



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

APPLIED ELECTRONICS AND INSTRUMENTATION (AEI)

Semester VI / AEI / B.TECH

Sl. No	Sub Code	Subject	Hrs			Credits C
			L	T	P	
	Theory					
1	EC131601	Microcontroller and Applications	3	2	0	4
2	MA131602	Fuzzy Mathematics	3	0	0	3
3	AI131603	Process Control	3	2	0	4
4	AI131604	Industrial Instrumentation	3	0	0	3
5	CS131605	Computer Networks	3	2	0	4
6	AI131606	Biomedical Instrumentation and Engineering	3	0	0	3
	Practical					
7	EC131611	Microcontroller and Applications Lab	0	0	2	1
8	AI131613	Process Control Lab	0	0	2	1
9	AI131614	Industrial Instrumentation Lab	0	0	2	1
10	CS131615	Computer Networks Lab	0	0	2	1
Total			18	6	8	25
Total Contact Hours : 32						
Total Credit : 25						

Course Title: MICROCONTROLLER AND APPLICATIONS

Course Code: EC131601

L-T-P-C: 3-2-0-4

Class Hours/week	4
Expected weeks	12
Total hrs. of classes	36+12 =48

MODULE	TOPIC	COURSE CONTENT	HOURS
1	INTEL 8051	Architecture of 8051, block diagram, pin diagram of 8051, functional description of internal units, registers, PSW, internal RAM, ROM, stack, oscillator, clock, reset circuits. I/O Pins, ports and circuits connecting external memory. Addressing modes, instruction set assembly language programs. Delay routines, software time delays, software polled timer, hardware delay. Look up tables.	12
2	8051 INTERRUPTS, COUNTERS AND TIMERS	Serial data interrupt. Serial data transmission /reception and transmission modes. Timer flag interrupt. External interrupt, software generated interrupts. External memory and memory space decoding, expanding I/Os, memory mapped I/O. Interrupt driven serial transmission and reception. Serial data transmission using time delays and polling.	12
3	PIC MICROCONTROLLER	CPU architecture, register file structure, addressing modes, instruction set, programs, MPASM assembler, PIC development Tools. PIC Timer- interrupts-PWM outputs-I/O port expansion, Keypad and display interface, I2C Bus, Serial EPROM, Analog to Digital Converter, UART- Special features.	12
4	8051 APPLICATIONS	Interfacing Keyboards Programs for small keyboards and matrix keyboards. Interfacing LCD displays. Measuring frequency and pulse width. Interfacing ADCs & DACs. PID Control Algorithms, 8051 Serial data communication modes- Mode 0, Mode 1, Mode 2 and Mode 3. Programs for serial port communication (receive/transmit).	12

TEXT BOOKS/ REFERENCES:

1. K J Ayala, The 8051 Microcontroller Architecture, Programming and Application, Penram international Publishing (India).
2. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, The 8051 Microcontroller and Embedded Systems, Prentice Hall of India, 2nd Ed.
3. Intel's manual on "Embedded Microcontrollers".
4. John Peatman, Design with PIC Microcontrollers, Pearson Education, New Delhi.
5. Udayashankara, 8051 Microcontroller- TMH.

Course Title: FUZZY MATHEMATICS
Course Code: MA131602
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

MODULE	TOPIC	COURSE CONTENT	HOURS
1	DEFINITION OF A FUZZY SET	Elements of Fuzzy logic, Relations including Operations, reflexivity, symmetry and transitivity; Pattern Classification based on fuzzy relations; Fuzzy analysis including metric spaces, distances between fuzzy sets, area, perimeter, height, width of fuzzy subsets, continuity and integrals; Applications	18
2	PATHS AND CONNECTEDNESS	Clusters including cluster analysis and modelling information systems, applications; Connectivity in fuzzy graphs, application in database theory; Applications to neural networks; Fuzzy algebra including Fuzzy substructures of algebraic structures, Fuzzy subgroups, pattern recognition and coding theory.	18

TEXTBOOKS / REFERENCES :

1. Fuzzy Mathematics- An Introduction for Engineers and Scientists, John N. Mordeson, Premchand S. Nair, Springer Books
2. Fuzzy Mathematics- Approximation Theory, Anastassiou George A., Springer

Course Title: PROCESS CONTROL
Course Code: AI131603
L-T-P-C: 3-2-0-4

Class Hours/week	4
Expected weeks	12
Total hrs. of classes	36+12 = 48

MODULE	TOPIC	COURSE CONTENT	HOURS
1	INTRODUCTION TO PROCESS CONTROL	Definition of a process, Block diagram representation of a process. Position and regulatory control system.	6
2	RECAP OF BASIC CONTROL SYSTEM CONCEPTS	Transfer function, block diagram of feedback control system. Block diagram manipulation, signal flow graphs, stability studies. Basic state-space representation of processes. Mathematical models: study of common techniques. Simple mathematical models of heat-transfer system, heat-transfer with mixers, electric dc motor and common pneumatic devices.	12
3	THEORY OF CONTROLLERS	Different types of controllers: on-off type, proportionate, integral and derivative (a combination of all these types in one unit). Circuits and devices implementing such controllers. Tuning of controllers: Cohen & Coon and Ziegler-Nichols methods.	9
4	CONNECTING CONTROL ELEMENTS AND COMMON CONTROL LOOPS	RLC components, control of flow, pressure, level and temperature.	9
5	USE OF COMPUTERS IN PROCESS CONTROL	Programmable Logic Controllers (PLC): ladder diagrams, example of simple cases. Distributed control system and basic concepts about adaptive controllers.	12

TEXTBOOKS / REFERENCES:

1. Principles of process control: D. Patranabis. Tata –McGraw -Hill
2. Process Control technology and Instrumentation: Curtis D. Johnson. Prentice-Hall of India
3. Modern Control Engineering: Ogata. Prentice-Hall of India

Course Title: INDUSTRIAL INSTRUMENTATION
Course Code: AI131604
L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

MODULE	TOPIC	COURSE CONTENT	HOURS
1	DIMENSION MEASUREMENT	Measurement of length, thickness, Area, Diameter, Roughness and Angle, Optical Methods of length and distance measurements.	4
2	SPEED, TORQUE AND FORCE MEASUREMENT	Measurement of speed: Revolution counter, Drag-cup tachometer, stroboscope, ac and dc tacho-generators, speed measurement using reluctance pick-up, photo-transducer. Torque measurements using resistive, inductive, magneto – Strictive and digital transducers. Measurement of force - strain gauges and LVDT load cells, Hydraulic and Pneumatic force meter, proving ring.	6
3	PRESSURE MEASUREMENT	Basics of Pressure measurement, manometer and its types, Manometers, Bourdon gauges, Diaphragm gauges, Bellow gauges, Bell gauges, Electrical types - vaccum gauges, McLeod gauge, Knudsen gauge, Pirani gauge, thermocouple gauge, ionization gauge, thermal conductivity gages.	6
4	TEMPERATURE MEASUREMENT	Temperature scales, Temperature standard, Bimetallic thermometer, filled-in thermometers, vapour pressure thermometers, resistance thermometers, 3-lead and 4-lead arrangement - thermistor, thermocouples - types and ranges, laws of thermocouples, cold-junction compensation, linearization, thermo well, installation of thermocouples Radiation fundamentals – Total radiation and selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometer, temperature transmitter, Semiconductor Junction Thermometers- Transistor as temperature sensor, integrated temperature sensors (LM 75, LM 135/235/335, AD 590), IR thermometers, Manometric thermometers, Fiber-Optic temperature Sensors.	8

5	FLOW MEASUREMENT	Variable Head Flow Meter- orifice plate, venturi tube, dal tube, flow nozzle, pitot tube, mass flow meter, positive displacement meter, turbine flow meter, Variable Area Flow Meter – Rotameters. Ultrasonic, electromagnetic flow meters, Thermal mass flow meters, hot-wire anemometer.	6
6	LEVEL MEASUREMENT	Definition of level, Sight glass, float gauge, displacer, torque tube, bubbler tube, diaphragm box, Differential pressure method, Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors, Measurement of level of solids – paddle wheel type.	6

TEXBOOKS / REFERENCES:

1. Principles of Industrial Instrumentation- D Patranbis, McGraw Hill.
2. Industrial Instrumentation & control- S K Singh- Tata McGraw Hill.
3. Industrial Instrumentation- K Krishnaswamy and S Vijayachitra- New age international publisher.
4. Electrical and electronic measurements and instrumentation-A.K. Swahney- Dhanpat Rai & Co.

Course Title: COMPUTER NETWORKS

Course Code: CS131605

L-T-P-C: 3-2-0-4

Class Hours/week	4
Expected weeks	12
Total hrs. of classes	36+12 = 48

MODULE	TOPIC	COURSE CONTENT	HOURS
1	INTRODUCTION	Hardware and software, Data communication, Networking, Protocols and Protocol architecture, standards. Data transmission concepts. Analog and digital transmission. Transmission impairments. Layered Architecture of Computer Networks, OSI and TCP/IP architectures.	5
2	PHYSICAL LAYER	Guided transmission media and wireless transmission, Data encoding - Digital and analog data and signals, spread spectrum. Data communication interface - asynchronous and synchronous transmission, line configuration and interfacing. Data link control - Flow control. Error detection and error control. HDLC and other data link protocols. Multiplexing – Frequency-division, synchronous time-division, and statistical time-division multiplexing.	7
3	LINK LAYER: MEDIUM ACCESS CONTROL: CDMA, ALOHA, AND ETHERNET	Link Layer Addressing and Forwarding; Spanning Trees; The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs, Broadband Wireless, Bluetooth, Data Link Layer Switching, Switched networks. Circuit-switched networks. Switching concepts. Routing in circuit-switched networks. Control signaling. Packet switching principles. Routing and congestion control, x.25 protocol standard. LAN Technology - LAN architecture. Bus/tree, ring, star, and wireless LANs. LAN Systems - Ethernet and Fast Ethernet (CSMA/CD) Token ring and FDDI, ATM LANs, Fiber channel, wireless LANs. Bridges - Bridge operation and routing with bridges.	8
4	NETWORK LAYER	Network layer design issues. Routing algorithms , Flooding, Shortest path routing, Link State routing, Hierarchical routing, Broadcast and multicast routings, Routing in the Internet, Path Vector routing, OSPF routing. The network layer in the Internet: IP protocol, ARP and RARP, BOOTP, ICMP, DHCP, Network Address Translation(NAT) Internetworking.	7
5	TRANSPORT LAYER	TCP introduction, Reliable/Un- Reliable Transport, TCP , UDP, Congestion Control, Intra-Domain Routing: Distance-Vector, Intra-Domain Routing: Link- State, Wireless Networks: 802.11 MAC,	4

		Efficiency considerations	
6	APPLICATION LAYER	DNS-The Domain Name System,Electronic Mail, HTTP, FTP, Simple network management protocol (SNMP),The World Wide Web	6
7	WEB AND MULTIMEDIA	The World Wide Web – client and server side of www, HTML and webpages, JAVA language, Locating on the web. Multimedia- Audio & Video, Data compression, Video on demand, Multicast backbone.	6
8	SECURITY	Introduction, Cryptography and Cryptanalysis, Public Key Cryptography Algorithms, RSA Algorithm, DES, Authentication and Authorization.	5

TEXT BOOKS:

- 1 .Computer Networks, by Andrew S Tanenbaum, PHI.
2. Data and Computer Communications, by Walliam Stallings, PHI

REFERENCE BOOKS:

1. Data Communications, Computer networking on OSI, by Fred Halsall, Addison Wesley Publishing Co.
2. Computer Networking -A Top-Down Approach Featuring the Internet, James F. Kurose and Keith W. Ross, Addison Wesley Publishing Co.
3. Computer Networks: Protocols standards and interfaces, by Uyles Black, Prentice Hall.
4. Data communication & Networks, by Behrou A. Forouzan, Tata McGraw Hill.

Course Title: BIOMEDICAL INSTRUMENTATION AND ENGINEERING

Course Code: AI131606

L-T-P-C: 3-0-0-3

Class Hours/week	3
Expected weeks	12
Total hrs. of classes	36

MODULE	TOPIC	COURSE CONTENT	HOURS
1	INTRODUCTION	Classification and components of biomedical instrumentation, Physiological systems of the body: cardiac, nervous, muscular and respiratory systems. Engineering analogy of physiological system, Problems encountered in measuring a living system. Shock hazard from electrical equipment, Methods of accident prevention.	5
2	BIOELECTRIC POTENTIALS AND TRANSDUCERS	Resting and Action potentials, Propagation of action potential, types of bioelectric potential; Different types of transducers and their selection for Biomedical applications. Electrode theory, Different types of electrodes, Hydrogen calomel, Ag-Agcl, pH, PO ₂ , PCO ₂ electrodes.	6
3	CARDIOVASCULAR SYSTEM AND MEASUREMENTS	The heart and cardiovascular system. Measurement of blood pressure and flow, heart sounds, Cardiac output, Plethysmography, Pacemakers, Defibrillators. Electrocardiography leads. Vectorial analysis of normal ECG. Electrocardiography interpretation of cardiac abnormalities.	6
4	PATIENT MONITORING SYSTEM	Elements of intensive care monitoring. Diagnosis, calibration and reparability of patient monitoring equipment. Instrumentation for the mechanics of breathing. Respiratory therapy equipment. Temperature measurements. Ultrasonic measurements and diagnosis.	5

5	MEASUREMENTS OF NERVOUS, MUSCULAR AND RESPIRATORY SYSTEM	Measurement of electrical activities in muscles and brain: Electromyography; Electroencephalograph and their interpretation; pulmonary circulation, lung volume and lung capacities, Spirometer	5
6	BIOTELEMETRY	Physiological parameters adaptable to Biotelemetry. Components of a biotelemetry system. Implantable units. Application of telemetry in patient care.	4
7	MEDICAL IMAGING SYSTEMS	Instrumentation of diagnostic X-rays. Instrumentation for the medical use of radioisotopes. Radiation therapy: Principles of CAT scan. MRI, Ultrasonic transducers and Ultrasound imaging.	5

TEXTBOOKS / REFERENCES:

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers.
2. G. J. Thaler, "Automatic Control Systems", Jaico Publishing House.
3. M.Gopal, Modern Control System Theory, New Age International Publishers.

PRACTICALS

Course Title: MICROCONTROLLER AND APPLICATIONS LAB

Course Code: EC131611

L-T-P-C: 0-0-2-1

Expected No. of weeks : 12 (approx)

EXPERIMENT NO	AIM OF THE EXPERIMENT	HOURS
1	Write a program to add two 16 bit unsigned numbers 2040H and 202BH	3
2	Write a program to generate BCD up counter and send each count to port P1.	3
3	Write a program to find the maximum and minimum of 10 numbers stored in RAM.	3
4	Write a program to convert a 3-digit decimal number into corresponding three ASCII numbers.	3
5	Write a program to generate a square wave of 1KHz frequency on pin P1.0	3
6	Write a program to generate an accurate delay of 1ms using timer and use it to blink an LED with a frequency of 1Hz.	3
7	Write a program to read a keyboard using interrupt method and display the characters on the PC monitor screen	3
8	Write a program to interface a 16x2 character LCD with 8051 microcontroller and display characters on the LCD.	3
9	Write a program to interface a pushbutton momentarily ON switch with 8051 microcontroller using interrupt method and cause it to alternately turn ON/OFF an LED.	3
10	Write a program to interface a pushbutton momentarily ON switch with 8051 microcontroller using polling method and cause it to alternately turn ON/OFF an LED.	3
	TOTAL	30

Note: Program number from 1 to 3 will be written using assembly language. Rest of the programs from 4 to 10 will be written in C language and compiled using KEIL C compiler.

Course Title: PROCESS CONTROL LAB

Course Code: AI131613

L-T-P-C: 0-0-2-1

Expected No. of weeks : 12 (approx)

EXPERIMENT NO	AIM OF THE EXPERIMENT	HOURS
1	Study of Level measurement and control.	3
2	Study of Flow measurement and control.	3
3	Study of Force measurement and control.	3
4	Calibration of measuring instruments.	3
5	Study of Proportional, derivative and integral control action.	6
6	Study of PID controller.	6
	TOTAL	24

Course Title: INDUSTRIAL INSTRUMENTATION LAB

Course Code: AI131614

L-T-P-C: 0-0-2-1

Expected No. of weeks : 12 (approx)

EXPERIMENT NO	AIM OF THE EXPERIMENT	HOURS
1	Study of temperature measurement.	3
2	Study of load measurement.	3
3	Study of pressure measurement.	3
4	Study of linear displacement measurement.	3
5	Study of distance measurement.	3
6	Study of sound and vibration measurement.	3

7	Study of telemetry and remote control.	3
	TOTAL	21

Course Title: COMPUTER NETWORKS LAB

Course Code: CS131615

L-T-P-C: 0-0-2-1

Expected No. of weeks : 12 (approx)

EXPERIMENT NO	AIM OF THE EXPERIMENT	HOURS
1	Study of different network cables and devices.	3
2	Study of college LAN with references to network IP and design a LAN for it.	3
3	Study of basic network command and network configuration command	3
4	Study of LAN transmission media's, topologies, interconnection devices & LAN standards.	3
5	Write a program in 'C' for PC to PC communication using RS-232 port. Implement Dijkstra's algorithm to compute the Shortest path in a graph.	3
6	Study of Different network simulators for simulations	3

7	Token bus and token ring protocol To create scenario and study the performance of token bus and token ring protocols through simulation. Implement Transfer of files from PC to PC using Windows / Unix socket programming	3
8	Case study of client/server scenario. Observing the difference between UDP and TCP servers. To observe the working of TCP three-way-hand-shaking procedure. Locating different packets like, SYN, SYN-ACK and ACK. Comparing different fields of these packets	3
9	Write a program for Hamming Code generation for error detection and correction Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.	3
10	Study & Simulation of Routing Protocols using Standard Network Simulator	3
	TOTAL	30