SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

Electronic Instrumentation & Control Engineering

V Semester

Effective for the students admitted in year 2021-22 and onwards.

B. Tech. Electronic Instrumentation & Control
3rd Year – V Semester

S.No.	Category	Course Code	Course Title	Contact hrs/ week L	T	P	Marks Exam Hrs.	IA	ETE	Total	Cr
THEORY											
1	DC	**5EI4-01**	Microprocessor & Microcontroller	3	0	0	3	30	70	**100**	**3**
2		**5EI4-02**	Digital Signal Processing	3	0	0	3	30	70	**100**	**3**
3		**5EI4-03**	Biomedical Instrumentation	3	0	0	3	30	70	**100**	**3**
4		**5EI4-04**	Process Control	3	0	0	3	30	70	**100**	**3**
5	DE	**Department Elective : Any One**		2	0	0	2	30	70	**100**	**2**
		5EI5-11	Modern Control System								
		5EI5-12	Optical Instrumentation								
		5EI5-13	Computer Networks								
6	DE	**Department Elective: Any One**		2	0	0	2	30	70	**100**	**2**
		5EI5-14	Industrial Data Communication								
		5EI5-15	Control System Components								
		5EI5-16	Analog and Digital Communication								
		Sub-Total		**16**	**0**	**0**		**180**	**420**	**600**	**16**
PRACTICAL & SESSIONAL											
7	DC	**5EI4-20**	Microprocessor & Microcontroller Lab	0	0	3	3	60	40	**100**	**1.5**
8		**5EI4-21**	Digital Signal Processing Lab	0	0	3	3	60	40	**100**	**1.5**
9		**5EI4-22**	Process Control Lab	0	0	3	3	60	40	**100**	**1.5**
10		**5EI4-23**	Biomedical Instrumentation Lab	0	0	3	3	60	40	**100**	**1.5**
11	**UI**	**5EI7-30**	Industrial Training (45 Days)	0	0	6	-	60	40	**100**	**3**
12	**CCA**	**5EI8-00**	Co-Curricular Activities	0	0	2	-	60	40	**100**	**1**
		Sub- Total		**0**	**0**	**20**		**360**	**240**	**600**	**10**
		TOTAL OF V SEMESTER		**16**	**0**	**20**		**540**	**660**	**1200**	**26**

L: Lecture, **T**: Tutorial, **P**: Practical, **Cr**: Credits
ETE: End Term Exam, **IA**: Internal Assessment

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

5EI4-01: Microprocessor & Microcontroller

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: To study the architecture, working and programming of Microprocessor and Microcontrollers

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand architecture, instructions of 8085 Microprocessor
CO-2: Write 8085 based assembly language programs
CO-3: Learn the interfacing concepts of different peripherals
CO-4: Learn the functioning of 8051 microcontroller and applications

S. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	1
2.	**ARCHITECTURE OF 8085:** Microprocessor architecture & operations, Memory, I/O device, Memory and I/O operations, Address, data and control buses, Pin functions, Concept of multiplexing and de-multiplexing of buses, Generation of control signals, Instruction cycle, Machine cycles, T-states, Memory interfacing.	8
3.	**INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING:** Introduction to 8085 assembly language programming, Instruction set, Addressing modes, Data transfer, Arithmetic, Logical, Branch, Stack and machine control groups of instruction set, Macro RTL and micro RTL flow chart of instructions, Code conversion, BCD arithmetic and 16-bit data operations.	9
4.	**INTERFACING WITH I/O DEVICES:** Interfacing concepts, Ports, Interfacing of I/O devices, Interrupts in 8085, Programmable interrupt controller 8259A, Programmable peripheral interface 8255A, DMA controller 8257, Programmable interval timer 8253/8254.	8
5.	**ARCHITECTURE OF 8051 MICROCONTROLLER:** Internal block diagram, CPU, ALU, Address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and stack pointer, Program counter, I/O ports, Memory structures, Data and program memory, Timing diagrams and Execution cycles.	8
6.	**PROGRAMMING AND APPLICATION OF 8051 MICROCONTROLLER:** Programming timer interrupts, External hardware interrupts, Serial communication interrupts, Timers and counters.	6
	Total	40

Suggested Books:

1. Gaonkar R.S., "Microprocessor Architecture ,Programming and Applications", 5th Ed., Penram International, 2007.
2. Hall D.V., "Microprocessor and Interfacing-Programming and Hardware", 2nd Ed., Tata McGraw-Hill Publishing Company Limited, 2008.
3. Stewart J, "Microprocessor Systems- Hardware, Software and Programming", Prentice Hall International Edition,1990.
4. The 8051 Microcontroller and Embedded System-M.A. Mazidi, Pearson Education.
5. Microcontrollers-A.J. Ayala, Penram International Publishing (1) Pvt. Ltd.

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

5EI4-02: Digital Signal Processing

Credits: 03
3L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 3 Hours

Course Objectives: To impart knowledge of discrete-time and digital signal processing in time and frequency domains.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Learn the basic concepts and properties of discrete-time signals and systems
CO-2: Learn the frequency domain characteristics of discrete-time signals and systems
CO-3: Design and implement different structures of FIR and IIR filters.
CO-4: Design and implement digital filter design techniques.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	1
2.	**FUNDAMENTALS OF SIGNAL PROCESSING:** Introduction to signals and systems, Signal processing fundamentals, Discrete-time and digital signals, A/D conversion and Nyquist rate, Need for anti-aliasing, Basic elements of digital signal processing, z-transform and its properties.	8
3.	**ANALYSIS OF DISCRETE-TIME SYSTEMS:** Linear convolution, Causality and stability of discrete time systems, Solving difference equations and analysis of discrete-time systems in z domain, Transfer function, Pole-zero plot, Complexity of the DFT and the FFT, Algorithmic advantages of the FFT, Inverse FFT.	9
4.	**FIR Filters:** Ideal digital filters, Classification of linear phase FIR filters, Window methods and frequency sampling, Comparison of design methods.	8
5.	**IIR FILTERS:** Design of analog prototype filters, Analog frequency transformation, Impulse invariance method and digital frequency transformation, Bilinear transformation, Analog prototype to digital transformations, Difficulties in direct IIR filter design, Comparisons with FIR filters.	9
6.	**FILTER REALIZATION:** Structures for FIR filters, Structures for IIR filters.	5
	Total	40

Suggested Books:

1. Proakis, J.G., Manolakis, D.G., Digital Signal Processing: Principles, Algorithms, & Applications, Prentice Hall of India, 3rd Edition, 2007.
2. A. V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Pearson Education.
3. P. Ramesh Babu, “Digital Signal Processing”, Sci- Tech Publications.
4. Mitra, S.K., Digital Signal Processing: A Computer-Based Approach, McGraw Hill, NY, 4th Edition, 2011.

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI4-03: Biomedical Instrumentation

Credits: 03
3L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 3 Hours

Course Objectives: To learn the working of various biomedical instruments to record various physiological parameters

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Learn the basics of physiology and anatomy of human body sub-systems
CO-2: To learn about generation of bio potentials, working of bio-transducers and bio-electrodes.
CO-3: Learn functioning of various medical instruments
CO-4: Learn safety standards used in biomedical equipments

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	1
2.	**TRANSDUCERS AND ELECTRODES:** Principles and classification of transducers for Bio-medical applications, Electrode theory, Different types of electrodes, Selection criteria for transducers and electrodes. **Biopotentials-** Electrical activity of excitable cells, ECG, EMG, EEG, ERG, EOG.	6
3.	**CARDIOVASCULAR SYSTEM MEASUREMENTS:** Measurement of blood pressure, Blood flow, Cardiac output, Cardiac rate, Heart sounds, Electrocardiograph, Phonocardiograph, Plethysmograph, Echocardiograph.	7
4.	**INSTRUMENTATION FOR CLINICAL LABORATORY:** Measurement of pH value of blood, ESR measurement, Hemoglobin measurement, O_2 and CO_2 concentration in blood, GSR measurement. Spectrophotometry, Chromatography, Hematology,	6
5.	**MEDICAL IMAGING**: Diagnostic X-rays, CAT, MRI, Thermography, Ultrasonography, Medical use of isotopes, Endoscopy.	7
6.	**PATIENT CARE, SAFETY MEASURES AND BIOTELEMETRY:** Elements of Intensive care monitoring, Basic hospital systems and components, Physiological effects of electric currents, Shock hazards from electrical equipments, Safety measures, Standards & practices. **Biomedical telemetry:** Introduction, block diagram and description of single channel/multi channel telemetry systems.	6
7.	**THERAPEUTIC AND PROSTHETIC DEVICES:** Introduction to cardiac pacemakers, Defibrillators, Ventilators, Muscle stimulators, Diathermy, Heart lung machine, Hemodialysis, Applications of Laser.	7
	Total	40

Suggested Books:

1. Biomedical Instrumentation and Measurements By Cromwell, 2nd edition, Pearson Education
2. Medical Instrumentation Application and Design, John G. Webster, John Wiley and sons, New York, 1998.
3. Handbook of Biomedical Instrumentation By R. S. Khandpur, TMH
4. Introduction To Biomedical Equipment Technology By Carr & Brown
5. Biomedical Digital Signal Processing, Tompkins, PHI

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI4-04: Process Control

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: To impart knowledge about system modeling, controllers and its tuning and advanced control techniques used in process industries.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand the terminology, concepts and practices in process modeling and automatic process control.
CO-2: Gain knowledge in the design of control systems and PID controller tuning for processes.
CO-3: Understand working and significance of final control elements.
CO-4: Learn concepts of advanced process control.

S. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**BASIC CONCEPTS OF PROCESS CONTROL:** General concepts and terminology, Piping and instrumentation diagram, Types of dynamic process: Instantaneous, Integral, First and second Order, Self-regulating, Interacting and non-interacting processes. Dead time elements	06
3.	**MATHEMATICAL MODELING OF SYSTEMS:** Liquid systems (Level and flow), Perturbation variable and linearization methods. Response of a thermometer bulb, Concentration response of a stirred tank, Temperature response of a stirred tank, Process lag, Load disturbance and their effect on processes.	06
4.	**BASIC CONTROL ACTION:** Basic control action, Two position, Multi position, Continuous controller modes: Proportional, Integral and Derivative composite controller modes PI, PD, PID, Integral wind up and anti-wind up. Response of controllers for different test Input, Selection of control modes for processes like level, temperature and flow.	06
5.	**CONTROLLER TUNING METHODS:** Evaluation criteria IAE, ISE, ITAE etc., Process reaction curve method, Continuous oscillation method, Damped oscillation method, Auto tuning.	05
6.	**FINAL CONTROL ELEMENTS:** Pneumatic control value, Construction details and types, Value sizing, Selection of control valves, Inherent and Installed characteristics, Valve actuators and positioners.	05
7.	**ADVANCED CONTROL SYSTEM:** Cascade control, Ratio control, Feed forward control. Over-ride, Split range and selective control. Multivariable process control, Interaction of control loops.	05
8.	**CASE STUDY:** Distillation column, Basic features of composition control schemes, Control of overhead composition, Bottom composition and both product compositions, Location of sensing element, Control of columns with varying feed rates, Pressure control, Control of feed temperature and internal reflux control, boiler drum level control.	06
	Total	40

Suggested Books:

1. G. Stephanopoulos, Chemical Process Control-An Introduction to Theory and Practice Prentice Hall of India, New Delhi, 3rd Edition, 2008.
2. D.R. Coughanowr, Steven E LeBlanc, Process Systems Analysis and Control, McGraw Hill, Singapore, 3rd Edition, 2009.
3. B.W. Bequette, Process Control Modeling, Design and Simulation, Prentice Hall of India, New Delhi, 2004.

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI5-11: Modern Control System
(Department Elective-1)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To study control techniques used for complex dynamic systems using modern state-space approach.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Construct state space models of dynamic systems.
CO-2: Explain basic control concepts such as controllability, observability, poles and zeros, stability
CO-3: Design observer for state estimation
CO-4: Learn discrete time systems and their modeling

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**SYSTEMS IN STATE SPACE:** Concept of states and state model, State equation for dynamical system, Relation between transfer function and state equation, Modeling of various dynamical systems- Electrical, Hydraulic, Liquid level systems, Electrical drives etc.	05
3.	**CANONICAL FORMS:** Non-uniqueness of state equations, Similarity transformations, Building blocks of state space model, Controllable canonical form. Observable canonical form, Diagonalization, Significance of Eigen values and Eigen vectors in control systems, Diagonal form, Jordan canonical form.	06
4.	**SOLUTION TO STATE-SPACE EQUATIONS:** State transition matrix, Properties of state transition matrix, Computation of state transition matrix, Definition of controllability, Observability, Stabilizability and Detectability, Caley Hamilton's theorem, State feedback control (pole placement) , Ackerman's formula, Output feedback control.	06
5.	**OPEN LOOP OBSERVERS FOR ESTIMATION OF STATES:** Closed loop observers, Full order and reduced order observers, Separation principle, Combined control law and observer.	06
6.	**INTRODUCTION TO DISCRETE TIME SYSTEMS:** Analogies with Continuous-time systems, Mathematical models for LTI discrete- time systems, Z- transforms, State space modeling of discrete-time dynamical systems. **CASE STUDY:** Design a complete control system utilizing above concepts.	06
	Total	**30**

Suggested Books:

1. Modern Control Engineering: Ogata K, Prentice Hall, New Delhi 2010
2. Richard Dorf & Robert Bishop,Modern Control Systems, Pearson Education, 2011
3. M .Gopal, Control Systems: Principles and Design, Mc Graw Hill Publications, 2008
4. Digital Control Systems, George / Kurian, Cengage learning, 2011
5. Franklin Powell , Feedback Control Of Dynamical Systems, Pearson Education, 2008

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI5-12: Optical Instrumentation
(Department Elective-1)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To contribute to the knowledge of Fiber optics, Measurements and Instrumentation along with Applications

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand basic concepts of optical transmitting and receiving
CO-2: Analyze opto-electronic devices and optical components
CO-3: Learn optical fiber measurements
CO-4: Learn fiber optical applications in various fields

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**OPTICAL FIBER OVERVIEW:** Introduction, Ray theory, Optical fibers: Multimode, Single mode, Step index, Graded index, Plastic & glass fibers. Transmission characteristics of optical fibers - Introduction, Attenuation, Material absorption loss, Fiber bend loss, Scattering, Dispersion (intermodal & intra-modal), Dispersion shifted fibers, Dispersion compensating fibers.	05
3.	**OPTICAL FIBER SOURCES:** Laser- Emission and absorption of radiation, Einstein relation, Absorption of radiation, Population inversion, Optical feedback, Threshold condition. Population inversion and threshold, Working of three levels & four level laser. Basic idea of solid state, Semiconductors, Gas & liquid laser. Basic concept of Q-switching and mode locking, Light emitting diode - Structure, Material, Characteristics, Power & efficiency.	07
4.	**OPTICAL DETECTORS & CONNECTION:** Optical detection principles, Quantum efficiency, Responsivity, PIN photo diode, Avalanche photo diodes, Noise in detectors, Photo diode materials. Fiber alignment, Fiber splices, Fiber connectors, Expanded beam connectors, Fiber couplers.	06
5.	**OPTICAL FIBER MEASUREMENTS:** Measurements of fiber attenuation, Dispersion, Refractive index profile, Cut off wave length, Numerical aperture & diameter, Field measurement through optical time domain reflectometry (OTDR), Laser based systems for measurement of distance, Velocity, Holography.	06
6.	**OPTICAL FIBER APPLICATIONS:** Wavelength division multiplexing, DWDM, Active and passive components, Optical sensors, Optical amplifiers, Public network applications, Military, Civil and Industrial applications.	05
	Total	30

Suggested Books:

1. J. Wilson & J. F. B. Hawkes, "Optoelectronics: An Introduction" PHI/ Pearson
2. Rajpal S. Sirohi "Wave Optics and its Application", Hyderabad, Orient longman Ltd.
3. A. Yariv, "Optical Electronics", C. B. S. Collage Publishing, New York, 1985.
4. G. Hebbar, "Optical Fiber Communication", Cengage

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI5-13: Computer Networks
(Department Elective-1)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To build understanding of the fundamental concepts of computer networking.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand basic computer network technology.
CO-2: Learn about switching networks.
CO-3: Identify the different types of network topologies and protocols.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**INTRODUCTION TO COMPUTER NETWORKS AND THE INTERNET:** Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.	05
3.	**SWITCHING IN NETWORKS:** Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Cross bar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing.	07
4.	**TRANSPORT LAYER:** Connectionless transport - User Datagram Protocol, Connection oriented transport –Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.	06
5.	**NETWORK LAYER:** Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing.	06
6.	**LINK LAYER:** ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.	05
	Total	30

Suggested Books:

1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.
2. Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
3. Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India.
4. An Engineering Approach to Computer Networks-S.Keshav,2nd Edition,Pearson Education

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI5-14: Industrial Data Communication
(Department Elective-2)

Credits: 02 **Max. Marks: 100 (IA:30, ETE:70)**
2L:0T:0P **End Term Exam: 2 Hours**

Course Objectives: To impart knowledge of real-time communication between systems in industries and to adopt adequate protocol.

Course Outcomes: Upon successful completion of the course, students will be able to

CO-1: Understand the communication system used in the field of instrumentation
CO-2: Understand the data communication standards
CO-3: Learn the system interconnection and protocols
CO-4: Understand the working of wireless sensor networks

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**FUNDAMENTAL OF INDUSTRIAL DATA COMMUNICATION SYSTEMS:** Review of Data Acquisition, Automation System Architecture - Hierarchical Levels, Functional Layered Models - OSI reference model, System engineering approach, Input / Output Structures, Control Unit Structure, Protocols, Communication principles and modes: network topology, transmission media, noise, cable characteristic and selection; bridges, routers and gateways, Instrumentation and control devices.	05
3.	**INDUSTRIAL COMMUNICATION STANDARDS AND PROTOCOLS:** Serial communication standards: Standards organizations, Serial data communication interface standards, Balanced and unbalanced transmission lines, Synchronous and asynchronous communication, RS 232,422,485 standards. Industrial protocols: XON/OFF Signaling, Binary Synchronous Protocol (BSC), HDLC/SDLC protocol, CSMA/CD, CA protocol, OSI implementation for Industrial communications, Industrial control applications: ASCCII-based protocol – ANSI –X 3.28-2.5.	06
4.	**BASICS OF FIELDBUS AND PROFIBUS:** Introduction to Foundation Fieldbus: Physical layer and wiring rules, Data Link layer, Application layer, User layer; Wiring and installation practice with Fieldbus:Termination Preparation, Installation of the complete system, Introduction to ProfiBus standard: ProfiBus protocol stack, Physical layer, Data Link layer, Application layer	06
5.	**HART AND MODBUS:** Concept of Highway Addressable Remote Transducer (HART), HART and smart Instrumentation, Communication Protocol Architecture: Physical, data link, application layer, communication technique, normal and burst mode of communication, benefits of HART.	06
6.	**WIRELESS SENSOR NETWORKS:** Hardware components – energy consumption of sensor nodes – Network architecture – sensor network scenario. Wireless HART – Existing Wireless Options: IEEE 802.15.4 -ISA 100 – Zigbee – Bluetooth – their relevance to industrial applications.	06
	Total	30

Suggested Books:

1. Deon Reynders, Steve Mackay, Edwin Wright, Practical Industrial Data Communications, 1st Edition ELSEVIER,2005.
2. Behrouz A. Forouzan, Data Communications and Networking, 2nd Edition, Mc Grow – Hill, 2001
3. William C. Dunn, Fundamental of industrial instrumentation and process control, Mc Graw- Hill, 2005.
4. John Park, Steve Mackay, Edwin Wright, Practical Data Communications for Instrumentations and Control, 1st Edition ELSEVIER,2003.

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI5-15: Control System Components
(Department Elective-2)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To study different electrical, pneumatic, hydraulic components used in control systems.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Identify basic control system components
CO-2: Understand the working discrete and analog controllers
CO-3: Understand the working of advanced controllers
CO-4: Gain knowledge of control valves and positioners.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**INTRODUCTION TO CONTROL SYSTEM COMPONENTS:** Electrical, Mechanical, Hydraulic, Pneumatic etc., Components of different systems, P&I diagram representation.	06
3.	**TRANSMITTERS:** Buoyancy, Force balance, Motion balance, Differential pressure, Temperature, Electro-hydraulic, 2 wire transmitters, Converters: Resistance-to-current, Voltage to current, Pneumatic to electrical, Electrical to pneumatic	06
4.	**CONTROL ACTIONS: Discrete controllers**: On-Off two position, neutral zone, Three-position, Multi position. **Analog controllers:** Proportional (P), Integral (I), Derivative (D), PI, PD, PID, their actions and characteristics of controllers, Proportional band, Gain and relation between proportional band and gain. Tuning of controllers and methods, Pneumatic and hydraulic controllers	06
5.	**ADVANCED CONTROLLERS:** Sequential and timing control, Relay logic diagrams, Ladder diagram, Introduction to electronic controllers, Solid state electronic logic circuit based controllers, Programmable logic controllers (PLC), Distributed controllers.	06
6.	**CONTROL VALVES AND POSITIONERS:** Terminology, Types , Characteristics, Selection criteria, Concept of C_v value, Calculation of C_v and trim size, Valve positioners: Necessity, Types and effect on performance of control valve, Actuators, Pneumatic, Hydraulic, Electrical, Electro-pneumatic, Electro-hydraulic	05
	Total	30

Suggested Books:

1. Process control and Instrumentation technology, C.D. Johnson
2. Instrumentation for process measurement and control, N. A. Anderson
3. Process Control, Instrument Engineering Hand book, B.G. Liptak, Butterworth-Heinemann Ltd
4. Industrial hydraulics, Pipepinger
5. Hydraulics and Pneumatic application notes, festocontrol.com

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI5-16: Analog and Digital Communication
(Department Elective-2)

Credits: 02
2L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 2 Hours

Course Objectives: To learn the analog and digital communication systems and applications.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Analyze analog communication techniques.
CO-2: Understand data and pulse communication systems
CO-3: Demonstrate various digital communication techniques
CO-4: Design and implement error control coding schemes.

Se. No.	Contents	Hours
1.	**INTRODUCTION:** Objective, Scope and Outcome of the course	01
2.	**ANALOG COMMUNICATION:** Introduction to communication systems, Modulation types, Need for modulation, Theory of amplitude modulation, Evolution and description of SSB techniques, Theory of frequency and phase modulation, Comparison of analog communication systems.	06
3.	**PULSE AND DATA COMMUNICATION: Pulse communication:** Pulse amplitude modulation (PAM), Pulse time modulation (PTM), Pulse code modulation (PCM), Comparison of various pulse communication system (PAM – PTM – PCM), **Data Communication**: History of data communication, Standards organizations for data communication, Data communication circuits, Data communication codes, Data communication hardware, Serial and parallel interfaces.	07
4.	**DIGITAL COMMUNICATION:** Amplitude shift keying (ASK), Frequency shift keying (FSK), Phase shift Keying (PSK), BPSK, QPSK, Quadrature amplitude modulation (QAM), 8 QAM, 16 QAM, Bandwidth efficiency, Comparison of various digital communication system (ASK – FSK – PSK – QAM).	05
5.	**SOURCE AND ERROR CONTROL CODING:** Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, Mutual information, Channel capacity, Error control coding, Linear block codes, Cyclic codes, ARQ techniques.	05
6.	**MULTI-USER RADIO COMMUNICATION:** Global system for mobile communications (GSM), Code division multiple access (CDMA), Cellular concept and frequency reuse, Channel assignment and handover techniques, Overview of multiple access schemes, Satellite communication, Bluetooth.	06
	Total	30

Suggested Books:

1. B.P.Lathi,"Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press,2007.
2. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, Pearson Education, 2007.
3. B.Sklar,"Digital Communication Fundamentals and Applications"2nd Edition Pearson Education 2007
4. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004
5. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI4-20: Microprocessor & Microcontroller Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Objectives: To impart knowledge in the programming and interfacing the microprocessor and microcontroller with external peripherals.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Write assembly language programs for 8085 microprocessor
CO-2: Understand the interfacing of peripherals with 8085 microprocessors
CO-3: Learn programming concepts of 8051 microcontroller
CO-4: Implement 8051 interfacing with peripherals

Se. No.	Name of Experiments
1.	Study the hardware, functions, memory structure, Instruction set and operation of 8085 microprocessor
2.	Write an assembly language program to Add/Subtract two 8-bit/16-bit number.
3.	To perform multiplication and division of two 8 bit numbers using 8085.
4.	Write an assembly language program to Data transfer/Exchange from one memory block to another in
5.	To write a program to arrange an array of data in ascending and descending order.
6.	To find the largest and smallest number in an array of data using 8085 instruction set.
7.	Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
8.	Write a program using 8085 Microprocessor to generate square wave.
9.	Write a program using 8085 Microprocessor to generate triangular wave.
10.	Write an assembly language program for displaying the decimal numbers in 7 Segment display using Microcontroller
11.	Write an assembly language program for interfacing stepper motor with 8051.
12.	Write an assembly language program to interface relay with 8051

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI4-21: Digital Signal Processing Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Objectives: To impart practical knowledge of digital signal processing techniques, filter design using MATLAB

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: To understand about the basic signal generation and operations
CO-2: To learn Fourier Transform, FFT, DFT Concepts
CO-3: To design FIR filters
CO-4: To design IIR filters

Se. No.	Name of Experiments
1.	Write a Program to generate the basic signals.
2.	Write a Program to implement the basic operations on the given signals
3.	Write a Program to implement Linear Convolution of the two given sequences.
4.	Write a Program to obtain the auto-correlation and Cross-correlations of the given sequences.
5.	Write a Program to obtain the transfer function and plot is pole-zero plot
6.	Write a Program to find the DTFT of the given sequence and plot its magnitude and phase plot.
7.	Write a Program to obtain the linear convolution using circular convolution of two given
8.	Write a Program to obtain the DFT of the given sequences using DIT-FFT algorithm and plot its magnitude and phase spectrum.
9.	Write a Program to design and implement FIR filters using difference windowing methods.
10.	Write a Program to design and implement IIR filters (Using Butterworth or Chebyshev Filter)

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI4-22: Process Control Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Objectives: To impart practical knowledge about controllers and advanced control schemes used in process industries.

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand the working of PID controllers
CO-2: Draw the characteristics of control valves
CO-3: Understand the working of advanced control schemes.
CO-4: Learn the concepts of PLC programming

Se. No.	Name of Experiments
1.	To perform experiments on Linear system simulator.
2.	To draw response of temperature controlled process for on/off, P, PI, PID controller.
3.	Tuning of controllers on a pressure loop.
4.	To study the design and application of Lag compensator circuits.
5.	To study the design and application of Lead compensator circuit.
6.	To study process simulator. (a) To perform experiments on P, PI, PD, PID controller with Process simulation. (b) To study the effect of loading the process.
7.	To study the operation of linear & equal percentage type control valves and determine the Following:- (i) Valve flow coefficient (ii) characteristics of control valve (iii) Rangeability of control valves.
8.	To perform experiments on Ratio Control Scheme and Cascade Control Scheme on liquid level and flow system.
9.	To plot and analyze step/impulse response of a first order system in (i) Non interacting mode (ii) Interacting mode.
10.	(a) Study of basic logic operations, timer, counter, arithmetic operations in PLC. (b) Problem solving In PLC. (c) To perform experiments on PLC controlled process.

SYLLABUS
3rd Year- V Semester: B.Tech. (Electronic Instrumentation & Control Engineering)
5EI4-23: Biomedical Instrumentation Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Objectives: To impart practical knowledge of physiological signals and their measurements

Course Outcomes: Upon successful completion of the course, students will be able to
CO-1: Understand different ECG lead configurations
CO-2: Learn origin of different physiological signals and their measurements.
CO-3: Design electronic amplifiers for bio-signals
CO-4: Get practical exposure of biomedical instruments

Se. No.	Name of Experiments
1.	Study of different ECG lead configurations Lead I, II, III, Lead aVR, Lead aVL, Lead aVF
2.	Measurement of blood pressure using sphygmomanometer
3.	Record ECG waveform in different lead configurations and compare following (a) P wave, R, wave and T wave amplitude (b) PR interval, QRS duration, QT interval
4.	Recording of the EMG signal
5.	Recording of the heart sounds and heart rate
6.	Measurement of various lungs capacities
7.	Study of EEG monitoring system and EEG analysis
8.	Measurement of respiration rate
9.	Study of real time patient monitoring system (visit to hospital)
10.	Design of ECG amplifier and draw its characteristics