G.B. TECHNICAL UNIVERSITY, LUCKNOW

Syllabus

3rd & 4th Year

[Effective from session 2009-10]

1. **B.Tech. Instrumentation & Control Engineering**
2. **B.Tech. Applied Electronics & Instrumentation Engineering**
3. **B.Tech. Electronics & Instrumentation Engineering**
4. **B.Tech. Electronics Instrumentation & Control Engineering**
5. **B.Tech. Instrumentation Engineering**

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.Tech. Instrumentation & Control Engineering, B.Tech. Applied Electronics & Instrumentation Engineering, B.Tech. Electronics & Instrumentation Engineering, B.Tech. Electronics Instrumentation & Control Engineering, B.Tech. Instrumentation Engineering
[Effective from the session 2009-10]

YEAR 2nd, SEMESTER-III

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EHU-301/ EHU-302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
2.	EAS-301/ EOE-031-EOE-038	Mathematics III/ Science based open Elective**	3	1	0	30	20	50	100	150	4
3.	EEC-301	Fundamentals of Electronics Devices	3	1	0	30	20	50	100	150	4
4.	EEC-302	Digital Electronics	3	1	0	30	20	50	100	150	4
5.	EEC-303	Electromagnetic Field Theory	3	1	0	30	20	50	100	150	4
6.	EEC-304	Fundamentals of Network Analysis & Synthesis	3	1	0	30	20	50	100	150	4
7.	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
8	EEC-351	Electronics Engineering Lab I	0	0	2	--	20	20	30	50	1
9.	EEC-352	Digital Electronics Lab-I	0	0	2	--	20	20	30	50	1
10.	EEC-353	PCB & Electronics Workshop	0	0	2	--	10	10	15	25	1
11.	GP 301	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**17**	**5**	**6**	**165**	**160**	**375**	**625**	**1000**	**26**

* Human Values & Professional Ethics will be offered as compulsory Audit Course for which passing marks are 40% in theory & 50% in aggregate. Students will be required to audit it within the period of their study. There will not be carry over facility for this course and a failure student will be required to repeat this course.

Note : Numbers of departmental subjects/labs in any semester may vary as per requirement keeping subject total and credit total unchanged.

** **Science based open Elective**

EOE031/EOE041 Introduction to soft computing (Neural network, Fuzzy logic and Genetic algorithm)
EOE032/EOE042 Nano-sciences
EOE033/EOE043 Laser systems and applications
EOE034/EOE044 Space sciences
EOE035/EOE045 Polymer science and technology
EOE036/EOE046 Nuclear science
EOE037/EOE047 Material science
EOE038/EOE048 Discrete mathematics

U.P. TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation Scheme

B.Tech. Instrumentation & Control Engineering, B.Tech. Applied Electronics & Instrumentation Engineering, B.Tech. Electronics & Instrumentation Engineering, B.Tech. Electronics Instrumentation & Control Engineering, B.Tech. Instrumentation Engineering

[Effective from the session 2009-10]

YEAR 2nd, SEMESTER-IV

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EHU-402/ EHU-402	Industrial Sociology/Industrial Psychology	2	0	0	15	10	25	50	75	2
2.	EOE-41-EOE-048/ EAS-401	Science based open Elective** / Mathematics III	3	1	0	30	20	50	100	150	4
3.	EEC-401	Electronic circuits	3	1	0	30	20	50	100	150	4
4.	EEC-403	Electronic Instrumentation and Measurements	3	1	0	30	20	50	100	150	4
5.	EEC-404	Signals and Systems	3	1	0	30	20	50	100	150	4
6.	EIC-401	Transducer and Sensors	3	1	0	30	20	50	100	150	4
7.	EHU-111	*Human Values & Professional Ethics	2	2	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
8.	EEC-451	Electronics Engineering Lab II	0	0	2	--	20	20	30	50	1
9	EIC-451	Transducer Lab	0	0	2	--	20	20	30	50	1
10	EEC-453	Measurement Lab	0	0	2	--	10	10	15	25	1
11.	GP 401	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**17**	**5**	**6**	**165**	**160**	**375**	**625**	**1000**	**26**

** **Science based open Elective**

EOE031/EOE041 Introduction to soft computing (Neural network, Fuzzy logic and Genetic algorithm)
EOE032/EOE042 Nano-sciences
EOE033/EOE043 Laser systems and applications
EOE034/EOE044 Space sciences
EOE035/EOE045 Polymer science and technology
EOE036/EOE046 Nuclear science
EOE037/EOE047 Material science
EOE038/EOE048 Discrete mathematics

Modified

G.B. TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation Scheme

B.Tech. Instrumentation & Control Engineering, B.Tech. Applied Electronics & Instrumentation Engineering, B.Tech. Electronics & Instrumentation Engineering, B.Tech. Electronics Instrumentation & Control Engineering, B.Tech. Instrumentation Engineering

[Effective from the session 2010-11]

YEAR 3rd, SEMESTER-V

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EHU 501	Engineering and Managerial Economics	3	1	0	30	20	50	100	150	3
2.	ECE 509	Fluid Mechanics	3	1	0	15	10	25	50	75	3
3.	EEC 501	Integrated Circuits	3	1	0	30	20	50	100	150	4
4.	EIC 501	Control Systems - I	3	1	0	30	20	50	100	150	4
5.	EIC 502	Industrial Instrumentation	3	1	0	30	20	50	100	150	4
6.	EEC 503	Microprocessors	3	1	0	15	10	25	50	75	3
7.	AUC 001	*Human Values & Professional Ethics	2	0	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
8.	EEC 551	Integrated circuits Lab	0	0	2	--	20	20	30	50	1
9.	EIC 551	Control Systems Lab I	0	0	2	--	20	20	30	50	1
10.	EIC 552	Instrumentation Lab	0	0	2	--	20	20	30	50	1
11.	EEC 553	Microprocessors Lab	0	0	2	--	20	20	30	50	1
12.	GP 501	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**18**	**6**	**8**	**150**	**180**	**380**	**620**	**1000**	**26**

Modified

G.B. TECHNICAL UNIVERSITY, LUCKNOW

Study and Evaluation Scheme

B.Tech. Instrumentation & Control Engineering, B.Tech. Applied Electronics & Instrumentation Engineering, B.Tech. Electronics & Instrumentation Engineering, B.Tech. Electronics Instrumentation & Control Engineering, B.Tech. Instrumentation Engineering

[Effective from the session 2010-11]

YEAR 3rd, SEMESTER-VI

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EHU 601	Industrial Management	3	0	0	30	20	50	100	150	3
2.		Departmental Elective-I	3	1	0	15	10	25	50	75	3
3.	EIC 602	Electrical Machines	3	1	0	15	10	25	50	75	3
4.	EIC 601	Microcontroller	3	0	0	30	20	50	100	150	4
5.	EEC 609	Communication Engineering	3	1	0	30	20	50	100	150	4
6.	EEC 602	Digital Signal Processing	3	1	0	30	20	50	100	150	4
7.	AUC001	*Human Values & Professional Ethics	2	0	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
8.	EIC 652	Seminar	0	0	2	--	50	50	-	50	1
9.	EEC 659	Communication Lab	0	0	2	--	20	20	30	50	1
10.	EIC 651	Microcontroller lab	0	0	2	--	20	20	30	50	1
11.	EEC 652	DSP Lab	0	0	2	--	20	20	30	50	1
12.	GP 601	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**18**	**5**	**8**	**150**	**210**	**410**	**590**	**1000**	**26**

LIST OF ELECTIVES:

Elective – I

1. EIC 011 Opto Electronics
2. EEC 012 Data Structure
3. EIC 012 Intelligent Instrumentation
4. EEC 603 Microwave Engineering

Syllabus third semester:

THEORY SUBJECTS

EEC 301 FUNDAMENTALS OF ELECTRONICS DEVICES			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Crystal Properties and charge Carriers in Semiconductors: Elemental and compound semiconductor materials, crystal lattice structure, Bonding forces and energy bands in solids, charge carriers in semiconductors, carrier concentrations, drift of carriers in electric and magnetic fields.	1.1 to 1.2 3.1 to 3.4	8
II	Excess Carriers in Semiconductors: Optical absorption, luminescence, carrier life time and photo conductivity, diffusion of carriers.	4.1 to 4.3 and 4.4.1 to 4.4.4	8
III	Junction Properties: Equilibrium conditions, biased junctions, steady state conditions, reverse bias break down, transient and AC conditions. Metal semiconductor junctions.	5.2 to 5.5 5.7	10
IV	Transistors: Metal-semiconductor-field-effect-transistors (MESFET), Metal-insulator-semiconductor-field-effect-transistors (MISFET), Metal oxide semiconductor field effect transistor (MOSFET): Construction, Operation and characteristics of above devices. Bipolar junction transistors: Fundamentals of BJT operation, amplification with BJTs,	6.3.1 to 6.3.2, 6.4.1 to 6.4.2, 6.5.1 to 6.5.2 7.1 to 7.2	6
V	Some special devices: Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, light emitting materials. Tunnel Diode: degenerate semiconductors, IMPATT diode; The transferred electron mechanism: The GUNN diode. P-N-P-N diode, semiconductor controlled rectifier (SCR), bilateral devices: DIAC, TRIAC, IGBT.	8.1, 8.2.1, 8.2.3, 8.3, 8.4; 10.1 10.2 10.3.1, 10.3.2 11.1 to 11.3	8
Text Book: B. G. Streetman and S. Banerjee "Solid state electronics devices", 5th Edition, PHI.			
Reference Books:1. Alok Dutta, "Semiconductor Devices and circuits", Oxford University Press. 2. Donald A Neaman, "Semiconductor Physics and Devices Basic Principles" 3rd Ed TMH India.			

EEC 302 DIGITAL ELECTRONICS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Digital system and binary numbers: Signed binary numbers, binary codes, cyclic codes, error detecting and correcting codes, hamming codes. Floating point representation Gate-level minimization: The map method up to five variable, don't care conditions, POS simplification, NAND and NOR implementation, Quine Mc-Clusky method (Tabular method).	1.6, 1.7, 7.4 3.1 to 3.7, 3.10	8
II	Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers	4.1 to 4.11	8
III	Synchronous Sequential logic: Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure. Registers and counters: Shift registers, ripple counter, synchronous counter, other counters.	5.1 to 5.5, 5.7 to 5.8 6.1 to 6.5	8
IV	Memory and programmable logic: RAM, ROM, PLA, PAL. Design at the register transfer level: ASMs, design example, design with multiplexers.	7.1 to 7.3, 7.5 to 7.7 8.4, 8.5, 8.10	8
V	Asynchronous sequential logic: Analysis procedure, circuit with latches, design procedure, reduction of state and flow table, race free state assignment, hazards.	9.1 to 9.7	8
Text Book: M. Morris Mano and M. D. Ciletti, "Digital Design", 4th Edition, Pearson Education			
Reference Books: 1. Hill & Peterson, "Switching Circuit & Logic Design", Wiley.			

EEC 303 Electromagnetic Field Theory			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Coordinate systems and transformation: Cartesian coordinates, circular cylindrical coordinates, spherical coordinates Vector calculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stoke's theorem, Laplacian of a scalar.	2.1 to 2.4 3.1 to 3.8	6
II	Electrostatics: Electrostatic fields, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses's Law – Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields. Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation and relaxation time, boundary condition. Electrostatic boundary value problems: Poission's and Laplace's equations, general procedures for soling Poission's or Laplace's equations, resistance and capacitance, method of images.	a. to 4.9 5.1 to 5.6, 5.8, 5.9 6.1, 6.2, 6.4 to 6.6	10
III	Magnetostatics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential. Magnetic forces, materials and devices: Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials, magnetic boundary conditions, inductors and inductances, magnetic energy.	7.1 to 7.7 8.1 to 8.9	8
IV	Waves and applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, displacement current, Maxwell's equation in final form. Electromagnetic wave propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plain waves in good conductors, power and the pointing vector, reflection of a plain wave in a normal incidence.	9.1 to 9.5 10.1, 10.3 to 10.8	8
V	Transmission lines: Transmission line parameters, Transmission line equations, input impedance, standing wave ratio and power, The Smith chart, Some applications of transmission lines.	11.1 to 11.6	8
Text Book: M. N. O. Sadiku, "Elements of Electromagnetics", 4th Ed, Oxford University Press.			
Reference Books: W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th Ed., TMH.			

EEC 304 FUNDAMENTAL OF NETWORK ANALYSIS & SYNTHESIS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Signal analysis, complex frequency, network analysis, network synthesis General characteristics and descriptions of signals, step function and associated wave forms, The unit impulse Introduction to network analysis, network elements, initial and final conditions, step and impulse response, solution of network equations,	1.1 to 1.4 2.1 to 2.3 5.1 to 5.5	10
II	Review of Laplace transforms, poles and zeroes, initial and final value theorems, The transform circuit, Thevenin's and Norton's theorems, the system function, step and impulse responses, the convolution integral. Amplitude and phase responses. Network functions, relation between port parameters, transfer functions using two port parameters, interconnection of two ports.	7.1 to 7.5 8.1 9.1 to 9.4	8
III	Hurwitz polynomials, positive real functions. Properties of real immittance functions, synthesis of LC driving point immittances, properties of RC driving point impedances, synthesis of RC impedances or RL admittances, properties of RL impedances and RC admittances.	10.2,10.3 11.1 to 11.5	8
IV	Properties of transfer functions, zeroes of transmission, synthesis of Y_{21} and Z_{21} with 1Ω terminations.	12.1 to 12.3	6
V	Introduction to active network synthesis Active Network Synthesis	Material available on UPTU website & 8.7 (Text Book 2)	8

Text Book:

1. Franklin F. Kuo, "Network Analysis and synthesis", 2nd Edition, Wiley India Pvt Ltd.
2. Behrouz Peikari, "Fundamentals of Network Analysis & synthesis", Jaico Publishing House, 2006.

Reference Books: M. E. Van Valkenberg, "Network Analysis", 2nd Edition, Prentice Hall of India Ltd.

LABORATORY

EEC 351 ELECTRONICS ENGINEERING LAB I

Objective: To attain expertise in lab equipment handling and understanding the basic devices, their properties, characteristics in detail. Along with their practical usage in the circuit

1. **Study of lab equipments and components:** CRO, Multimeter, Function Generator, Power supply-Active, Passive Components & Bread Board.
2. **P-N Junction Diode**: Characteristics of PN Junction diode-Static and dynamic resistance measurement from graph.
3. **Applications of PN junction diode**: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor-use of filter- ripple reduction (RC Filter)-Clipper & Clamper
4. **Properties of junctions** Zener diode characteristics. Heavy doping alters the reverse characteristics. Graphical measurement of forward and reverse resistance.
5. **Application of Zener diode:** Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.
6. **Characteristic of BJT**: BJT in CB and CE configuration- Graphical measurement of h parameters from input and output characteristics. Measurement of A_v, A_I, R_o and R_i of CE amplifier with potential divider biasing.
7. **Characteristic of FET**: FET in common source configuration. Graphical measurement of its parameters gm, rd & m from input and output characteristics.
8. **Characteristic** of silicon-controlled rectifier.
9. **To plot** V-I Characteristics of DIAC.
10. **To draw** V-I characteristics of TRIAC for different values of Gate Currents.

EEC 352 DIGITAL ELECTRONICS LAB

Objective: To understand the digital logic and create various systems by using these logics.

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of V_{cc} and ground, verification of the truth tables of logic gates using TTL ICs.
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
4. Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.
5. Implementation of 4x1 multiplexer using logic gates.
6. Implementation of 4-bit parallel adder using 7483 IC.
7. Design, and verify the 4-bit synchronous counter.
8. Design, and verify the 4-bit asynchronous counter.
9. Mini Project.

EEC 353 ELECTRONIC WORKSHOP & PCB LAB

Objective: To create interest in Hardware Technology.

1. Winding shop: Step down transformer winding of less than 5VA.
2. Soldering shop: Fabrication of DC regulated power supply
3. PCB Lab: (a) Artwork & printing of a simple PCB.
   (b) Etching & drilling of PCB.
4. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.
5. Testing of regulated power supply fabricated.

Fabricate and test the audio amplifier circuit by using above power supply

Syllabus fourth semester:

THEORY SUBJECTS

EEC 401 Electronic circuits			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	**Operational Amplifier:** Inverting and non-inverting configurations, difference amplifier, Effect of finite open loop gain and bandwidth on circuit performance, Large signal operation of op-amp.	2.2 to 2.6	8
II	**MOSFET:** Review of device structure operation and V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier	4.3 to 4.9 and 4.11	8
III	**BJT:** Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier.	5.3 to 5.9	8
IV	**Differential Amplifier:** MOS differential pair, small signal operation of the MOS differential pair, BJT differential pair, other non-ideal characteristic of the Differential amplifier (DA), DA with active load.	7.1 to 7.5	9
V	**Feedback:** The general feed back structure, properties of negative feed back, the four basic feed back topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier. **Oscillators:** Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator.	8.1 to 8.6 13.1 to 13.3	4+3
Text Book: A. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, 5th Ed.			
Reference Books: **1.** Neamen D A, "Electronics Circuits", 3rd Ed TMH **2.** Jacob Millman and Arvin Grabel, "Microelectronics", 2nd Ed TMH			

EEC 403 Electronic Instrumentation and Measurements			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, Other unit systems, dimension and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter,	1.1 to 1.7 2.1 to 2.5 3.1 to 3.4	8
II	Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, multimeter probes Digital voltmeter systems, digital multimeters, digital frequency meter system	4.1, 4.2, 4.4, 4.5, 4.7 6.1 to 6.3	8
III	Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter	7.1, 7.3, 7.4, 7.5 8.2 to 8.4, 8.9	8
IV	CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications	9.1, 9.3, 9.4, 9.5, 9.7, 9.9, 9.12 10.1, 10.3, 10.4, 10.5	8
V	Instrument calibration: Comparison method, digital multimeters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters	12.1, 12.2, 12.3 13.2, 13.4	8

Text Book: David A. Bell, "Electronic Instrumentation and Measurements", 2nd Ed., PHI , New Delhi 2008.

Reference Books:

1. Oliver and Cage, "Electronic Measurements and Instrumentation", TMH, 2009.
2. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Buterworth Heinmann), 2008.

EEC 404 Signals and Systems			3 1 0
Unit No.	Topics	Chapter/ Section	Proposed number of Lectures
I	**Signals:** Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one-dimensional/multi-dimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their inter-relationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables).	1.1 to 1.5	6
II	**Laplace-Transform (LT) and Z-transform (ZT):** (i) One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping	2.1 to 2.15	3+5
III	**Fourier Transforms (FT):** (i) Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT (ii) Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT	4.1 4.11; 5.1 to 5.7	6+4
IV	**Systems:** Classification, linearity, time-invariance and causality, impulse response, characterization of linear time-invariant (LTI) systems, unit sample response, convolution summation, step response of discrete time systems, stability. convolution integral, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density,	7.1 to 7.12; 9.2, 9.6 to 9.8	8
V	**Time and frequency domain analysis of systems** Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter	8.1-8.6; 8.8	10
Text Book: P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi			
Reference Books: 1. Chi-Tsong Chen, `Signals and Systems', 3rd Edition, Oxford University Press, 2004 2. V. Oppenheim, A.S. Willsky and S. Hamid Nawab, 'signals & System',PEARSON Education, Second Edition, 2003.			

EIC 401 Transducers and Sensors			3 1 0
Unit No.	Topics	Chapter/ Section	Proposed number of Lectures
I	**Generalised configurations, functional description & performance characteristics of measuring instruments**: Functional elements of an instrument; active & passive transducers; analog & digital modes of operation; null & deflection methods; I/O configuration of measuring instruments & instrument system – methods of correction for interfering & modifying inputs. Generalized performance characteristics of Instruments: Static characteristics and static calibration- Meaning of static calibration, measured value versus true value, Some basic statistics least square calibration curves, calibration accuracy versus installed accuracy, Combination of component errors in overall system accuracy calculations, static sensitivity, linearity, threshold,	2.1 to 2.5 3.2.1 to 3.2.6, 3.2.8 to 3.2.13	08

	noise floor, resolution, hysteresis and dead space. Scale readability. Span, Generalized static stiffness & input impedance.		
II	**Motion and Dimensional measurement**: Fundamental standards, relative displacements- translational and rotational, Calibration, Resistive potentiometers, differential transformers, variable inductance & variable reluctance pickups, capacitance pickup, Piezo-electric transducers, digital displacement transducers, Relative velocity Translational and rotational, calibration, velocity by electrical differentiation of displacement voltage signals, average velocity from measure Δx and Δt, mechanical fly ball angular velocity sensor, mechanical revolution counters and timers, tachometer encoder methods, stroboscopic method, translational velocity transducer, eddy current Drag-cup tachometer, Gyroscopic angular displacement and velocity sensors.	4.3.1 to 4.3.5, 4.3.7 to 4.3.10, 4.4.1 to 4.4.6, 4.4.8 to 4.4.10, 4.11	08
III	**Force, Torque, Shaft power and Pressure measurement**: Standards & calibration; basic methods of force measurement; characteristics of elastic force transducer-Bonded strain gauge, differential transformer, Piezo electric transducer, variable reluctance/FM-oscillator, digital systems. Loading effects; Torque measurement on rotating shafts, shaft power measurement (dynamometers). Basic methods of pressure measurement; dead weight gauges & manometer, manometer dynamics; elastic transducers; high pressure measurement; low pressure (vacuum) measurement – McLeod gage, Knudsen gage, momentum-transfer (viscosity) gages, thermal conductivity gages, ionization gages, dual gage technique.	5.1 to 5.5 6.1, 6.3, 6.4, 6.7 6.8, 6.8.2, 6.8.4 to 6.8.7	8
IV	**Flow measurement**: Local flow velocity, magnitude and direction. Flow visualization. Velocity magnitude from pilot static tube. Velocity direction from yaw tube, pivoted vane, servoed sphere, dynamic wind vector indicator. Hot wire and hot film anemometer. Hot-film shock-tube velocity sensor. Laser Doppler anemo-meter; gross volume flow rate: calibration and standards. Constant-area, variable-pressure-drop meters (obstruction meters). Averaging pitot tubes. Constant pressure drop, variable area meters (Rota meters), turbine meters, positive displacement meters. Metering pumps. Electromagnetic flow meters. Drag force flow meters. Ultrasonic flow meters, vortex shedding flow meters.	7.1 to 7.2	08
V	**Temperature measurement**: Standards & calibration; thermal expansion methods- bimetallic thermometers, liquid-in-glass thermometers, pressure thermometers; thermoelectric sensor (thermocouple) – common thermocouple, reference junction considerations, special materials, configuration & techniques; electrical resistance sensors – conductive sensor (resistance thermometers), bulk semiconductor sensors thermistors), bulk semiconductor sensors (thermistors); junction semiconductor sensors; digital thermometers. Radiation Methods – radiation fundamentals, radiation detectors: thermal and photon, automatic null-balance radiation thermometers, monochromatic brightness radiation thermometers, two colour radiation thermometers, black body tipped fiber optic radiation thermometer, fluoroptic temperature measurement, infrared imaging systems.	8.1 to 8.7	08
Text Books: E. DOEBELIN and D. N. Manik, "Measurement systems application and design", 5th Ed., TMH, 2007, New Delhi.			

LABOROTARY

EEC 451 ELECTRONICS ENGINEERING LAB II

Objective -To design and implement the circuits to gain knowledge on performance of the circuit and its application.

1. **Measurement of Operational Amplifier Parameters-**Common Mode Gain, Differential Mode Gain, CMRR, Slew Rate.
2. **Applications of Op-amp**- Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator
3. **Field Effect Transistors**- Single stage Common source FET amplifier –plot of gain in dB Vs frequency, measurement of, bandwidth, input impedance, maximum signal handling capacity (MSHC) of an amplifier
4. **Bipolar Transistors**- Design of single stage RC coupled amplifier –design of DC biasing circuit using potential divider arrangement –Plot of frequency Vs gain in dB. Measurement of bandwidth of an amplifier, input impedance and Maximum Signal Handling Capacity of an amplifier.
5. **Two stage Amplifier**. Plot of frequency Vs gain. Estimation of Q factor, bandwidth of an amplifier
6. **Common Collector Configuration-Emitter Follower** (using Darlington pair)-Gain and input impedance measurement of the circuit.
7. **Power Amplifiers-**Push pull amplifier in class B mode of operation –measurement of gain.
8. **Differential Amplifier** –Implementation of transistor differential amplifier .Non ideal characteristics of differential amplifier
9. **Oscillators** -Sinusoidal Oscillators- (a) Wein-bridge oscillator (b) phase shift oscillator
10. **Simulation of Amplifier** circuits studied in the lab using any available simulation software and measurement of bandwidth and other parameters with the help of simulation software.

EIC 451 TRANSDUCER LAB

1. Characteristics of resistance transducer
   - (i.) Potentiometer
   - (ii.) Strain Gauge/ Measurement of Strain using quarter, half and full bridge.
2. Characteristics of LVDT.
3. Characteristics of capacitance transducer:
   - (i) Variable area
   - (ii) Variable distance.
4. Characteristics of Thermistors
5. Characteristics of RTD.
6. Thermocouples and AD590.
7. Characteristics of LDR, Photo Diode, and Phototransistor:
   - (i) Variable Illumination.
   - (ii) Linear Displacement.
8. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
9. Measurement of Capacitance by de'Sautys and Schering Bridge.
10. Measure of low resistance by Kelvin's double bridge.
11. Characteristics of diaphragm type pressure transducer.
12. Characteristics of one Solid State sensor/ Fiber optic sensor,

EEC 453 MEASUREMENT LAB

1. Study of semiconductor diode voltmeter and its us as DC average responding AC voltmeter .
2. Study of L.C.R. bridge and determination of the value of the given components.
3. Study of distortion factor meter and determination of the % distortion of the given oscillator.
4. Study of the transistor tester and determination of the parameters of the given transistors.
5. Study of the following transducer (i) PT-100 trans (ii) J- type trans. (iii) K-type trans (iv) Presser trans
6. Measurement of phase difference and frequency using CRO (lissajous figure)
7. Measurement of low resistance Kelvin's double bridge.
8. Radio Receiver Measurements

Fifth Semester Syllabus: **Theory Subjects**

(Revised) **ECE 509 Fluid Mechanics**			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Introduction: Fluids and continuum: Physical properties of fluids, ideal and rear fluids, Newtonian and non-Newtonian fluids, measurement of surface tension. Kinematics of Fluid Flow: Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, one, two and three dimensional flows, streamlines, streak lines and path lines, continuity equation, rotation and circulation, elementary explanation of stream function and velocity potential, graphical and experimental methods of drawing flow nets. Fluid statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies.		8
II	Dynamics of Fluid flow: Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications-Pitot tube, flow through orifices, mouthpieces, nozzles, notches, free and forced vortex, momentum equation and its application to stationary and moving vanes, pipe bends, Problems related to combined application of energy and momentum equations, flow measurements.		8
III	Laminar and Turbulent Flow: Equation of motion for laminar flow through pipes, Stoke's law, flow between parallel plates, flow through porous media, fluidization, measurement of viscosity, transition from laminar to turbulent flow, turbulent flow, equation for turbulent flow, eddy viscosity, mixing length concept and velocity distribution in turbulent flow, Hot-wire anemometer and LDA.		8
IV	(a) Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham's theorem, important dimensionless numbers and their significance, geometric, Kinematic and dynamic similarity, model studies. (b) Introduction to Boundary Layer. (c) Flow past Submerged Bodies: Drag and lift, drag on a sphere, cylinder and disc, lift magnus effect and circulation.		8
V	(a) Pipe Flow: Nature of turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, resistance coefficient and its variation, flow in sudden expansion, contraction, diffusers, bends, valves and siphons, concept of equivalent length, branched pipes, pipes in series and parallel, simple networks. (b) Compressibility Effects in pipe flow: Transmission of pressure waves in rigid and elastic pipes, water hammer, and analysis of simple surge tank excluding friction.		8

Text & Reference Book:

1. Som and Biswas, "Introduction to fluid mechanics and machines", TMH
2. S. K. Agrawal, "Fluid mechanics and machinery", TMH
3. R. J. Garde, A. G. Mirajgaoker, "Engineering fluid mechanics including hydraulic machines", Nemchand & Bros, Roorkee, 2nd Edition, 1983.

(Revised) **EEC 501 INTEGRATED CIRCUITS**			3 1 0
Unit	Topic	Chapter/ Section From Text [1]	Proposed number of Lectures
I	**Analog Integrated circuit Design: an overview:** Current Mirrors using BJT and MOSFETs, Simple current Mirror, Base current compensated current Mirror, Wilson and Improved Wilson Current Mirrors, Widlar Current source and Cascode current Mirror **The 741 IC Op-Amp:** Bias circuit, short circuit protection circuitry, the input stage, the second stage, the output stage, and device parameters; D**C** Analysis of 741: Small Signal Analysis of input stage, the second stage, the output stage; Gain, Frequency Response of 741; a Simplified Model, Slew Rate, Relationship Between f_t and SR	5.6, 6.4, 6.5 10.1-10.6	8
II	**Linear Applications of IC op-amps:** An Overview of Op-Amp (ideal and non ideal) based Circuits V-I and I-V converters, generalized Impedance converter, simulation of inductors Filters: First and second order LP, HP, BP BS and All pass active filters, KHN, Tow-Thomas and State Variable Biquad filters; Sinusoidal oscillators	2.2-2.7 11.4, 11.7, 12.1, 12.2	8
III	**Digital Integrated Circuit Design-An Overview**: CMOS Logic Gate Circuits**:** Basic Structure CMOS realization of Inverters, AND, OR, NAND and NOR Gates Latches and Flip flops**:** The Latch, The SR Flip-flop, CMOS Implementation of SR Flip-flops, A Simpler CMOS Implementation of the Clocked SR Flip-flop, D Flip-flop Circuits.	13.2-13.3 13.7	8
IV	**Non-Linear applications of IC Op-amps:** Log–Anti Log Amplifiers, Precision Rectifiers, Peak Detectors, Simple and Hold Circuits, Analog Multipliers and their applications. Op-amp as a comparator, Zero crossing detector, Schmitt Trigger, Astable multivibrator, Monostable multivibrator, Generation of Triangular Waveforms	12.1, 12.4, 12.5 12.9	8
V	**D/A and A/D converters** **Integrated Circuit Timer:** The 555 Circuit, Implementing a Monostable Multivibrator Using the 555 IC, Astable Multivibrator Using the 555 IC. **Phase locked loops (PLL):** Ex-OR Gates and multipliers as phase detectors**,** Block Diagram of IC PLL, Working of PLL and Applications of PLL.	10.9-10.11 12.7 6.5 of Ref [2]	8

Text Book:
[1] Sedra and Smith, "Microelectronic Circuits", 4th Edition, Oxford University Press.

Reference Books:
[2] Michael Jacob, `Applications and Design with Analog Integrated Circuits', PHI, 2nd Edn, 2006
[3] Jacob Milliman and Arvin Grabel, "Microelectronics", 2nd Edition, TMH, 2008.

Unit	EIC 501 CONTROL SYSTEM - I	Text Book/ Chapter	Lectures
I	Introduction: Basic Components of a control system, Feed back and its effect, types of feed back control systems. Block diagrams and signal flow graphs, Modeling of Physical systems	1.1 to 1.3 3.1 to 3.2 4.1 to 4.3, 4.5 to 4.6	8
II	State-Variable Analysis: Introduction, Vector matrix representation of State equation, State Transition Matrix, State-Transition Equation, Relationship between State Equations and High-order Differential Equations, Relationship between State Equations and Transfer Functions.	5.1 to 5.6	8
III	Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, the unit step response and time-domain specifications, Steady-State error, Time response of a First order system, Transient response of a Prototype second order system	7.1 to 7.6	8
IV	Stability of Linear Control Systems: Introduction, Bounded-Input Bounded-output Stability Continuous Data Systems, Zero-input and asymptotic stability of continuous data systems, Methods of determining stability, RH criterion.	6.1 to 6.5	8
V	Frequency Domain Analysis: Introduction: Mr ωr and Bandwidth of the Prototype Second Order System ,Effects of Adding a zero to the Forward path, Effects of Adding a pole to the Forward Path, Nyquist Stability criterion, Relative Stability: Gain Margin and Phase Margin, Stability Analysis with the Bode Plot	9.1to 9.11	10
Text Book: B.C. Kuo, "Automatic Control Systems" ,8th Edition, John Wiley			
Reference Books: 1. I. J Nagrath & M Gopal, Control System Engineering; New Age International publishers 2. ,Joseph J Distefano III, Allen R Stubberud, Ivan J Williams, Control Systems Shaums out lines Series , 3rd Edition, Mc Graw Hill.			

EIC 502 INDUSTRIAL INSTRUMENTATION		3 1 0
Unit	Topic	Proposed number of Lectures
I	Units of pressure and vacuum, Different type of manometers, diaphragm gauges bellows and force balance type sensors, Boudern guage, Piezoelectric, Capacitive and Inductive Pressure pickups. **Vacuum pressure measurements:** Meleod gauge, Pirani gauge, thermocouple gauge, Knudsen gauge Ionization calibration procedures, Temperature measurements, standards and calibration procedures.	8
II	Temperature measurements: Standards and calibration, thermal expansion methods, bimetallic thermometer, Liquid-in-gas (thermocouples) common thermocouples, Resistance thermometers: bulk semiconductor sensors. Radiation thermometers, automatic null balance radiation thermometers. Optical pyrometers.	8
III	Differential pressure flowmeters: Bernoulli's theorem: pitut tube orifice, vanturi, flow nozzle, Hot wire and hot film anemometers, constant pressure drop, variable area meters (rotameter), turbine meters, Electromagnetic flow meters, Ultrasonic flowmeters, Measurement of level, Float type gauge, purge method, differential pressure method, conductive and capacitive method; electromechanical method, use of radioscope for level measurement.	8
IV	Measurement of weight- Load cell method, strain gauge, LVDT; piezoelectric, pneumatic and hydraulic load cell, null balance method. Conveyor belt weighting for on line measurement of viscosity, definition of absolute and kinematic viscosity, industrial viscosity meter.	8
V	Measurement of Moisture, Thermal Dying Method, Distillation Method, Chemical Reaction Method, Electrical Method.	8

Text & Reference Book:

1. Doeblin/Measurements systems: Applications and Design, 4th ed. / Mc.Graw Hill.
2. Beckwith & Beck/Mechanical Measurements/Narona Publishers, 1988.
3. Eckman/Industrial Instrumentation/Wiley Eastern Ltd.
4. Nakra/Instrumentation: Measurements & Analysis/Tata Mc. Graw Hill

EEC 503 MICROPROCESSORS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Introduction to Microprocessor, Microprocessor architecture and its operations, Memory, Input & output devices, Logic devices for interfacing, The 8085 MPU, Example of an 8085 based computer, Memory interfacing.	1.1, 3.1, 3.2, 3.3, 3.5, 4.1, 4.2, 4.3,	8
II	Basic interfacing concepts, Interfacing output displays, Interfacing input devices, Memory mapped I/O, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing.	5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4, 6.5, 7.1	8
III	Additional data transfer and 16 bit arithmetic instruction, Arithmetic operations related to memory, Logic operation: rotate, compare, counter and time delays, Illustrative program: Hexadecimal counter, zero-to-nine, (module ten) counter, generating pulse waveforms, debugging counter and time delay, Stack, Subroutine, Restart, Conditional call and return instructions, Advance subroutine concepts, The 8085 Interrupts, 8085 vector interrupts.	7.2, 7.3, 7.4, 7.5, 8.1, 8.2, 8.3, 8.4, 8.5, 9.1, 9.2, 9.3, 9.4, 12.1, 12.2	8
IV	Program: BCD-to-Binary conversion, Binary-to-BCD conversion, BCD-to-Seven segment code converter, Binary-to-ASCII and ASCII-to-Binary code conversion, BCD Addition, BCD Subtraction, Introduction to Advance instructions and Application, Multiplication, Subtraction with carry.	10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9	8
V	8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller. Introduction to 8086 microprocessor: Architecture of 8086 (Pin diagram, Functional block diagram, Register organization).	15.1, 15.2, 15.4, 15.5, 15.6, 2.11*, 2.12*	8
Text Book: 1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Penram International Publication (India) Pvt. Ltd. 2. * Douglas V. Hall, "Microprocessors and Interfacing", 2nd Edition, TMH, 2006.			
Reference Book: Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson Education Inc.			

LABOROTARY

EEC 551 INTEGRATED CIRCUITS LAB

Objective: - To design and implement the circuits to gain knowledge on performance of the circuit and its application. These circuits should also be simulated on Pspice.

1. Log and antilog amplifiers.
2. Voltage comparator and zero crossing detectors.
3. Second order filters using operational amplifier for–
    a. Low pass filter of cutoff frequency 1 KHz.
    b. High pass filter of frequency 12 KHz.
    c. Band pass filter with unit gain of pass band from 1 KHz to 12 KHz.
4. Wien bridge oscillator using operational amplifier.
5. Determine capture range; lock in range and free running frequency of PLL.
6. Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50 mA.
7. A/D and D/A convertor.
8. Voltage to current and current to voltage convertors.
9. Function generator using operational amplifier (sine, triangular & square wave)
10. Astable and monostable multivibrator using IC 555.

EIC 551 CONTROL SYSTEM LAB I

1. DC SPEED CONTROL SYSTEM
   (a) To study D.C. speed control system on open loop and close loop.
   (b) To study of Transient performance, another time signal is added at the input of control Circuit.
   (c) To study how eddy current breaking is being disturbance rejected by close and open loop.
2. DC MOTOR POSITION CONTROL
   (a) To study of potentiometer displacement constant on D.C. motor position control.
   (b) To study of D. C. position control through continuous command.
   (c) To study of D.C. position control through step command.
   (d) To study of D.C. position control through Dynamic response.
3. AC MOTOR POSITION CONTROL
   (a) To study of A.C. motor position control through continuous command.
   (b) To study of error detector on A.C. motor position control through step command.
   (c) To study of A.C. position control through dynamic response.
4. MAGNETIC AMPLIFIER
   (a) To study Input / Output characteristic of a magnetic amplifier in mode (i) Saturable Reactor, (ii) Self Saturable Reactor.
5. SYNCHRO TRANSMITTER / RECEIVER
   (a) To study of Synchro Transmitter in term of Position v/s Phase and voltage magnitude with respect to Rotor Voltage Magnitude/Phase.
   (b) To study of remote position indication system using Synchro-transmitter/receiver.
6. PID CONTROLLER
   (a) To observe open loop performance of building block and calibration of PID Controls.
   (b) To study P, PI and PID controller with type 0 system with delay.
   (c) To study P, PI and PID controller with type 1 system.
7. LEAD LAG COMPENSATOR
   (a) To study the open loop response on compensator.
   (b) Close loop transient response.
8. LINEAR SYSTEM SIMULATOR
   (a) Open loop response
   (i) Error detector with gain, (ii) Time constant, (iii) Integrator
   (b) Close loop system
   (I) First order system (II) Second order system (III) Third order system
9. Introduction to MATLAB (Control System Toolbox), Implement at least any two experiment in MATLAB.
    a. Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox.
    b. Determine transpose, inverse values of given matrix.
    c. Plot the pole-zero configuration in s-plane for the given transfer function.
    d. Determine the transfer function for given closed loop system in block diagram representation.
    e. Plot unit step response of given transfer function and find peak overshoot, peak time.

f. Plot unit step response and to find rise time and delay time.
g. Plot locus of given transfer function, locate closed loop poles for different values of k.
h. Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.
i. Plot bode plot of given transfer function.
j. Plot bode plot of given transfer function and find gain and phase margins
k. Plot Nyquist plot for given transfer function and to compare their relative stability
l. Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

EIC 552 INSTRUMENTATION LAB

1. Instrumentation Amplifier: Design for specific gain and verification of CMRR.
2. Realization of PCM signal using ADC and reconstruction using DAC using 4-bit/8 bit systems. Observe the Quantization noise in each case.
3. Study of Storage Oscilloscope & Transient response of RLC.
4. Convert a given AC Analog signal into digital using S/H & ADC and recover the analog signal using DAC IC.
5. Study of Characteristics of a Strain Gauge.
6. Construction of chopper amplifier.
7. Study of low noise and low frequency amplifier for biomedical application.
8. Study of Piezoelectric transducer.
9. Study of Capacitive and Inductive Pressure pickups.

Note :-In addition, Institutes may include two more experiments based on the expertise.

EEC 553 MICROPROCESSOR LAB

1. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085.
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program to arrange an array of data in ascending and descending order.
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085 instruction set.
7. To write a program to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmable interval timer to 8085 and verify the operation of 8253 in six different modes.
9. To interface DAC with 8085 to demonstrate the generation of square, saw tooth and triangular wave.
10. Serial communication between two 8085 through RS-232 C port.

Note :-In addition, Institutes may include two more experiments based on the expertise.

Sixth Semester Syllabus: **Theory Subjects**

EIC 601 MICROCONTROLLER			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Introduction , Microcontrollers and Embedded processors, Overview of the 8051, Inside the 8051, Addressing modes,	0.3, 1.1, 1.2, 2.1, 5.1-5.4,	6
II	Introduction to 8051 assembly programming, Assembling and running an 8051 program, The program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and the PSW register, 8051 register banks and stack, 8051 I/O programming, I/O bit manipulation programming.	2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 4.1, 4.2	8
III	Programming the 8051 timers, Counter programming, Basics of serial communications, 8051 connection to RS-232, 8051 serial port programming assembly, 8051 interrupts, Programming timer interrupts, programming external hardware interrupts, programming the Serial communication interrupts, Interrupts priority in the 8051,	9.1, 9.2, 10.1, 10.2, 10.3, 11.1, 11.2, 11.3, 11.4, 11.5	10
IV	Interfacing with 8051: Memory address decoding 8031/ 51 interfacing with external ROM, 8051 data memory space, LCD, Keyboard, Parallel and Serial ADC, DAC interfacing, Sensor interfacing and Signal Conditioning, Stepper motor and DC motor,	14.2, 14.3, 14.4, 12.1, 12.2, 13.1, 13.2, 13.3, 17.2, 17.3,	10
V	Programming the 8255 and Interfacing, Introduction to Intel 8096 and MC68HC11 microcontroller*.	15.1, 15.2, Text Book 2: Ch. 3 & 4	6

Text Book:

1. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and McKinlay Rolin D., " The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson, 2nd Edition.
2. Chhabra Bhupendra Singh, "Microcontrollers & its Applications" Dhanpat Rai Publishing Company

Reference Book:

1. Ayala Kenneth, "The 8051 Microcontroller", Cengage Learning, 3rd Edition
2. Shah Satish, " 8051 Microcontrollers MCS 51 Family and its variants", Oxford
3. Ghoshal Subrata, " 8051 Microcontroller Internals, Instructions, Programming and Interfacing" Pearson

EIC 602 ELECTRICAL MACHINES			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Basic concept of rotating machines: Elementary machines – synchronous machines, dc machine, generated emf, rotating magnetic field, torque in round rotor machines. Operations of Basic Machine types – synchronous, asynchronous, ac machines, dc machines, matching characteristics of electric machines and load.	5.1-5.3, 5.5 – 5.7, 5.11	8
II	DC Machine: Introduction, emf equation, torque equation, power balance, linear magnetization, circuit model, generating mode, motoring mode, armature reaction, compensating winding, commutation, method of excitation, characteristics of dc shunt, series and compound motors and generators. Starting of dc motor, speed control of dc motor, breaking of dc motor.	7.1-7.8, 7.11-7.15	8
III	Synchronous machines: Introduction of basic synchronous machine model, circuit model of synchronous machine, determination of armature reaction ampere turn and leakage reactance of synchronous machine, synchronizing to infinite bus bar, operating characteristics, power flow equations, parallel operation of synchronous generators, hunting in synchronous machines.	8.2 – 8.5, 8.7 – 8.9, 8.12, 8.13	8
IV	Induction Motor: Introduction, construction, flux and mmf phasor in induction motors, slip and frequency of rotor currents, rotor emf, power, induction motor phasor diagram, torque slip characteristics, determination of equivalent circuit parameters, circle diagram, starting of induction motor, speed control.	9.1 – 9.10	8
V	Single Phase Motors: Introduction, types of single phase motor, single phase induction motor, split phase motors, single phase commutator motor, single phase synchronous motor, stepper motor.	10.1 – 10.6	8
Text Book: D P Kothari & I J Nagrath, "Electric Machines", Tata McGraw Hill Education Pvt Ltd, 3rd Edition, 2004.			
Reference Books: A. Fitzgerald, C. Kingsley and S Umans , "Electric Machinery", Tata McGraw Hill Education Pvt Ltd, 6th Edition, 2002.			

EEC 609 COMMUNICATION ENGINEERING			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	**1. Introduction:** The Communication Process, The Layered Approach, Example of communication **2. Amplitude Modulation:** Introduction, Amplitude modulation, Double Sideband-Suppressed Carrier modulation, Quadrature-Carrier Multiplexing, Single-Sideband and Vestigial-Sideband Methods of modulation, VSB Transmission of Analog and Digital Television, Frequency Translation, Frequency-Division Multiplexing	1.1 to 1.3 3.1 to 3.8	8
II	**3. Phase and Frequency Modulation:** Introduction, Basic Definitions, Frequency Modulation, Phase-Locked Loop, Nonlinear Effects in FM Systems, The Super-heterodyne Receiver, Analog and Digital FM Cellular Telephones	4.1 to 4.7	8
III	**4. Noise in Analog Modulation:** Introduction, Receiver Model, Noise in DSB-SC Receivers, Noise in AM receivers, Noise in FM Receivers, Pre-emphasis and De-emphasis in FM **5. Digital Representation of Analog Signals:** Introduction, Digitization of Analog Sources, The Sampling Process, Pulse-Amplitude Modulation, Time-Division Multiplexing, Pulse-Position Modulation, PPM in Impulse Radio, The Quantization Process, Pulse-Code Modulation, Delta Modulation, Digitization of Video and MPEG,	6.1 to 6.6 7.1 to 7.10	8
IV	**6. Base band Transmission of digital Signals:** Introduction, Baseband Pulses and matched Filter Detection, Probability of Error Due to Noise, Inter symbol Interference, Eye Pattern, Nyquist Criterion for Distortion less Transmission, Baseband M-ary PAM Transmission, Tapped Delay Line Equalization, Transmission of 100 Mbps Over Twisted Pair	8.1 to 8.9	8
V	**7. Band-Pass Transmission of Digital Signals:** Introduction, band-Pass Transmission Model, Transmission Binary PSK and FSK, M-ary Data Transmission Systems, Comparison of Noise Performances of various PSK and FSK ?Systems, Orthogonal Frequency Division Multiplexing (OFDM), **8. Information and Forward Error Correction:** Introduction, uncertainty, Information and Entropy, Source-Coding Theorem, Lossless Data Compression	9.1 to 9.6 10.1 to 10.4	8

Text Book:

1. Simon Haykin & Michael Moher "Communication Systems", 5th Edition, Wiley India Publication.

Reference Books:

1. B.P. Lathi & Zhi Ding , " Modern Digital and Analog Communication Systems" International 4th Ed. Oxford University Press

EEC 602 DIGITAL SIGNAL PROCESSING			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	**Realization of Digital Systems:** Introduction, direct form realization of IIR systems, cascade realization of an IIR systems, parallel form realization of an IIR systems, Ladder structures: continued fraction expansion of H(z), example of continued fraction, realization of a ladder structure, example of a ladder realization.	4.1, 4.5, 4.6, 4.7, 4.8	8
II	**Design of Infinite Impulse Response Digital Filters**: Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All-Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters	5.2-5.6	8
III	**Finite Impulse Response Filter Design:** Windowing and the Rectangular Window, Other Commonly Used Windows, Examples of Filter Designs Using Windows ,The Kaiser Window	6.2-6.5	8
IV	**Discrete Fourier Transforms:** Definitions, Properties of the DFT, Circular Convolution, Linear Convolution	7.1-7.4	8
V	**Fast Fourier Transform Algorithms:** Introduction, Decimation –In Time(DIT) Algorithm, Computational Efficiency, Decimation in Frequency(DIF) Algorithm	8.1-8.4	8
Text Books: Johnny R. Johnson, "Digital Signal Processing", PHI Learning Pvt Ltd., 2009.			
Reference Books: 1. John G Prokias, Dimitris G Manolakis, "Digital Signal Processing", Pearson Education. 2. Oppenheim & Schafer, " Digital Signal Processing" PHI			

EIC 011 OPTO ELECTRONICS			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Introduction to Optical waveguide, Photo sources and detectors: Optical waveguide modes-Theory of Dielectric slab waveguides-Symmetric and Asymmetric slab wave guide, Channel waveguide Light emitting diode (LED), materials, constructions, Drive circuitry, Fundamentals of lasers and its applications	Book 1	6
II	Electro Optic Effects: Birefringence phenomenon EO Retardation, EO Amplitude and Phase Modulator, Electro optic Intensity Modulators, Beam deflection, Acousto-optics, A-O Modulators, Integrated optic spectrum analyzer, Non linear optics second harmonic generation, Parametric amplification.	Book 1	8
III	Fourier Optics and Holography: Phase transformation of thin lens , Fourier transforming property of Lens, Image forming property of Lens, Interferometry, Principles of Holography On axis and Off Axis Holography, Holographic interferometry-Real time, Double exposure, Contour generation ,Optical data storage, Holographic optical elements, Speckle Phenomenon and methods of Measurements, Laser Interferometer.	Book 1	10
IV	Optical Fiber Sensors: Multimode fiber Sensors-Displacement, pressure, stress, strain. Intensity modulated sensors, Active multimode FO sensors, Micro-bend optical fiber sensor, Current sensors, Magnetic sensors, Single mode FO sensors, Phase modulated, Polarization modulated, Fibre Optic Gyroscope.	Book 1	6
V	Optical Computing: Analog linear optical processing, halftone processing, non linear processing, analog arithmetic operation-addition/subtraction, multiplication, division, averaging, differentiation and integration. Digital logic: modified signed digit number system, residue number system, logarithmic number system. Arithmetic operations: MSD, residue, signed logarithmic arithmetic, threshold logic, threshold devices, spatial light modulators, theta modulation devices shadow casting and symbolic substitution.	Book 2	12

Text Books:

1. J. Wilson, J.F.B. Hawkes, "Opto Electronics - An Introduction", PHI, 2000.
2. M. A. Karim, "Optical Computing –An introduction", Wiley India, 2010.

Reference Books: A. Yariv, P. Yeh, "Photonics", 6th Ed., Oxford University Press, 2007.

EIC 012 INTELLIGENT INSTRUMENTATION		3 1 0
Unit	Topic	Proposed number of Lectures
I & II	Introduction: Introduction to intelligent instrumentation, Historical Perspective, Current status, software based instruments.	2
	Virtual Instrumentation: Introduction to graphical programming, data flow & graphical programming techniques, advantage of VI techniques, VIs and sub VIs loops and charts, arrays, clusters and graphs, case and sequence structure, formula nodes, string and file I/O, Code Interface Nodes and DLL links.	10
III	Data Acquisition Methods: Analog and Digital IO, Counters, Timers, Basic ADC designs, interfacing methods of DAQ hardware, software structure, use of simple and intermediate Vis. Use of Data Sockets for Networked communication and controls.	8
IV	PC Hardware Review and Instrumentation Buses: Structure, timing, interrupts, DMA, operating system, ISA, PCI, USB, PCMCIA Buses. IEEE488.1 & 488.2 serial Interfacing-RS 232C,RS422, RS423, RS485, USB, VXI, SCXI, PXI.	8
V	Analysis Techniques: DSP software, Measurement, filters and wavelets, windows, curve fitting probability & statistics. Communication: Basic networking methods and their applications in instrumentation, use of Data sockets for distributed control.	8

Text Books:

1. G. C. Barney, "Intelligent Instrumentation", Prentice Hall, 1995.
2. Lisa, K. Wells & Jeffery Travis, "Lab VIEW For every one", Prentice Hall, 1997.

EEC 012 DATA STRUCTURE			3 1 0
Unit	**Topic**	Chapter/ Section	Proposed number of Lectures
I	**Introduction:** Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, time-Space trade-off, Abstract Data Types (ADT) **Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays: Row major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List, Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.		8
II	**Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of Postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion**.** **Queues:** Operations of Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue		8
III	Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: In-order, Pre-order and Post-order, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.		8
IV	**Graphs:** Terminology, Sequential and linked Representations, of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal: Depth First Search and Breadth first Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kurskal algorithm, Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm, Introduction to Activity Networks.		8
V	**Searching:** Sequential search, Binary search, Comparison and Analysis, Internal Sorting: Insertion Sort, selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting. Search Trees: Binary Search Trees (BST), Insertion and Deletion in BST, Complexity of search Algorithm, AVL trees, Introduction to m-way Search Trees, B Trees & B+ Trees Storage Management: Garbage Collection and Compaction.		8

Text Book:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein “Data structures Using C and C++”, PHI
2. Lipschutz, “Data Structures” Schaum’s Outline Series, TMH

Reference Books:

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication

EEC 603 MICROWAVE ENGINEERING			3 1 0
Unit	Topic	Chapter/ Section	Proposed number of Lectures
I	Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant TE_{10} mode, Field Distribution, Power, Attenuation. Circular Waveguides: TE, TM modes. Wave Velocities, Micro strip Transmission line (TL), Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL, Microwave Cavities,	4.1-4-3,11.0-11.3	8
II	Scattering Matrix , Passive microwave devices: Microwave Hybrid Circuits. , Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S Matrix of a Directional coupler, Hybrid Couplers, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators. S parameter analysis of all components.	4.4-4.6	8
III	Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube, Backward Wave Oscillators: Their Schematic, Principle of Operation, Performance Characteristic and their applications.	9.0-9.5, 10.0-10.2	8
IV	Solid state amplifiers and oscillators: Microwave Bipolar Transistor, Microwave tunnel diode, Microwave Field-effect Transistor, Transferred electron devices, Avalanche Transit –time devices: IMPATT Diode, TRAPPAT Diode,	5.0-5.1,5.3,6.0-6.1,7.0-7.3	10
V	Microwave Measurements: General set up of a microwave test bench, Slotted line carriage, VSWR Meter, microwave power measurements techniques, Crystal Detector, frequency measurement, wavelength measurements, Impedance and Refection coefficient, VSWR, Insertion and attenuation loss measurements, measurement of antenna characteristics, microwave link design.	14.1-14.4 (Book 2)	8

Text Books:

3. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Ed, Pearson Education.
4. A. Das and S. K. Das, "Microwave Engineering", TMH.

Reference Books:

1. R.E Collin, "Foundation for Microwave Engineering ", 2nd Ed., John Wiley India.

LABORATORY

EIC 651 MICRO CONTROLLER LAB

1. Write a program of Flashing LED connected to port 1 of the Micro Controller
2. Write a program to show the use of INT0 and INT1.
3. Write a program to generate 10 kHz square wave.
4. Write a program to generate 10 kHz frequency using interrupts.
5. Write a program for temperature & to display on intelligent LCD display
6. Write a program to demonstrate the polling of Interrupt of 8051/8031 micro controllers.
7. Write a program to generate a Ramp waveform using DAC with micro controller.
8. Write a program to control a stepper motor in direction, speed and number of steps.
9. Write a program to control the speed of DC motor.
10. Write a program to interface Microcontroller with 8255.
11. Write a program to set the Baud rate at 9600 , 8 Bit data and 1 Stop bit, to send the text string "Microcontroller" to serial port 1.

EEC-652 DIGITAL SIGNAL PROCESSING LAB

1. With the help of Fourier series, make a square wave from sine wave and cosine waves. Find out coefficient values.
2. Evaluate 4 point DFT of and IDFT of $x(n) = 1, 0 \leq n \leq 3; 0$ elsewhere.
3. Implement the FIR Filters for 2 KHz cutoff frequency and 2 KHz bandwidth for band pass filter.
4. Design FIR filter using Fourier series expansion method.
5. Implement IIR low pass filter for a 4 KHz cutoff frequency and compare it the FIR filter with the same type use chirp as input signal.
6. Verify Blackman and Hamming windowing techniques for square wave as an input which window will give good results.
7. Implement the filter functions.
8. Generate DTMF sequence 1234567890*# and observe its spectrogram.
9. Generate an Amplitude Modulation having side low frequencies 1200 Hz and 800 Hz. Observe and verify the theoretical FFT characteristics with the observed ones.
10. Generate Frequency Modulation having carrier frequencies 1 KHz and modulating frequency 200 Hz with the modulation index of 0.7. Observe and verify the theoretical FFT characteristics with the observed ones.
11. Generate an FSK wave form for transmitting the digital data of the given bit sequence. Predict and verify the FFT for the same one.
12. To study the circular convolution.

EEC 659 COMMUNICATION LAB

1. To study DSB/ SSB amplitude modulation & determine its modulation factor & power in side bands.
2. To study amplitude demodulation by linear diode detector
3. To study frequency modulation and determine its modulation factor
4. To study sampling and reconstruction of Pulse Amplitude modulation system.
5. To study Pulse Width Modulation and Pulse Position Modulation.
6. To construct a triangular wave with the help of Fundamental Frequency and its Harmonic component.
7. To construct a Square wave with the help of Fundamental Frequency and its Harmonic component.
8. Study of Pulse code modulation (PCM) and its demodulation using Bread Board.
9. Study of Amplitude shift keying modulator and demodulator.
10. Study of Frequency shift keying modulator and demodulator.
11. Study of Phase shift keying modulator and demodulator.