced modulator & determine modulation Index & detection of DSB using Diode detector.
- Generation of SSB AM signal & detection of SSB signal using product detector.
- To generate a FM Signal using Varactor & reactance modulation.
- Detection of FM Signal using PLL & foster seelay & resonant detector.
- To Study Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
- To study the circuit of PWM & PPM modulator & Demodulator
- Study of Frequency Division Multiplexing / Demultiplexing with sinusoidal & audio inputs Using DSBSC.
- Generation & study of Analog TDM at least 4 channels.
- Sampling Theorem & Reconstruction of Signal from its samples using Natural Sampling, Flat Top Sampling & Sample & Hold Circuits & effect of duty cycle.
- To draw & study Polar plots & polarization of Helical, Ground plane, Yagiuda & dipole Antenna & calculate Antenna gain, Antenna beam width, Element current & Front-back ratio of antenna.
- To study Antenna matching using stubline.
- To study a transmission line attenuation & frequency characteristics.

BTEC407 Electronic Measurement & Instrumentation

- Measurement of Inductance by Maxwell's Bridge.
- Measurement of small resistance by Kelvin's Bridge.
- Measurement of Capacitance by Schering Bridge.
- Measurement of Frequency by Wein Bridge.
- Measurement of medium resistance by Wheat Stone's Bridge.
- Determination of frequency & phase angle using C.R.O.
- To find the Q of a coil using LCR-Q meter.
- To determine output characteristic of a LVDT and determine its sensitivity.
- Study characteristics of temperature transducer like Thermocouple, Thermistor and RTD with implementation of small project using signal conditioning circuit.
- Study characteristics of Light transducer like Photovoltaic cell, Phototransistor and Pin Photodiode with implementation of small project using signal conditioning circuit.
- To study input- output characteristics of a potentiometer and to use two potentiometers as an error detector.
- To study transmitter- receiver characteristics of a synchro set to use the set as control component.
- To study the operation of a d-c positional servo system and to investigate the effect of damping and supply voltage on its response.
- To study the operation of an a.c. position servo-system and to obtain effects of supply voltage and system parameter on its transient response.
- To study a stepper motor and control its direction speed and number of steps with the help of a microprocessor.

BTEC408 Lab Signal & Systems Using MATLAB / MENTOR DSP

- Generation of continuous and Discrete Unit step signal.
- Generation of exponential and Ramp Signal in Continuous and Discrete Domain.
- Continuous and Discrete time Convolution.
- Adding and subtracting two Given Signals (Continues as well as Discrete Signals)
- To generate a random binary wave.
- To Generate a Random Sequences with arbitrary distribution, means and Variances for following:
- Rayleigh Distribution
- Uniform distribution
- Gaussian distribution.
- To Plot Probability density functions. Find Mean and Variance for the above distribution

- To study Power Spectrum Density
- To study Difference Equation to develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
- To develop program modules based on operation on sequences like signal shifting, signal folding, signal addition and signal multiplication.
- To develop program for discrete convolution and correlation .
- To develop program for finding response of the LTI system described by the difference equation.
- To develop program for computing inverse Z-transform.