Department of Applied Electronics & Instrumentation Engineering
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: B. Tech in Applied Electronics & Instrumentation Engineering

FIRST YEAR : 1ST SEMESTER		
Course Name (Code)	**Course Outcomes (COs)**	
	On completion of the course, the students will be able to:	
English Language & Technical Communication (HU101)	CO1	Develop advanced skills of technical communication in English.
	CO2	Communicate confidently and competently in English language in all spheres.
	CO3	Develop writing competence- technical report, business letters, job applications etc.
	CO4	Develop reading comprehension skill through non-technical texts.
	CO5	Conduct conversation practice: face to face and via media.
Chemistry-I (CH101)	CO1	Understand the theory based ideas in thermodynamics and its importance in engineering.
	CO2	Understand the theory based ideas in electrochemistry and its importance in engineering.
	CO3	Understand the theory based ideas in industrial chemistry and polymer chemistry and its importance in engineering.
	CO4	Understand the theory based ideas in Solid state chemistry and its importance in engineering.
	CO5	Understand the theory based ideas in organic reaction mechanism.
	CO6	Develop conceptual and analyzing skills in solving broad range problems. The skills will ultimately help students to initiate scientific research in the field of nano science, superconductivity and innovate technologies that benefit society.
Mathematics-I (M101)	CO1	Use Determinants and Matrices; solve system of linear equations and Eigen value/vector problems.
	CO2	Apply Leibnitz Theorem on successive derivatives.
	CO3	Apply Mean Value theorems, Taylor series for expansion of elementary functions.
	CO4	Apply Reduction Formulae for some integrals.
	CO5	Basic understanding of functions of several variables and multiple integrals

	CO6	Basic Vector Calculus and simple problems of Divergence and Stoke's Theorem.
	CO7	Check convergence of infinite series of positive terms/alternating terms.
Basic Electrical & Electronic Engineering-I (ES101)	CO1	Demonstrate and explain electrical components, electrical circuits and DC network theorems.
	CO2	Apply the knowledge of series, parallel and electromagnetic circuits.
	CO3	Distinguish between conductors, nonconductors and semiconductors based on energy band theory and classify different types of semiconductors.
	CO4	Demonstrate the operating principle and output characteristics of p-n junction diodes, zener diode, Varactor diode, BJT, rectifiers and different diode circuits.
	CO5	Compute different parameters for characterizing different circuits like rectifiers, regulators etc. using diodes and BJTs.
	CO6	Employ the concept of Energy Band Theory and Fermi Levels to explain the operating principle of semiconductors.
Engineering Mechanics (ME101)	CO1	Construct the free-body diagrams and calculate the actions and reactions necessary to ensure static equilibrium and compute different types of internal stresses developed in a solid body.
	CO2	Analyze any static or dynamic problem to form equilibrium equations in two or three dimensions and solve them by applying the knowledge of various principles of mechanics.
	CO3	Locate the positions of centroids and calculate the moments of inertia of laminas and solids about an axis.
	CO4	Describe the motion of a particle in terms of its position, velocity and acceleration.
	CO5	Understand kinematic and kinetic analysis and energy and momentum methods for attacking problems on particles, systems of particles and rigid bodies in motion.
	CO6	Use work-energy principle to solve problems related to static and dynamic equilibrium.
Chemistry-I Laboratory (CH191)	CO1	The experiment of determining hardness of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO2	The experiment of redox reaction helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO3	The experiment of determining alkalinity of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO4	The experiment of determining viscosity of liquid helps students to learn the basics of experiments to apply in day to day life as well as in industry.

	CO5	Students can measure and suggest which source of water is drinkable, the harmful effect of containers used for tea, fruit juices etc.
	CO6	Which source of water can be used in boiler; which source of ore can be used as a good resource of iron.
Basic Electrical & Electronic Engineering-I Laboratory (ES191)	CO1	Apply concepts of electrical components, electrical circuits and DC network theorems.
	CO2	Create series & parallel circuit & the effect of resonance.
	CO3	Distinguish between conductors, nonconductors and semiconductors based on energy band theory and classify different types of semiconductors.
	CO4	Demonstrate the operating principle and output characteristics of p-n junction diodes, zener diode, Varactor diode, BJT, rectifiers and different diode circuits.
	CO5	Compute different parameters for characterizing different circuits like rectifiers, regulators etc. using diodes and BJTs.
	CO6	Employ the concept of Energy Band Theory and Fermi Levels to explain the operating principle of semiconductors.
Engineering Drawing & Computer Graphics (ME191)	CO1	Perform free hand sketching of basic geometrical constructions and multiple views of objects.
	CO2	Do orthographic projection of lines and plane surfaces.
	CO3	Draw projections and solids and development of surfaces.
	CO4	Prepare isometric and perspective sections of simple solids.
	CO5	Demonstrate computer aided drafting.
	CO6	Develop graphic skills for communication of concepts, ideas and design of Engineering products.
Language Laboratory (HU181)	CO1	Honing 'listening skill', 'speaking skill' and its sub skills through language lab audio device.
	CO2	Practice conversation sessions to internalize basic intervention by using correct body language.
	CO3	Honing 'reading skills' and its sub skills using visual/ graphics/ diagrams.
	CO4	Learning global/ contextual/ inferential comprehension.
	CO5	Practice different master linguistic and paralinguistic features.
	CO6	Participate in group discussion through audio visual input and acquaint with key strategies for success.
Extra Curricular Activities(NSS/ NCC/NSO etc) (XC181)	CO1	Create awareness in social issues.
	CO2	Participate in mass education program.
	CO3	Develop some proposals for local slum area development and waste disposal.
	CO4	Create environmental awareness.
	CO5	Participate in relief and rehabilitation work during natural

		calamities.
	CO6	Propose production oriented programmes.
FIRST YEAR : 2ND SEMESTER		
Basic Computation & Principles of Computer Programming (CS201)	CO1	Analyze problems, design and implementing algorithmic solutions.
	CO2	Understand and trace the execution of programs written in C language.
	CO3	Write the C code using a modular approach and recursive concepts.
	CO4	Explain the dynamics of memory by the use of pointers and create/update basic data files.
	CO5	Design C Programs for problems.
	CO6	Write and execute C programs for simple applications.
Physics-I (PH 201)	CO1	Analyse and apply the concepts of oscillations and of wave.
	CO2	Understand the some basic properties of physical optics.
	CO3	Distinguish different ways of application of polarization of light and LASER.
	CO4	Understand the basic concepts of Quantum Physics.
	CO5	Classify crystal structures and to identify the properties of X-rays and its application.
Mathematics-II (M201)	CO1	Solve ODE of 1st order & 1st degree.
	CO2	Solve some special cases of 2nd order ODE and simultaneous linear ODE of Basic graph theory, matrix representation of graphs.
	CO3	Trees and simple tree algorithms.
	CO4	Improper integrals & their convergence.
	CO5	Laplace Transform and application on ODE.
Basic Electrical & Electronic Engineering-II (ES 201)	CO1	Demonstrate and characterize DC machine, single phase transformer and three phase induction motor.
	CO2	Classify different types of FETs and demonstrate feedback amplifiers, OP-AMPs, and oscillator circuits.
	CO3	Compute and characterization of feedback amplifiers, OP-AMPs, and oscillator circuits.
	CO4	Employ the concept of positive feedback to design of an oscillator circuit.
	CO5	Relate the characteristics of PN junction in the operation of FET.
	CO6	Illustrate the basics of Boolean algebra and logic gates and their realization using discrete electronic components.
Engineering Thermodynamics & Fluid Mechanics (ME201)	CO1	Understand the basic concepts of thermodynamic systems and processes. Understand the fundamental concepts of fluid mechanics.
	CO2	Apply and analyze energy balance and demonstrate first and second law of thermodynamics to various thermodynamic devices.

	CO3	Use & practice thermodynamic tables, thermodynamic diagrams and concept of equation of state, and their simple application.
	CO4	Explain and compare gas power cycles, refrigeration cycle and Rankine cycle; calculate their efficiencies and coefficients of performance.
	CO5	Solve problems involving fluid properties and shear forces resulting from Newtonian fluid. Apply the basic equation of fluid statics to determine forces and pressures.
	CO6	Formulate and apply fundamental equation of fluid motion to determine flow properties.
Basic Computation & Principles of Computer Programming Laboratory (CS291)	CO1	Design a document using MS_WORD.
	CO2	Demonstrate and compute the data using Spread Sheet.
	CO3	Implement the basic elements of a C program including arithmetic and logical operators, functions, control structures, and arrays
	CO4	Execute a walk-through of a program containing pointers, Structures, Unions and File Concepts.
	CO5	Design a program related to challenging questions.
	CO6	Write and execute C programs for simple applications.
Physics-I Laboratory (PH291)	CO1	Application of the concepts of elasticity of materials by finding Young's modulus and other characteristics of a metallic bar and accordingly verifying Hook's Law.
	CO2	Application of the concepts of elasticity of materials by finding Rigidity Modulus of a metallic rod and accordingly verifying Hook's Law.
	CO3	Application of the theoretical knowledge of interference and division of amplitude by measuring wavelength of light or curvature of lens using Newton's ring experimental set up.
	CO4	Application of the idea of dispersion and minimum deviation of light for prism by finding out dispersive power of the material of a prism.
	CO5	Application of the knowledge of Wheatstone Bridge Principle by measuring the resistivity of the wire of a meter bridge and by calculating the value of resistance of a unknown sample.
Basic Electrical & Electronic Engineering- II Laboratory (ES 291)	CO1	Demonstrate and characterize DC machine, single phase transformer and three phase induction motor.
	CO2	Classify different types of FETs and demonstrate feedback amplifiers, OP-AMPs, and oscillator circuits.
	CO3	Compute and characterization of feedback amplifiers, OP-AMPs, and oscillator circuits.
	CO4	Employ the concept of positive feedback to design of an oscillator circuit.
	CO5	Relate the characteristics of PN junction in the operation of FET.

	CO6	Illustrate the basics of Boolean algebra and logic gates and their realization using discrete electronic components.
Workshop Practice (ME 292)	CO1	Use various tools, machines, devices used in engineering practice.
	CO2	Carrying out various operations in mechanical engineering workshop.
	CO3	Adhere "Hands on" training and practice to students for use of various tools, devices, machines.
	CO4	Exhibit engineering skills and create objects from raw materials.
	CO5	Interpret job drawing, application of processes and operations to produce basic components from raw material.
	CO6	Utilize measuring and practical skills in the trades.
SECOND YEAR : 3RD SEMESTER		
Numerical Methods (MCS301)	CO1	Sources of error in computation and its propagation.
	CO2	Simple polynomial interpolation on equally & unequally spaced data.
	CO3	Trapezoidal & Simpson's 1/3rd Rules.
	CO4	Iterative and Matrix-Factorization methods for system of linear equations.
	CO5	Finding root by Regula Falsi and Newton-Raphson methods.
	CO6	Euler, RK4, Predictor-Corrector for 1st order ODE and Finite Difference methods for simple ODE's.
Mathematics-III (M302)	CO1	Fourier Series and application in simple PDE.
	CO2	Basics of Fourier Transform and application in simple PDE.
	CO3	Functions of Complex variable and their properties.
	CO4	Apply Cauchy-Goursat theorem, Laurent's series and elementary contour integration. Residue calculation. Basics of Conformal Mapping.
	CO5	Basic Probability theory with application of Binomial, Poisson & Normal distributions.
	CO6	Solution of simple PDE by Laplace Transform.
	CO7	Series solution of some 2nd Order ODE, special cases: Bessel's & Legendre's functions.
Digital Electronic Circuits (EC(EI)301)	CO1	Have a thorough understanding of the fundamentals and techniques used in digital electronics.
	CO2	Understand and study the formation of combinational circuits and its applications in digital system.
	CO3	Understand, analyze and design various sequential logic circuits in digital system.
	CO4	Identify, create and design the complex logical circuits problems with appropriate solutions individually or in a team.
	CO5	Understand the function of Analog to digital and Digital to analog

		converter with their proper applications.
	CO6	Carry out their project works and higher studies in future in the digital electronics.
Analog Electronic Circuits (EC(EI)302)	CO1	Develop the ability to analyze and design analog electronic circuits using discrete components.
	CO2	Understand the working principles of different electronic devices like filter, regulators and SMPS.
	CO3	Analyze the basics of transistor biasing and stability, and further understand the concept of multistage amplifiers, analysis of multistage amplifier and its frequency response.
	CO4	Study and analyze the performance of the various types of feedback amplifiers.
	CO5	Design the various types of RC and LC oscillators.
	CO6	Design, develop and analyze the various applications using operational amplifiers and timer IC 555.
Circuit Theory and Networks (EE(EI)301)	CO1	Prepare the students to have a basic knowledge in the analysis of Electric Networks.
	CO2	Understand advanced mathematical methods such as Laplace transform along with linear algebra and differential equations techniques for solving different circuit problems.
	CO3	Solve the given circuit with various theorems and methods.
	CO4	Relate various two port parameters and transform them.
	CO5	Distinguish between tie set and cut set methods for solving various circuits.
	CO6	Design various types of filters.
Electrical Measurement & Instrumentation (EI 301)	CO1	Understand and analyze construction and operational aspects of different electro-mechanical measuring instruments along with their application domains.
	CO2	Study and analyze statistical data presentation and evaluation from static and dynamic characteristics including errors of different electro-mechanical instruments.
	CO3	Understand and Analysis the fundamental measurement method of resistance, capacitance, inductance, frequency etc. by using various a.c bridges and other techniques.
	CO4	Measurement of high voltage and localization of cable faults with various methods and a detail knowledge about potentiometers and A.C and D.C energy meters.
	CO5	Understand the impact of electrical measurement methods not only to measure and analysis of the modern sophisticated instruments/systems for human utilities and industrial application but also in higher studies and R&D.
Numerical	CO1	Choose the appropriate numerical methods for solving engineering

methods Lab (M(CS)391)		problems using C language.
	CO2	Demonstrate understanding of different numerical methods.
	CO3	Derive numerical methods for various mathematical operations and tasks such as interpolation, integration, to calculate the solution of linear & non-linear equations and solve differential equations.
	CO4	Compare and distinguish between different numerical methods solving engineering problems giving better optimal results and roots of equation.
	CO5	Test and evaluate the accuracy of common numerical methods.
	CO6	Design and develop numerical methods for solving complex engineering problems by combining numerical algorithms of linear & non-linear equations with the help of MATLAB TOOL.
Digital Electronic Circuits Lab(EC(EI) 391)	CO1	Operate and understand standard electronic equipment such as breadboard, pulse generator, digital multi-meters, power supplies and digital ICs to analyze, test and implement the digital circuits.
	CO2	Illustrate the basic of logic gates and their realization using universal gates.
	CO3	Design, simulate and implement basic combinational circuits using logic gates.
	CO4	Analyze different sequential circuits and compare its theoretical performance to actual performance.
	CO5	Apply troubleshooting techniques to test digital circuits and acquire teamwork skills for working effectively in groups.
Analog Electronic Circuits Lab (EC(EI) 392)	CO1	Identify different circuit components (R, L, C, Diode, Transistor, Op-Amp etc.) with ratings.
	CO2	Understand the use of Function generator and CRO.
	CO3	Design, fabricate and demonstrate the working of diodes, transistors with simple circuits.
	CO4	Design and fabricate different timer and multivibrator circuits.
	CO5	Design and fabricate different IC based electronic circuits.
Circuits and Networks Lab (EE(EI) 391)	CO1	Construct and simulate RL, RC and RLC circuit using PSPICE.
	CO2	Analyze the transient response of RL, RC and RLC circuit.
	CO3	Determine Z and Y parameter in two port network.
	CO4	Learn to design different types of filters using PSPICE.
	CO5	Represent different function and to develop their use in s-domain circuit analysis using MATLAB.
	CO6	Use the Laplace transform to represent time-domain circuits in the frequency domain and to observe the pole and zero concept using MATLAB.
SECOND YEAR : 4TH SEMESTER		

Values & Ethics in Profession (HU401)	CO1	Understand pros and cons of technological growth on society and environment from theoretical and applied perspective.
	CO2	Implement motivational tools and use their ability to reason ethically about social issues and to connect them to ethical models of value.
	CO3	Analyze the duties and responsibilities as professionals through gaining knowledge of the codes of professional ethics and ethical dilemma in real-world situation.
	CO4	Judge the value crisis in contemporary Indian society, and evaluate also how to live a good professional as well as personal life.
	CO5	Perform in multiple social and academic disciplines for ethical analysis of psychological, societal, aesthetics, moral and ethical issues.
Physics – II (PH(EE)401)	CO1	Understand the physical significance of various algebraic operations of vectors, vector calculus and related theorems.
	CO2	Understand concept of electrostatics, magnetostatics and apply them in real physical systems.
	CO3	Understand concept of electromagnetic field theory and apply them in real physical systems.
	CO4	Understand the basics of classical mechanics and quantum mechanics and apply the knowledge in case of complex mechanical problems and electrons trapped inside crystal respectively.
	CO5	Classify particles in terms of MB, BE and FD stats with their properties and apply the knowledge in real photonic and electronics systems.
Basic Environmental Engineering & Elementary Biology (CH401)	CO1	Understand the fundamental physical and biological principles that govern the natural processes and the fundamental concepts from the social sciences and the humanities underlying environmental thought and governance.
	CO2	Explain and Express the relationships between living organisms, including humans, and their physical environment; it seeks to understand the vital connections between plants and animals and the world around them and their method of conservation.
	CO3	Interrelate the concept of the structure of atmosphere, atmospheric phenomenon with the air pollutants, effects and their methods and control.
	CO4	Explain the importance of protecting water from contamination and the techniques for undertaking a sanitary survey of drinking water. Learning the sources and types of water pollution, the public health impacts and indicators of water pollution and approaches to the control of pollution.
	CO5	Understand the sources, types and management of solid waste, noise pollution.
	CO6	Associate the actions geared to improve the quality of the human

		environment.
Sensors and Transducers (EI401)	CO1	Recognize and define electrical & electromechanical sensors according to applications.
	CO2	Explain & analyze the working principle of different electrical & electromechanical sensors.
	CO3	Appraise the transfer function and characteristic curves of different electrical & electromechanical sensors.
	CO4	Design and develop appropriate signal conditioning circuits for different types of sensors.
	CO5	Outline the basics of smart sensors in different applications.
Microprocessors and Computer Architecture (EI402)	CO1	Understand the generalized architecture of 8085 microprocessor.
	CO2	Demonstrate programming proficiency using the various addressing modes and data transfer instructions of the microprocessor.
	CO3	Understand an in-depth analysis of the addressing modes, timing diagram, time delay and interrupts for executing programs efficiently.
	CO4	Design and develop 8085 electronic instrumentation systems using external peripherals and I/O devices by understanding the concept of interfacing with peripherals.
	CO5	Discriminate different types of computer architecture and develop the concept of pipelining and multiprocessing system.
Field theory (EE402(EI))	CO1	Understand the basic concepts of electric and magnetic fields.
	CO2	Apply vector calculus to static electric magnetic fields in different engineering situations.
	CO3	Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
	CO4	Examine the phenomena of wave propagation in different media and its interfaces.
	CO5	Analyze the nature of electromagnetic wave propagation in guided medium.
Technical report writing & language laboratory Practice (HU481)	CO1	Hone speaking skills through impromptu discussions, thereby creating awareness about the social environment.
	CO2	Develop strategies of group discussion to build up team-spirit, and develop lateral thinking and problem-solving analytical competence.
	CO3	Mock – interview sessions to develop company readiness and employability skills, focussing on technical communication and inter-personal skills.
	CO4	Develop of group/corporate presentation through audio visual aids,

		aiming correct usage of language, visual effects and body language.
	CO5	Develop listening and writing skills through audio-visual aids for success in competitive examinations.
Physics –II Lab (PH(EE)491)	CO1	Apply of the concepts of P-N junction and functionality of energy conversion by introducing solar cell and measuring its characteristics.
	CO2	Understand of the theoretical knowledge of semiconductor by measuring Band Gap of a semiconductor through four probe method.
	CO3	Understand of the theoretical knowledge of hot body radiation by measuring Stefans' constant using a diode valve.
	CO4	Apply of the theoretical concepts of Lorentz force and Helmotz's Coil by measuring the value of charge and mass ratio of a tiny particle like electron.
	CO5	Adopt the above knowledge of the experiments, students are expected to design, develop and execute an innovative experiment with the existing instrument.
Electrical Measurement & Instrumentation Lab (EI 491)	CO1	Demonstrate variety of practical electrical circuits and conduct experiments to analyze and interpret data.
	CO2	Identify various measuring equipments/meters and to predict correctly their expected performance through different calibration methods.
	CO3	Differentiate the working principle and use of PMMC and moving iron type instruments.
	CO4	Measure Resistance, Inductance, Capacitance, Frequency, Voltage, Current, Power and Energy.
	CO5	Prepare graphical presentations of laboratory data and computational results, incorporating standard data analysis methods to develop technically sound reports of outcomes.
	CO6	Interact effectively on a social and interpersonal level with peer students, divide up and share task responsibilities to complete assignments.
Microprocessor Lab (EI 492)	CO1	Understand the instruction sets of 8085 microprocessor.
	CO2	Analyze timing sequence of different instruction and apply the knowledge instruction sets in the programming of 8085 microprocessors.
	CO3	Apply the programming techniques in designing simple assembly language programs for solving simple problems by using instruction sets of microprocessor.
	CO4	Develop the experiments, analyze and interpret data to identify,

		formulate and solve engineering problems.
	CO5	Demonstrate the idea to interface the external devices with the processor according to the requirements to create novel products and solutions for the real time problems.
THIRD YEAR : 5TH SEMESTER		
Economics for Engineers (HU - 501)	CO1	Recognize financial statements, their importance and usages.
	CO2	Understand major principles of financial accounting, cost accounting and financial management.
	CO3	Utilize the tools and techniques for economic analysis of alternative opportunities, considering time value of money and risk associated with returns.
	CO4	Appraise investment opportunities considering forthcoming changes in economy, including inflation and their effect.
	CO5	Rank the opportunities with proper justifications.
	CO6	Make optimal engineering investment decisions.
Industrial Instrumentation (EI 501)	CO1	Understand the knowledge of basic fundamentals, terms, and units of pressure, temperature, level and flow rate.
	CO2	Illustrate the construction and working principle of various type of transducers/sensor to measure physical quantities.
	CO3	Recognize the physics of pressure, temperature, level and flow measurement used to control dynamics of processes.
	CO4	Assemble commonly used process variable measurement devices through proper selection, identification, design, installation and principle of operation in industries.
	CO5	Demonstrate a working knowledge of safety practices used in the measurement and control of industrial processes.
	CO6	Develop critical and creative thinking to bring the technology, problem-solving skills in trouble shooting problems with the measurement and control of industrial instrumentation work.
Control Theory (EI 502)	CO1	Understand the basic concepts of transfer functions, block diagrams and different control algorithms in control theory.
	CO2	Analyze basic performance criteria for first and second order control systems including steady-state and transient response, parametric sensitivity, disturbances, error, and Stability.
	CO3	Design specifications of second order systems.
	CO4	Examine system stability in time domain and frequency domain.
	CO5	Design of linear continuous –time systems using state model, and compensation techniques.
Optoelectronics & Fibre Optics (EI 503A)	CO1	Understand the fundamentals of semiconductor material properties and semiconductor opto-electronic systems and their applications in engineering fields.
	CO2	Demonstrate the basic mechanisms of light generation (including

		LED & LASER) through detailed understanding and analysis of operation principles, characteristics, design architectures, modulation classification & application of LEDs and semiconductor lasers.
	CO3	Conversant with the application of optical properties, operation, structures, performance and application of photo detectors, LDR and Opto-coupler etc.
	CO4	Understand an in-depth analysis of optical fibers and their applications in communications and as optical sensing devices.
	CO5	Learn how to use optical sensing systems in security, military system, oil & gas industries, civil engineering and transportation etc. and also be familiar with the impact of Opto-electronics and optical fibre in R & D.
Data Structures & Algorithms(CS) (EI 504A)	CO1	Remember data types, array, pointers, memory allocation techniques.
	CO2	Understand the concepts of linear, non-linear data structure such as stacks, queues, trees and graphs.
	CO3	Handle different type of operations such as insertion, deletion, traversal mechanism etc. on various data structures.
	CO4	Implement various data structure to solve computing problems using C-programming language.
	CO5	Compare different algorithms, their advantages and disadvantages and evaluate time complexities of different algorithms.
	CO6	Choose appropriate data structure as applied to specified problem definition.
Industrial Instrumentation Lab (EI 591)	CO1	Get an adequate knowledge about selecting particular sensing elements for the measurement of physical parameters.
	CO2	Calibrate dead weight tester.
	CO3	Verify the characteristics of Thermocouple and RTD.
	CO4	Acquire knowledge about the principles different type of flow measurements.
	CO5	Measure Level using capacitive type level instrument.
	CO6	Acquire knowledge about the principles of Moisture and viscosity measurement.
Sensors and Transducers Lab (EI 592)	CO1	Understand the design, calibration and characteristics of various measuring systems/ instruments.
	CO2	Recognize the fundamental principles of various types of sensors including thermal, mechanical, electrical, electromechanical and optical sensors. Understand their general characteristics, terminologies, sensing and transduction principles.
	CO3	Analyze the measured data (resolution, error analysis etc) obtained from sensors and transducers.

	CO4	Develop different innovative techniques of measurement in industrial control system structure and scientific activities.
	CO5	Explain the criteria for sensors and transducers selection and choose appropriate measurement methods for engineering tasks and scientific researches.
Control Engineering Lab (EI 593(EE))	CO1	Understand and describe MATLAB control system toolbox.
	CO2	Analyze the physical systems represented in transfer function.
	CO3	Describe and design step response for first and second order system with unity feedback.
	CO4	Analyze the impulse response for types 0, 1 and 2 with unity feedback using MATLAB.
	CO5	Understand the stability of an Electrical, mechanical and other Physical systems using root-locus, Bode plot, Nyquist plot by MATLAB software.
	CO6	Design controllers, compensators using MATLAB software.
Data Structures & Algorithms Lab(CS) (EI 594A)	CO1	Analyze algorithms and correctness of algorithms.
	CO2	Design and analyze simple linear and non linear data structures.
	CO3	Summarize searching and sorting techniques.
	CO4	Gain practical knowledge on the applications of data structures.
	CO5	Design and analyze the time and space efficiency of algorithms.
	CO6	Identify and apply the suitable data structure for the given real world problem.
THIRD YEAR : 6TH SEMESTER		
Principles of Management (HU – 601)	CO1	Recognize the fundamentals of Management thoughts that are vital for the development of conceptual frame work of Management as a discipline.
	CO2	Demonstrate knowledge of organizational structure, organizational conflict, negotiation, politics, and change.
	CO3	Apply the principles of decision making through planning, organizing, staffing, directing and controlling.
	CO4	Analyze business opportunities through interpretation of financial statements and quality control to meet global competitions.
	CO5	Relate knowledge of ethics in the context of corporate social responsibility and advertising, brand management and product positioning across cultural diversities.
	CO6	Generate innovative ideas towards development of products and entrepreneurship.
Process Control-I (EI 601)	CO1	Develop mathematical modeling of different process using differential equation.
	CO2	Describe the different mode of control action.
	CO3	Design and tune process (PID) controllers.
	CO4	Analyze different control strategies.

	CO5	Select control valves for different systems.
	CO6	Understand the basics of Programmable Logic Control.
Electronic Instrumentation and Measurement (EI 602)	CO1	Acquire the knowledge about applications of electronics measurements and understand the actual field where electronics measurements are required for measurement purpose in instrumentation field.
	CO2	Understand the working principles of different electronic instruments like VCO, PLL, Charge Amplifier, Programmable Gain Amplifier, Current Mirror, voltage to frequency and frequency to voltage converters for the application of instrumentation.
	CO3	Study and analysis the performance of Basic Emitter Follower Voltmeter, Voltmeters with IC Operational Amplifiers, True R.M.S Voltmeter, Digital voltmeters along with Q meter.
	CO4	Understand the working principles of Current-to-voltage converter type Electronic Ammeters, Chopper stabilized amplifiers for measurement of very low voltages and currents. Cathode ray oscilloscopes and its applications, LED, LCD, Spectrum Analyzer and the basic knowledge of virtual instrumentation.
	CO5	Understand the impact of electronics instrumentation not only for the measurement of the modern sophisticated electronic instruments/ systems for human utilities and electronic industry but also in higher studies and R & D.
Advanced Microprocessors & Microcontrollers (EI -603)	CO1	Understand the internal organization and different modes of operation of advanced microprocessors and microcontrollers.
	CO2	Analyze or impart the knowledge of the addressing modes and the instruction set of the microprocessor / microcontroller which is used for programming the processor and controller.
	CO3	Develop algorithm/program for a particular task using advanced microprocessors and microcontrollers.
	CO4	Understand memory organization and interrupts of microprocessors/ micro-controllers helps in various system designing aspects.
	CO5	Interface a microprocessor or microcontroller to external input/output devices and perform input/output device programming in assembly language.
	CO6	Design and conduct experiments related to microprocessor/ microcontroller based system design.
Bio Medical Instrumentation (EI 604A)	CO1	Review the cardiac, respiratory, nervous and muscular physiological systems.
	CO2	Learn several signals that can be measured from the human body and understand theory of signal conditioning.
	CO3	Familiarize students with various medical equipment and their

		technical aspects.
	CO4	Understand the medical imaging.
	CO5	Describe the evolution of biotelemetry.
Soft Computing (EI 604B)	CO1	Identify and describe soft computing techniques and their roles in designing intelligent machines.
	CO2	Recognize the feasibility of applying a soft computing methodology for a particular problem.
	CO3	Apply fuzzy logic and reasoning to handle and solve uncertainty-related engineering problems.
	CO4	Develop genetic algorithms to combinatorial optimization problems.
	CO5	Solve the pattern classification and regression problems using neural networks technique.
	CO6	Integrate various kinds of soft computing techniques to design hybrid (neuro-fuzzy and fuzzy-GA) systems.
Digital Signal Processing (EC) (EI-605A)	CO1	Introduce discrete time signal processing and characterize random signals, understand the concepts of time invariance, stability, discrete convolution and discrete correlation.
	CO2	Perform forward and inverse z-transforms and to use them in performing convolution and analysis of discrete-time systems, casual and non- casual.
	CO3	Compute Discrete-time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT) and understand their uses in discrete-time systems.
	CO4	Perform Fast Fourier Transform (FFT) algorithms.
	CO5	Specify and design both FIR and IIR digital filters.
Process Control Lab (EI 691)	CO1	Understand basic components of process control loop.
	CO2	Employ control of a process using personal computer.
	CO3	Realize control of different processes using PID controllers.
	CO4	Acquire knowledge about PLC programming.
	CO5	Learn control of processes using DCS and MATLAB.
Electronic Instrumentation and Measurement Lab (EI 692)	CO1	Acquire the practical knowledge about applications of electronics measurements and understand the actual field where electronics measurements are required for measurement purpose in instrumentation field.
	CO2	Understand the working principles of different electronic instruments to determine the static and dynamic characteristics in practical field as well as the statistical error analysis of output results.
	CO3	Study the operating principle and analyze the output characteristics of different electronics instruments like VCO , voltage to current and current to voltage converter, spectrum analyzer etc to

		understand the applications of the instruments in.
	CO4	Understand the application of virtual instrumentation by analysis the real world data by determine the output characteristics of instruments using data acquisition card.
	CO5	Understand the impact of practical side of electronics instrumentation not only for the measurement of the modern sophisticated electronic instruments/systems for human utilities and electronic industry but also in higher studies and R & D.
Advanced Microprocessors & Microcontrollers Lab (EI 693)	CO1	Understand and apply the fundamentals of assembly level programming of advanced microprocessor (8086) and microcontroller (8051).
	CO2	Design and conduct experiments, analyze and interpret data to identify, formulate and solve engineering problems.
	CO3	Develop ALP for arithmetic and logical operations using 8086 microprocessor8051 microcontroller.
	CO4	Demonstrate how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.
	CO5	Analyze abstract problems and apply a combination of hardware and software to address the problem.
Seminar (EI 681)	CO1	Apply effective strategies in literature searches and practice of finding relevant materials.
	CO2	Perform critical readings of own writing and the writing of others.
	CO3	Demonstrate effective writing skills and processes.
	CO4	Effectively incorporate and document properly according to a specific style.
	CO5	Capability to interact intellectually through informal and formal speaking.
	CO6	Apply principles of ethics and respect in interaction with others
FOURTH YEAR : 7TH SEMESTER		
Telemetry and Remote Control (EI 701)	CO1	Understand the purpose of different Telemetry & Remote control systems in Instrumentation field.
	CO2	Recognize the various Telemetry systems, coding, and Time Division Multiplexing and Frequency Division Multiplexing techniques.
	CO3	Apply both the analog and digital modulation techniques in Telemetry systems.
	CO4	Describe the Fiber optics, Satellite communication and multiple access schemes like FDMA, TDMA and CDMA.
	CO5	Design and implement the Remote control system for various Industrial application purposes.
Analytical Instrumentation	CO1	Determine the physical properties of samples using pH meters and conductivity meters.

(EI 702)	CO2	Measure the composition of dissolved oxygen, sodium, silica elements present in the given samples.
	CO3	Understand the applications and usage of chromatography in industrial environments.
	CO4	Analyze qualitatively and quantitatively different industrial products using spectrometer.
	CO5	Measure the relative humidity of air and compare different humidity measuring instruments and understand the viscosity measurement.
	CO6	Adequate knowledge of a number of analytical instruments which are useful for clinical analysis in health care, drugs and pharmaceutical laboratories and above all for environmental pollution monitoring and control.
Process Control-II (EI 703)	CO1	Understand the different stages of sampling process of a continuous signal and allied signal conversion process.
	CO2	Use Numerical differentiation and Numerical integration techniques to discretize ordinary differential equations to difference equations in order to facilitate the application of Z – transform in Sampled data systems.
	CO3	Investigate frequency domain analysis of sampled data systems along with different digital control algorithms.
	CO4	Understand the fundamental knowledge about DCS, HMI, Communication networks and allied protocols used in process industries.
	CO5	Analyze and design specific control strategies for various process parameters (temp, level, flow, pressure).
Communication Theory (EI 704A)	CO1	Identify and select the various building blocks of a communication system and their functions.
	CO2	Understand, analyze and design the different modulation techniques like AM, FM and Pulse Modulation etc.
	CO3	Analyze the signal transformation using sampling theorem and understand the knowledge of PCM.
	CO4	Study and explore the digital communication system and the various modulation techniques such as ASK, FSK and PSK etc.
	CO5	Establish the performance and efficiency of the communication systems with information and coding techniques.
Computer Networking (EI 705A)	CO1	Know and identify the concepts of protocols, network interfaces, network models, OSI and TCP/IP reference model and design/performance issues in local area networks and wide area networks.
	CO2	Understand basic computer networking technologies (error and flow control, access control and congestion control) and various networking protocols.

	CO3	Solve the problems related to error control, flow control, access control, congestion control, network addressing and network layer protocols.
	CO4	Analyze and justify why network needs security and control, what errors might occur, and how to control network errors with the use of simulator to deal with the related issues.
	CO5	Specify and identify deficiencies in existing protocols and design a whole computer network for an organization.
Telemetry and Remote Control Lab (EI 791)	CO1	Understand and describe voltage telemetry system using a process variable transducer.
	CO2	Analyze the 4-20 mA current telemetry system: 2 wire and 3 wire systems.
	CO3	Apply basic concepts of modulation techniques including frequency modulation (FM) and phase modulation (PM) that are widely used in analogue communication systems, and basic techniques for analyzing such systems in the frequency domains.
	CO4	Understand and describe of a digital communication system including, pulse code modulation (PCM) and basic techniques for analyzing such systems in the time and frequency domains.
	CO5	Identify and study Computerized control wireless telemetry system and (wireless) remote control system.
Communication Lab (EI 794A)	CO1	Each graduate will be able to understand and compare different analog modulation schemes.
	CO2	Each graduate will be able to understand and compare different digital modulation schemes.
	CO3	Each graduate will be able to design and conduct experiments, analyze and interpret data.
	CO4	Each graduate will be able to design analog and digital communication systems, component or process as per needs and specification.
	CO5	Each graduate will be able to convert analog signals to digital while satisfying certain specs.
	CO6	Each graduate will be able to evaluate fundamental communication system parameters, such as bandwidth, power, signal to quantization noise ratio, and data rate, and prepare graphical presentations of laboratory data to develop technically sound reports of outcomes.
	CO7	Each graduate will be able to interact effectively on a social and interpersonal level with peer students, divide up and share task responsibilities to complete assignments.
	CO8	Each graduate will be able to perform safe practices in laboratory environment with professional and ethical responsibilities.
Computer	CO1	Familiarization with transmission media,connector,Hubs,Switches

Networking Lab (EI 795A)		and installation of NIC.
	CO2	Implementation of client server applications with TCP/UDP Socket programming in a standalone machine and networks.
	CO3	Implement the other different protocols.
	CO4	Perform some mathematical services in client Server architecture.
	CO5	Implement and compare the various routing algorithms.
	CO6	Make an ad-hoc network with few computers.
Industrial Training Evaluation (EI 781)	CO1	Recognize the 'real' working environment and get acquainted with the application, installation and operation of different measuring instruments and allied instrumentation and control strategies in an industrial environment.
	CO2	Appraise hands-on experience in Instrumentation and allied industries so that they can relate and reinforce what has been taught at the institute.
	CO3	Set up synergetic collaboration between industry and institute to promote a more effective and industry-ready Instrumentation engineer's society.
	CO4	Define engineering ethics in practice and demonstrate the same in appropriate industries.
	CO5	Communicate effectively and present ideas clearly and coherently to specific audience.
	CO6	Implement the methodology and propose a meaningful solution to complete the project within a given time frame.
Project-1 (EI 792)	CO1	Demonstrate a sound technical knowledge of their selected project topic.
	CO2	Manage the scope, cost, timing, and quality of the project defined by project stakeholders.
	CO3	Understand the problem identification, formulation and solution.
	CO4	Design engineering solutions to complex problems utilising a systems approach.
	CO5	Develop culture of working within a group as team and build up leadership quality.
	CO6	Communicate with engineers and the community at large in written an oral forms.
FOURTH YEAR : 8TH SEMESTER		
Organizational Behavior (HU - 801)	CO1	Identify the importance and intricacies of organizational behaviour.
	CO2	Describe personality, attitudes and perception to motivate employees.
	CO3	Implement effective communication skills to handle group behaviour.
	CO4	Resolve organizational conflicts and politics through negotiations.
	CO5	1. Monitor human resources through effective leadership.
	CO6	Create a congenial and cohesive ambience within the framework of

		organizational structure in achieving the organizational goals.
Power Electronics (EI 801A)	CO1	Understand basic operation of various power semiconductor devices and passive components.
	CO2	Understand the basic principle of switching circuits.
	CO3	Analyze and design an AC/DC rectifier circuit.
	CO4	Analyze and design DC/DC and AC/AC converter circuits.
	CO5	Analyze DC/AC inverter circuit.
	CO6	Understand the role power electronics play in the improvement of energy usage efficiency and the development of renewable energy technologies.
Mobile Communication (EI 802A (EC))	CO1	Explain different multiple access techniques in cellular communication.
	CO2	Explain the characteristics of wireless channel and propagation path loss models.
	CO3	Explain different standards of cellular network and wireless network protocol.
	CO4	Explain different wireless communication systems and WLAN family.
	CO5	Explain the components of satellite communication system.
Embedded Systems (EI 802B (EC))	CO1	Explain the differences between the general computing system and the embedded system.
	CO2	Demonstrate different devices and communication buses used in embedded system.
	CO3	Explain hardware software co-design issues.
	CO4	Assemble various embedded systems based on popular microcontrollers.
	CO5	Construct and implement some embedded programs.
	CO6	Design real time embedded systems using the concepts of RTOS.
Power Electronics Lab (EI 891A(EE)	CO1	Describe and analyze characteristic curves of Power Semiconductor Devices.
	CO2	Analyze and design different triggering/ commutation circuits for SCR.
	CO3	Analyze and design different rectifier circuits with/ without free-wheeling diode.
	CO4	Analyze and design different DC/DC and DC/AC converter circuits both in hardware and software platforms.
	CO5	Demonstrate and design simple control circuits for stepper motor and PMDC motor.
Instrumentation and Control Design	CO1	Understand the basics of Instrumentation and Control Design concepts and practices.
	CO2	Understand the use and application of instrument/ component data

Lab (EI 892)		sheets, manuals, manufacturer's catalogues in consultation with handbooks, reference books etc.
	CO3	Design specific Flow and Level Control loops choosing suitable controllers and final control elements.
	CO4	Survey industrial installations & developments through industrial visit and implement partially/ completely industrial design criterion.
	CO5	Design any one of the following • Signal to data converter with multirate sampling • Design & Simulation of specific sensor • Digital controller design including Smith Predictor • Design of Thermal conductivity analyzer/ Piezo electric analyzer • Design of specified amplifier/ counter
Project – 2 (EI 893)	CO1	Apply the relevant knowledge and skills, which are acquired within the technical area, to a given problem.
	CO2	Analyze and discuss complex inquiries/problems and handle larger problems on the advanced level within the technical area.
	CO3	Estimate complete project time and its management.
	CO4	Acquire collaborative skills through working in a team and build up leadership quality to achieve common goals.
	CO5	Amalgamate knowledge from various areas of learning, and creatively apply it to real life situations.
	CO6	Enhance their knowledge and enable them to acquire skills like collaboration, communication and independent learning, prepare them for lifelong learning and the challenges ahead.
Grand Viva (EI 894)	CO1	Express ideas, concepts and arguments in a logical and coherent manner.
	CO2	Get a virtual platform of technical interview, which will help them to face interviews both at the academic and industrial sectors.
	CO3	Excel in their overall technical knowledge and industry readiness.
	CO4	Develop their confidence, verbal communication, thinking skill and intuition power.
	CO5	Engage them in independent and life-long learning.
	CO6	Realize the impact of the professional engineering solutions in societal and environmental contexts.