B.TECH. II Semester-4	L	T	P	C
EC 401: Control Systems	3	0	2	4

Unit - 1	14 Hours
Introduction to Control Systems, Mathematical Modeling of Control Systems Introduction to Control Systems: Introduction, Examples of Control Systems, Closed-Loop Control Versus Open-Loop Control, Design and Compensation of Control Systems Mathematical Modeling of Control Systems: Introduction, Transfer Function and Impulse-Response Function, Automatic Control Systems, Modelling in State Space, State-Space Representation of Scalar Differential Equation Systems, Linearization of Nonlinear Mathematical Models Mathematical Modeling of Mechanical Systems and Electrical Systems **Transient and Steady-State Response Analyses** Introduction, First-Order Systems, Second-Order Systems, Routh's Stability Criterion, Effects of Integral and Derivative Control Actions on System Performance, Steady-State Errors in Unity-Feedback Control Systems	
Unit - 2	**14 Hours**
Control Systems Analysis and Design by the Frequency Response Method Introduction, Bode Diagrams, Polar Plots, Log-Magnitude-versus-Phase Plots, Nyquist Stability Criterion, Stability Analysis, Relative Stability Analysis, Closed-Loop Frequency Response of Unity-Feedback Systems, Experimental Determination of Transfer Function, Control Systems Design by Frequency-Response approach, Lead Compensation, Lag Compensation, Lag-Lead Compensation	
Unit - 3	**14 Hours**
Control Systems Analysis and Design by the Root-Locus Method Introduction, Root-Locus Plots, Root-Locus Plots of Positive Feedback Systems, Root-Locus Approach to Control System Design, Lead Compensation, Lag Compensation, Lag-Lead Compensation, Parallel Compensation **Control Systems Analysis and Design in State Space** Introduction, State-Space Representations of Transfer-Function Systems, Controllability, Observability, Pole Placement	
Total Contact Time: 42 Hours	

Recommended Books

1. Modern Control Engineering, 5th Edition, by Katsuhiko Ogata.
2. Farid Golnaraghi and Benjamin C Kuo, Automatic Control Systems, 9th Edition, John Wiley and Sons
3. I. J. Nagrath and M. Gopal, Control Systems Engineering, 4th Ed., New age international publishers.
4. D'Azzo and Houpis, Feedback Control Systems, Analysis and Synthesis, 1988.
5. Richard M. Murray and Karl J. Astrom, Feedback Systems: An introduction for Scientists and Engineers, Princeton University Press, 2010.

B.TECH. II Semester-4	L	T	P	C
CS 402: Computer Networks	3	0	2	4

Unit - 1	9 Hours
Introduction: Overview of network and data communication, Data Communications, Computer Networking, Protocols and Standards, types of Network, Network Topology, Protocol hierarchies, and design issues of layers, Interfaces and services. Reference Model: The OSI reference model, TCP/IP reference model, network standards and protocols. *Physical Layer*: Data and transmission techniques, Multiplexing, Transmission media, Asynchronous Communication, Wireless transmission, ISDN, ATM, Cellular Radio, Switching techniques issues.	
Unit - 2	**14 Hours**
Data Link Layer: Layer design issues, services provided to network layers, Framing, Error control and Flow control, Data link control and protocols – Simplex protocol, Sliding window protocol. *Medium Access Layer*: Channel Allocations, Multiple Access protocols- ALOHA, CSMA, CSMA/CD protocols, Collision free protocols, Limited contention protocols, LAN architectures, IEEE 802 and OSI, Ethernet(CSMA/CD), Bus, Token Ring, DQDB, FDDI, Bridges and recent developments.	
Unit - 3	**8 Hours**
Network Layer: Network Layer design issue, Routing algorithms and protocols, Congestion Control Algorithms, Internetworking, Addressing, N/W Layer Protocols and recent developments.	
Unit - 4	**11 Hours**
Transport Layer: Transport services, Design issues, transport layer protocols, Congestion Control, QOS and its improvement. *Application Layer*: Client Server Model, DNS, SMTP, FTP, HTTP, WWW and recent development *Advanced Topics*	
Total Contact Time: 42 Hours	

Recommended Books

1. Tanenbaum, “Computer Network”, 4th Edition, PHI,1996.
2. William Stalling: “Data and Computer Communication”, 8th Edition, Prentice Hall, 2006.
3. Douglas E. Comer:” Internetworking with TCP/IP Volume – I”, 3rd Edition, PHI, 1991.
4. W. Richard Stevens: “TCP/IP Illustrated Volume-I”, Addison Wesley, 1994.
5. B. Forouzan , ” Data Communication And Networking “, 5th Edition, TMH, 1997.

B.TECH. II Semester-4	L	T	P	C
EC 403: Analog Circuits	3	0	2	4

Prerequisite
OP-AMPs

Filters and Tuned Amplifiers	14 Hours
Introduction, Filter Transmission, Filter Types, Filter Specification, The Filter Transfer Function, Butterworth and Chebyshev Filters, First-Order and Second-Order Filter Functions, The Second-Order LCR Resonator, Second-Order Active Filters Based on Inductor Replacement, Second-Order Active Filters Based on the Two-Integrator-Loop Topology, Single-Amplifier Biquadratic Active Filters, Sensitivity, Tuned Amplifiers	
Signal Generators and Waveform-Shaping Circuits	**14 Hours**
Basic Principles of Sinusoidal Oscillators, Op Amp–RC Oscillator Circuits, LC and Crystal Oscillators, Bistable Multivibrators (Schmitt Trigger), Generation of Square and Triangular Waveforms Using Astable Multivibrators, Generation of a Standardized Pulse—The Monostable Multivibrator, Integrated Circuit Timers, Nonlinear Waveform-Shaping Circuits, Precision Rectifier Circuits Voltage-Controlled Oscillator (566 function generator), Phase-Locked Loop: Introduction, Basic PLL Operation, Applications (565 IC: Frequency Demodulation, Frequency Synthesis, FSK Decoders)	
Data Converts and Voltage Regulators	**14 Hours**
Digital Processing of Signals, Sampling of Analog Signals, Signal Quantization, The A/D and D/A Converters as Functional Blocks, Performance Specifications *D/A Converter Circuits*: Basic Circuit Using Binary-Weighted Resistors, R-2R Ladders, A Practical Circuit Implementation, Current Switches *A/D Converter Circuits*: The Feedback-Type Converter, The Dual-Slope A/D Converter, The Parallel or Flash Converter, The Charge-Redistribution Converter Voltage Regulation, Basic Linear Series Regulators, Basic Linear Shunt Regulators, Basic Switching Regulators, Integrated Circuit Voltage Regulators, Integrated Circuit Voltage Regulator Configurations	
Total Contact Time: 42 Hours	

Recommended Books

Text-Book

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, Oxford University Press, 7th Edition.

Reference Books

2. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, Oxford University Press, 5th Edition.

3. Thomas L. Floyd, "Electronic Devices", Prentice Hall, 9th Edition.

4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw-Hill, 3rd Edition, Reprint 2007.

5. Coughlin and Driscol, "Op-Amps and Linear Integrated Circuits", PHI, 6th Edition, 2003.

6. Ramakant Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th Edition, 2003.

7. Salivahanan S., "Linear Integrated Circuits", McGraw-Hill, 4th Edition Reprint, 2010.

B.TECH. II Semester-4	L	T	P	C
EC 404: Communication Systems	3	0	2	4

Prerequisite
Signals & Systems, Probability and Random Variables, Expectation, Transformation of Random Variables, Gaussian Random Variables, The Central Limit Theorem

Unit - 1	16 Hours
Amplitude Modulation: Amplitude Modulation, *Virtues, Limitations, and Modifications of Amplitude Modulation*, Double Sideband-Suppressed Carrier Modulation, Costas Receiver, Quadrature-Carrier Multiplexing, Single-Sideband Modulation, Vestigial Sideband Modulation, Baseband Representation of Modulated Waves and Band-Pass Filters, Theme Examples *Angle Modulation*: Basic Definitions, Properties of Angle-Modulated Waves, Relationship between PM and FM waves, Narrow-Band Frequency Modulation, Wide-Band Frequency Modulation, Transmission Bandwidth of FM Waves, Generation of FM waves, Demodulation of FM signals, Theme Example: FM Stereo Multiplexing	
Unit - 2	**14 Hours**
Pulse Modulation: Sampling Process, Pulse-Amplitude Modulation, Pulse-Position Modulation, Completing the Transition from Analog to Digital, Quantization Process, Pulse-Code Modulation, Delta Modulation, Differential Pulse-Code Modulation, Line Codes, Theme Examples *Baseband Data Transmission*: Baseband Transmission of Digital Data, The Intersymbol Interference Problem, The Nyquist Channel, Raised-Cosine Pulse Spectrum, Baseband Transmission of M-ary Data, The Eye Pattern, Computer Experiment: Eye Diagrams for Binary and Quaternary Systems, Theme Example: Equalization	
Unit - 3	**12 Hours**
Digital Band-Pass Modulation Techniques: Some Preliminaries, Binary Amplitude-Shift Keying, Phase-Shift Keying, Frequency-Shift Keying, Summary of Three Binary Signaling Schemes, Noncoherent Digital Modulation Schemes, M-ary Digital Modulation Schemes, Mapping of Digitally Modulated waveforms onto Constellations of Signal Points, Theme Examples *Random Signals and Noise*: Random Processes, Correlation of Random Processes, Spectra of Random Signals, Gaussian Processes, White Noise, Narrowband Noise	
Total Contact Time: 42 Hours	

Recommended Books

Text-Book

1. Simon Haykin, and Michael Moher, "Introduction to Analog and Digital Communication", John Wiley & Sons, 2nd Edition.

Reference Books

2. Lathi B. P., and Ding Zhi, “Modern Digital & Analog Communication Systems”, Oxford University Press, 4th Edition, 2010.
3. Proakis J., and Salehi M., “Fundamental of Communication Systems”, PHI/Pearson Education-LPE, 2nd Edition, 2006.
4. Carlson Bruce A., “Communication Systems- An Introduction to Signal and Noise in Electrical Communication”, McGraw-Hill, 5th Edition, 2009.
5. Leon W. Couch, “Digital & Analog Communication Systems”, Pearson Education-LPE, 6th Edition, 2004.

B.TECH. II Semester-4	L	T	P	C
EC 405: Embedded Systems	3	0	2	4

Unit - 1	8 Hours
Microprocessors & Microcontrollers: Introduction, ARM Family History ARM Architecture: General Purpose Registers, Memory Map, Load & Store Instructions, CPSR (Current Program Status Register), ARM Data Format & Directives Assembly Language Programming (ARM Cortex – M): Introduction, Assembling an ARM program, Program Counter & Program ROM space, ARM addressing modes, RISC architecture in ARM	
Unit - 2	**8 Hours**
ARM Cortex - M Instruction Set and Programming: Arithmetic & Logic Instructions & Programs; Branch, Call, and Looping in ARM; ARM Memory Map, Memory Access, and Stack; ARM Pipeline and CPU Evolution	
Unit - 3	**(9+9) Hours**
Peripheral Interfacing (ARM Cortex - M): ➢ GPIO Programming (LED & Switch Interfacing), Seven Segment Display, LCD & Keypad Interfacing, UART ➢ Timers, Interrupts, ADC, DAC, Sensor Interfacing, SPI, I2C	
Unit - 4	**8 Hours**
Embedded Systems: Introduction, Embedded Systems Vs General Computing Systems, History, Classification, Major Application areas, Purpose Core of the Embedded system, Memory, Sensor and Actuators, Communication Interface, Embedded Firmware Characteristics and Quality Attributes of Embedded systems, Hardware Software Co-Design, Embedded Firmware Design and Development	
Total Contact Time: 42 Hours	

Recommended Books

1. Shibu K. V, “Introduction to Embedded Systems”, McGraw Hill, 2nd Edition, 2017.
2. Mazidi, “ARM Assembly Language Programming & Architecture”, Pearson Education, 2013.
3. Mazidi, “STM32 ARM Programming for Embedded Systems”, 2018.
4. Mazidi, “Freescale ARM Cortex-M Embedded Programming Using C Language”, 2014.
5. David E. Simon, “An Embedded Software Primer”, Pearson Education, 1st Edition, 12th Indian Reprint, 2005
6. Raj Kamal, “Embedded Systems”, Tata McGraw Hill, 2017.
7. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley, 2006.
8. Sloss A. N., Symes D. and Wright C., "ARM System Developer's Guide", Morgan Kaufmann Publishers, 1st Ed., 3rd Reprint, 2006.

B.TECH. II Semester-3	L	T	P	C
EC 406: Electromagnetics	3	0	0	3

Prerequisite
Vector Calculus, Coordinate Systems (Rectangular, Circular Cylindrical, Spherical)

Unit - 1	12 Hours
Electromagnetic Theorem: Divergence & Stoke's Theorem, Gauss Law, Laplace's & Poisson's Equation, Faradays Law & Ampere's work, Law in the differential vector form, Biot Savart's Law. *Maxwell's Equations*: Introduction, The Equation of Continuity For Time-Varying fields, Inconsistency of Ampere's Law, Maxwell's Equation, Condition at a Boundary surface.	
Unit - 2	**8 Hours**
Electromagnetic Waves: Solution for Free-Space conditions, Uniform Plane Waves & Propagation, The Wave Equations for a Conducting Medium, Sinusoidal Time Variations, Conductors and Dielectrics, Polarization, Reflection by a Perfect Conductor Normal Incidence & Oblique Incidence, Reflection by a Perfect Dielectric — Normal Incidence & Oblique Incidence, Reflection at The Surface of a Conductive Medium, Poynting Theorem.	
Unit - 3	**12 Hours**
Transmission Line Theory: ***The Lumped-Element Circuit Model for a Transmission Line***: Wave propagation on a transmission line, The lossless line; ***Field Analysis of Transmission Lines***: Transmission line parameters, The Telegrapher Equations Derived from Field Analysis of a Coaxial Line, Propagation Constant, Impedance, and Power Flow for the Lossless, Coaxial Line; ***The terminated Lossless transmission line; The Smith Chart***: The Combined Impedance–Admittance Smith Chart, The Slotted Line; ***The Quarter-Wave Transformer***: The Impedance Viewpoint, The Multiple-Reflection Viewpoint; ***Generator and Load Mismatches***: Load Matched to Line, Generator Matched to Loaded Line, Conjugate Matching; ***Lossy Transmission Lines***: The Low-Loss Line, The Distortionless Line, The Terminated Lossy Line, The Perturbation Method for Calculating Attenuation, The Wheeler Incremental Inductance Rule; ***Transient on Transmission Lines***: Reflection of Pulses from a Terminated Transmission Line, Bounce Diagrams for Transient Propagation	
Unit - 4	**10 Hours**
Waveguides: ***General Solutions for TEM, TE, and TM Waves***: TEM Waves, TE Waves, TM Waves, Attenuation Due to Dielectric Loss; ***Parallel Plate Waveguide***: TEM Modes, TM Modes, TE Modes; ***Rectangular Waveguide***: TE Modes, TM Modes, TE_{m0} & TE_{0n} Modes of a Partially Loaded Waveguide; ***Circular Waveguide***: TE Modes, TM Modes; ***Coaxial Line***: TEM Modes, Higher Order Modes; ***Surface Waves on a Grounded Dielectric Sheet***: TM Modes, TE Modes; ***Stripline***: Formulas for Propagation Constant, Characteristic Impedance, and Attenuation, An Approximate Electrostatic Solution; ***Microstrip Line***: Formulas for Effective Dielectric Constant, Characteristic Impedance, and Attenuation, Frequency-Dependent Effects and Higher Order Modes; ***Summary of Transmission Lines and Waveguides***	
Total Contact Time: 42 Hours	

Recommended Books

1. R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill, 1st Edition, 2006.
2. Jordan E. C. and Balmain K. G., "Electromagnetic Waves and Radiating Systems", Prentice Hall, Reprint, 2010.
3. David M. Pozar, "Microwave Engineering", 4th Edition, John Wiley & Sons.
4. Kraus John D., Marhefka Roland J. and Khan Ahmed S., "Antennas and Wave Propagation", Tata McGraw-Hill, 4th Edition, 2006.
5. William H. Hayt, "Engineering Electromagnetics", TMH, 8th Edition.
6. David J. Griffiths, "Introduction to Electrodynamics", Pearson, 4th Edition
7. J. D. Jackson, "Classical Electrodynamics", Wiley, 3rd Edition