Uttar Pradesh Technical University, Lucknow

Syllabus

3rd Year

[Effective from Session 2015-16]

1. B.Tech. Electronics & Instrumentation Engineering
2. B.Tech. Instrumentation & Control Engineering
3. B. Tech. Applied Electronics and Control Engineering

Semester - V

No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECTS											
1	NEC-501	Integrated Circuits	3	1	0	30	20	50	100	150	4
2	NIC-501	Control Systems – I	3	1	0	30	20	50	100	150	4
3	NIC-502	Transducer and Sensors	3	1	0	30	20	50	100	150	4
4	NEC-503	Microprocessors	3	1	0	30	20	50	100	150	4
5	NCE-509	Fluid Mechanics	2	1	0	15	10	25	50	75	3
6	NHU-501	Engineering Economics	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NEC-551	Integrated circuits Lab	0	0	2	10	10	20	30	50	1
8	NIC-551	Control Systems-I Lab	0	0	2	10	10	20	30	50	1
9	NIC-552	Transducer Lab	0	0	2	10	10	20	30	50	1
10	NEC-553	Microprocessors Lab	0	0	2	10	10	20	30	50	1
11	NGP-501	GP						50		50	
		TOTAL	16	5	8					1000	25

SEMESTER - VI

No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECTS											
1	NIC-601	Microcontrollers	3	1	0	30	20	50	100	150	4
2	NIC-602	Industrial Instrumentation	3	1	0	30	20	50	100	150	4
3	NEC-609	Communication Engineering	3	1	0	30	20	50	100	150	4
4		Departmental Elective-I	3	1	0	30	20	50	100	150	4
5		Departmental Elective-II	2	1	0	15	10	25	50	75	3
6	NHU-601	Industrial Management	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NIC-651	Microcontroller Lab	0	0	2	10	10	20	30	50	1
8	NEC-652	Instrumentation Lab	0	0	2	10	10	20	30	50	1
9	NEC-659	Communication Lab	0	0	2	10	10	20	30	50	1
10	NIC-654	Seminar	0	0	2	10	10	20	30	50	1
11	NGP-601	GP						50		50	
		TOTAL	16	5	8					1000	25

Departmental Elective-I

1. NEC-011 Digital Signal Processing
2. NEC-012 Computer Architecture and Organization
3. NEC-601 Microwave Engineering
4. NIC-011 Electrical Machines

Departmental Elective – II

1. NIC-021 Opto-Electronics
2. NIC-022 Intelligent Instrumentation
3. NEC-021 Industrial Electronics
4. NEC-023 Analog Signal Processing

NEC 501 INTEGRATED CIRCUITS		
Unit	Topic	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; DC 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	10
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.	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.	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, Astablemultivibrator, Monostable multivibrator, Generation of Triangular Waveforms	7
V	**D/A and A/D converters** **Integrated Circuit Timer:** The 555 Circuit, Implementing a Monostable Multivibrator Using the 555 IC, AstableMultivibrator 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.	7

Text Books:

1. Sedra and Smith, " Microelectronic Circuits" , 6th Edition, Oxford University Press.
2. Michael Jacob, " Applications and Design with Analog Integrated Circuits" , PHI, 2nd Edition.

Reference Books:

1. Jacob Milliman and Arvin Grabel, " Microelectronics" , 2nd Edition, Tata McGraw Hill.
2. BehzadRazavi, " Fundamentals of Microelectronics" , 2nd Edition, Wiley.
3. Mark N. Horenstein, " Microelectronic Circuits and Devices" , PHI.
4. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, " Analysis and Design of Analog Integrated Circuits" , Wiley.

NIC-501 CONTROLSYSTEM-I		
Unit	**Topic**	**No. of Lectures**
1	**Introduction:** Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs, Modeling of Physical systems	8
2	**State-Variable Analysis:** Introduction, Vector matrix representation of State equation, State Transition Matrix, State-Transition Equation, Relationship between State Equations and Higher-order Differential Equations, Relationship between State Equations and Transfer Functions. Similarity Transformation, Decomposition of transfer functions, Controllability and observability.	8
3	**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	8
4	**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. **Root-Locus Technique:** Introduction, Properties of the Root Loci, Design aspects of the Root Loci	8
5	**Frequency Domain Analysis:** Introduction: Mrωr 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.	8

Text Book:

1. B.C. Kuo&FaridGolnaraghi, “Automatic Control Systems”, 8th Edition, John Wiley India.

Reference Books:

1. William A. Wolovich, “Automatic Control Systems”, Oxford University Press.
2. Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, “Feedback and Control Systems” Schaums Outlines Series, 3rd Edition, Tata McGraw Hill.
3. I. J. Nagrath& M. Gopal, “Control System Engineering”, New Age International Publishers.

NIC-502 TRANSDUCERS AND SENSORS		
Unit	**Topic**	**No. of Lectures**
1	**Generalized 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, noise floor, resolution, hysteresis and dead space. Scale readability. Span, Generalized static stiffness & input impedance.	8
2	**Motion and Dimensional measurement:** Fundamental standards, relative displacements- translational and rotational, Calibration, Resistive potentiometers, differential transformers, variable inductance & variable reluctance pickups, capacitance pickup, Digital displacement transducers, Mechanical fly ball angular velocity sensor, Mechanical revolution counters and timers, tachometer encoder methods, stroboscopic method, translational velocity transducer, eddy current Drag-cup tachometer, velocity sensors.	8
3	**Force, Torque, Shaft power:** 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).	8
4	**Flow measurement:** Local flow velocity, magnitude and direction. Flow Visualization. Velocity magnitude from pilot static tube. Velocity direction from yaw tube, dynamic wind vector indicator. 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. **Measurement of Liquid Level:** inductive method, capacitive method, ultrasonic method, using gamma rays, using float.	8
5	**Temperature measurement:** Standards & calibration; thermal expansion methods-bimetallic thermometers, liquid-in-glass thermometers, pressure thermometers; RTD, termister and thermocouple (comparative study); digital thermometers. Radiation Methods – radiation fundamentals, radiation detectors: thermal and photon, monochromatic brightness radiation thermometers, two color radiation thermometers, black body tipped fiber optic radiation thermometer, Fluor optic temperature measurement, infrared imaging systems.	8

Text Book:

1. E. O. Doebelin and D.N. Manik,"Measurement systems application and design",5th Edition., Tata McGraw Hill.

Reference Book:

1. Arun K Ghosh, "Introduction to Transducers", PHI, 2015.
2. Bela G. Liptak, "Process Measurement and Analysis, Vol. 1", CRC Press.

NEC 503 MICROPROCESSORS		
Unit	**Topic**	**No. of Lectures**
1.	Evolution of microprocessors, Microprocessor architecture and its operations, 8085 pins description, programming model, basic interfacing concepts, input and output devices, logic devices and memory interfacing, addressing modes, Concept of instruction cycle, machine cycle and T-states, Concept of interrupts, Classification of 8085 instructions.	8
2.	8086 architecture-functional diagram, register organization, memory segmentation, programming model, memory address, physical memory organization, pins description, clock generator 8284A, maximum mode and minimum mode signal descriptions, timing diagrams, introduction to DOS and BIOS interrupts.	8
3.	Instruction formats, addressing modes, classification of instruction set, assembler directives (debug, TASM & MASM), macros, Programs techniques and assembly language programs: simple programs involves data transfer operation, arithmetic operation, logical operation, branch operation, machine control operation, string manipulations, stack and subroutine operations.	8
4.	8255 Programmable peripheral interfacing various mode of operation to 8086, interfacing keyboard and seven segment display, stepper motor interfacing, D/A and A/D converter, 8254 (8253) programmable interval timer, Direct Memory Access and 8237 DMA controller.	8
5.	Memory interfacing to 8086. Interrupt structure of 8086, interrupt handling, vector interrupt table and interrupt Service routine. Interfacing interrupt controller 8259 and DMA Controller 8257 to 8086. Serial communication standards, Serial data transfer schemes.	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, Tata McGraw Hill.

Reference Books:

1. Sivarama P. Dandamudi, "Introduction to Assembly Language Programing From 8086 to Pentium Processors", Springer.
2. Walter A. Triebel and Avtar Singh, "The 8088 and 8086 Microprocessors: Programming, Interfacing Software, Hardware and Applications", Pearson.
3. A. K. Ray and K. M. Bhurchandi, "Advance microprocessors and Peripherals" Tata McGraw Hill.
4. Lyla B. Das, "The X86 Microprocessors, Architecture, Programming and Interfacing (8086 to Pentium)", Pearson.

NCE-509 FLUID MECHANICS		
Unit	**Topic**	**No. of Lectures**
1	Introduction: Fluids and continuum: Physical properties of fluids, ideal and rearfluids, 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.	8
2	Fluid statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies. 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.	8
3	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 low, turbulent flow, equation for turbulent flow, eddy viscosity, mixing length concept and velocity distribution in turbulent flow, Hot-wire anemometer and LDA.	8
4	Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham's theorem, important dimensionless numbers and their significance, geometric, Kinematic and dynamic similarity, model studies. 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.Compressibility Effects in pipe flow	8

Text Books:

1. Som and Biswas, “Introduction to fluid mechanics and machines”, Tata McGraw Hill.
2. S.K.Agrawal, “Fluid mechanics and machinery”, Tata McGraw Hill.

Reference Books:

1. R.J. Garde, A.G. Mirajgaoker, “Engineering fluid mechanics including hydraulic machines”, 2nd Edition,Nemchand& Bros, Roorkee, 1983.

LABORATORY

NEC-551 INTEGRATEDCIRCUITSLAB

Objective:-Todesignandimplementthecircuitstogainknowledgeonperformanceofthecircuitandits application.Thesecircuitsshouldalsobesimulatedon Pspice.

1. Logandantilogamplifiers.
2. Voltagecomparatorandzerocrossingdetectors.
3. Secondorderfiltersusingoperationalamplifierfor–
   i. Lowpassfilterofcutofffrequency1KHz.
   ii. Highpassfilteroffrequency12KHz.
   iii. Bandpassfilterwithunitgainofpassbandfrom1KHzto12KHz.
4. Wienbridgeoscillatorusingoperationalamplifier.
5. Determinecapturerange;lockinrangeandfreerunningfrequencyofPLL.
6. Voltageregulatorusingoperationalamplifiertoproduceoutputof12Vwithmaximumloadcurrentof 50mA.
7. A/DandD/Aconvertor.
8. Voltagetocurrentandcurrenttovoltageconvertors.
9. Functiongeneratorusingoperationalamplifier(sine,triangular&squarewave)
10. AstableandmonostablemultivibratorusingIC555.

NIC-551 CONTROL SYSTEM-ILAB

1. DifferentToolboxesinMATLAB,IntroductiontoControlSystemsToolbox.
2. Determinetranspose,inversevaluesofgivenmatrix.
3. Plotthepole-zeroconfigurationins-planeforthegiventransferfunction.
4. Determinethetransferfunctionforgivenclosedloopsysteminblockdiagramrepresentation.
5. Plotunitstepresponseofgiventransferfunctionandfindpeakovershoot,peaktime.
6. Plotunitstepresponseandtofindrisetimeanddelaytime.
7. Plotlocusofgiventransferfunction,locateclosedlooppolesfordifferentvaluesofk.
8. Plot root locusofgiventransferfunction and tofind outS,Wd,Wnatgivenroot &todiscuss stability.
9. Plotbodeplotofgiventransferfunction.
10. Plotbodeplotofgiventransferfunctionandfindgainandphasemargins
11. PlotNyquistplotforgiventransferfunctionandtocomparetheirrelativestability
12. PlottheNyquistplotforgiventransferfunctionandtodiscussclosedloopstability,gainand phasemargin.

Note:-Inaddition,Institutesmayincludemoreexperimentsbasedontheexpertise.

NIC-552 TRANSDUCERLAB

1. Characteristicsofresistancetransducer
   (i) Potentiometer
   (ii) StrainGauge
2. CharacteristicsofLVDT.
3. Characteristicsofcapacitive transducer

(i) Variablearea
   (ii) Variabledistance.

4. CharacteristicsofThermistors
5. CharacteristicsofRTD.
6. Characteristics of Thermocouples
7. CharacteristicsofLDR,PhotoDiode,andPhototransistor:
   (i) VariableIllumination.
   (ii) LinearDisplacement.
8. Measurementof resistancebyWheatstonebridgeandmeasurementofbridgesensitivity.
9. MeasurementofCapacitancebyDe'SautysandScheringBridge.
10. MeasureoflowresistancebyKelvin'sdoublebridge.
11. Characteristicsofdiaphragmtypepressuretransducer.
12. CharacteristicsofoneSolidStatesensor/Fiberopticsensor.

NEC-553 MICROPROCESSORSLAB

1. Write a program using 8085/ 8086 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085/ 8086 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085/ 8086.
4. To find the largest and smallest number in an array of data using 8085/8086 instruction set.
5. To write a program to arrange an array of data in ascending and descending order using 8085/ 8086.
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085/ 8086 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/ 8086 and verify the operation of 8253 in six different modes.
9. To interface DAC with 8085/ 8086 to demonstrate the generation of square, saw tooth and triangular wave.
10. Serial communication between two 8085/8086 through RS-232 C port.

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

Syllabus of Sixth Semester

NIC-601 MICROCONTROLLERS		
Unit	**Topic**	**No. of Lectures**
1	Introduction to microcontrollers and embedded systems, Von Neumann (Princetone) and Harvard architecture, RISC and CISC machine, overview of the 8051 family, general architecture (pins and signals, internal architecture, program memory and data memory organization, system clock, reset, programming technique), input/ output ports and special function registers, addressing mode.	8
2	Instruction groups of MCS-51: data transfer operation, arithmetic operations, branch operation, logical operation, Boolean variable manipulation, subroutine & stack operation and advance instructions. Assembler data type and directives, introduction to assembly programming and programming in C.	9
3	External interrupts and software interrupt, timer/ counter interrupt, interrupt service routine, programming 8051 timer, counter programming, Basic of serial communication, mode of serial communication, RS232, serial communication issue, serial port programming,	8
4	Interfacing with 8051: external memory, 8255, keyboards, display devices, DAC/ADC, DC Motor, Stepper Motor, Servomotor, power management.	8
5	Sensor interfacing and signal conditioning, Advance microcontrollers: MC68HC11, AVR, MCS-96, ARM, Renesas.	7

Text Books:

1. Mazidi Ali Muhammad, MazidiGillispie Janice, and McKinlayRolin 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. Shah Satish, "8051 Microcontrollers MCS 51 Family and its variants", Oxford
2. SubrataGhoshal, "8051 Microcontroller Internals, Instructions, Programming and Interfacing" Pearson
3. V. Udayashankara, M.S. Mallikajunaswamy, "8051 Microcontroller Hardware, Software and Applications", McGraw-Hill.
4. DoganBrahim, "Microcontroller Projects in C for the 8051", Newnes
5. SubrataGhoshal,"Embedded System & Robots Projects using the 8051 Microcontroller", Cengage Lerning

NIC-602 INDUSTRIALINSTRUMENTATION		
Unit	**Topic**	**No. of Lectures**
1	Introduction to industrial symbols and standards, classification of industry and type of measurement required; detectors, probe analysers, actuators — principles and applications. Measurement of weight- Load cell method, strain gauge, LVDT; piezoelectric, pneumaticandhydraulicloadcell,nullbalancemethod.	8
2	Temperaturemeasurements:Standardsandcalibration,thermalexpansionmethods, bimetallic thermometer, thermocouple, reference junction considerations, special materials, configuration & techniques, Measurement of thermocouple output, electrical resistance sensors – conductive sensor (resistance thermometers), bulk semiconductor sensors thermistors), Radiationthermometers, automaticnullbalanceradiationthermometers.Opticalpyrometers.	8
3	**Units ofpressureand vacuum:**dead weight gauges & manometer dynamics; Differenttype of manometers,diaphragmgauges bellowsandforcebalancetypesensors,Boudernguage,Piezoelectric,Capacitiveand InductivePressurepickups. **Vacuumpressuremeasurements:**Meleodgauge,Piranigauge,thermocouple gauge, Knudsen gauge Ionization gauge	8
4	Differentialpressureflowmeters: Bernoulli'stheorem:pituttube,orifice,vanturi,flow nozzle,Hotwireandhotfilmanemometers,variablearea meters (rotameter), turbine meters, Electromagnetic flowmeters, Ultrasonic flowmeters. Drag force flow meters. vortex shedding flow meters. Measurement of level, Float type gauge, purge method, differential pressure method,conductiveandcapacitivemethod; electromechanicalmethod	8
5	MeasurementofMoisture,ThermalDyingMethod,DistillationMethod,Chemical ReactionMethod,ElectricalMethod. Measurementofviscosity,definitionofabsolute andkinematicviscosity,industrialviscositymeter.	8

Text Book:

1. E. O. Doebelin, "Measurementssystems:ApplicationsandDesign",4th Edition, McGraw Hill.
2. D. P. Eckman, "IndustrialInstrumentation", Wiley.

Reference Book:

1. T. G. Beckwith, R. D. Maragoni and J. H. Lienhard, "MechanicalMeasurements", Pearson.
2. B. C. Nakra and K. K. Chaudhry, "Instrumentation:Measurements&Analysis" TataMcGrawHill

NEC-609 COMMUNICATIONENGINEERING		
Unit	**Topic**	**No. of Lectures**
1	**Introduction:** The Communication Process, Modulation Process, The Layered Approach, Example of communication **Amplitude Modulation:** Introduction, Amplitude modulation, Double Sideband-Suppressed Carrier modulation, Quadrature-Carrier Multiplexing, Single-Sideband and Vestigial-Sideband Methods of modulation, Frequency Translation, Frequency- Division Multiplexing	8
2	**Phase and Frequency Modulation:** Introduction, Basic Definitions, Frequency Modulation Phase Modulation , Phase-Locked Loop, Nonlinear Effects in FM Systems, The Super-heterodyne Receiver,	8
3	**Noise in Analog Modulation:** Introduction, white noise ,power spectral densities, Noise in DSB-SC Receivers, Noise in AM receivers, Noise in FM Receivers, Pre-emphasis and De-emphasis in FM **Digital Representation of Analog Signals:** Introduction, Digitization of Analog Sources, The Sampling Process, The Quantization Process, Pulse-Amplitude Modulation, Pulse-Position Modulation**,** Pulse-Code Modulation, Delta Modulation, Time-Division Multiplexing,	8
4	**Baseband Transmission of digital Signals:** Introduction, Baseband Pulses and matched Filter Detection, Probability Of Error Due to Noise, Inter symbol Interference, Eye Pattern, NyquistCriterion for Distortion less Transmission, Baseband M-ary PAM Transmission, Tapped Delay Line Equalization,	8
5	**Band-Pass Transmission of Digital Signals:** Introduction, band-Pass Transmission Model, Transmission Binary ASK ,PSK and FSK, Orthogonal Frequency Division Multiplexing (OFDM), **Information and Forward Error Correction:** Introduction, Uncertainty, Information and Entropy, Information rate, Channel capacity, Source-Coding Theorem, Lossless Data Compression	8

Text Book:

1. Simon Haykin& Michael Moher, "Communication Systems", 5thEdition, Wiley India Publication.
2. Herbert Taub and Donald L. Schilling, "Principles of Communication Systems", Tata McGraw Hill.

Reference Book

1. B.P. Lathi&ZhiDing, "Modern Digital and Analog Communication Systems", International 4thEdition, Oxford University Press.
2. R.P. Singh and Sapre, "Communication Systems:Analog and Digital",3rd Edition ,McGraw Hill.
3. H.P.HSU & D.Mitra,"Analog and Digital communication" ,2nd Edition ,Tata McGraw Hill.

LABORATORY

NIC-651 MICROCONTROLLERLAB

1. Writeaprogram to copy the value into RAM memory locations 40H to 50H using
   i. Register indirect addressing mode without a loop, and
   ii. With a loop
2. WriteaprogramofFlashingLEDconnectedtoport1 oftheMicroController.
3. Writeaprogramto convert packed BCD to two ASCII numbers and store in register.
4. Writeaprogramto convert
   i. Binary to Decimal , and then
   ii. Decimal to ASCII
5. Writeaprogramtogenerate10kHzsquarewave.
6. Writeaprogramtogenerate10kHzfrequencyusinginterrupts.
7. WriteaprogramtoshowtheuseofINT0andINT1.
8. Writeaprogramtodemonstratethepollingof Interruptof8051/8031microcontrollers.
9. Writea programto set the Baudrate at 9600, 8 Bit dataand 1 Stopbit, to sendthetext string“Microcontroller”toserialport1.
10. Writeaprogramfortemperature&todisplayonintelligentLCDdisplay
11. WriteaprogramtogenerateaRampwaveformusingDACwithmicrocontroller.
12. Writeaprogramtocontrolasteppermotorindirection,speedandnumberofsteps.
13. Writeaprogramto controlthespeedofDCmotor.
14. WriteaprogramtointerfaceMicrocontrollerwith8255.

NIC-652 INSTRUMENTATIONLAB

1. InstrumentationAmplifier:Designforspecificgainandverificationof CMRR.
2. RealizationofPCMsignalusingADCandreconstructionusingDACusing4-bit/8bitsystems. ObservetheQuantizationnoiseineachcase.
3. StudyofStorageOscilloscope&TransientresponseofRLC.
4. ConvertagivenACAnalogsignalintodigitalusingS/H&ADCandrecovertheanalogsignalusingDACIC.
5. StudyofCharacteristicsofaStrainGauge.
6. Constructionofchopperamplifier.
7. Studyoflownoiseandlowfrequencyamplifierforbiomedicalapplication.
8. StudyofPiezoelectrictransducer.
9. StudyofCapacitiveandInductivePressurepickups.

Note:-Inaddition,Institutesmayincludemoreexperimentsbasedontheexpertise.

NEC-659 COMMUNICATION LAB

1. With the help of Fourier series,
   i. To construct a triangular wave with the help of Fundamental Frequency and its Harmonic component.
   ii. To construct a Square wave with the help of Fundamental Frequency and its Harmonic component.
2. Amplitude Modulation & Demodulation
   i. To generate amplitude modulated wave and determine the percentage modulation.
   ii. To demodulate the modulated wave using envelope detector.
3. To study DSB-SC and SSB modulation & determine power in side bands.
4. Frequency Modulation & Demodulation
   i. To study frequency modulation and determine its modulation factor
   ii. To demodulate a Frequency Modulated signal using FM detector
5. To study Pulse Amplitude Modulation, Pulse Width Modulation and Pulse Position Modulation.
6. To study and verify the sampling theorem and reconstruction of sampled wave form.
7. Study of Pulse code modulation (PCM) and its demodulation.
8. To verify the operation of Time Division Multiplexing.
9. To study of Amplitude shift keying modulator and demodulator.

10. To study of Frequency shift keying modulator and demodulator.
11. To study of Phase shift keying modulator and demodulator
12. Design and implement a Transmitter and receiver for the corresponding modulation system.

NEC 011 DIGITAL SIGNAL PROCESSING		
Unit	**Topic**	**No. of Lectures**
1	**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), realization of a ladder structure with example.	8
2	**Design of Infinite Impulse Response Digital Filters**: Introduction to All Pole Analog Filter, Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters	8
3	**Finite Impulse Response Filter Design:** Designof FIR filters byWindowing and other commonly used Windowing Techniques, Examples of Filter Designs Using Windows ,The Kaiser Window	8
4	**Discrete Fourier Transforms:** Definitions, Properties of the DFT, Circular Convolution and Its Methodology, Linear Convolution, Examples of Circular Convolution and Linear Convolution.	8
5	**Fast Fourier Transform Algorithms:** Introduction, Decimation –In Time(DIT) Algorithm, Computational Efficiency, Decimation in Frequency(DIF) Algorithm, Composite-Radix FFT	8

Text Book:

1. John G Prokias, Dimitris G Manolakis, “Digital Signal Processing”, Pearson Education.
2. Oppenheim & Schafer, “Digital Signal Processing” PHI.

Reference Book:

1. Johnny R. Johnson, “Digital Signal Processing”, PHI.

NEC 012 COMPUTER ARCHITECTURE AND ORGANIZATION		
Unit	**Topic**	**No. of Lectures**
1.	Introduction to Design Methodology: System Design – System representation, Design Process, the gate level (revision), the register level components and PLD (revision), register level design The Processor Level: Processor level components, Processor level design.	8
2.	Processor basics: CPU organization- Fundamentals, Additional features Data Representation – Basic formats, Fixed point numbers, Floating point numbers. Instruction sets – Formats, Types, Programming considerations.	8
3.	Datapath Design: Fixed point arithmetic – Addition and subtraction, Multiplication and Division, Floating point arithmetic, pipelining.	8
4.	Control Design: basic concepts – introduction, hardwired control, Micro programmed control – introduction, multiplier control unit, CPU control unit, Pipeline control-instruction pipelines, pipeline performance.	8
5.	Memory organization: Multi level memories, Address translation, Memory allocation, Caches – Main features, Address mapping, structure vs performance, System Organisation: Communication methods- basic concepts, bus control. Introduction to VHDL.	8

TextBooks:

1. John P Hayes “Computer Architecture and Organisation”, 3rd Edition, McGraw Hill.

Reference Books:

1. M Morris Mano, “Computer System Architecture”,3rd Edition, Pearson.
2. Carl Hamacher, ZvonkoVranesic and SafwatZaky, “Computer Organization and Embedded Systems”, McGraw Hill.
3. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier.

NEC-601 MICROWAVE ENGINEERING		
Unit	**Topic**	**No. of Lectures**
1	RectangularWaveGuide:FieldComponents,TE,TMModes,Dominant TE_{10} mode, FieldDistribution,Power, Attenuation.Circular Waveguides: TE,TMmodes. Wave Velocities,MicrostripTransmissionline(TL), CoupledTL, StripTL,CoupledStripLine,CoplanarTL,Microwave Cavities,	8
2	ScatteringMatrix, Passive microwave devices: Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Directional Couplers: TwoHole directional couplers,SMatrix ofa Directional coupler,HybridCouplers,MicrowavePropagationinferrites,Faraday Rotation,Isolators,Circulators.Sparameteranalysis ofallcomponents.	8
3	Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube,BackwardWave Oscillators:Their Schematic,Principle ofOperation, PerformanceCharacteristicandtheir applications.	8
4	Solid stateamplifiers and oscillators: Microwave Bipolar Transistor, Microwavetunnel diode,MicrowaveField-effectTransistor,Transferred electron devices,Avalanche Transit –time devices:IMPATT Diode, TRAPPATDiode.	8
5	MicrowaveMeasurements:Generalsetupofamicrowavetestbench, Slottedlinecarriage, VSWRMeter,microwave powermeasurements techniques,CrystalDetector,frequency measurement,wavelength measurements,Impedance andRefection coefficient, VSWR,Insertion andattenuationlossmeasurements, measurementofantenna characteristics, microwave linkdesign.	8

Text Book:

1. Samuel Y. Liao, "MicrowaveDevices and Circuits",Pearson.
2. A.DasandS.K.Das,"MicrowaveEngineering", 3rd Edition, Tata McGraw Hill,.

Reference Book:

1. R.E Collin, "Foundation forMicrowaveEngineering", 2nd Edition.,JohnWiley India.

Unit	NIC-011 ELECTRICAL MACHINES	No. of Lectures
1	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.	8
2	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.	8
3	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
4	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	8
5	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.	8

Text Book:

1. D P Kothari & I J Nagrath, “Electric Machines”, 3rd Edition, Tata McGraw Hill.

Reference Book:

1. Fitzgerald, C. Kingsley and S.Umans , “Electric Machinery”, 6th Edition, Tata McGraw Hill.

NIC-021 OPTOELECTRONICS		
Unit	**Topic**	**No. of Lectures**
1	IntroductiontoOpticalwaveguide,Photosourcesanddetectors:Optical waveguidemodes-TheoryofDielectricslabwaveguides-Symmetric and Asymmetric slabwaveguide,ChannelwaveguideLightemittingdiode (LED),materials,constructions, Drivecircuitry,Fundamentals oflasers anditsapplications	8
2	ElectroOpticEffects: BirefringencephenomenonEORetardation,EO Amplitude and Phase Modulator,Electro optic Intensity Modulators, Beam deflection, Acousto-optics, A-O Modulators, Integrated optic spectrum analyzer.	8
3	OpticalFiberSensors:MultimodefiberSensors-Displacement, pressure, stress,strain.Intensity modulatedsensors,ActivemultimodeFOsensors, Micro-bend optical fiber sensor, Current sensors,Magnetic sensors, SinglemodeFOsensors,Phase modulated,Polarizationmodulated,FibreOpticGyroscope.	8
4	Optical Computing: Analogarithmeticoperation- addition/subtraction, multiplication,division,averaging,differentiation and integration.Digital logic: modified signed digitnumber system, residuenumbersystem,logarithmic numbersystem.Arithmetic operations: MSD,residue,signedlogarithmic arithmetic,thresholdlogic, thresholddevices,spatiallightmodulators.	10

Text Book:

1. J.Wilson and J.Hawkes,“Optoelectronics-AnIntroduction”,PHI.
2. M.A.Karim,“OpticalComputing–Anintroduction”,WileyIndia.

Reference Book:

1. A.Yariv,P.Yeh,“Photonics”,6th Ed.,OxfordUniversityPress.
2. Emmanuel Rosencher and BorgeVinter, "Optoelectronics", Cambridge University Press.

NIC-022 INTELLIGENTINSTRUMENTATION		
Unit	**Topic**	**No. of Lectures**
1	Introduction: Introduction to intelligent instrumentation, Historical Perspective, Current status, software based instruments.	4
2	Virtual Instrumentation:Introductiontographicalprogramming,data flow&graphical programmingtechniques,advantageofVItechniques,VIsandsubVIsloopsand charts,arrays,clustersandgraphs,caseandsequencestructure,formulanodes,string andfileI/O,CodeInterfaceNodesandDLLlinks.	Book 2 12
3	DataAcquisitionMethods:AnalogandDigitalIO,Counters,Timers,BasicADC designs,interfacingmethodsofDAQhardware,softwarestructure,useofsimpleand intermediateViz.UseofDataSocketsfor Networkedcommunicationandcontrols.	Book2 8
4	PC Hardware Review and Instrumentation Buses: Structure, timing, interrupts, DMA, operating system, ISA, PCI, USB, and PCMCIA Buses. IEEE488.1 & 488.2 serial Interfacing-RS 232C, RS422, RS423, RS485, USB, VXI, SCXI, PXI. Smart Instruments: Smart/intelligent transducer — comparison with conventional transducers — self diagnosisand remote calibration features — smart transmitter with HART communicator —Micro ElectroMechanical Systems — sensors, nonlinearity compensation.	8

Text Books:

1. G.C.Barney,“Intelligent instrumentation: microprocessor applications in measurement and control”,PrenticeHall,1995.
2. Jovitha Jerome,“Virtual Instrumentation using Lab VIEW”, PHI.

Reference Book:

1. Lisa,K.Wells&JefferyTravis,“LabVIEWForeveryone”,PrenticeHall,1997.
2. D. Patranabis, "Principle of Industrial Instrumentation",Tata McGraw Hill.
3. E. O. Doebelin, "Measurement systems", McGraw Hill.
4. P. Chapman, "Smart Sensors", ISA publication.

NEC 021 INDUSTRIAL ELECTRONICS		
Unit	**Topic**	**No. of Lectures**
1	**Power Semiconductor Devices:** Power semiconductor devices their symbols and static characteristics and specifications of switches, types of power electronic circuits Operation, steady state & switch characteristics & switching limits of Power Transistor Operation and steady state characteristics of Power MOSFET and IGBT Thyristor – Operation V- I characteristics, two transistor model, methods of turn-on Operation of GTO, MCT and TRIAC.	8
2	**Phase Controlled Rectifiers:** Phase Angle Control, Single-phase Half-wave Controlled Rectifier (One quadrant), Single-phase Full-wave Controlled Rectifier (Two quadrant Converters),Performance Factors of Line-commutated Converters, The Performance Measures of Two-pulse Converters, Three phase Controlled Converters **Inverters:** Introduction Thyristor Inverter Classification, Series Inverters, Parallel Inverter, Three-phase Bridge Inverters, Three-phase Bridge Inverter with Input-circuit Commutation.	8
3	**Choppers:** Introduction, Principle of Chopper Operation, Control Strategies, step-up/Down Chopper, Jones Chopper. Introduction to basic Cycloconverters. **Control of D.C. Drives:** Introduction, Basic Machine Equations, Breaking Modes, Schemes for D.C. Motor Speed Control, Single-phase Separately Excited Drives, Braking Operation of Rectifier Controlled Separately excited Motor, Single-phase Separately Excited Drives, Power Factor Improvement, Three-phase Separately Excited Drives, D.C. Chopper Drives	8
4	**Control of A.C. Drives:** Introduction, basic Principle of Operation, Squirrel-cage Rotor Design, Speed Control of Induction Motors, stator Voltage Control, Variable Frequency control, Rotor Resistance Control, Slip Power Recovery Scheme, Synchronous Motor Drives	8

Text Books:

1. M H. Rashid, " Power Electronics" , 3rd Edition, Pearson Education.
2. M D. Singh & K. Khanchandani, " Power Electronics" , Tata McGraw Hill.

Reference Books:

1. V.R. Moorthy, "Power Electronics: Devices, Circuits and Industrial Applications", Oxford University Press,2007.
2. M.S. Jamil Asghar, "Power Electronics",PHI.
3. Chakrabarti& Rai, "Fundamentals of Power Electronics &Drives"Dhanpat Rai & Sons.
4. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications and Design", Wiley India.
5. S.N.Singh, "A Text Book of Power Electronics",Dhanpat Rai & Sons.

NEC 023 Analog Signal Processing		
Unit	Topic	Proposed number of Lectures
I	Introduction to domains and the analogue/digital trade off, Introduction to basic building blocks: nullor, voltage feedback amplifier, operation transconductance amplifier, current conveyor, current feedback amplifier. Analog signal filtering: introduction to bilinear transfer functions and active realizations. First-order and second-order filter realization, filter design parameters (Q and ω_0), frequency response, effect of finite gain of op-amp, realization of Single-Amplifier Biquad and General Impedance Convertor circuit.	8
II	Ideal low-pass filter, Buttreworth and Chebyshev magnitude response, pole locations, low-pass filter specifications.	8
III	Delay equalization: equalization procedures, equalization with first-order and second-order modules, strategies for equalization design. Definition of Bode sensitivity.	8
IV	Properties of Lossless ladders, the general impedance convertor (GIC), optimal design of the GIC, realization of simple ladders, Gorski-Popiel's Embedding Technique, Bruton's FDNR technique, creating negative components.	8

Text Books:

1. R.Schaumann and M.E.Valkenberg,"Designof AnalogCircuits", Oxford University Press.