PSOs and POs of Applied Electronics & Instrumentation Engineering Department

Program Specific Outcomes (PSOs):

The students of Applied Electronics and Instrumentation Engineering (AEIE) will be able to:

PSO1: Apply the fundamentals of electrical, electronic, computer, mathematics, science and engineering knowledge to identify, design, develop and investigate complex problems of electrical and electronic circuits, electronic process instrumentation, measurement and process control field.

PSO2: Apply appropriate technique and modern engineering hardware and software tools to design, develop, measure and control the electronic and instrumentation system to engage in life-long learning and work efficiently as an individual and in a multidisciplinary team.

PSO3: Understand the impact of professional behaviour and ethics and effective communication with engineering community and the society.

Program Outcomes (POs):

Applied Electronics and Instrumentation Engineering Graduates will be able to:

i. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
ii. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
iii. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
iv. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
v. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
vi. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
vii. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
viii. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
ix. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
x. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

xi. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

xii. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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.

PSOs and POs of Biodemical Engineering Department

Program Specific Outcomes (PSOs)

The graduates will have qualities and will be able to:

PSO1 An understanding of biology and physiology, and the capability to apply advanced science and engineering to solve the problems at the interface of engineering and biology.

PSO2 The ability to make measurement and interpret data from living systems, addressing the problems associated with the interaction between living and nonliving materials and systems.

PSO3 The ability to demonstrate, develop or modify medical devices, materials, instruments, systems and processes for improvement of human health and health care.

Program Outcomes (POs)

Graduates of Biomedical Engineering program will attain proficiency and will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriateconsideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
4. Conduct investigations of complex problems: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one?s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Department of Biomedical Engineering
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: B.Tech. in Biomedical 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	Determine hardness of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO2	Evaluate redox potential and apply in day to day life as well as in industry.
	CO3	Calculate the alkalinity of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO4	Measure the viscosity of liquid helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO5	Measure the pH and conductance with the help of instruments of given samples e.g. tea, fruit juices, soil etc.
	CO6	Differentiate two heterogeneous liquid solutions and determine the distribution of solvent among them.
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	Analyze 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	Apply 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	Apply the concepts of elasticity of materials by finding Rigidity Modulus of a metallic rod and accordingly verifying Hook's Law.
	CO3	Apply 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	Apply the idea of dispersion and minimum deviation of light for prism by finding out dispersive power of the material of a prism.
	CO5	Apply 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.
Biophysical Signals & Systems (BME301)	CO1	Distinguish different signals present in human body and develop system for different signals.
	CO2	Describe the characteristics of different types of biological signals and their specific applications.
	CO3	Illustrate the different mathematical analysis and outcomes of different biological signals.
	CO4	Demonstrate and adjust the technical factors of the biological signals and systems.
	CO5	Well versed with MATLAB for mathematical analysis of Bio signals and systems.
	CO6	Illustrate and explain the mode of operation of filtering techniques for biological signals.
Circuit Theory & Networks (BMEEC301)	CO1	Explain the principal of resonance and formulate equation of quality factor, bandwidth and half power point for RLC circuit.
	CO2	Demonstrate the principal of mesh current and network analysis.
	CO3	Illustrate network theorems and their realization in circuit response analysis
	CO4	Analyze transient response of RLC circuit and characterize the response using Laplace Transform.
	CO5	Describe the concept of induction and classify induced inductance using the law of Coupling
	CO6	Demonstrate the principal of Laplace transform and application in circuit response analysis.
Engineering Physiology & Anatomy (BME302)	CO1	Analyze the basic principles of human physiology.
	CO2	Explain the structural unit of body and its function.
	CO3	Analyze the relation between different physiological parts of a human body.
	CO4	Describe different vital organs of our body and their internal structure.
	CO5	Explain critical parts of human body system, their function and the importance.
	CO6	Develop idea regarding various common diseases and related problems.
Analog Electronic Circuits (BMEEC304)	CO1	Describe the principal of regulation and analyze basic forms of power supply filters.
	CO2	Analyze concept of electron flow in semiconductor materials and design semiconductor based diode and transistor element.
	CO3	Determine quiescent point, gain, bandwidth and other I/O

		characteristics of transistor.
	CO4	Explain principles of feedback in various oscillator circuits.
	CO5	Analyze function of operational amplifier and design Op-Amp based circuit like differentiator, integrator logarithmic amplifier, precision rectifier, etc.
	CO6	Describe operating principle of 555 based monostable and astable multivibrator.
Numerical methods Laboratory (MCS391)	CO1	Choose the appropriate numerical methods for solving engineering 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.
Biophysical Signals & Systems Laboratory (BME 391)	CO1	Distinguish different signals present in human body and develop system for different signals.
	CO2	Describe the characteristics of different types of biological signals and their specific applications.
	CO3	Illustrate the different mathematical analysis and outcomes of different biological signals.
	CO4	Demonstrate and adjust the technical factors of the biological signals and systems.
	CO5	Well versed with MATLAB for mathematical analysis of Bio signals and systems.
	CO6	Illustrate and explain the mode of operation of filtering techniques for biological signals.
Circuits & Networks Laboratory (BMEEC 391)	CO1	Explain the principal of Kirchoff's voltage and current law and apply in complex circuit analysis
	CO2	Illustrate network theorems and their realization in circuit response analysis
	CO3	Apply the knowledge of maximum power transfer to design biopotential amplifier
	CO4	Describe transient response analysis for R-L and R-C circuit
	CO5	Define various damping condition and their realization
	CO6	Classify different standard test input according to their wave pattern
Physiology Laboratory (BME 392)	CO1	Analyze and explain the basic parameters of human physiological system.
	CO2	Explain and identify the micro level inner structure of different body parts.
	CO3	Explain the importance of blood corpuscles and can identify it.

	CO4	Describe the clinical interpretation of bleeding, clotting, Hb, ESR etc.
	CO5	Explain the significance and measurements of blood group, blood pressure and other parameters.
	CO6	Develop idea regarding different kind of diseases and their remedies.
Analog Electronic Circuits Laboratory (BMEEC394)	CO1	Describe the principal of regulation and analyze basic forms of power supply filters.
	CO2	Explain the function of diode and its application as clipper and clamper
	CO3	Analyze the process of rectification and design half wave and full wave rectifier
	CO4	Describe the operating principle of 555 timers as multivibrator.
	CO5	Characterize the function of Class A amplifier and its design using Op-Amp.
	CO6	Classify current to voltage and voltage to current conversion with proper design.
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.
Biophysics & Biochemistry (BMEPH401)	CO1	Analyze different biochemical process and biological principles.
	CO2	Describe different bioelectrical response pattern of different body parts.
	CO3	Analyze the character of macromolecules, enzymes, Nucleic acid and their role inside the body.
	CO4	Describe radioactivity and their application in health care.
	CO5	Explain the function of electrical stimulus and their biophysical activity.
	CO6	Explain different instruments and interpret different body parameters from such instruments for diagnostic purposes.
Basic Environmental Engineering & Elementary Biology (CH401)	CO1	Explain the basics of environment, ecology, sustainable development and Environmental degradation
	CO2	Describe the different components of ecosystem, bio geocycle and importance of biodivervisity.
	CO3	Analyze the Indian Environmental law, atmospheric chemistry, soil chemistry, material balances.
	CO4	Explain the different types of pollution like air, water, soil and

		others.
	CO5	Analyze the causes of pollution and its prevention.
	CO6	Solve and manage different environmental problems like waste disposal and others.
Biosensors & Transducers (BME402)	CO1	Identify and classify different sensors and transducers with their functions.
	CO2	Explain the instrumentation part of sensors and transducers to measure different biological signals.
	CO3	Demonstrate the advantages and disadvantages of different sensor & Transducer for their application in different field.
	CO4	Demonstrate and adjust the technical factors of the sensors.
	CO5	Develop good quality transducers for diagnostic purpose.
	CO6	Analyze and interpret data for clinical use.
Digital Electronics & Integrated Circuits (BMEEC402)	CO1	Describe relationship between various number systems and their conversions.
	CO2	Illustrate the basics of Boolean algebra and logic gates and their realization using discrete electronic components.
	CO3	Explain operating principal of various logic families and their application in logic design.
	CO4	Demonstrate the operating principal of combinational circuit to design adder, subtractor, decoder, encoder and multiplexer, demultiplexer circuit.
	CO5	Describe the functions of sequential circuits to design flip-flop, counter and register
	CO6	Classify different memory systems based on their operating principal and explain the design of ROM, RAM, PROM, PLD, and FPGA.
Communica-tion skill & Report writing (HU481)	CO1	Develop listening, speaking, reading and writing skills.
	CO2	Develop self-confidence and able to reach corporate expectations.
	CO3	Successfully answer questions in interviews and take international examination
	CO4	Develop interpersonal skills on current problems and events.
	CO5	Make presentations and participate in Group Discussions.
	CO6	Produce well versed technical report in recognized format.
Biophysics & Biochemistry Laboratory (BME491)	CO1	Analyze and explain the basic parameters of human physiological system.
	CO2	Explain the importance of body fluids and their measurement.
	CO3	Analyze and interpret data obtained from different body parts like heart, muscles etc.
	CO4	Analyze and quantify different proteins, glucose etc.
	CO5	Explain and interpret blood viscosity and GSR.
	CO6	Develop idea regarding different kind of cardiac, muscular diseases and their remedies.
Biosensors & Transducers Laboratory	CO1	Identify and classify different sensors and transducers with their functions.
	CO2	Explain the instrumentation part of sensors and transducers to

(BME 492)		measure different biological signals.
	CO3	Analyze how to calibrate a transducers.
	CO4	Demonstrate and adjust the technical factors of the sensors.
	CO5	Analyze and interpret data of transducers.
	CO6	Analyse to develop new system.
Digital Electronics & Integrated Circuits Laboratory (BMEEC492)	CO1	Understand the basic of the Digital systems
	CO2	Explain the application of Digital ICs in the designing circuit.
	CO3	Do applications of Digital ICs.
	CO4	Understand the basic of the Digital systems.
	CO5	Design various functional circuits using these ICs.
THIRD YEAR : 5TH SEMESTER		
Economics for Engineers (HU501)	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.
Biomedical Instrumenta-tion (BME501)	CO1	Illustrate and explain the mode of operation of various instrument and its medical applications.
	CO2	Demonstrate and adjust the technical factors of the instruments.
	CO3	Understand electrical safety of the patients with the ability to design relevant protection systems.
	CO4	Analyze and interpret the static and dynamic characteristics of bioinstrumentation systems
	CO5	Identity and solve the problem and servicing the instrument properly.
	CO6	Formulate simple analog circuits (e.g. instrumentation amplifiers and active filters) used in bioinstrumentation
Analytical & Diagnostic Equipments (BME502)	CO1	Classify and explain different types of clinical test instruments for medical diagnosis.
	CO2	Demonstrate the basic principle of working, mode of operation and various advancements.
	CO3	Choose appropriate instruments for specific application and accurate measurement.
	CO4	Integrate knowledge of engineering and biology to repair and calibrate the instruments.
	CO5	Make measurement, analyze and interpret the results for clinical purposes.
	CO6	Exhibit competency in suggesting, designing and offering reliable and optimum solution.
Communica-tion	CO1	Formulate and interpret the presentation and processing of signals in communication systems

Engineering & Bio-Telemetry (BME503)	CO2	Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency
	CO3	Design, assess and evaluate different modulation and demodulation techniques
	CO4	Determine the influence of noise on communications signals
	CO5	Perform the time and frequency domain analysis of the signals in a digital communication system
	CO6	Interpret and analyze the design of a communication system.
Data Structure & C (BME504A)	CO1	Design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.
	CO2	Apply good programming design methods for program development.
	CO3	Apply the different data structures for implementing solutions to practical problems.
	CO4	Analyze algorithms and determine their time complexity.
	CO5	Implement linked list data structure to solve various problems.
Object Oriented Programming & JAVA (BME504B)	CO1	Code a program using JAVA constructs.
	CO2	Formulate a program that correctly implements the algorithm.
	CO3	Generate different patterns and flows using control structures and use recursion in their programs.
	CO4	Use thread methods, thread exceptions and thread priority.
	CO5	Implement method overloading in their code.
	CO6	Demonstrate reusability with the help of inheritance.
Computer Organization (BME504C)	CO1	Design arithmetic and logic unit.
	CO2	Implement fixed point and floating-point arithmetic units.
	CO3	Compare and contrast the memory systems.
	CO4	Compare and contrast the different ways of communicating with I/O devices.
	CO5	Compare and contrast parallel processing architectures.
Biomedical Instrumenta-tion Laboratory (BME591)	CO1	Ability to apply knowledge of mathematics, science, and engineering
	CO2	Ability to design and conduct experiments, as well as to analyze and interpret data
	CO3	Have knowledge of the principle operation and design and the background knowledge of biomedical instruments and specific applications of biomedical engineering
	CO4	Ability to make measurements on and interpret data from living systems & an ability to communicate effectively
	CO5	Calibrate biomedical instruments used in hospital
Biomedical Equipments Laboratory (BME592)	CO1	Analyze and clarify some of the basic equipments used in biomedical industry.
	CO2	Analyze and describe the principle of colorimetry, spectrophotometry.
	CO3	Describe the technology behind autoanalyzer and interpret the data.
	CO4	Analyze and explain the working of flame photometry.
	CO5	Develop idea on ultrasound and its quantification.
	CO6	Describe different lungs parameters, oxygen saturation in blood and

		related problems and their remedies.
Communica-tion Engineering Laboratory (BME593)	CO1	Analyze the knowledge about of basics analog and digital communication
	CO2	Perform Analog and Digital Modulation and Demodulation techniques
	CO3	Design different Multiplexing and Demultiplexing techniques
	CO4	Acquire knowledge about quantization and coding
	CO5	Analyze the application of sampling theorem
	CO6	Perform Pulse Modulation and Demodulation techniques.
Data Structure & C Laboratory (BME594A)	CO1	Able to understand the importance of structure and abstract data type, and their basic usability in different applications through different programming languages.
	CO2	Able to analyze and differentiate different algorithms based on their time complexity
	CO3	Able to understand the linked implementation, and its uses both in linear and non-linear data structure.
	CO4	Able to understand various data structure such as stacks, queues, trees, graphs, etc. to solve various computing problems.
	CO5	Able to implement various kinds of searching and sorting techniques, and know when to choose which technique.
	CO6	Able to decide a suitable data structure and algorithm to solve a real world problem.
Object Oriented Programming & JAVA Laboratory (BME594B)	CO1	Explain basic concepts of internet
	CO2	Discuss the need for client and server side programming
	CO3	Write java programs
	CO4	Develop internet applications using Java.
	CO5	Differentiate between structures
	CO6	Oriented programming and object oriented programming.
Computer Organization Laboratory (BME594C)	CO1	Design arithmetic and logic unit.
	CO2	Implement fixed point and floating-point arithmetic units.
	CO3	Compare and contrast the memory systems.
	CO4	Compare and contrast the different ways of communicating with I/O devices.
	CO5	Compare and contrast parallel processing architectures.
THIRD YEAR : 6TH SEMESTER		
Principles of Management (HU601)	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.
Therapeutic Equipments (BME602)	CO1	Develop the knowledge to use the equipment's for particular purpose.
	CO2	Good knowledge of instrumentation for good quality treatments.
	CO3	Illustrate the advantages and disadvantages and potential hazards of an instrument for its specific application.
	CO4	Develop technical knowledge to quest the physiotherapy team.
	CO5	Select the specific system for better therapy.
	CO6	Compute and draw inference neonatal care and drug delivery system.
Biomedical Digital Signal Processing (BME602)	CO1	Describe the knowledge of the basic signal processing techniques in analyzing biological signals
	CO2	Develop basic mathematical, scientific and computational skills necessary to analyze biomedical signals
	CO3	apply advanced mathematics, science and engineering to solve the problems at the interface of engineering And biology
	CO4	Interpret the complexity of bio-logical signals and the impact, promise of biomedical engineering in understanding these signals
	CO5	Understand sampling and quantization such that they can specify instrumentation and procedures for digitally recording biological data
	CO6	Make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems
Medical Imaging Techniques (BME603)	CO1	Classify and explain different imaging techniques for medical application.
	CO2	Describe the underlying physics principles of image formation and demonstrate the mode of operation of imaging instruments.
	CO3	Analyze and interpret the images for clinical purposes
	CO4	Characterize and improve the image quality.
	CO5	Demonstrate the potential hazards and devise relevant protection systems.
	CO6	Respond technically to the quests of radiology team.
Microprocessor & Microcontroller (BME604A)	CO1	Demonstrate the principal of Boolean algebra to simplify complex logic equations.
	CO2	Describe architecture of Intel 8085 with internal bus connections between different units.
	CO3	Explain techniques of bus demultiplexing and interfacing between the processors and peripheral devices.
	CO4	Classify memory register and calculate the effective addresses of any operand.
	CO5	Explain generation of status and control signals and describe synchronization between different units.
	CO6	Analyze the functions of Intel 8251,8253,8255,8259 and 8279 with interface between microprocessors.

Microelectro-nics & VLSI Designs (BME-604B)	CO1	Compute carrier concentrations for semiconductor materials under a variety of conditions.
	CO2	Compute terminal voltage and current characteristics for bipolar transistors under a variety of conditions.
	CO3	Compute terminal voltage and current characteristics for MOS transistors under a variety of conditions
	CO4	Explain the basic CMOS circuits and the CMOS process technology.
	CO5	Discuss the techniques of chip design using programmable devices.
	CO6	Model the digital system using Hardware Description Language.
Electronic Measurement & Instrumenta-tion (BME605B)	CO1	Master the basic concepts and understand the applications of database systems.
	CO2	Construct an Entity-Relationship (E-R) model from specifications and to perform the transformation of the conceptual model into corresponding logical data structures.
	CO3	Understand the basic database storage structures and access techniques.
	CO4	Distinguish between good and bad database design, apply data normalization principles, and be aware of the impact of data redundancy on database integrity and maintainability.
	CO5	Construct queries and maintain a simple database using SQL.
	CO6	Apply database transaction management and database recovery.
Operating System (BME605C)	CO1	Understand the design and management
	CO2	Concepts along with issues and challenges of main memory, virtual memory and file system.
	CO3	Understand the types of I/O
	CO4	Manage disk scheduling, protection and security problems faced by operating systems and how to minimize these problems.
	CO5	Understand the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.
Biomedical Digital Signal Processing Laboratory (BME692)	CO1	Operate biomedical instruments used in hospital
	CO2	Understand different bio signals / potentials
	CO3	Identify, formulates, and solves engineering problems
	CO4	Make measurements on and interpret data from living systems, addressing the problems
	CO5	Function on multi-disciplinary teams
	CO6	Communicate effectively
Microprocessor & Microcontroller Laboratory (BME694A)	CO1	Write ALP Programmes for fixed and Floating Point and Arithmetic.
	CO2	Differentiate Serial and Parallel.
	CO3	Interface different I/Os with processor.
	CO4	Generate waveforms using Microprocessors.
	CO5	Execute Programs in 8086 and 8051.
	CO6	Explain the difference between simulator and Emulator.
VLSI Design Laboratory	CO1	Aware about the trends in semiconductor technology, and how it impacts scaling and performance.

(BME694B)	CO2	Learn Layout, Stick diagrams, Fabrication steps, Static and Switching characteristics of inverters
	CO3	Synthesize digital VLSI systems from register-transfer or higher level descriptions in hardware design languages.
	CO4	Understand MOS transistor as a switch and its capacitance.
	CO5	Design digital systems using MOS circuits.
Seminar (BME696)	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		
Biomaterials & Tissue Engineering (BME701)	CO1	Explain the biomaterial science , its role and importance and tissue engineering for sustaining life functions
	CO2	Explain the structure-properties relationships in ceramic, metal, and polymer biomaterials.
	CO3	Characterize the biological environment and able to explain the mechanisms of interaction of host tissue with implanted biomaterials.
	CO4	Analyze different characterization process like hardness, toughness, sterilization techniques of materials, and biocompatibility.
	CO5	Explain basic biomedical application area of ceramic, metal, and polymer biomaterials.
	CO6	Explain the cell culture, matrix, and scaffold and wound healing process and basic applications of tissue engineering.
Biomechanics & Implants (BME702)	CO1	Develop the knowledge of mechanics for its application in Biological systems.
	CO2	Develop knowledge for designing of artificial implants.
	CO3	Interpret and explain the mode of operation of different artificial implants and its medical applications.
	CO4	Develop relation between the mechanics and human body.
	CO5	Interpret technically to the quests of Biomechanical team.
	CO6	Recognize the limitations and formulate design specification.
Medical Image Processing (BME703A)	CO1	Understand image formation and the role human visual system plays in perception of gray and color image data
	CO2	Get broad exposure to and understanding of various applications of image processing in industry, medicine, and defense
	CO3	Analyze the signal processing algorithms and techniques in image enhancement and image restoration
	CO4	Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems

	CO5	Be able to conduct independent study and analysis of image processing problems and techniques
	CO6	Assess the societal impact of image processing and the engineer's responsibilities in this regard.
Adaptive Signal Processing (BME703B)	CO1	Build a strong foundation in approaching problems in diverse areas as acoustic, sonar, radar, geophysical, biomedical, and communication signals processing.
	CO2	Understand the theoretical foundations of adaptive signal processing theory.
	CO3	Achieve a combination of theoretical and computer based homework assignments
Advanced Medical Imaging Techniques (BME704A)	CO1	Describe the underlying physics principles of the advanced medical imaging techniques: Ultrasound, MRI, Nuclear Medicine and PET-CT.
	CO2	Explain the underlying mode of operation of modern medical imaging equipments.
	CO3	Demonstrate the instruments and apply mathematical methods for image reconstruction.
	CO4	Analyze and interpret the images for clinical purposes.
	CO5	Compare and justify imaging techniques for specific diagnostic applications.
	CO6	Plan and minimize the risks and health hazards.
Virtual Instrumenta-tion (BME704B)	CO1	Create Virtual Instruments, Edit and Debug Virtual Instruments, Build Arrays, Loops, Formulas and Sequence.
	CO2	Structures using LabVIEW software, Customize Charts and Graphs utilizing LabVIEW software,
	CO3	Design a complete Data Acquisition System, Accommodate PC interfacing principles and
	CO4	Instrument Driver for Computer measurement and control,
	CO5	Employ PC ports for real time programming,
	CO6	Using Data Sockets to control a stepper motor over the Network.
Power & Control System (BME705A)	CO1	Describe various Power Electronics devices such as SCR, TRIAC, DIAC, IGBT, GTO etc
	CO2	Identify application of aforesaid Power Electronics devices in Choppers, Inverters and Converters etc
	CO3	Determine the stability of an Electrical, Electronics and other physical systems
	CO4	Draw inference of the words Transient & Steady State Performance of a system
	CO5	Formulate their concepts regarding basics of Inductor and Capacitor will be enhanced, as the response of R-L circuit, R-L-C circuit is a part of this subject
	CO6	Express variation of frequency in the power system with varying load.
Biological	CO1	Represent the physiological control system and discuss the stability

Control System & Modelling (BME705B)		analysis of the given system.
	CO2	Analyze the time and frequency domains of the given system using different mathematical techniques
	CO3	Model dynamically varying physiological system
	CO4	Discuss methods and techniques to analyze and synthesis dynamic models
	CO5	Develop differential equations to describe the dynamic models, simulate and visualize.
	CO6	Implement physiological models using software to get dynamic responses.
Artificial Intelligence & Pattern Recognition (BME705C)	CO1	Describe the design of a compiler and the phases of program translation.
	CO2	Explain lexical analysis phase and its underlying formal models.
	CO3	Explain the syntax analysis phase and identify the similarities and differences among various parsing techniques and grammar transformation techniques.
	CO4	Apply formal attributed grammars for specifying the syntax and semantics of programming languages.
	CO5	Identify the effectiveness of optimization and explain the differences between machine- dependent and machine-independent translation
	CO6	Design and apply different pattern recognition techniques to the applications of interest.
Group Discussion (HU791)	CO1	Introduce different models and topics in terms of skills, content mastery, attitudes, or values.
	CO2	Explore live recorded sessions for mending attitude/ approach and take remedial measures.
	CO3	Select Strategies and standard practices of seminar presentation.
	CO4	Conduct SWOT analysis and fixing targets.
	CO5	Participate and succeed in competitive examinations.
	CO6	Formulate strategies or framework to complete the specific tasks.
Biomaterials & Biomechanics Laboratory (BME791)	CO1	Describe different type of characterization method and their significance in biomaterial and biomechanics.
	CO2	Analyze the mechanical and ultrasonic characterization of biomaterials.
	CO3	Develop idea on surface roughness, Hardness of biomaterials.
	CO4	Estimate the hemocompatibility and torque measurement studies.
	CO5	Interpret the moment of inertia of limb and bone of human body.
	CO6	Explain the Stress- strain measurement and its significance.
Biomedical Instruments & System Laboratory (BME792)	CO1	Apply techniques, skills, and modern engineering tools necessary for engineering practice.
	CO2	Design a system, component, or process to meet desired needs.
	CO3	Integrate techniques, skills, and modern engineering tools necessary for engineering practice associated with the interaction between living and non-living materials and system.
	CO4	Identify the necessity of equipment to a specific problem.
	CO5	Understand diagnostic and therapeutic related equipments.

	CO6	Function on multi-disciplinary teams.
Medical Image Processing Laboratory (BME793A)	CO1	Perform MATLAB programs to process medical images.
	CO2	Identify Point, Line, and Edge etc. detection.
	CO3	Design compression of unutilized data at the time of image processing.
	CO4	Perform Fourier and Image Transform.
	CO5	Perform Image Enhancement.
	CO6	Characterize the images.
Adaptive Signal Processing Laboratory (BME793B)	CO1	Generate various types of waveforms using MATLAB and DSP kit.
	CO2	Compute auto correlation and cross correlation sequences.
	CO3	Compute power spectral density of a sequence using MATLAB and implement with DSP kit.
	CO4	Implement FFT algorithm by decimation in time and decimation in frequency using MATLAB.
	CO5	Convolute long duration sequences using overlap add.
	CO6	Implement noise cancellation using adaptive filters on a DSP kit.
Industrial Training (BME794)	CO1	Visualize the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions.
	CO2	Demonstrate the use, interpretation and application of an appropriate engineering standard in a specific situation.
	CO3	Analyze a given engineering problem and identify an appropriate problem solving methodology.
	CO4	Implement the methodology and propose a meaningful solution.
	CO5	Manage project within a given time frame.
	CO6	Adopt a factual approach to decision making.
Project-I (BME795)	CO1	Develop the power of critical thinking and innovation.
	CO2	Exhibit both analytical and synthetically skills.
	CO3	Develop culture of working within a group/ as team and build up leadership quality.
	CO4	Transform knowledge and skill appropriate to professional activities and demonstrate highest standard of ethical issues.
	CO5	Solve real life problems, provide the limitations and validate the results.
	CO6	Propose new design and construct appropriate tools.
FOURTH YEAR : 8TH SEMESTER		
Organizational Behavior (HU801)	CO1	Identify the importance and intricacies of organizational behavior.
	CO2	Describe personality, attitudes and perception to motivate employees.
	CO3	Implement effective communication skills to handle group behavior.
	CO4	Resolve organizational conflicts and politics through negotiations.
	CO5	Monitor human resources through effective leadership.
	CO6	Create a congenial and cohesive ambience within the framework of organizational structure in achieving the organizational goals.
Artificial Organs &	CO1	Explain the role of artificial organs and rehabilitation devices for sustaining functions.

Rehabilitation Engineering (BME801A)	CO2	Describe the expected functionalities of an artificial organ, orthotics and prosthesis.
	CO3	Identify available technology and recognize the user needs and benefits.
	CO4	Prioritize in technological innovations for longer, healthier and more productive lives.
	CO5	Summarize the limitations and formulate design specifications.
	CO6	Facilitate design and prototype modelling.
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Lasers & Fiber Optics in Medicine (BME801B)	CO1	Recognize and classify the structures of Optical fiber and types.
	CO2	Explain Laser physics, Light and its working principle with different modes of operation.
	CO3	Demonstrate the construction, working principle of fibers and Light propagation through fibers.
	CO4	Integrate biomedical sensor optical fiber for therapeutic, diagnostic and imaging purposes.
	CO5	Apply lasers in different areas of medicine
	CO6	Propose curing different diseases accurately by fiber optic laser system.
Health Technology Management (BME802A)	CO1	Analyze and develop the technical and managerial issues and management of Indian Hospitals- challenges and strategies.
	CO2	Clarify the different units and their alliance in a Hospital.
	CO3	Develop, plan and design of emergency Medical Services in a hospital like Operation Theater, blood banks etc.
	CO4	Design and plan for different types of Engineering Services sectors like maintenance, communication, gas supply, fire and safety etc.
	CO5	Understand and formulate the networking for information flow and data recording.
	CO6	Analyze the legal, ethical regulation of health care delivery.
Medical Informatics (BME802B)	CO1	Understand Hospital Information Systems, data format and recent trends.
	CO2	Discuss health informatics and different ICT applications in medicine.
	CO3	Explain the function of Hospital Information Systems
	CO4	Analyze medical standards.
	CO5	Facilitate the adoption of health information technology in hospitals.
	CO6	Improve the performance of health providers and the health care system in different order.
Neural Network & Fuzzy Logic Control (BME802C)	CO1	Explain the different architecture of neural networks of human nervous system.
	CO2	Apply neural tissue engineering for rehabilitation.
	CO3	Regenerate nervous system.
	CO4	Develop artificial neural networks and intelligent system.
	CO5	Construct different algorithms and neural controller for a temperature process.
	CO6	Apply fuzzy logic principles, membership principles and functions.

Seminar/PPT presentation etc on a topic of interest (BME891)	CO1	Understand the history of medical research and bioethics.
	CO2	Identify, understand and discuss current, real-world issues.
	CO3	Distinguish and integrate differing forms of knowledge and academic disciplinary approaches.
	CO4	Improve oral and written communication skills.
	CO5	Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
	CO6	Develop audience-centric visual presentations with concrete professional objectives.
Design Lab / Industrial problem related practical training (BME892)	CO1	Identify and enumerate contemporary medical engineering issues.
	CO2	Review and solve Industry related problems and asses its impact.
	CO3	Take up developmental project and able to work in a team as well as independently.
	CO4	Analyze different design, test the prototypes and troubleshooting.
	CO5	Evaluate project with respect to effort and development time.
	CO6	Propose a design system with its safety, manufacturability and sustainability.
Project-II (BME893)	CO1	Estimate complete project time and its management.
	CO2	Apply knowledge of various simulation tools.
	CO3	Develop culture of working as team and build up leadership quality.
	CO4	Solve well defined problems and document in standard format.
	CO5	Develop computing skill, logical skill and decision making skill.
	CO6	Propose innovative ideas and suggest possible solution.

PSOs and POs of Civil Engineering Department

Program Specific Outcomes (PSOs)

The PSOs of Civil engineering programme supported by the curriculum are given below. The graduates will be able to

PSO1: (Proficiency in mathematics, physics, chemistry, engineering sciences and humanities) Possess ability in analyze and design problems related to civil engineering by applying knowledge of mathematics through differential equations, calculus based physics, chemistry and engineering science.

PSO2: (Proficiency in four technical areas of civil engineering) Develop knowledge in four major technical areas in civil engineering; Structural, Geotechnical, Transportation and Environmental engineering. <br.

PSO3: (Proficiency in conducting experiments and analyze / interpret data) Conduct Civil engineering experiments, analyze, interpret resulting data in the major civil engineering areas and design systems, components, processes or elements of structure.

Program Outcomes (POs)

Electrical Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriateconsideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
4. Conduct investigations of complex problems: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one?s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Department of Civil Engineering
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: B.Tech in Civil 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 innovative 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	Determine hardness of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO2	Evaluate redox potential and apply in day to day life as well as in industry.
	CO3	Calculate the alkalinity of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO4	Measure the viscosity of liquid helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO5	Measure the pH and conductance with the help of instruments of given samples e.g. tea, fruit juices, soil etc.
	CO6	Differentiate two heterogeneous liquid solutions and determine the distribution of solvent among them.
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	Analyze 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	Apply 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	Apply the concepts of elasticity of materials by finding Rigidity Modulus of a metallic rod and accordingly verifying Hook's Law.
	CO3	Apply 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	Apply the idea of dispersion and minimum deviation of light for prism by finding out dispersive power of the material of a prism.
	CO5	Apply 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		
Values & Ethics in Profession (HU 301)	CO1	Understand pros and cons of technological growth on society and environment from theoretical and applied perspective.
	CO2	Perform in multiple social and academic disciplines for ethical analysis of psychological, societal, aesthetics, moral and ethical issues.
	CO3	Implement motivational tools and use their ability to reason ethically about social issues and to connect them to ethical models of value.
	CO4	Analyze the duties and responsibilities as professionals through gaining knowledge of the codes of professional ethics and ethical dilemma in real-world situation.
	CO5	Judge the value crisis in contemporary Indian society, and evaluate also how to live a good professional as well as personal life.

Physics-2 (PH 301)	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 (CH 301)	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.
Solid Mechanics (CE 301)	CO1	Establish the fundamental concepts of mechanics involving deformable solids; including static equilibrium, geometry of deformation, material constitutive relationship and to determine corresponding shear force, bending moment and stress distribution.
	CO2	Determine basic concepts of shear stress and bending stress due to flexure of regular sections and establishment of their corresponding formulations and its applications.
	CO3	Analyze statically determinate beams and truss.
	CO4	Analyze Two- Dimensional stress problems for planer and shell structures.
	CO5	Analyze torsional problems for circular shaft.
	CO6	Apply buckling theory problems for columns for various support conditions within elastic deformation.

Surveying (CE 302)	CO1	Understand the working principles of survey instruments
	CO2	Identify data collection methods, prepare field notes and maps.
	CO3	Measure the horizontal distances, difference in elevations, draw and use contour plots
	CO4	Calculate angles, distances and levels
	CO5	Assess errors and apply corrections
	CO6	Interpret survey data and compute areas and volumes
Building Materials and Construction (CE 303)	CO1	Build knowledge to categorize materials associated with building constructions and their related quality, durability and development.
	CO2	Understand the properties and manufacturing process of bricks and composition of cement and concrete.
	CO3	Appreciate the importance of detection of defects in timber along with timber preservation method.
	CO4	Analyze the factors affecting building construction and different component of building.
	CO5	Imply different techniques of building construction as per requirement.
	CO6	Impart knowledge of various types of properties, uses, and variety of materials important in construction.
Physics-2 (PH 391)	CO1	Apply the concepts of P-N junction and functionality of energy conversion by introducing solar cell and measuring its characteristics.
	CO2	Apply the theoretical knowledge of semiconductor by measuring Band Gap of a semiconductor through four probe method.
	CO3	Apply the theoretical knowledge of hot body radiation by measuring Stefans' constant using a diode valve.
	CO4	Apply theoretical concepts of Lorentz force and Helmoltz's Coil by measuring the value of charge and mass ratio of a tiny particle like electron.
	CO5	Use the knowledge of the experiments to design, develop and execute an innovative experiment with the existing instrument.
Solid Mechanics Lab (CE-391)	CO1	Analyze and correlate stress, strain and elastic deformation of an engineering material.
	CO2	Predict the engineering property and behavior of material under different loading and support conditions under static loading conditions.
	CO3	Analyze and predict the engineering property and behavior of material under impact loading conditions
	CO4	Analyze and correlate the elastic constants and deformation under flexural loading and torsion.
Surveying Practice I (CE 392)	CO1	Able to measure difference in elevation, length, calculate the area of a land and prepare the map.
	CO2	Gain basic understanding of the principle of chain survey,

		compass survey and plane table survey.
	CO3	Able to prepare field book for planning and construction of any engineering project.
	CO4	Able to take and analyze field data and prepare detailed topography map
Building Design & Drawing (CE 393)	CO1	Conversion with ideas and concept in drawing form
	CO2	Able to convert drawing to real life problems
	CO3	Able to implement rules and regulations according to code specifications
	CO4	Able to prepare detailed working drawing for foundation, door, windows, stair and roof truss
	CO5	Create, analyze and produce 2D drawing of buildings in software based Auto CAD environment of preliminary knowledge gained
SECOND YEAR : 4TH SEMESTER		
Numerical Methods (M(CS)401)	CO1	Able to learn Sources of error in computation and its propagation.
	CO2	Able to learn Simple polynomial interpolation on equally & unequally spaced data.
	CO3	Able to learn Trapezoidal & Simpson's 1/3rd Rules.
	CO4	Able to learn Iterative and Matrix-Factorization methods for system of linear equations.
	CO5	Able to learn Finding root by Regula Falsi and Newton-Raphson methods
	CO6	Able to find root by Regula Falsi and Newton-Raphson methods.
Mathematics – 3 (M 402)	CO1	Able to learn Fourier Series and application in simple PDE.
	CO2	Able to learn Basics of Fourier Transform and application in simple PDE.
	CO3	Able to learn 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	Able to learn Basic Probability theory with application of Binomial, Poisson & Normal distributions.
	CO6	Able to learn Solution of simple PDE by Laplace Transform.
	CO7	Able to learn Series solution of some 2nd Order ODE, special cases: Bessel's & Legendre's functions.
Fluid Mechanics (CE 401)	CO1	Develop the basic knowledge of fluid statics
	CO2	Apply fundamental concept of mathematics to obtain discharge from different type of notches and weirs
	CO3	Develop basic concept of turbulent flow in circular pipe.
	CO4	Built up idea of water hammer, turbine, pumps and their working principles
	CO5	Develop basic knowledge of open channel flow.
	CO6	Analyze dimension and model studies.
Structural Analysis (CE 402)	CO1	Analyze different types of determinate structures, viz., Portal frames, arches, cables, etc.
	CO2	Develop knowledge on statically indeterminate beams and frames.

	CO3	Analyze two-hinged and three-hinged arches.
	CO4	Analyze structures using Energy method and principle of virtual work.
	CO5	Analyze statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads to evaluate maximum moments and shear forces using influenc line diagram.
	CO6	Evaluate the Degree of indeterminacy for different type of structures.
Soil Mechanics (CE 403)	CO1	Understand relationship between different physical and mechanical properties of different types of soil
	CO2	Develop basic knowledge of soil like classification, index properties, engineering properties and its suitability as foundation material
	CO3	Understand the concept of compaction and consolidation of soil
	CO4	Apply fundamental concept of mathematics, soil mechanics principle to obtain various soil mechanics and foundation engineering problems
	CO5	Build knowledge on principle of stress and stress distribution in soil
	CO6	Develop theoretical background for design of foundation system with economy
Technical Report Writing & Language Lab Practice (HU 481)	CO1	Conversation practice session.
	CO2	Teaching strategies of group discussion.
	CO3	Mock – interview session.
	CO4	Presentation: teaching presentation as a skill
	CO5	Competitive examination- strategies/tactics for success in competitive examination
Numerical Methods Lab (M(CS)491)	CO1	Get an idea of various software used to solve engineering problems
	CO2	Build knowledge on numerical integration using Trapezoidal rule, Simpson's $1/3^{rd}$ rule
	CO3	Able to find numerical solution of a engineering system using Gauss elimination and Gauss-Seidel iterations
	CO4	Apply differential equation based on Euler's and Runga-Kutta methods to solve complex mathematical problems
Fluid Mechanics Lab (CE 491)	CO1	Identify the name and characterize the flow patterns and regimes, measurement of water surface profile for a hydraulic jump
	CO2	Understand basic units of measurement, converted units and appreciate their magnitude
	CO3	Determine different coefficients and factors involved in fluid flow like broad crested weir
	CO4	Build knowledge on the working principles, components, function of hydraulic equipment and evaluate efficiency of various types of turbines and pumps
	CO5	Identify, formulate and solve engineering problems and interpret data obtained from practical cases

Surveying Practice – II (CE 492)	CO 1	Able to use Theodolite for traversing and analysis of field data.
	CO 2	Able to use Total Station for traversing, leveling and contouring.
	CO 3	Able to setting out Simple Curve in field.
Soil Mechanics Lab – I (CE 493)	CO1	Classify the soils and predict its behavior in terms of Physical properties i.e. sieve analysis and hydrometer analysis.
	CO2	Understand the procedure to classify the coarse grained and fine grained soil.
	CO3	Evaluate the index properties of soil.
	CO4	Evaluate the engineering properties of soil and interpret field data with respect to specifications given in IS codes.
	CO5	Apply the concept of MDD and OMC to control compaction in the field.
THIRD YEAR : 5TH SEMESTER		
Economics for Engineers (HU501)	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.
Foundation Engineering (CE 501)	CO1	Analyze and design various geotechnical structures like foundations, piles, retaining walls applying principles of soil mechanics
	CO2	Understand bearing capacity of different foundations systems
	CO3	Analyze finite and infinite slope and apply stability equation to find out critical height and slope angle
	CO4	Develop knowledge on various subsoil exploration techniques and samplers used for different soil types
	CO5	Understand the settlement behaviour of different type of soil under different foundation
	CO6	Understand the concept of earth pressure behind earth retaining structures and perform stability analysis
Design of RC Structures (CE 502)	CO1	Explain the design philosophies of working stress method and limit state method for reinforced concrete structures.
	CO2	Apply the principles and current Codal practices in designing the reinforced concrete elements beam, slab, column, footing and stair using limit state method.
	CO3	Design the reinforced concrete beams as per limit state method.
	CO4	Design the reinforced concrete slabs using limit state method.
	CO5	Design the reinforced concrete column and footing as per limit state method.
	CO6	Follow current practices in detailing the reinforced concrete

		members.
Concrete Technology (CE 503)	CO1	Develop basic knowledge of concrete making ingredients along with their sources and properties.
	CO2	Assess the behavior of concrete at fresh and hardened state.
	CO3	Design the concrete mixes with and without plasticizer/super-plasticizers as per latest Indian Standard IS 10262: 2009.
	CO4	Follow standard practices in the production of quality concrete.
	CO5	Understand basic features of some of the new generation concretes like polymer concrete, fiber reinforced concrete and light weight concrete.
Engineering Geology (CE 504)	CO1	Understand the role of geology in the design and construction process of underground openings a rock.
	CO2	Identification of the minerals types of clay minerals their properties and effects on engineering project.
	CO3	Classification of rock (Igneous, Sedimentary, and Metamorphic), Civil engineering importance of rock forming minerals.
	CO4	Sedimentary processes (Weathering, erosion, deposition), Metamorphism and volcanic eruptions.
	CO5	Geological structures (Joint, veins, crack, faults, and fold), reasons of formation for each type and their side effects on the engineering projects. Geological studies of Dams and Tunnels.
	CO6	To know the methods of Geophysical Exploration and Study ground water, factors affecting on the variation of water table depth.
Soil Mechanics Lab – II (CE 591)	CO1	Evaluate shear parameters of soil using various strength testing machines.
	CO2	Understand compressibility characteristics of soil.
	CO3	Apply standard penetration test results for determination of soil characteristic.
	CO4	Predict behavior of soil under field loading for safe design of structures over or under the soil.
	CO5	Classify the soils and predict its behavior in terms of mechanical properties i.e. strength, compressibility and permeability.
	CO6	Analyze various soil parameters and prepare soil report.
Concrete Lab (CE 592)	CO1	Conversant with ideas and concept of various properties of cement, fine aggregates & coarse aggregates.
	CO2	Relate the efficacy of test results with regard to acceptability of these materials to be used in concrete.
	CO3	Appreciate importance of quality control procedures of fresh & hardened concrete with regard to their suitability in construction jobs.
	CO4	Enable to proportion the ingredients of concrete of a given strength so as to prepare concrete to needs at site.
Quantity surveying, Specification and Valuation (CE 593)	CO1	Develop knowledge about different types of Estimates
	CO2	Apply the standard practices and procedures of quantity surveying for civil engineering structures
	CO3	Prepare Bar Bending Schedule for civil engineering projects.
	CO4	Carry out rate analysis of various items in construction,

	CO5	Design technical specifications for any project
	CO6	Determine the value of built up properties and land, fixation of rent for a property.
Engineering Geology Lab (CE 594)	CO1	Learn about the ground surface features based on map patterns of contour within the framework of fundamental concepts of basic sciences with emphasis on practical application of civil engineering.
	CO2	Identify physical and mechanical properties of rock and its application in civil engineering uses.
	CO3	Produce lab and technical reports for effective communication amongst stakeholders to comprehend complex problems and accordingly employ state of the art technology.
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.
Highway and Transportation Engineering (CE 601)	CO1	Perform cost – benefit analysis of a Highway Project.
	CO2	Prepare maps of alignment and location of a highway.
	CO3	Recognize the importance of various components of pavement
	CO4	Design the flexible pavement and rigid pavement of Highway.
	CO5	Supervise different types of roads Projects.
	CO6	Assess the quality of road materials
Design of Steel Structure (CE 602)	CO1	Apply the knowledge of IS code of practice for the design of different steel structural elements
	CO2	Analyze the behavior of riveted, bolted and welded connections and design different types of connections under axial as well as eccentric loadings
	CO3	Design tension and compression members using simple and built-up sections
	CO4	Design slab base and gusseted base for compression members under bi-axial bending
	CO5	Calculate shape factor and plastic moment capacity of different types of flexural members
	CO6	Analyze the behavior of laterally supported and unsupported beams and design those using simple and built-up sections and design of beam-column connections

	CO7	Design plate girder and its components and design gantry girder
Construction Planning and Management (CE 603)	CO1	Develop the basic knowledge of building planning as per building bye-laws and understand the concept of Floor area ratio.
	CO2	Analyze the fire safety issues involved at the time of planning of a building.
	CO3	Understand the working principal and effectiveness of different construction equipments.
	CO4	Plan and Schedule a civil engineering project by using techniques like CPM, PERT
	CO5	Understand the roles and responsibilities of engineer, contractors and owners.
	CO6	Learn about the technical details of different types of contracts associated with a civil engineering project as well as steps of tendering and arbitration process.
Prestressed Concrete (CE 604B)	CO1	Understand the concept of prestressing and prestressing system and select the materials for the intended use.
	CO2	Analyze and design a pre-stressed concrete section subjected to flexure, shear and torsion as per limit state method following Indian Standard IS 1343
	CO3	Determine and check for the losses and deflection of pre-stressed concrete member.
	CO4	Analyze the stresses in a composite construction of pre-stressed and in-situ concrete.
	CO5	Analyze statically indeterminate pre-stressed concrete members.
Operation Research (CE 605A)	CO1	Identify and develop operational research models from the verbal description of the real system.
	CO2	Understand the mathematical tools that are needed to solve optimisation problems.
	CO3	Use mathematical software to solve the proposed models.
	CO4	Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering
Highway Laboratory (CE 691)	CO1	Evaluate the strength of sub-grade soil by CBR (California Bearing Ratio) test.
	CO2	Recognize the knowledge about different physical properties of aggregates by performing different test on road aggregates
	CO3	Outline the various properties of bitumen material and mixes by performing various tests on it
	CO4	Apply the concepts of properties of aggregates and binding materials for design of roads
Detailing of RCC and Steel structures (CE692)	CO1	Develop the basic knowledge of drawing and detailing of RC building components like, beam, slab, column, staircase and isolated footings as per IS code provisions.
	CO2	Develop the basic knowledge of drawing and detailing of RC

		building components like, beam, slab, column, staircase and isolated footings as per IS code provisions.
	CO3	Analyze and design different steel structural components considering different loads (i.e. wind load, Dead load, live load and others) as per IS 875.
	CO4	Learn about the design and drawing of the different components of a roof truss, purlins etc.
	CO5	Develop the basic knowledge of drawing and detailing of column base plate, and column foundation, column bracings of steel structure.
CAD Laboratory (CE 693)	CO1	Introduced with different computing tools for analysis and design of structures.
	CO2	Analyze and design multi-storeyed buildings using computing tools.
	CO3	Able to prepare detailed drawing of different structural elements.
	CO4	Capable to prepare ductile detailing.
Seminar (CE 681)	CO1	Choose a topic related to analysis, design, maintenance and management of civil engineering system/process.
	CO2	Carry out review of existing literature in line with the assigned topic.
	CO3	Prepare and present a technical report following standard guidelines.
	CO4	Develop attitude for observational and interpretative skills.
FOURTH YEAR : 7TH SEMESTER		
Environmental Engineering (CE 701)	CO1	Realize importance of population forecasting and investigating quality of water for design of effective water treatment plant.
	CO2	Design pressure pipes, water distribution system and plumbing system in a community
	CO3	Build knowledge on water quality, conveyance and treatment of supply water
	CO4	Evaluate physical, chemical and biological characteristics of waste water
	CO5	Recognize the importance of proper sludge disposal to maintain hygienic condition
	CO6	Understand basic concepts of aerobic and anaerobic wastewater treatment processes and get an idea of modern treatment techniques
Water resource Engineering (CE 702)	CO1	Develop the basic knowledge of hydrologic cycle, precipitation, evaporation, evapo-transpiration, infiltration process
	CO2	Demonstrate the stream flow measurement
	CO3	Apply fundamental concept of mathematics to obtain hydrograph characteristics
	CO4	Develop the basic knowledge of types of irrigation systems, methods of irrigation, water requirement of crops, design of unlined alluvial channels by silt theories with canal irrigation.
	CO5	Understand solution regarding water logging and drainage
	CO6	Built up the introduction to ground water flow and solve the problem on well irrigation on the basis of Darcy's Law.
Advanced Highway and	CO1	Perform traffic survey for new and old highway
	CO2	Design Traffic signals, Road intersections, Traffic rotaries

Transportation Engineering (CE703C)	CO3	Appreciate importance of traffic planning and management
	CO4	Prepare a detailed project report for construction of highway
	CO5	Carry out survey for railway alignment and geometric design of railway track and signaling system of railway engineering.
	CO6	Design Airport Runway and its orientation.
Hydraulic Structure (CE 704B)	CO1	Develop the basic knowledge of diversion head work.
	CO2	Develop and apply the concepts of Bligh's and Khosla's theory.
	CO3	Built up the basic knowledge of different types of canal falls and cross drainage works.
	CO4	Apply the fundamental concept of different types of dams and analyze.
Engineering Materials (CE 705A)	CO1	Build knowledge about the crystal structure and classification of materials.
	CO2	Understand methods of determining mechanical properties and their suitability for applications.
	CO3	Classify cast irons and study their applications.
	CO4	Interpret the phase diagrams of materials.
	CO5	Select suitable heat-treatment process to achieve desired properties of metals and alloys.
	CO6	Appraise the applications of advanced materials technology in their daily life
Group Discussion (HU 781)	CO1	Teaching strategies of group discussion
	CO2	Introducing different models and topics of group discussions. Teaching strategies of group discussion.
	CO3	Exploring live recorded GD sessions for mending students' attitude/ approach and for taking remedial measures Mock – interview session.
	CO4	Strategies and standard practices of seminar presentation.
	CO5	SWOT analysis and its application in fixing targets
Environmental Engineering Lab (CE 791)	CO1	Build knowledge about the crystal structure and classification of materials.
	CO2	Understand methods of determining mechanical properties and their suitability for applications.
	CO3	Classify cast irons and study their applications.
	CO4	Interpret the phase diagrams of materials.
	CO5	Select suitable heat-treatment process to achieve desired properties of metals and alloys.
	CO6	Appraise the applications of advanced materials technology in their daily life
Civil	CO1	Develop the concept of the structural design and detailing of isolated

Engineering Practice Sessional (CE 792)		rectangular and combined footing.
	CO2	Apply fundamental concept of water resources engineering to estimate different parameters related to hydrology and irrigation.
	CO3	Analyze and design of water distribution network, hydraulic design of sewer and population forecasting.
	CO4	Design the pavement design and traffic signal design of highway along with different geometric parameters of highway.
	CO5	Understand the preparation of soil test report from bore log data and estimate of bearing capacity and settlement behavior of foundation
Material Testing lab (CE 793)	CO1	Conduct a meaningful hardness, tensile, and impact test and report the test results in a clear and useful manner.
	CO2	Determine appropriate tests to be employed to determine given mechanical properties using both destructive and non-destructive techniques.
	CO3	Interpret and quantitatively determine standard mechanical properties from plots of stress versus strain.
	CO4	Conduct fatigue test
Industrial Training (CE 782)	CO1	Provides an insight to students about what is happening in the real world.
	CO2	Helps students to get practice in works in industry which will be of immense help to them later when they join for jobs in industry after their course completion.
	CO3	Enhance students' knowledge in engineering subjects.
Project Part – I (CE 783)	CO1	Work in a group to select a problem related to real life problem
	CO2	Review the literature available on selected problem and recognize scope of work
	CO3	Formulate new expressions, equations to solve that chosen problem
	CO4	Apply basic engineering principles to solve the problem
	CO5	Prepare project report and present it
FOURTH YEAR : 8TH SEMESTER		
Organizational Behaviour (HU801A)	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	Monitor human resources through effective leadership.
	CO6	Create a congenial and cohesive ambience within the framework of organizational structure in achieving the organisational goals.
Environmental Pollution and Control (CE 801A)	CO1	Understand meteorological aspects of air pollution and dispersion models used for designing of stack height
	CO2	Develop knowledge on air pollution control methods
	CO3	Analyze effect of noise pollution in environment in terms of sound pressure, power and intensity.
	CO4	Characterize pollutants from industries and design treatments

		methods
	CO5	Recognize global environmental issues with understanding of preventive measures
	CO6	Appreciate importance of administrative control for industries and infrastructural projects employing several acts like Air act, Water act, Motor vehicle act etc.
Pavement Design (CE802D)	CO1	Identify the pavement components, functions and the differences between different types of pavement
	CO2	Characterize the response characteristics of soil, aggregate, asphalt, and asphalt mixes
	CO3	Calculate stresses and ESWL in flexible pavements
	CO4	Design the flexible pavement using empirical and semi empirical methods
	CO5	Analyze the warping, friction, wheel load stress and calculate the combined stress
	CO6	Design rigid pavements by IRC method and evaluate the pavements
Structural Engineering Design Practice (CE891)	CO1	Apply RCC and steel design concepts in designing different civil engineering structures
	CO2	Design different types of concrete water tanks, viz., circular tanks, rectangular tanks and underground water tanks
	CO3	Design bunkers, silos and plate girder bridges
	CO4	Perform load analysis on bridges based on IRC codes and design box culverts and T-beam bridges
	CO5	Remember the concept of designing plate girders and its components
	CO6	Analyze the loads on steel roofs and design of different components of a steel roof
Project Part II (CE 892)	CO1	Work in a team and effectively communicate with team members
	CO2	Review and evaluate the literature available related to chosen problem
	CO3	Formulate new expressions, equations to solve that selected problem to enhance problem solving skill
	CO4	Validate theoretical and reported data with results obtained from numerical/ experimental/ analytical study
	CO5	Identify scope of future studies
	CO6	Prepare project report in standard format
Grand Viva (CE 882)	CO1	Evaluate overall technical knowledge and industry readiness
	CO2	Analyze various applications of civil engineering in real life problem solving
	CO3	Accustomed with virtual environment of technical interview

PSOs and POs of Computer Science and Engineering Department

Program Specific Outcomes (PSOs)

The PSOs of Computer Science and Engineering program supported by the curriculum are given below. The students will be able to

PSO1: Apply fundamental knowledge of mathematics (discrete mathematics), basic science, electrical and electronics engineering, computing, programming aptitude to identify, and define the computing systems.

PSO2: Analyze the mathematical foundations, algorithmic principles, computer science theory for the modeling, design of computing systems in a way that demonstrates the construction of software systems of varying complexity.

PSO3: Be prepared to work professionally in software industries, able to achieve the higher studies and develop the modern tools and communicate the techniques, skills.

Program Outcomes (POs)

Students graduating from the Department of Computer Science and Engineering at NSEC will be expected and prepared to exercise the skills and abilities (1) through (14) Programme Outcomes listed below

A. Graduates will demonstrate mastery of the mathematical foundations and familiarity with the scientific foundations of Computer Engineering. These include:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriateconsideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
4. Conduct investigations of complex problems: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one?s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Department of CSE
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: B. Tech In Computer Science & 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	To impart advanced skills of technical communication in English.
	CO2	To enable them to communicate confidently and competently in English language in all spheres.
	CO3	To develop writing competence- technical report, business letters, job applications etc.
	CO4	To develop reading comprehension skill through non-technical texts.
	CO5	To conduct conversation practice: face to face and via media.
Physics-I (PH101)	CO1	Reproduce the requirements of simple harmonic motion and can differentiate between damped and forced vibration analytically and apply the knowledge in the analysis of operation of various LCR circuits.
	CO2	Understand theory of optical interference and diffraction and can apply the knowledge in understanding thin film interference in films of equal thickness and wedge shaped films, can essentially differentiate between two diffraction types and Fraunhofer diffraction through single, double and multiple slits and can also be familiar with functioning of various optical instruments.
	CO3	Understand about the true nature of light as an electromagnetic wave, can apply the knowledge in understanding working of polar meter and polaroid of different kinds. Also, they will be able to understand the production and principle of working of LASERs at the atomic level. apply the knowledge in designing many modern devices and technologies based on lasers and optical fibres and holography.
	CO4	To understand the basic concepts and experiments of modern physics and can understand the basic differences between Newtonian mechanics and quantum mechanics, wave-particle duality, Heisenberg's uncertainty principle.
	CO5	Understand seven types of crystal systems, unit cell properties of different cubic, HCP and diamond structures, identify Miller

		indices of given crystal planes and draw planes using Miller indices, important orientation of crystal planes in cubic systems and inter-planar spacing and can also gather knowledge about how X-rays are produced in laboratory using Coolidge tube, types of X-rays and application in crystallography.
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	Understand the basic properties of electrical elements, and solve DC circuit analysis problems. DC network theorems.
	CO2	Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
	CO3	Apply the knowledge gained to explain the behavior of the circuit at series & parallel
	CO4	Explain the basic properties of electromagnetic circuit &their application.
	CO5	Distinguish between conductors, non-conductors and semiconductors based on energy band diagram and can classify different types of semiconductors.
	CO6	Explain the operation of pure and impure semiconductors with the help of enegy band diagram and can also define the phenomena of drift and diffusion.
	CO7	Demonstrate the operating principle and output characteristics of p-n junction diodes, zener diode, Varactor diode, BJT, rectifiers and different diode circuits.
	CO8	Compute different parameters for characterizing different circuits like rectifiers, regulators etc. using diodes.
	CO9	Relate the concept of PN junction in the operation of BJT and can explain the output/input characteristics of BJT along with the operation.
	CO10	Compute the stability factor of different BJT circuits and can also

		compare the quality of stability among them
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.
Physics 1 Lab (PH191)	CO1	Apply their knowledge practically about the elastic properties of matter.
	CO2	To match the hands on experiment on basic electrical bridge circuits with the previous theoretical knowledge.
	CO3	To acquire knowledge of optics regarding interference and diffraction of various kind by performing the experiments.
	CO4	To understand the basic technical aspects of experimental perfections in data acquisition, plotting, interpretation and error calculation.
Basic Electrical & Electronic Engineering-I Laboratory (ES191)	CO1	Understand the difference in characteristic of different lamps and learn about their constructional features.
	CO2	Familiarize with and illustrate Thevenin's, Norton's, superposition and maximum power transfer theorem.
	CO3	Create resonance condition in R-L-C series and parallel circuit and learn how to draw phasor diagram for the circuit.
	CO4	Classify different active and passive components & electronic equipments such as CRO,Regulated DC Power Supply, Function Generator, Digital multi-meters etc.
	CO5	Determine experimentally voltage and current components in any circuit using electronic equipments.
	CO6	Design a suitable circuit with PN Junction diode and prepare the V-I characteristics to analyze it.
	CO7	Develop a circuit using Zener diode and prepare the V-I

		characteristics for analysis.
	CO8	Demonstrate the operation of Half and Full wave rectifiers and will also be able to determine different rectifier parameters.
	CO9	Design a circuit using BJT and prepare the output characteristics of BJT and analyze it.
Workshop Practice (ME192)	CO1	Students will be able to acquire thorough knowledge of various tools, machines, devices used in engineering practice.
	CO2	Students will be able to acquire thorough knowledge of carrying out various operations in mechanical engineering workshop.
	CO3	Students will be able to gain measuring skills.
	CO4	Students will be able to acquire "Hands on" training and practice to students for use of various tools, devices, machines.
	CO5	Students will be able to acquire skills in basic engineering practice for creating objects from raw materials.
	CO6	Students will be able to acquire skills in basic engineering practice for creating objects from raw materials.
	CO7	Students will be able to obtain practical skills in the trades.
Language Laboratory (HU181)	CO1	Honing 'listening skill', 'speaking skill' and its sub skills through language lab audio device.
	CO2	G.D. practice sessions for helping them 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	Helping students to master linguistic/ paralinguistic features.
Extra Curricular Activities(NSS /NCC/NSO etc) (XC181)	CO1	Creating awareness in social issues.
	CO2	Participating in mass education programmes.
	CO3	Proposal for local slum area development.
	CO4	Waste disposal.
	CO5	Environmental awareness.
	CO6	Production Oriented Programmes.
	CO7	Relief & Rehabilitation work during Natural calamities.
FIRST YEAR : 2ND SEMESTER		
Basic	CO1	To able to understand basic concepts of digital computer, binary

Computation & Principles of Computer Programming (CS201)		arithmetic & different computer programming languages.
	CO2	To able to understand transform flow chart and algorithms into a programming language.
	CO3	To able to implement to write, compile and debug programs in C language.
	CO4	To able to design programs involving decision structures, loops and functions.
	CO5	To evaluate document their work, write clearly and appropriately in an Information Technology context, respect user's data, including backup and security, and to think through the ethical consequences of Information Technology decision.
	CO6	To able to create different data structures and create/update basic data files.
Engineering Chemistry (CH201)	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-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	Basic graph theory, matrix representation of graphs.
	CO4	Trees and simple tree algorithms.
	CO5	Improper integrals & their convergence.
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 Electrical & Electronics Engineering II (ES201)	CO1	Apply the basic concepts of electrostatics to electric field and potential calculation.
	CO2	Understand the construction, operating principle and characteristics of DC machine, single phase transformer and three phase induction motor.
	CO3	Prepare circuits for starting and speed control of DC machine and three phase induction motor.
	CO4	Identify the parameters of single phase transformer by test.
	CO5	Learn the basic principles involved in power generation, transmission &distribution.
	CO6	Classify different types of FETs and illustrate their physical structures for explaining operating principles.
	CO7	Explain the basic principle of CMOS.
	CO8	Compute overall gain, loop gain, feedback factors etc. of both positive and negative feedback amplifiers and will also be able to explain the effect of negative feedback on gain stability, bandwidth, non-linear distortion, input and output impedances etc.
	CO9	Explain the effect of positive feedback on stability and the condition for oscillation
	CO10	Explain the operating principles of different applications of OP-AMP such as Adder, Subtractor, Integrator, Differentiator, Inverting amplifier, Non-inverting amplifier etc and can compute the voltage gain.
	CO11	Illustrate the basics of Boolean algebra and logic gates and their realization using discrete electronic components.
Computation & Principles of Computer Program (CS 291)	CO1	To understand the basic concept of writing a program.
	CO2	To understand role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language
	CO3	To apply the use of conditional expressions and looping statements to solve problems associated with conditions, repetitions and function.
	CO4	To analyze the concept of array and pointers dealing with memory

		management.
	CO5	To Evaluate the File handling concepts for permanent storage of data or record.
	CO6	To create dynamic data structure applications as self. referential structure.
Engineering Chemistry Laboratory (CH291)	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-II Laboratory (ES 291)	CO1	Calibrate the ammeter and voltmeter and compute their errors.
	CO2	Identify the parameters of a single phase transformer by open circuit and short circuit test.
	CO3	Demonstrate the different characteristics of D.C shunt Generators.
	CO4	Devise circuit for starting -reversing and speed control of a D.C. shunt motor.
	CO5	Measure power in a three phase, three wire circuit by using two wattmeter.
	CO6	Develop a circuit using FET and prepare the output characteristics of FET to analyze it.
	CO7	Design a circuit using IC741 and determine input-offset voltage, input bias current, slew rate, CMRR etc.
	CO8	Demonstrate the operation of OP-AMP as Inverting and Non-inverting amplifiers, Adders, Integrators, Differentiators etc.
	CO9	Prepare truth tables of different logic gates and can realize different Boolean functions using Logic Gates.
	CO10	Design a circuit using BJT and prepare the input characteristics of BJT.
	CO11	Compute experimentally the output characteristics of BJT.

Engineering Graphics (ME 292)	CO1	Know about different types of lines & use of different types of pencils in engineering drawing.
	CO2	Ability to hand letter will improve.
	CO3	Ability to perform basic sketching techniques will improve.
	CO4	Able to know different angle of projection& orthographic projection.
	CO5	Able to gain knowledge on plane, solids like pyramid, frustrum etc.
	CO6	Able to draw orthographic projections and sections.
	CO7	Understand the logic behind development of surfaces.
SECOND YEAR : 3RD SEMESTER		
Values & Ethics in Profession) (HU 301)	CO1	To define ethical issues
	CO2	To describe confidentiality, professional behavior to ethical dilemmas and determine appropriate approach.
	CO3	To apply fundamental ethical principles of integrity, objectivity, professional competence, due care.
	CO4	To analyze the role of ethics within profession fields.
	CO5	To develop proper relations with respect to the concept of social responsibility.
	CO6	To judge have the knowledge of ethics in operations of business and governance.
Physics – 2 (PH 301)	CO1	To state various advanced concepts of physics.
	CO2	To explain real world problems using broad theoretical insight
	CO3	To solve real world problems using classical and modern engineering physics analysis
	CO4	To compare electro magnetism, statistical mechanics and quantum mechanics.
	CO5	To develop conceptual and analytic skills to solve a broad range of problems
	CO6	To recommend various models for real life applications
Basic Environmental Engineering & Elementary	CO1	To define fundamental knowledge of scientific discipline and engineering principles
	CO2	To describe the ability to work effectively as a member of an interdisciplinary team on
	CO3	To apply effectively about complex environmental problems

Biology (CH301)	CO4	To analyze emerging environmental issues that are sustainable.
	CO5	To design solutions for both specialist and general audiences with equal facility.
	CO6	To justify air, water and land resources, health and environmental restoration.
Analog & Digital Electronics (CS301)	CO1	To state differences between number systems and describe some different codes.
	CO2	To explain the function of basic digital combinatorial circuits and sequential circuits.
	CO3	To demonstrate the behaviour of digital components.
	CO4	To analyze and construct both combinational and sequential networks.
	CO5	To design different types of programmable logic devices.
	CO6	To judge the functions, characteristics and structure of different memory systems.
Data Structure & Algorithm (CS302)	CO1	To remember data types, array, pointers, memory allocation Techniques.
	CO2	To understand the concepts of linear, non-linear data structure such as stacks, queues, trees and graphs.
	CO3	To implement various data structure to solve computing problems using C-programming language.
	CO4	To compare different algorithms, their advantages and disadvantages, choose appropriate data.
	CO5	To compare different algorithms, their advantages and disadvantages, choose appropriate data structure as applied to specified problem definition
	CO6	To evaluate the best case, average case and worst case time complexities of different algorithms.
Computer Organization (CS303)	CO1	Recognize and manipulate representations of numbers stored in digital computers. Recall the history and development of modern computers, developing an appreciation for the potential and directions for future changes
	CO2	Explain the computations of the functional units of the processor.
	CO3	Implement the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main

		components.
	CO4	Compare cost performance and design trade-offs in designing and constructing a computer processor including memory. Analyze the basics of, and develop the ability to determine the applicability of single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined,superscalar, and RISC/CISC architectures.
	CO5	Evaluate elementary quantitative performance of computer systems .
	CO6	Design elementary problems by assembly language programming.
Physics-2 Lab (PH391)	CO1	To state various advanced concepts of physics.
	CO2	To explain real world problems using broad theoretical insight
	CO3	To solve real world problems using classical and modern engineering physics analysis
	CO4	To compare electro-magnetism, statistical mechanics and quantum mechanics.
	CO5	To develop conceptual and analytic skills to solve a broad range of problems
	CO6	To recommend various models for real life applications
Analog & Digital Electronics Lab (CS391)	CO1	To define differences between the combinational and sequential circuits.
	CO2	To explain the merits and demerits of the different amplifiers and must be able ;
	CO3	To solve various transistors related applications.
	CO4	To compare various number systems.
	CO5	To design multi-vibrator circuits using 555 timers.
	CO6	To justify problems related to Boolean algebra, minimization problems etc.
Data Structure & Algorithm (Lab) (CS392)	CO1	To remember basic C Programming such as Array, Structure, Pointer and File etc.
	CO2	To understand implementation concepts of linear and non-linear data structures.
	CO3	To analyze the concepts of static and dynamic data structure algorithms.
	CO4	To apply different sorting and searching algorithms.
	CO5	To evaluate time complexity of different data structure algorithms.
	CO6	To create different Data Structures which plays a vital role in real

		world applications.
Computer Organization (Lab) (CS393)	CO1	Able to know basic gates and their truth tables and to implement using bread board.
	CO2	Able to know various IC chips and their pin diagram and truth tables.
	CO3	Able to implement adder subtractor composite unit
	CO4	Able to implement various ALU operations using Multiplexer and Decoder.
	CO5	Able to design Arithmetic Logical Unit for multi-bit Arithmetic operation.
	CO6	Able to implement RAM chips.
SECOND YEAR : 4TH SEMESTER		
Numerical Methods (M(CS)401)	CO1	Explain the consequences of finite precision and the inherent limits of the numerical methods considered.
	CO2	Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.
	CO3	Demonstrate the mathematics concepts underlying the numerical methods considered.
	CO4	Demonstrate understanding applied to the following classes of problems like finding roots of equations, solving systems of algebraic equations, interpolation, numerical integration of data and functions, solutions of ordinary differential equations.
	CO5	Design algorithms and corresponding codes for implementation of numerical solution of the above problems.
	CO6	Perform an error analysis for a given numerical method.
Mathematics-3 (M401)	CO1	To define mathematical models
	CO2	To explain the needs of mathematical tool in various fields
	CO3	To use enhanced mathematical knowledge
	CO4	To analyze various probabilistic use
	CO5	To design statistical methods or models
	CO6	To judge the application areas of different abstract models.

Communication Engg. & Coding Theory (CS401)	CO1	To state different communication processes based on these two methods and appreciate their relative merit and demerit.
	CO2	To describe the carrier and message frequencies from the expression for AM signals and Angle modulated signals.
	CO3	To apply the type of modulation and explain each and every block of the PCM system must be acquired.
	CO4	To differentiate between base-band transmission and modulation and compute antenna size from knowledge of carrier frequency.
	CO5	To design the coding efficient binary and decimal coding systems.
	CO6	To judge between the channel capacity in case of channels of varying band-width and SNR value and predict the maximum data rate possible.
Formal Language & Automata Theory (CS402)	CO1	To differentiate and manipulate formal descriptions of languages, automata and grammars with focus on regular and context-free languages, finite automata, push down automata and regular expressions, Turing machine.
	CO2	To design recognizer and grammars for different formal languages and identify the language accepted by an automaton or a grammar.
	CO3	To transform between equivalent deterministic and non-deterministic finite automata, and regular expressions.
	CO4	To construct minimize finite automata and grammar of context free language.
	CO5	To explain the power and the limitations of regular languages and context-free languages and compare different system.
	CO6	To design Turing Machine for simple computable functions and know the fundamental concepts of tractability and decidability of computational problems.
Computer Architecture (CS403)	CO1	To define the Flynn's classification of computer architecture SISD, SIMD, MISD, MIMD.
	CO2	To explain how computer hardware has evolved to meet the needs of multi-processing systems.
	CO3	To construct a wide variety of memory technologies both internal and external and also able to Compute CPU and memory performance.
	CO4	To compare array processor and vector processors both in terms of parallelism in SIMD architecture.

	CO5	To evaluate different types of systems: pipelined, super-scalar, super- pipelined, super. scalar–super, pipelined architecture.
	CO6	To design the hardware of multiprocessors including cache coherence and synchronization.
Technical Report Writing & Language **Laboratory Practice** **(HU481)**	CO1	To label their skills in English speaking and listening.
	CO2	To describe overall personality development.
	CO3	To handle group discussions and public speaking, awareness of body language.
	CO4	To handle interviews, practice of preparing.
	CO5	To empower themselves to present project report, etc.
	CO6	To handle power point presentations.
Numerical Methods Lab (M(CS)491)	CO1	Be aware of the mathematical background for the different numerical methods introduced in numerical theory.
	CO2	Understand the different numerical methods to solve the algebraic equations and to solve system of linear and non linear equations.
	CO3	Understand the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations.
	CO4	Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.
	CO5	Demonstrate they understand the mathematics concepts underlying the numerical methods considered.
	CO6	Identify and classify the numerical problem to be solved and understand the characteristics of the method to correctly interpret the results.
Communication Engg & Coding Theory (CS491)	CO1	To identify different communication processes based on these two methods and appreciate their relative merit and demerit.
	CO2	To explain the carrier and message frequencies from the expression for AM signals and Angle modulated signals.
	CO3	To compute the coding efficiency of binary and decimal coding systems; The relative merits and demerits of the different digital modulation techniques and capability to calculate signal power in digital systems to be understood clearly.
	CO4	To categorize the types of modulation. The ability to explain each

		and every block of the PCM system must be acquired.
	CO5	To design various base-band transmission and modulation systems and compute antenna Size.
	CO6	To judge the importance of digital modulation over analog modulation in respect of noise immunity concept.
Software Tools Lab (CS492)	CO1	Describing the basic of design, create, build, and debug Visual Basic applications.
	CO2	Explaining variables and data types used in program development and also the arithmetic operations for displaying numeric output.
	CO3	Implementing one and two dimensional arrays for sorting, calculating, and displaying of data.
	CO4	Structuring decision structures for determining different operations and loop structures to perform repetitive tasks. Also organizing procedures, sub. procedures, and functions to.
	CO5	Monitoring Visual Basic programs using object oriented programming techniques polymorphism and that will help to design projects on VB Programming.
	CO6	Designing Windows applications using forms, controls, and events.
Computer Architecture Lab (CS493)	CO1	To define the detailing of VHDL simulation and internal configuration of FPGA.
	CO2	To explain major syntactic elements of VDHL entities, architectures, processes functions, common concurrent statements, and common sequential statements.
	CO3	To construct user defined subprograms, packages using VHDL program.
	CO4	To compare behavioural and structural coding styles of VHDL program.
	CO5	To evaluate the VDHL test bench and use it to test/verify a sequential VHDL design of moderate complexity.
	CO6	To design combinational logic and sequential logic circuit by using VHDL programming, as an awareness of timing and resource usage.
THIRD YEAR : 5TH SEMESTER		
Economics for Engineers (HU501)	CO1	Recognise 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.
Design & Analysis of Algorithm (CS501)	CO1	To Know various advanced design and analysis techniques such as greedy algorithms, dynamic programming & know the concepts of tractable and intractable problems and the classes P, NP and NP complete problems.
	CO2	To Understand how the worst case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms, the difference between the lower and upper bounds of various problems and their importance in deciding the optimality of an algorithm.
	CO3	To Solve the problem related to Divide and Conquer, Dynamic programming, Backtracking and Greedy method, solve problem related to String matching, problem related to network flow with the help of Ford Fulkerson algorithm, matrix multiplication problem with the help of Stassen's matrix manipulation algorithm, problem related to Clique decision problem, the problem related to vertex cover problem, travelling salesman problem.
	CO4	To Analyze the complexity/performance of different algorithms using different computational models, order notation and various complexity measures.
	CO5	To Evaluate different algorithms related to Divide and Conquer, Dynamic programming, Backtracking and Greedy method, Ford Fulkerson algorithm for network flow and vertex cover problem, travelling salesman problem.
	CO6	To Design efficient algorithms by comparing existing algorithms with their problems for fundamental problems in computer science and engineering work.
Microprocessors & Microcontrollers (CS502)	CO1	To define the architecture and operation of 8085, 8086 microprocessor and 8051 microcontroller.
	CO2	To explain the instruction set of 8085, 8086 microprocessor and 8051 microcontroller, memory paging.
	CO3	To construct simple program writing for 8085, 8086 microprocessor & 8051 microcontroller and to compute time complexity and space complexity for these programs.
	CO4	To compare Memory mapped IO and peripheral mapped IO and their interfacing procedure and also compare microprocessor with microcontroller.
	CO5	To evaluate the addressing modes of a sample microprocessor and

		microcontroller.
	CO6	To design the different kind of embedded applications.
Discrete Mathematics (CS503)	CO1	To know that students should get some mathematical idea in linear algebra, Graph Theory, Boolean Algebra etc. from discrete mathematics course and expand those skills in the other subjects of Computer Sciences.
	CO2	To understand the graphical ideas which should be used by various computer applications in Soft Computing like data mining, image processing, clustering, image capturing etc. Graph theory can be used to represent communication and computer networks.
	CO3	To solve the problems of different papers outcomes, and expose them to the research world. Illustrate the current research works and publications of the subjects in various journals and conference.
	CO4	To explain the latest and modern developments in the research fields and the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals executing the knowledge adopted from the course.
	CO5	To formulate various problems which Cryptography, Networking, etc.
	CO6	To evaluate the professional, ethical, responsibilities from this course.
Object Oriented Programming (CS504D)	CO1	Able to learn the concept of object oriented programming that helps to organize complex programs.
	CO2	Able to understand of the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements;
	CO3	A competence to design, writes, compile, test and execute straightforward programs using a high level Language and also applying the knowledge of OOP.
	CO4	Able to analyze the complex problems and provide awareness of the need for a professional approach to design and the importance of good documentation to the finished programs.
	CO5	Be able to implement, compile, test and run Java programs comprising more than one class, to address a particular software problem, and also able to evaluate solution of the complex programs as well as student will able to know the concept of parallel code execution through the concept of multithreading.
	CO6	Demonstrate the ability to employ various types of selection constructs in a Java program. Be able to employ a hierarchy of Java classes to provide a solution to a given set of requirements and also get exposure of developing the

		web application which is the essential technology in modern era.
Design & Analysis of Algorithm Lab (CS591)	CO1	Students are able to understand basic data structures for searching and sorting, trees, heaps, and the computational complexity of the searching and sorting algorithms that use these structures.
	CO2	Students should be able to understand basic graph algorithms and their computational complexity.
	CO3	Students should be able to prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
	CO4	Students are able to compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.
	CO5	Students are able to implement an algorithm in any programming language by choosing the appropriate data structure.
	CO6	Students are able to design a new algorithm or they can modify the existing algorithm by choosing exact data structures to support specific applications.
Microprocessors & Microcontrollers Lab (CS592)	CO1	To define the detailing (8085 IC, RAM, ROM, keyboard, display unit, crystal oscillator etc.) of 8085 training board.
	CO2	To explain 8085 microprocessor instruction set, addressing mode and the procedure for storing data and execution of program.
	CO3	To construct the 8085 microprocessor programming with the help of binary instructions.
	CO4	To compare various design of same program and find out their efficiency in terms of space and time complexity.
	CO5	To evaluate the machine code program on the training board.
	CO6	To design the different kind of interfacing and embedded applications.
Programming Practices using C++ (CS593)	CO1	To be able to Define an object oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.
	CO2	To be able to understand the code and write the classes which work like built in types.
	CO3	To be able to develop applications which are easier to debug, maintain and extend.
	CO4	To be able to Compare object-oriented concepts in real world applications.
	CO5	Able to Justify the philosophy of object-oriented design and the

		concepts of encapsulation, abstraction, inheritance, and polymorphism
	CO6	Able to Design, implement, and test the implementation of "is-a" relationships among objects using a class hierarchy and inheritance.
OOP Lab (CS594D)	CO1	Able to learn the practical concept of OOP and various aspect of OOP in through programming.
	CO2	It helps to learn about, how to write, compile & execute basic java program which are essential for programming.
	CO3	It helps to learn about the effective program writing in the environment of Object Oriented Concept.
	CO4	Understand that how to use OOP to simplify complex programs and also got knowledge about the advantage of using Object Oriented Programming over Process Oriented Programming.
	CO5	It provides practical exposure about the use of threads, handle exceptions and write applets and also about the use of interfaces and inner classes, wrapper classes, generics and that will help to develop projects over OOP(on Java).
	CO6	It will help to get sense about the web project that will be helpful for them in future to develop the web application.
THIRD YEAR : 6TH SEMESTER		
Principles of Management (HU601)	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.

Data Base Management System **(CS601)**	CO1	Define the terminology, features, classifications, and characteristics embodied in database systems.
	CO2	Demonstrate an understanding of relational database using normalization theory.
	CO3	Transform an information model into a relational database schema and to apply a data definition language, data manipulation language and/or utilities to implement the schema using a SQL.
	CO4	Analyze an information storage problem and derive an information model expressed in the form of an entity relationship diagram and other optional analysis forms, such as a data dictionary.
	CO5	Evaluate the query optimization and transaction processing schemes.
	CO6	Design a broad range of query problems using relational algebra and relational calculus solutions.
Computer Networks (CS602)	CO1	To know the concepts of protocols, network interfaces, network models and design/performance issues in local area networks and wide area networks.
	CO2	To understand basic computer network technology, explain Data Communications System and its components and to identify the different types of network devices and their functions within a network.
	CO3	To solve the main problems related to error control, flow control, MAC and addressing, routing.
	CO4	To analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
	CO5	To justify why networks need security and control, what errors might occur, and how to control network errors.
	CO6	To Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
Operating Systems (CS603)	CO1	To know the basic principles of operating systems and compare different styles of operating systems.
	CO2	To understand the main principles and techniques for the implementation of processes, threads as well as the different algorithms for process scheduling and inter process communication.
	CO3	To solve the main problems related to concurrency and the different synchronization mechanisms.
	CO4	To explain the device and I/O management functions in operating systems as part of a uniform device abstraction.
	CO5	To formulate the rationale view for virtual memory abstractions and explain the disk organization and file system structure.

	CO6	To evaluate security risks in operating systems and justify the role of operating systems in establishing security.
Computer Graphics (CS604B)	CO1	To remember and understand and analyze contemporary graphics principles and graphics hardware.
	CO2	To understand and apply geometrical transformations.
	CO3	To understand and demonstrate 2D transformation and apply it onto 2D image processing techniques.
	CO4	To understand and demonstrate 2D transformation and apply it onto 3D image processing techniques.
	CO5	To understand and demonstrate computer graphics animation.
	CO6	Create interactive graphics applications in C++ using one or more graphics application programming interfaces.
Operation Research (CS605A)	CO1	Provides knowledge about the concept of operation research that helps to provide various methods which will be applied to various problems.
	CO2	Understand about various problems of statistics and management and get knowledge about the mathematical process to solve those.
	CO3	Identify and applying operational research models from the verbal description of the real system. The model used on fields such as Finance, Accounting, Construction, Marketing etc.
	CO4	Understand and applying the mathematical tools that are needed to solve problems and able to analyze the data for the final result.
	CO5	Able to evaluate the optimal solution of the problems by applying the mathematical models of operation research
	CO6	Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.
Data Base Management System Lab (CS691)	CO1	To develop conceptual understanding of database management system. Ability to create database tables.
	CO2	Ability to formulate SQL queries based on the problems given.
	CO3	To solve time effective solutions. Ability to apply PL/SQL.
	CO4	To develop understanding of different applications and constructs of SQL PL/SQL
	CO5	To understand how a real world problem can be mapped to schemas.

		Embedded and Nested Queries.
	CO6	To develop understanding of different applications and constructs of SQL PL/SQL to recommend various industry oriented and real life applications. Handling online Transactions.
Computer Networks Lab (CS692)	CO1	Students are able to identify and use various networking components and able to learn various networking commands.
	CO2	Students should be able to understand different transmission media and design cables for establishing a network.
	CO3	Students are able to install a network system consists of various computers using NIC, networking cables, connector, hubs and switches.
	CO4	Students are able to understand the basic concepts of network and application layer protocol design; including client/server models, peer to peer models and able to implement inter process communication and message passing.
	CO5	Students should be able to implement networking in software using various socket programming and also able to learn how to implement various networking protocols.
	CO6	Students should be able to learn the major software and hardware technologies used on computer networks and able to implement device sharing on network.
Operating System Lab (CS693)	CO1	To use (utilize) basic UNIX/LINUX Commands.
	CO2	To create the codes in the Shell Programming.
	CO3	To program on process creation synchronization, Inter process communication including shared memory, pipes and messages.
	CO4	To develop the codes using UNIX/LINUX System calls.
	CO5	To simulate of CPU Scheduling Algorithms like FCFS, RR, SJF, Priority, Multilevel Queuing and Banker's Algorithm for Deadlock Avoidance, Prevention.
	CO6	To program the FIFO, LRU, and OPTIMAL page replacement algorithms.
Seminar (CS681)	CO1	Understand the past and present of the disciplines by exploring their purpose, practice, and philosophy.
	CO2	Gain an understanding of advanced research methodologies in the field, including theory, interdisciplinary approaches, and the

		analysis of available primary sources.
	CO3	Demonstrate through short written assignments and critical reviews the ability to synthesize and assess the arguments of scholarly articles and monographs at the level of professionals in the field.
	CO4	Understand the privileges and obligations associated with a career as a professional
	CO5	Understand historical and recent trends in theory and method and be able to identify and explain major trends and issues in industry and research.
	CO6	Learn to write a scholarly book review.
FOURTH YEAR : 7TH SEMESTER		
Software Engineering (CS 701)	CO1	Demonstrate knowledge of the distinction between critical and non-critical systems.
	CO2	Demonstrate the ability to manage a project including planning, scheduling, and testing and risk assessment/management.
	CO3	Author a software requirements document and demonstrate an understanding of the proper contents of a software requirements document.
	CO4	Demonstrate an understanding of the differences between real-time and non-real time systems.
	CO5	Identify specific components of a software design that can be targeted for reuse.
	CO6	Author a software testing plan and demonstrate proficiency in software development cost estimation.
Compiler Design (CS702)	CO1	Know and Understand different components of a compiler and their functioning.
	CO2	Understand the role of a lexical analyzer, use of regular expression and finite automata to design lexical rules for a programming language, semantic errors, recovery techniques, and precise meaning of programming construct.
	CO3	Construct parser and identify the similarities and differences among various parsing techniques and grammar transformation techniques.
	CO4	Examine various code optimization techniques to improve the performance of a program in terms of speed & space.
	CO5	Explain instruction scheduling and register allocation techniques

		during the code generation.
	CO6	Design different types of compiler tools to meet the requirements of the realistic constraints of compilers, and recognize the need for continuing education, research and professional development.
Artificial Intelligence (CS703C)	CO1	The student will learn the basics of the theory and practice of Artificial Intelligence as a discipline about intelligent agents capable of deciding what to do, and do it.
	CO2	The student will be introduced to Artificial Intelligence (AI) programming.
	CO3	The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.
	CO4	The student will design simple software to experiment with various AI concepts and analyze results.
	CO5	The student will build self-learning and research skills to be able to tackle a topic of interest on his/her own or as part of a team.
	CO6	The students will analyze a problem, and identify and define the computing requirements appropriate to its solution.
Data Mining and Data Warehousing (CS704C)	CO1	Understand the basic principles, concepts and applications of data warehousing and data mining.
	CO2	Introduce the task of data mining as an important phase of knowledge recovery process.
	CO3	Apply the knowledge of the fundamental concepts that provide the foundation of data mining.
	CO4	Analyze the Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.
	CO5	Design a data warehouse or data mart to present information needed by management in a form that is usable for management client.
	CO6	Research about the complex problems of data mining.
Internet Technology (IT) (CS705A)	CO1	Able to remember & understand the concepts and architectures of the Internet and its applications.
	CO2	Able to understand various threats and challenges of the underlying system and its architecture.
	CO3	Able to understand & analyze real time and complexity Analysis.
	CO4	Able to analyze and implement various security aspects.
	CO5	Able to understand and apply communications among various heterogeneous systems.
	CO6	Able to design and implement various industry oriented and real life applications.
Group Discussion (HU781)	CO1	Teaching strategies of group discussion.
	CO2	Introducing different models and topics of group discussions.
	CO3	Exploring live recorded GD sessions for mending students' attitude/ approach and for taking remedial measures.

	CO4	Strategies and standard practices of seminar presentation.
	CO5	SWOT analysis and its application in fixing targets.
Software Engineering Laboratory (CS791)	CO1	Indicate, design and construct application using CASE tools.
	CO2	Translate a requirement specification into an implementable design, following a structured and organized process.
	CO3	Identify some of the main risks of software development use it in development process.
	CO4	Employ group working skills including general organization, planning and time management and inter group negotiation.
	CO5	Formulate testing strategy for a software system, employing techniques such as unit testing, test driven development and functional testing.
	CO6	Develop software applications in a development environment that makes use of commonly supported tools.
Industrial Training (CS792)	CO1	The students will be able to demonstrate the use, interpretation and application of an appropriate international engineering standard in a specific situation.
	CO2	The students will be able to analyse a given engineering problem, identify an appropriate problem solving methodology, implement the methodology and propose a meaningful solution.
	CO3	The students will be able to apply prior acquired knowledge in problem solving.
	CO4	The students will be able to identify sources of hazards, and assess/identify appropriate health & safety measures.
	CO5	The students will be able to take initiatives, communicate, work in a team and manage a project within a given time frame.
	CO6	The students will be able to adopt a factual approach to decision engineering making.
Artificial Intelligence Lab (CS793C)	CO1	To apply knowledge of computing and mathematics appropriate to the discipline.
	CO2	To understand a problem and identify and define the computing requirements appropriate to its solution.
	CO3	To implement and evaluate a computer. based system, process, component, or program to meet desired needs.
	CO4	To apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
	CO5	To apply knowledge representation techniques and problem solving strategies to common AI applications.
	CO6	To design simple software to experiment with various AI concepts and analyze results.

Internet Technology Lab (CS795A)	CO1	To define the concepts over the architectures of the Internet and it's applications.
	CO2	To explain and implement various threats an challenges of the underlying system and its architecture.
	CO3	To solve time effective solutions.
	CO4	To analyze various security aspects.
	CO5	To develop communications among various heterogeneous systems.
	CO6	To recommend various industry oriented and real life applications.
Project- 1 (CS794)	CO1	Understand programming language concepts, particularly Java and object-oriented concepts or go through research activities.
	CO2	Plan, analyze, design and implement a software project or gather knowledge over the field of research and design or plan about the proposed work.
	CO3	Demonstrate the ability to locate and use technical information from multiple sources.
	CO4	Demonstrate the ability to communicate effectively in speech and writing.
	CO5	Learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project.
	CO6	Learn about and go through the software development cycle with emphasis on different processes - requirements, design, and implementation phases.
FOURTH YEAR : 8TH SEMESTER		
Organizational Behavior (HU801A)	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	Monitor human resources through effective leadership.
	CO6	To create a congenial and cohesive ambience within the framework of organizational structure in achieving the organizational goals.
Project Management (HU801B)	CO1	Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.
	CO2	Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management.
	CO3	Demonstrate effective project execution and control techniques that result in successful projects.
	CO4	Conduct project closure activities and obtain formal project acceptance.

	CO5	Demonstrate a strong working knowledge of ethics and professional responsibility.
	CO6	Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders.
Cryptography and Network Security (HU801D)	CO1	To Acquire knowledge in security issues, services, goals and mechanism.
	CO2	To understand the basic concept of Cryptography and Network Security ,their mathematical models.
	CO3	To evaluate Encryption and decryption of messages using block ciphers. Sign and verify messages using well.known signature generation and verification algorithms.
	CO4	To Describe and analyze existing authentication protocols for two party communications and Analyze key agreement algorithms to identify their weaknesses.
	CO5	To Determine the ethical issues related to the misuse of computer security.
	CO6	To Develop code to implement a new cryptographic algorithm or write an analysis report on any existing security product.
E-Commerce (802E)	CO1	Demonstrate an understanding of the foundations and importance of E-Commerce.
	CO2	Understand legal, privacy and payment issues in an E-Commerce system.
	CO3	Analyze the impact of E-Commerce on business models and strategy.
	CO4	Apply Internet trading relationships including Business to Consumer, Business-to-Business,Intra-organizational.
	CO5	Design security mechanism associated with an E-Commerce system.
	CO6	Evaluate Internet based technological aspects of an E-Commerce system.
Design Lab (CS891)	CO1	Formulate the requirements from a given problem.
	CO2	Synthesize and employ knowledge from Software Engineering and Project Management.
	CO3	Create, design, develop and deploy a solution, according to the Software Development Life Cycle.
	CO4	Incorporate good design principles in solution.
	CO5	Plan and execute a project
	CO6	Conform to a designated quality standard & Employ industry best practices and tools.
Project-2 (CS892)	CO1	Understand programming language concepts, particularly Java or C# along with object oriented concepts as well as software engineering principles or go through the research work and gather knowledge over the field and develop an ability to apply them to software design of real life problems in an industry/ commercial environment

		or propose methodology in the field of research.
	CO2	Plan, analyze, design a software project and demonstrate the ability to communicate effectively in speech and writing.
	CO3	Introduce with major software engineering topics and position them to lead medium sized software projects in industry or propose any new model over the selected field of research that will be useful for future activities.
	CO4	Learn about and go through the software development cycle with emphasis on different processes -requirements, design, and implementation phases and also learn details about different artifacts produced during software development.
	CO5	Learn about different software development process models and how to choose an appropriate one for a project.
	CO6	Gain confidence at having conceptualized, designed, and implemented a working, medium sized project with their team.
Grand Viva (CS893)	CO1	Explore their field of knowledge, which includes a critical awareness of current problems and/or new insights at the forefront of that field.
	CO2	Understand of techniques applicable to their own area of professional practice.
	CO3	Demonstrate originality in the application of knowledge, together with a practical understanding of how established techniques professional enquiries are used to create and interpret knowledge in their discipline.
	CO4	Evaluate current professional practice in Computer Science and Engineering, to evaluate methodologies and develop critiques of them and, where appropriate, to propose new forms of practice or knowledge.
	CO5	Demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level.
	CO6	Advance their knowledge and to develop new skills to a high level with complex issues both systematically and creatively, make sound judgments in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences.

PSOs and POs of Electrical Engineering Department

Program Specific Outcomes (PSOs)

The PSOs of electrical engineering programme supported by the curriculum are given below.

The students will be able to

PSO1: apply principles of engineering, electronics and computer science; physics, chemistry, environmental science, mathematics (including differential equations, discrete mathematics, linear algebra and complex variables) and laboratory skills for building, testing, operation and maintenance of high currents electrical systems, such as, electrical machines, power and energy systems.

PSO2: model, analyse, design, and realize physical systems, components or processes related to high current electrical engineering systems.

PSO3: work professionally in power systems engineering, control systems engineering and software industries.

Program Outcomes (POs)

Electrical Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriateconsideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
4. Conduct investigations of complex problems: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one?s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Department of Electrical Engineering
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name:B. Tech In Electrical 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	To impart advanced skills of technical communication in English.
	CO2	To enable them to communicate confidently and competently in English language in all spheres.
	CO3	To develop writing competence- technical report, business letters, job applications etc.
	CO4	To develop reading comprehension skill through non-technical texts.
	CO5	To conduct conversation practice: face to face and via media.
Chemistry-I (CH101)	CO1	Explain the laws of thermodynamics and its applications in engineering field.
	CO2	Analyze the laws of electrochemistry and its application in the field of engineering.
	CO3	Understand the concept of industrial chemistry and polymer chemistry and its importance in engineering.
	CO4	Understand the concept of Chemical kinetics and its application.
	CO5	Understand the theory based ideas in Solid state chemistry and its importance in engineering.
	CO6	Express the reaction mechanism of organic chemistry.
Mathematics-I (M101)	CO1	Use Determinants and Matrices; solve system of linear equations and Eigen value/vector

	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	
	CO7	
Basic Electrical & Electronic Engineering-I (ES101)	CO1	understand the basic properties of electrical elements, and solve DC circuit analysis problems. DC network theorems.
	CO2	understand the fundamental behaviour of AC circuits and solve AC circuit problems.
	CO3	Apply the knowledge gained to explain the behavior of the circuit at series & parallel resonance of circuit & the effect of resonance.
	CO4	Explain the basic properties of electromagnetic circuit &their application.
	CO5	
	CO6	
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	Locate the positions of centroids and calculate the moments of inertia of laminas and solids about an axis.
	CO3	Describe the motion of a particle in terms of its position, velocity and acceleration.
	CO4	Understand kinematic and kinetic analysis and energy and momentum methods for attacking problems on particles, systems of particles and rigid bodies in motion.
	CO5	Use work-energy principle to solve problems related to static and dynamic equilibrium
	CO6	
Chemistry-I Laboratory	CO1	Determining hardness of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.

(CH191)	CO2	Evaluate redox potential andapply in day to day life as well as in industry.
	CO3	Calculate the alkalinity of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO4	Measurethe viscosity of liquid helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO5	Measure the pH and conductance with the help of instruments of given samples e.g. tea, fruit juices, soil etc.
	CO6	Differentiate two heterogeneous liquid solutions and determine the distribution of solvent among them.
Basic Electrical & Electronic Engineering-I Laboratory (ES191)	CO1	**understand**the difference in characteristic of different lamps and learn about their constructional features.
	CO2	familiarize with and illustrateThevenin's, Norton's, superposition and maximum power transfer theorem.
	CO3	create resonance condition in R-L-C series and parallel circuit and learn how to draw phasor diagram for the circuit.
	CO4	
	CO5	
	CO6	
Engineering Drawing & Computer Graphics (ME191)	CO1	Students will be able to know about different types of lines & use of different types of pencils in engineering drawing.
	CO2	Student's ability to hand letter will improve.
	CO3	Student's ability to perform basic sketching techniques will improve.
	CO4	Students are able to know different angle of projection& orthographic projection
	CO5	Students will able to gain knowledge on plane, solids like pyramid, frustrum etc.
	CO6	Students will be able to draw orthographic projections and sections.
		Students will understand the logic behind development of surfaces.
Language Laboratory	CO1	To impart advanced skills of technical communication in English.
	CO2	To enable them to communicate confidently and competently in English

(HU181)		language in all spheres.
	CO3	To develop writing competence- technical report, business letters, job applications etc.
	CO4	To develop reading comprehension skill through non-technical texts.
	CO5	To conduct conversation practice: face to face and via media.
	CO6	
Extra Curricular Activities(NSS/ NCC/NSO etc) (XC181)	CO1	
	CO2	
	CO3	
	CO4	
	CO5	
	CO6	
FIRST YEAR : 2ND SEMESTER		
Basic Computation & Principles of Computer Programming (CS201)	CO1	On completion of this course, students are expected to learn about basic anatomy of computers, its applications and history.
	CO2	Write, compile and debug programs in C language, design programs involving decision structures, loops and functions.
	CO3	The students should be able to create program modules in C using functions and recursive functions.
	CO4	Declare and manipulate single and multi-dimensional arrays of the C data types. They should also know the difference between call by value and call by reference.
	CO5	Understand the dynamics of memory by the use of pointers. Apply different file operations to create/update basic data files.
	CO6	Apply different file operations to create/update basic data files.
Physics-I (PH 201)	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.
Mathematics-II (M201)	CO1	Solve ODE of 1^{st} order & 1^{st} degree
	CO2	Solve some special cases of 2^{nd} order ODE and simultaneous linear ODE of 1^{st} order
	CO3	Basic graph theory, matrix representation of graphs.
	CO4	Trees and simple tree algorithms.
	CO5	Improper integrals & their convergence.
		Laplace Transform and application on ODE
Basic Electrical & Electronic Engineering-II (ES 201)	CO1	**apply**the basic concepts of electrostatics to electric field and potential calculation.
	CO2	**understand**the construction, operating principle and characteristics of DC machine, single phase transformer and three phase induction motor.
	CO3	Prepare circuits for starting and speed control of DC machine and three phase induction motor.
	CO4	**identify**theparameters of single phase transformer by test
	CO5	**learn**the basic principles involved in power generation, transmission &distribution.
	CO6	
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	On completion of this course, the students are expected to know the importance of data structure and algorithm to create a program and correlate between the two.
	CO2	Students are expected to be capable of understanding the data structures and its applications.
	CO3	The students are expected to be strong in C. They should learn the advantages and disadvantages of using different data structures to achieve a particular goal of a problem.
	CO4	Students should be able to with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a program to enhance the efficiency (i.e. reduce the run-time) or for better memory utilization.
	CO5	Learn the different sorting methods and write the methods in C and analyze their time complexities.
	CO6	The students should be able to understand the concept of trees and graphs and how to perform search, insert delete operations and analyze its time and space requirements.
Physics-I Laboratory (PH291)	CO1	*Analyse* and *apply the concepts* of oscillations and of wave.
	CO2	To *understand* the some basic properties of physical optics.
	CO3	To *distinguish* different ways of *application* of polarization of light and LASER.
	CO4	To *understand* the basic concepts of Quantum Physics.
	CO5	To c*lassify* crystal structures and to *identify* the properties of X-rays and its *application.*
Basic Electrical & Electronic Engineering- II	CO1	calibrate the ammeter and voltmeter and compute their errors.
	CO2	identify the parameters of a single phase transformer by open circuit and short circuit test.

Laboratory (ES 291)	CO3	Demonstrate the different characteristics of D.C shunt Generators.
	CO4	Devise circuit for starting -reversing and speed control of a D.C. shunt motor.
	CO5	measure power in a three phase, three wire circuit by using two wattmeter.
	CO6	
Workshop Practice (ME 292)	CO1	Students will be able to acquire thorough knowledge of various tools, machines, devices used in engineering practice.
	CO2	Students will be able to acquire thorough knowledge of carrying out various operations in mechanical engineering workshop
	CO3	Students will be able to gain measuring skills
	CO4	Students will be able to acquire "Hands on" training and practice to students for use of various tools, devices, machines
	CO5	Students will be able to acquire skills in basic engineering practice for creating objects from raw materials
	CO6	Students will be able to acquire skills in basic engineering practice for creating objects from raw materials
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 RegulaFalsi and Newton-Raphson methods.
	CO6	Euler, RK4, Predictor-Corrector for 1st order ODE and Finite Difference methods for simple ODE's.
Mathematics (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 2^{nd} Order ODE, special cases: Bessel's & Legendre's functions.
Analog Electronic circuits (EC(EE)301)	CO1	Analyze different types of filters and regulators.
	CO2	Determine quiescent point, gain, input and output impedance of common emitter and common collector amplifiers.
	CO3	Explain principal of operation of various basic oscillators and feedback amplifiers.
	CO4	Analyze input/output relation for various simple applications of OP-Amp in analog circuits.
	CO5	Explain performance of basic class-A, class-B and class-C power amplifiers.
	CO6	Describe operating principle of 555 timer IC based monostablemultivibrator, 555 timer IC based astablemultivibrator and VCO, PLL.
Digital Electronic circuit (EC(EE)302)	CO1	State the types of digital devices and its applications in different domain, Conversion of different number systems as example conversion from binary to other number systems, implementation of different codes and conversions ,addition and subtraction of 1's and 2's complement numbers.
	CO2	Demonstrate the standard Boolean algebra and different minimization technique by stating different Boolean algebra. Explain SOP and POS, develop K-map for 2/3/4 variables.
	CO3	Explain different combinational circuits as adder, Substractor, MUX, DeMUX. Develop different combinational circuit by truth table and K-map, State the different important combinational circuit such as decoder, encoder and parity.
	CO4	Explain the memory system and develop the designating process of different memory.
	CO5	Explain the basic differences of combinational and sequential circuits, Develop flip flops as SR,JK,D flip flop, Develop register and counters and

		other advanced sequential circuits ,Prepare different conversion techniques from digital domain to analog domain and vice versa.
	CO6	State different types of logic families such as TTL, ECL, MOS and CMOS.
Electric Circuit theory (EE-301)	CO1	**apply**different techniques for analysis of electrical circuit.
	CO2	**explain**transient response of different circuits using Laplace transform.
	CO3	**Analyse**magnetically coupled circuits.
	CO4	**apply** graph theory to formulatenetwork equations.
	CO5	**compute** Fourier series for complex waveforms.
	CO6	**design** different kinds of two port networks filter circuits.
Field theory (EE-302)	CO1	**apply**vector calculus to understand the behavior of static electric field
	CO2	**apply** vector calculus to understand the behavior of static magnetic field
	CO3	**apply**Maxwell's equation in different forms (differential and integral) and analyze diverse engineering problems.
	CO4	**identify** the appropriate magnetic material for design purpose of electromagnetic machines.
	CO5	**describe** and analyze electromagnetic wave propagation in different media and its interfaces
	CO6	**apply** the knowledge of line parameters, propagation constant, characteristic impedance for designing a more reliable and optimized transmission line.
Analog & Digital Electronic circuit (EC(EE)391)	CO1	Demonstrate different applications of diode- clipper, clamper, full wave rectifier.
	CO2	Demonstrate voltage regulation by Zener diode.Demonstrate Switched Mode Power Supply & Design linear voltage regulator using regulator IC chip.
	CO3	Design two stage RC coupled amplifier. Demonstrate Power amplifier- Class A, B, C, Push-pull
	CO4	Design V to I & I to V using Op-Amp. Demonstrate NE 555 timer IC and design monostable, astable, bistable multivibrator.
	CO5	Design RS-JK & D filpflop using logic gates. Design Synchronous Up/Down

		counter
	CO6	Design of Combinational circuit for BCD to decimal conversion to drive 7-segment display using Multiplexer.
	CO7	Design decoder ,multiplexer and adder circuit
Numerical Methods (M (CS)391)	CO1	Be aware of the mathematical background for the different numerical methodsintroduced in numerical theory.
	CO2	Understand the different numerical methods to solve the algebraic equations and to solve system of linear and non linear equations.
	CO3	Understand the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations.
	CO4	Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.
	CO5	Demonstrate they understand the mathematics concepts underlying the numerical methods considered.
	CO6	Identify and classify the numerical problem to be solved and understand the characteristics of the method to correctly interpret the results
Electric Circuit Theory Lab (EE-391)	CO1	**Learn** use of standard software like PSPICE and MATLAB
	CO2	**apply**PSPICE to simulate R-L, R-C, R-L-C series and parallel network and **determine** their response.
	CO3	**Apply PSPICE to simulate two-port networks and determine**their Impedance (Z) and Admittance (Y) parameters.
	CO4	**generate**different kinds of signals like, Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp etc. using MATLAB in both discrete and analog form and **view** their waveforms.
	CO5	**compare** response of a circuit both in time and frequency domain also **analyze**the Amplitude and Phase spectrum of different waveform using MATLAB.
	CO6	**verify** the Network theorems using PSPICE.

TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE (HU-381)	CO1	Conversation practice session.
	CO2	Teaching strategies of group discussion.
	CO3	Mock – interview session.
	CO4	Presentation: teaching presentation as a skill
	CO5	Competitive examination- strategies/tactics for success in competitive examination
	CO6	
	CO1	
	CO2	
	CO3	
	CO4	
	CO5	
	CO6	
SECOND YEAR : 4TH SEMESTER		
Values and Ethics in Profession (HU-401)	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	Analyse 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 fundamental ideas of classical mechanics and apply the knowledge in case of complex mechanical problems.
	CO2	Understand the basics of quantum mechanics and apply the knowledge in case of electrons trapped inside crystal.
	CO3	Classify particles in terms of MB, BE and FD stats with their properties and apply the knowledge in real photonic and electronics systems.
	CO4	Understand basic Crystallography, associated theories and applications on X rays, electron transportation etc.
	CO5	Understand theories of Dielectrics and Magnetism in solids and apply the knowledge in relevant electrical systems.

	CO6	
Thermal Power Engineering (ME(EE)411)	CO1	Students able to Identify the different types of steam generators and the function of the components.
	CO2	Students able to calculate the rankine cycle efficiency of reheat and regeneration cycle of a thermal power plant.
	CO3	Students able to Perform combustion calculations for boiler furnaces and Distinguish between types of fuels.
	CO4	Students able to understand different types of turbine and their working principle and calculate the efficiency of turbine cycle.
	CO5	Describe the purpose, construction and operation of different condensers and cooling towers. Solve Thermal calculations
	CO6	Describe the purpose, construction and operation of I.C.Engine and gas turbine.
Basic Environmental Engineering & Elementary Biology (CH-401)	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.
Electric	CO1	**explain** the various types of torques produced in electrical machines and

Machine-I (EE-401)		fundamental principles of operation of rotating electrical machines.
	CO2	**categorize** different phenomena occurring in DC machines and AC three phase machines.
	CO3	**compare** the performance characteristics of different machines.
	CO4	**develop**theequivalent circuit andphasor diagram ofdifferent machines and **analyze**their performance using the equivalent circuit.
	CO5	**learn**about, parallel operation, tap-changing of three phase transformers and origin of production of harmonics in a machine and its importance.
	CO6	**identify**possible applications of different machines.
Electrical & Electronic measurement (EE-402)	CO1	**analyze** the mechanism of torque production and operation of analog electro-magnetic and electro-static measuring instruments.
	CO2	**Understand** the working of potentiometer and different DC and AC bridges for accurate measure-ment of electrical quantities.
	CO3	**Determine** the magnitude of electrical quantitieslike resistance, inductance, capacitance, power, energy etc. over wide range of magnitude.
	CO4	**understand**thefunctional block diagram and principle of operation of electronic instruments like cathode ray oscilloscope, signal generator, digital voltmeter, multi-meter.
	CO5	**understand** the working principles of different sensors and that can measure non electrical quantities like force, displacement, temperature, flow etc.
	CO6	**understand** the working principles of different sensors and that can measure non electrical quantities like force, displacement, temperature, flow etc.
Physics-II (PH(EE)-491)	CO1	*Application* of the concepts of P-N junction and functionality of energy conversion by introducing solar cell and measuring its characteristics.
	CO2	*Application* of the theoretical knowledge of semiconductor by measuring Band Gap of a semiconductor through four probe method.
	CO3	Application of the theoretical knowledge of hot body radiation by measuring Stefans' constant using a diode valve.
	CO4	Application 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	Adopting the above knowledge of the experiments, students are expected to *design, develop and execute* an innovative experiment with the existing instrument.
	CO6	
Thermal power Engineering Lab (ME(EE)481)	CO1	Students able to Identify the different types of steam generators and the function of the components.
	CO2	Students able to calculate the rankine cycle efficiency of reheat and regeneration cycle of a thermal power plant.
	CO3	Students able to Perform combustion calculations for boiler furnaces and Distinguish between types of fuels.
	CO4	Students able to understand different types of turbine and their working principle and calculate the efficiency of turbine cycle.
	CO5	Describe the purpose, construction and operation of different condensers and cooling towers. Solve Thermal calculations
	CO6	Describe the purpose, construction and operation of I.C.Engine and gas turbine.
Electric Machine-I (EE-491)	CO1	**verify** the characteristics of different machines and **predict** specific applications of those machines accordingly.
	CO2	**perform** the speed control of DC shunt motor.
	CO3	**determine** the parameters of equivalent circuit of different machines.
	CO4	**identify** polarity of windings to make parallel operation possible and to make proper connections of three phase transformers in the desired group.
	CO5	Students will be able to **classify** various losses in a three phase induction motor.
	CO6	
Electrical & Electronic measurement (EE-492)	CO1	acquire knowledge of internal structure of electrical measuring instruments.
	CO2	calibrate different types of ammeter , voltmeter and wattmeter and single phase AC energy meter.
	CO3	measure high voltage, current and power using instrument transformer.
	CO4	measure low resistance, inductance and capacitance using dc and ac

		Bridge.
	CO5	measurethree phase power by two watt meter method.
THIRD YEAR : 5TH SEMESTER		
Electric Machine-II (EE-501)	CO1	learn the construction and principle of operation of different kinds of rotating AC machines.
	CO2	analyse theoretically, the performance characteristics for different electrical machines and obtain simple equivalent circuit for the machine.
	CO3	Learn methods for testing of different electrical machines so as to identify their applicability in different practical situations.
	CO4	appraise the purpose for parallel operation of generators and learn the conditions to be satisfied for this.
	CO5	learn the process of 'synchronisation' of a generator to the live bus bar and method of starting a synchronous motor.
	CO6	Understand the construction, operation and characteristics of commonly used special purpose machines.
Power System-I (EE-502)	CO1	The students will be able to analyze the performance of transmission lines, efficiency in transmission lines
	CO2	The students will be able to understand basics of corona, sag and other problems arise in transmission lines
	CO3	The students will be able to understand power factor improvement, capacitor bank installation in distribution system, metering system in industrial and residential area.
	CO4	Students will be able to assess knowledge about different tariff structures and Indian electricity rules under deregulated environment
	CO5	Students will be able to assess knowledge about different tariff structures and Indian electricity rules under deregulated environment
	CO6	The students will be able to assess knowledge about substation design and along with its equipments
Control System-I (EE-503)	CO1	**Understand** the general concept of a system and **classify**systems into different types and represent a system using different techniques like block diagram, signal flow graph.
	CO2	**develop** transfer function model of mechanical, electrical, thermal, fluid system and different control system components like servomotors, synchros, potentiometer, tacho-generators etc.
	CO3	**analyze** system response and **evaluate** error dynamics in time domain.

	CO4	**Determine**system stability using routh-hurtwitz (RH) criteria, root locus techniques in time domain and bode plot and nyquist technique in frequency domain
	CO5	**design** different control law or algorithms like proportional control, proportional plus derivative(PD) control, proportional plus integration(PI) control, and proportional plus integration plus derivative (PID) control and different compensators like lag, lead, lag-lead.
	CO6	**Understand** the general concept of a system and **classify** systems into different types and represent a system using different techniques like block diagram, signal flow graph.
Data structure & algorithm (EE504A)	CO1	Able to understand the concepts of data structure, data type and array data structure.
	CO2	Able to analyze algorithms and determine their time complexity.
	CO3	Able to implement linked list data structure to solve various problems.
	CO4	Able to understand and apply various data structure such as stacks, queues, trees and graphs to solve various computing problems using C-programming language.
	CO5	Able to implement and know when to apply standard algorithms for searching and sorting.
	CO6	Able to effectively choose the data structure that efficiently model the information in a problem.
Microprocessor & Microcontroller (EE504C)	CO1	**explain** the fundamental architecture of microprocessor and bus configuration(8085 & 8086),CPU module, ROM & RAM families etc.
	CO2	**employ** assembly language and machine language program using 8085 instruction set which would help students hone their programming skills.
	CO3	**learn**memory interfacing, I/O interfacing, different interrupts and DMA controller so that they can **apply** µP unit for real life application.
	CO4	Students should be able to**apply**the concept of data transfer for interfacing peripherals with the microprocessor and **synthesize** the concept of interfacing for designing the microprocessor based system.
	CO5	**understand** thearchitecture and basic function of the micro-controller and the basic difference between the microprocessors and

		microcontroller.
	CO6	The students will be able to **employ** the 8051 microcontroller instructions and hardware interface of the microcontroller with the actual devices.
Economics for Engineers (HU501)	CO1	Recognise financial statements, their importance and usages.
	CO2	Understand major principles of financial accounting, cost accounting and financial management.
	CO3	Utilise 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.
Electric Machine-II (EE591)	CO1	compare the different methods of starting and speed control of ac motors .
	CO2	measure the regulation of alternator by different methods.
	CO3	compare the performance characteristics of different electrical machines.
	CO4	distinguish the operational features of synchronous machines and induction machines.
	CO5	learn method for control of active and reactive power of synchronous machines.
POWER SYSTEM-I LAB (EE592)	CO1	Students will be able to determine of the generalized constants and power circle diagram of transmission line.
	CO2	Students will be able to handle DC distribution by network analyzer and earth tester for measurement of earth resistance
	CO3	Students will be able to study the different types of insulators
	CO4	Students will be able to understand dielectric strength test of insulating oil; determination of breakdown strength of solid insulating material and dielectric constant, tan delta, resistivity test of transformer oil.
	CO5	Students will be able to handle modern software for analyzing electrical

		transmission line.
	CO6	Students will be able to perform the active and reactive power control of an alternator.
CONTROL SYSTEM-I (EE593)	CO1	Able to analyze the words Transient & Steady State Performance of a system.
	CO2	Able to understand the stability of an Electrical, Electronics and other physical systems.
	CO3	Able to develop their concepts regarding basics of Inductor and Capacitor will be enhanced, as the response of R-L circuit, R-L-C circuit is a part of this subject.
	CO4	Able to design the control system which is required in the process
MICROPROCESSOR &MICROCONTROLLER (EE594C)	CO1	**study**the 8085 register level architecture including the memory map and trainer kit components
	CO2	**employ**the assembly language programs and simulate system using trainer kit & PC.
	CO3	**implement** the micro-processor based programs for real scenarios.
	CO4	**carry out** the programs using 8255 peripheral interface on the trainer kit
	CO5	**write** programs with the help of 8051 Micro controller kit for practical applications.
Seminar (EE581:)	CO1	Prepare and deliver a seminar.
	CO2	Come across various research areas in the domain of Electrical Engineering.
	CO3	Improve the skill of presentation of Seminars.
	CO4	Evaluate and synthesize information in order to draw consistent conclusions
	CO5	Compose text characterized by clear and careful organization, coherent paragraphs and well-constructed sentences that employ the conventions of Standard Written English and appropriate diction.
	CO6	
THIRD YEAR : 6TH SEMESTER		
Principles of	CO1	Recognise the fundamentals of Management thoughts that are vital for

Management (HU601)		the development of conceptual frame work of Management as a discipline.
	CO2	Demonstrate knowledge of organisational structure, organizational conflict, negotiation, politics, and change.
	CO3	Apply the principles of decision making through planning, organising, staffing, directing and controlling.
	CO4	Analyse 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.
Data Base Management System (EE604B)	CO1	Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.
	CO2	Define the terminology, features, classifications, and characteristics embodied in database systems.
	CO3	Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary.
	CO4	Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.
	CO5	Formulate, using relational algebra and relational calculus solutions to a broad range of query problems.
	CO6	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CONTROL SYSTEM-II (EE601)	CO1	infer the general concept of state variable, state space, nonlinear system, nonlinear characteristics and sampled data system
	CO2	develop state space models of electrical, mechanical, thermal and fluid system and different control system components like servomotors etc
	CO3	analyse and evaluate stability of nonlinear systems by describing function method, Lyapunov's method and phase plane technique.
	CO4	Assess sampled data system and judge the issues faced in sampling, digital data and discrete time systems.

	CO5	design state feedback gains using pole allocation method and digital compensator in frequency domain.
	CO6	infer the general concept of state variable, state space, nonlinear system, nonlinear characteristics and sampled data system
POWER SYSTEM-II (EE602)	CO1	*Categorize* various types of substations and choose suitable equipment for Distribution substations.
	CO2	*Apply* the concept of per unit system and symmetrical components to analysis of different kinds of faults in an interconnected power systems.
	CO3	*Understand* methods available for analysis of load flow problem and develop software for solution of the same.
	CO4	*Understand* the principles of operation of different kinds of protection systems and apply them in real power system.
	CO5	*Assess* the applicability of a particular type of circuit breaker in a given situation.
	CO6	*Analyze* different kinds of stability problems in multi machine power system.
	CO7	*design* the relevant protection scheme for the main elements of a power system
Power Electronics (EE603)	CO1	get **familiar** with the characteristics of modern power electronic devices and the basic principle of operation of various power-electronic circuits
	CO2	**understand** the fundamental principles involved in the operation of power electronic switches and the different methods to **control** them
	CO3	**design** different types of phase-controlled single phase and three phase converters along with necessary protective circuits for **application** in different domains of engineering
	CO4	use research-based knowledge for **design** of DC-DC converter and inverter
	CO5	to **design** single phase and three phase step up/step down AC controller
	CO6	**design** power electronic controllers in the field of speed control of AC and DC motors. HVDC transmission, Static circuit breaker, UPS, Static VAR controller etc
DIGITAL	CO1	**implement** fundamentals of DSP in real life applications.

SIGNAL PROCESSING (EE603)	CO2	**demonstrate** a broad idea about the process of sampling, quantization, aliasing with respect to A/D and D/A conversion.
	CO3	**classify** discrete-time signals analytically and **identify**them in the discrete time domain and frequency domain.
	CO4	**employ** optimization of DFT in terms of FFT.
	CO5	**design**basic forms of FIR and IIR filters using different methods.
	CO6	**fabricate**an elementary architecture and instruction set of a practical signal processor.
CONTROL SYSTEM-II LAB (EE691)	CO1	**determine** time response specifications from closed loop time response of lightly and highly damped dc motor position control system.
	CO2	**determine** the controller (PID) parameters for a given 1st order time delay system using Z-N method.
	CO3	**design** of Lead, Lag and Lead-Lag compensation circuit for the given plant transfer function.
	CO4	**determine** zero output and zero state response from state variable diagram representation of a system using simulation.
	CO5	**illustrate** performance analysis for a continuous system model with digital controller using simulation.
	CO6	**illustrate** nonlinear system analysis in time domain.
	CO7	**illustrate** the stability of nonlinear system from phase plane trajectory and limit cycle devise
POWER SYSTEM-II LAB (EE692)	CO1	Student able to **check** the quantities CT and PT
	CO2	Student able to conduct **testing** about theof various electromagnetic relay
	CO3	Student able to apply appropriate technique for load flow analysis and its **Comparing**
	CO4	Student able to do **Experiment** on various protection methods on induction motor
	CO5	Student able to **verify** the differential relay used for transformer protection
	CO6	Student able to do **Experiment** in various protection of generator ,feeder

		and transmission line using relays and circuit breakers
POWER ELECTRINICS LAB (EE693)	CO1	analyze the characteristics of thyristors along with their triggering and firing circuits.
	CO2	examine the full and half bridge converters with R and R-L load.
	CO3	analyze the performance of step up and step down chopper with various switching circuits.
	CO4	analyze the performance of PWM bridge inverter using MOSFET as switch with R and R-L load.
	CO5	analyze the performance of three phase AC controller (with R and R-L load), Dual converter and cycloconverter
	CO6	analyze the characteristics of thyristors along with their triggering and firing circuits.
Data Base Management System Lab (EE694B)	CO1	Master the basics of SQL and construct queries using SQL. to create, secure, populate, maintain, and query a database.
	CO2	Demonstrate a rudimentary understanding of programmatic interfaces to a database and be able to use the basic functions of one such interface.
	CO3	Use SQL DDL commands to create tables, views, and indexes. Apply SQL DML commands to select, insert, update, and delete data.
	CO4	Use operators such as AND, OR, NOT., BETWEEN, IS NULL, LIKE, IN, and EXISTS with the WHERE clause. Use the aggregate functions: COUNT, MAX, MIN, SUM, and AVG for mathematical summaries.
	CO5	Use the ALTER and DROP TABLE command to manipulate and delete a table from the database. Use the ORDER BY clause to sort a listing in ascending or descending order.
	CO6	Use the GROUP BY clause in conjunction with an SQL aggregate function such as COUNT, MIN, MAX, AVG, and SUM to obtain summary row data, or subtotals in reports. Explain and use SQL functions to manipulate dates, strings, and other data.
FOURTH YEAR : 7TH SEMESTER		
ELECTRIC DRIVES EE701	CO1	**classify** electrical drives, and **justify** multi-quadrant operation of drives along with load equalization
	CO2	**analyze** the thermal model and **determine** the motor rating for different duty cycles considering the effect of load inertia and environmental

		factors
	CO3	**appraise** different starting and braking methods of electric motors.
	CO4	**explain** state space model of DC motor and **apply** different power electronics converters for control of DC drives.
	CO5	**appraise** the speed and frequency control method of Induction motor and synchronous motor
	CO6	**identify** suitable form of electrical drives system in Industry.
UTILISATION OF ELECTRIC POWER (EE702)	CO1	**understand** different kinds of drive and control systems as used in electric traction along with the details of its power supply arrangement.
	CO2	**achieve** thorough knowledge about series-parallel control of dc motors, multiple unit drive, current collecting device, and different braking schemes of electric traction.
	CO3	**classify** the spectral content of the light emitted by different kind of light sources and **measure** their total light output, spatial distribution and also to **identify** their field of application.
	CO4	**Choose** appropriate lamps and lighting scheme and **design** for different applications, including street and flood lighting.
	CO5	**Choose and adopt** right kind of heating and welding processes depending upon the actual situation.
	CO6	**understand** the principles and different applications of electrolytic processes namely electro-deposition, extraction, refining of metals etc.
POWER SYSTEM-III (EE703A)	CO1	**understand** the benefits of restructured power system, non-conventional energy sources, distributed generation system and their environmental impact.
	CO2	**compute** economic schedule for energy generating system.
	CO3	**explain** the principles involved in automatic control of generation of active and reactive power.
	CO4	**appraise** the need for transmission line compensation and become **aware** of the various types of techniques currently available for this purpose.
	CO5	**classify** the various types of transients that might occur in a power system,

		their effects and **measures** taken to overcome their ill effects.
High Voltage Engineering (EE704A)	CO1	discriminate the breakdown mechanism of solid, liquid, gases dielectric through different theorem
	CO2	classify the methods of high voltage generation
	CO3	comprehend the different techniques of high voltage measurement
	CO4	familiarize with the lightning phenomena and different protection schemes against lightning.
	CO5	assess condition of insulator as per Indian Standard Specifications.
Power Generation Economics (EE704C)	CO1	**resolve** the economic issues of various power plants.
	CO2	**understand** the guiding factors behind different electrical tariff systems.
	CO3	**understand** the basic techniques for unit commitment.
	CO4	**Apply** optimization techniques for economic operation of electric power.
	CO5	**get familiar** with techniques for state estimation and load forecasting in power system.
RENEWABLE ENERGY (EE704D)	CO1	**learn** and justify the Energy Scenario of Nation.
	CO2	**understand** the Impact of renewable energy generation on environment, Kyoto Protocol and **develop** themselves to play the role of ideal electrical engineer
	CO3	**learn** the strategy for meeting the future energy requirements in Global and National scenarios, prospects of renewable energy sources and **apply** the knowledge to plan for future.
	CO4	**learn** the basic concept of harnessing different renewable sources of energy like Solar, Wind, Biomass, Geothermal Energy etc. and Biomass in perspective.
	CO5	**formulate** the Mathematical equation for **designing** plants for conversion of energy into electrical form based on Solar, Ocean, Fuel Cell, Magneto Hydrodynamic generation etc
	CO6	**perform** different Hands on Experiment on Solar Energy and set up new laboratory experiments for benefit of the students.

Computer Network (EE705A)	CO1	Describe and analyze the hardware, software, components of a network and the interrelations.
	CO2	Explain networking protocols and their hierarchical relationship hardware and software. Compare protocol models and select appropriate protocols for a particular design.
	CO3	Manage multiple operating systems, systems software, network services and security. Evaluate and compare systems software and emerging technologies.
	CO4	Develop solutions for networking and security problems, balancing business concerns, technical issues and security.
	CO5	Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance and implementing new technologies.
	CO6	Identify infrastructure components and the roles they serve, and design infrastructure including devices, topologies, protocols, systems software, management and security. Analyze performance of enterprise network systems.
Seminar on industrial training (EE781)	CO1	**Achieve** skill to write technical documents and **deliver** oral presentation of the completed project, which in turn shall **develop** his communication skills.
	CO2	**Approach** ethically any multidisciplinary engineering challenges with economic, environmental and social contexts so that they are able to explain their work clearly and that helps them to set as a potential employers.
	CO3	**Identify and apply** appropriate steps to solve problems they have met during implementation of their project.
	CO4	**develop** skills towards discerning problems in the organisation, if any, and to **plan** for resolving it.
	CO5	**evaluate** the severity and consequences of the problems in the organisation and to take **steps** to address the problem.
	CO6	**design** simulation model for performing the validity tests of new approach towards the problem solving.
ELECTRIC	CO1	**analyze** the characteristics of thyristor controlled DC Drive

DRIVES (EE791)	CO2	**explain** operation of full and half bridge converters with R and R-L load.
	CO3	**judge** the quality of performance of step up and step down chopper with various switching circuits.
	CO4	**analyze** the performance of PWM bridge inverter using MOSFET as switch with R and R-L load .
	CO5	Students will be able to**assess** the performance of three phase AC controller (with R and R-L load), Dual converter and cycloconverter .
SYSTEM DESIGN LAB-I (EE782)	CO1	**design** an electrical component or system to meet desired needs.
	CO2	wiring and installation **design** of a multistoried residential building.
	CO3	**design** the power distribution system for a small township and substation.
	CO4	**design** different type of machines like 3ϕ IM, ONAN distribution transformer etc.
	CO5	**function** as a member of a multidisciplinary team in the solution of engineering problems.
	CO6	**Understand** ethical responsibility and professional integrity issues related to the practice of electrical engineering.
PROJECT –I (EE783)	CO1	Demonstrate a sound technical knowledge of their selected project topic.
	CO2	Undertake problem identification, formulation and solution by considering ethical responsibility.
	CO3	Design engineering solutions to complex problems utilizing as system approach.
	CO4	Conduct an engineering project that has environmental impact
	CO5	Communicate with engineers and the community at large in written and oral forms
	CO6	Demonstrate the knowledge, skills and attitudes of a professional engineer.
Network Lab EE792A	CO1	Upon successful completion of this laboratory, students are able to identify and use various networking components and able to learn various networking commands.

	CO2	Students should be able to understand different transmission media and design cables for establishing a network.
	CO3	Students are able to install a network system consists of various computers using NIC, networking cables, connector, hubs and switches.
	CO4	Students are able to understand the basic concepts of network and application layer protocol design; including client/server models, peer to peer models and able to implement inter process communication and message passing.
	CO5	Students should be able to implement networking in software using various socket programming and also able to learn how to implement various networking protocols.
	CO6	Students should be able to learn the major software and hardware technologies used on computer networks and able to implement device sharing on network.
	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	Monitor human resources through effective leadership.
	CO6	To create a congenial and cohesive ambience within the framework of organizational structure in achieving the organizational goals.
FOURTH YEAR : 8TH SEMESTER		
Organizational Behavior (HU801A)	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	Monitor human resources through effective leadership.
	CO6	To create a congenial and cohesive ambience within the framework of organizational structure in achieving the organizational goals.
HVDC	CO1	**point out** the concept of HVDC transmission in Power System

Transmission (EE801A)	CO2	**develop** knowledge about design, control and analysis of HVDC converters
	CO3	**learn** about the protection schemes for different types of faults in HVDC systems
	CO4	**appraise** the existence of different of harmonics in HVDC systems
	CO5	**indicate** the need for multi-terminal HVDC systems, Power upgrading and conversion of AC lines into DC lines
ILLUMINATION ENGINEERING (EE801B)	CO1	**distinguish**among different types of artificial light sources; different means for producing light, properties of light, role of human eye as visual processor.
	CO2	**measure** radiometric and photometric parameters of light using appropriate instruments.
	CO3	**Familiar** with the luminous efficacy, colour, electrical characteristics of different types of lamps.
	CO4	**Familiar** with luminaires based on their features, and recommend different types of lamps and luminaires for specific purposes.
	CO5	**design** interior lighting system for office, conference room, hospitals, house etc.
	CO6	**identify** energy efficient lamps, **prepare** energy efficient lighting design and **apply** of software for lighting system design.
ENERGY MANAGEMENT & AUDIT (EE801C)	CO1	**learn** in details, the objectives of energy audit, different types of energy audits like, energy management audit etc. and planning for energy audit.
	CO2	**understand** Bench marking, Energy performance, matching energy use to requirement and implementation.
	CO3	**assess**theenergy scenario, commercial and non-commercial energy requirement, availability of primary energy resources, commercial energy production, total energy consumption, energy needs of growing economy and **explain** the concept of energy conservation and its benefit.
	CO4	**understand** the implication of energy efficient processes, United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, Clean Development Mechanism (CDM), CDM methodology and Procedures, Sustainable development.
	CO5	**learn effectiveness** ofmaximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver,

		variable speed drives etc.
	CO6	**appraise** needs for energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting, heating and cooling system.
POWER PLANT INSTRUMENTATION & CONTROL (EE802A)	CO1	**categorize** the power generation technique used in different types of power plants.
	CO2	**identify** and **measure** physical parameters for instrumentation in various major power plant components.
	CO3	**Assess** different plant parameters and their control in the power plant.
	CO4	**develop** the P &I diagram of various power plant loops.
SENSOR & TRANDUCER (EE802B)	CO1	**sense** and **measure** the (common) physical parameter from natural material.
	CO2	**identify**the appropriate sensor, including powering of the sensor and signal conditioning (electrical and calculation conversions).
	CO3	**prescribe** compatible (voltage & current) signals using filters and computer interfaces for further data record and analysis
	CO4	**design**, **analysis**,**modelling**of transducers and evaluation of its performance
	CO5	**evaluate** current developments and potential future directions in sensing techniques and measurement system design.
	CO6	**select** appropriate transducers and instrumentation system components in the broad areas of temperature, level, flow, pressure and magnetic & optical properties measurement.
PROJECT-II (EE881)	CO1	Demonstrate a sound technical knowledge of their selected project topic.
	CO2	Undertake problem identification, formulation and solution by considering ethical responsibility.
	CO3	Design engineering solutions to complex problems utilizing as system approach.
	CO4	Conduct an engineering project that has environmental impact

	CO5	Communicate with engineers and the community at large in written and oral forms
	CO6	Demonstrate the knowledge, skills and attitudes of a professional engineer.
SYSTEM DESIGN-II (EE882)	CO1	**design** an electrical component or system to meet desired needs.
	CO2	**design** the power distribution system for a small township and substation.
	CO3	**design** different type of special machines like 1ϕ IM ,Servomotor etc
	CO4	**design** different type of controller circuit for different type of machines.
	CO5	**Achieve proficiency** in communicating ideas and information orally and in writing.
	CO6	**Understand** ethical responsibility and professional integrity issues related to the practice of electrical engineering.
GRAND VIVA (EE883)	CO1	Ability to apply the basic technical & engineering knowledge.
	CO2	Explain different type of theorem, laws and application.
	CO3	Apply the knowledge to solve engineering problems.
	CO4	Identify real life engineering problems and economic solution.
	CO5	Justify the application of different type of technical knowledge.
	CO6	Understanding of ethical responsibility and professional integrity issues related to the practice of electrical engineering.

PSOs and POs of Electronics and Communication Engineering Department

Program Specific Outcomes (PSOs)

Electronics and Communication Engineering graduates will be able to:
 # PSO 1 (Engineering Knowledge and Analysis): Analyze specific engineering problems relevant to Electronics & Communication Engineering by applying the knowledge of basic sciences, engineering mathematics and engineering fundamentals.

 # PSO 2 (System Design): Design electrical, electronics and communication systems containing electrical/electronic devices, software, and hardware using the significant analytical knowledge in Electronics & Communication Engineering and Computer Sciences, and applying modern tools.

 # PSO 3 (Application of the knowledge on society/environment): Apply the contextual knowledge of Electronics and Communication Engineering to assess societal, environmental, health, safety, legal and cultural issues with professional ethics and function effectively as an individual or a leader in a team to manage different projects in multidisciplinary environments as the process of life-long learning.

Program Outcomes (POs)

Electronics and Communication Engineering graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one?s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Department of Electronics and communication Engineering

Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: B. Tech in Electronics and Communication 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	Determine hardness of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO2	Evaluate redox potential and apply in day to day life as well as in industry.
	CO3	Calculate the alkalinity of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO4	Measure the viscosity of liquid helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO5	Measure the pH and conductance with the help of instruments of given samples e.g. tea, fruit juices, soil etc.
	CO6	Differentiate two heterogeneous liquid solutions and determine the distribution of solvent among them.
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	Analyze 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	Apply 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	Apply the concepts of elasticity of materials by finding Rigidity Modulus of a metallic rod and accordingly verifying Hook's Law.
	CO3	Apply 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	Apply the idea of dispersion and minimum deviation of light for prism by finding out dispersive power of the material of a prism.
	CO5	Apply 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 291)	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 2^{nd} Order ODE, special cases: Bessel's & Legendre's functions.
Circuit Theory & Networks (EC301)	CO1	Explain network elements, types of networks and network topology
	CO2	Analysis complex circuits using mesh current & nodal voltage method.
	CO3	Compute AC and DC Parameters in the circuits.
	CO4	Analyze RLC circuits and coupled circuits.
	CO5	Apply the concept of two port network in circuit analysis
	CO6	Explain fundamentals of filters.
Solid State Devices (EC302)	CO1	Explain the importance of Fermi level in Direct and indirect band-gap semiconductors.
	CO2	Distinguish degenerate and non-degenerate semiconductors.
	CO3	Evaluate the dependence of reverse saturation current on minority carrier concentration and forward diffusion current on potential barrier.
	CO4	Demonstrate the switching capability of minority carrier p-n diode and importance of PIV of a diode.
	CO5	Analyze the performance of CE, CB and CC modes of transistor and design biasing circuits.
	CO6	Calculate the threshold voltages for different MOSFETS and compute the junction capacitances.
Signals & Systems (EC-303)	CO1	Distinguish between different types of signals & systems and will also be able to analyze a signal using Fourier series.
	CO2	Apply Fourier transform and convolution on both continuous and discrete time signal.
	CO3	Employ Laplace transform on signals.
	CO4	Explain sampling theorem and can also illustrate the reconstruction procedure of the original signal from its samples.
	CO5	Apply Z transform on any discrete signal and also can relate it with the Laplace transform.
	CO6	Employ the concept of Random signals and variables in communication domain.
Analog Electronic Circuits (EC304)	CO1	Analyze basic forms of power supply filters and determine their filtering performance.
	CO2	Determine quiescent point, gain, input and output impedance of common emitter and common collector amplifiers
	CO3	Explain principal of operation of various basic oscillators.
	CO4	Analyze input/output relation for various simple applications of OP-Amp in analog circuits.
	CO5	Explain performance of basic class-A and class-B power amplifiers.

	CO6	Describe operating principle of 555 based monostable and astable multivibrator
Circuit theory and network Lab (EC391)	CO1	Characterize Series & Parallel Resonant circuits.
	CO2	Validate network theorems.
	CO3	Design Transient Response in R-L & R-C Networks and Transient Response in RLC Series & Parallel Circuits & Networks.
	CO4	Determine Z, Y parameters for a given two port network.
	CO5	Generate periodic, exponential, sinusoidal damped sinusoidal, step, impulse and ramp signals and represents poles and zeros in s-plane, determine partial fraction expansion in s domain and cascade connection of second order system using MATLAB.
	CO6	Determine Laplace transform, different time domain functions and inverse Laplace
Solid State Device Lab (EC392)	CO1	Analyze practical behavior of BJT, JFET and MOSFET and corresponding graphs.
	CO2	Analyze errors in the circuits using BJT/JFETs and rectify them.
	CO3	Analyze behaviour of different electronic structures using MATLAB software.
	CO4	Examine the characteristics of Varactor and MOS using software tools
	CO5	Experimentally determine Voltage Gain, Current Gain, Input Impedance, Output Impedance of a BJT amplifier in CE mode
	CO6	Examine the performance of a common-emitter RC coupled amplifier
Signals & Systems Lab (EC393)	CO1	Apply Fourier, Laplace and z- transform technique on various forms of signal.
	CO2	Analyze various signals in to its components.
	CO3	Employ filters in communication systems.
	CO4	Demonstrate experimental verification of sampling Theorem.
	CO5	Apply modern tools e.g. MATLAB in analyzing signals & systems.
Analog Electronic Circuit Lab (EC394)	CO1	Demonstrate different applications of diode- clipper, clamper, full wave rectifier.
	CO2	Demonstrate voltage regulation by Zener diode.Demonstrate Switched Mode Power Supply & Design linear voltage regulator using regulator IC chip.
	CO3	Demonstrate FET and BJT characteristics. Design two stage RC coupled amplifier.
	CO4	Demonstrate Power amplifier-Class A,B,C,Push-pull.
	CO5	Demonstrate NE 555 timer IC and design monostable, astable, bistable multivibrator.
	CO6	Design current mirror, level shifter, V to I & I to V using Op-Amp, PLL using VCO and function generator using IC.
	CO7	Demonstrate DAC and ADC.
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.
SECOND YEAR : 4TH SEMESTER		
Physics II (PH- 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. (CH–401)	CO1	Explain the basics of environment, ecology, sustainable development and Environmental degradation
	CO2	Describe the different components of ecosystem, bio geo-cycle and importance of bio-diversity.
	CO3	Analyze the Indian Environmental law, atmospheric chemistry, soil chemistry, material balances.
	CO4	Explain the different types of pollution like air, water, soil and others.
	CO5	Analyze the causes of pollution and its prevention.
	CO6	Solve and manage different environmental problems like waste disposal and others.
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.
EM Theory & Transmission Lines (EC401)	CO1	Demonstrate the physical interpretation of Gradient, Divergence and Curl and apply Coulomb's law, Gauss's law, Biot-Savart law, Ampere's law, Faraday's law and Lenz's law to solve an unknown problem.
	CO2	Analyze Maxwell's equations in differential/integral form and solution of these equations in terms of electromagnetic wave.
	CO3	Determine the electromagnetic boundary conditions for solving an unknown problem using Maxwell's equations.
	CO4	Describe the Poynting Theorem and demonstrate the interaction of electromagnetic wave with medium.
	CO5	Demonstrate and characterize transmission line parameters using distributed model and solve practical problems using analytical and graphical tools.
	CO6	Demonstrate and analyze different characteristics parameters of antenna for real time applications.
Digital Electronic & Integrated Circuits (EC402)	CO1	Solve different binary codes.
	CO2	Employ the minimization technique.
	CO3	Prepare various combinational and sequential circuits.
	CO4	Prepare various combinational and sequential circuits Develop i.e. modulo counters.
	CO5	Integrate basic computer system.
Physics II Laboratory (PH-491)	CO1	Application of the concepts of P-N junction and functionality of energy conversion by introducing solar cell and measuring its characteristics.
	CO2	Application of the theoretical knowledge of semiconductor by measuring Band Gap of a semiconductor through four probe method.
	CO3	Application of the theoretical knowledge of hot body radiation by measuring Stefans' constant using a diode valve.
	CO4	Application 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	Adopting the above knowledge of the experiments, students are expected to design, develop and execute an innovative experiment with the existing instrument.
Electromagnetic Wave and Transmission Lines Lab (EC491)	CO1	Demonstrate plotting of Standing Wave Pattern along a transmission line.
	CO2	Determine input Impedance of a terminated coaxial line using shift in minima technique.
	CO3	Demonstrate FET and BJT characteristics. Design two stage RC coupled amplifier.
	CO4	Demonstrate about the Smith chart on Matlab platform.
	CO5	Demonstrate radiation pattern of different antennas such as dipole

		antenna, 3-element Yagi-Uda Antenna, folded-dipole antenna.
	CO6	Demonstrate the comparison among 3-element, 5-element and 7-element Yagi-Uda antennas in terms of beam width, gain and radiation pattern.
	CO7	Demonstrate about the Spectrum Analyzer.
Digital Electronic & Integrated Circuits Lab (EC492)	CO1	Realize basic gates from universal gates.
	CO2	Convert from one number system to another.
	CO3	Analyze different combinational and sequential circuits.
	CO4	Design of sequential counter with irregular sequences.
	CO5	Develop the circuits on PCBs.
Technical Report Writing & Language Laboratory (EC481)	CO1	1. Conversation practice session.
	CO2	Teaching strategies of group discussion.
	CO3	Mock – interview session.
	CO4	Presentation: teaching presentation as a skill
	CO5	Competitive examination- strategies/tactics for success in competitive examination.
THIRD YEAR : 5TH SEMESTER		
Economics for Engineers (HU501)	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.
Analog Communication (EC501)	CO1	Describe basic components of communication system and concept of modulation, its needs.
	CO2	Classify different types of AM (Analog Modulation) techniques, their principles.
	CO3	Demonstrate different AM systems (generation and detection).
	CO4	Explain different types of angle modulation schemes (FM & PM), their generation and detection.
	CO5	Demonstrate the different types of multiplexing in communication system.
	CO6	Analyze the noise characteristics of a communication system using different modulation scheme.
Microprocessor& Micr-ocontroller (EC 502)	CO1	Identify the difference between the different microprocessor and microcontroller and can describe the advantages and disadvantages of both.
	CO2	Demonstrate the internal architecture of different microprocessor 8085 and compute assembly language programs of

		8085microprocessor and describe serial I/O,DMA and asynchronous and synchronous transmission using SID and SOD pins.
	CO3	Describe the architecture of 8051 microcontroller and apply the knowledge of microcontroller later in the real life problems.
	CO4	Demonstrate the detail architecture of 8086 microprocessor.
	CO5	Illustrate the chips(8255,8253,8251) supporting 8085,8086 microprocessor and 8051 microcontroller.
	CO6	Describe PIC microcontroller (16F877)
CONTROL SYSTEMS (EC503)	CO1	State open and closed loop control systems and their mathematical models.
	CO2	Explain transfer functions of linear systems, block diagram reduction technique, time response of the control systems, and stability analysis in terms of root-locus technique and bode plots.
	CO3	Prepare basic systems.
Data Structure & C (EC504B)	CO1	Design and Analyze of Algorithms
	CO2	capable of understanding the data structures, their advantages and drawbacks, how to implement them in C, how their drawbacks can be overcome
	CO3	learn about the data structures/ methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a program
	CO4	enhance the efficiency (i.e. reduce the run-time) or for better memory utilization, based on the priority of the implementation
	CO5	Demonstrate detailed time analysis of the graph algorithms and sorting methods and understand at least the efficiency aspects of the graph and sorting algorithms covered in this course
	CO6	convert an inefficient program into an efficient one using the knowledge gathered from this course
Analog communication Laboratory (EC591)	CO1	Analyze various analog modulation and demodulation schemes in time and frequency domains.
	CO2	Apply different types of measuring instruments including advance instruments like spectrum analyzer and digital storage oscilloscope for signal analysis.
	CO3	Measure and compute the transmission power of amplitude and frequency modulated signal.
	CO4	Measure and compute distortion of the demodulated output of an AM signal.
	CO5	Measure and calculate different parameters of radio receiver.
	CO6	Familiarization of different section and measure waveforms of various functional points of B/W TV receiver.
	CO7	Design and analysis demodulator circuit.
Microprocess-	CO1	analyze, specify, design, write and test assembly language programs

ors & Microcontroll-ers Lab (EC 592)		of moderate complexity
	CO2	select an appropriate 'architecture' or program design to apply to a particular situation
	CO3	design and build the necessary programs
	CO4	calculate the worst-case execution time of programs or parts of programs
	CO5	design and build, or to modify, software to maximize its run time memory or execution-time behavior
Control System Lab (EC593)	CO1	Solve different block diagrams of control systems using software tool (preferably MATLAB).
	CO2	Show different time-domain responses for different standard inputs in computer as well as using hardware.
	CO3	Apply concepts of making an open loop control system to a closed one using SIMULINK tool.
	CO4	Analyze and examine the stabilities of different closed (automatic) control systems using different stability-analysis tool e.g. Nyquist or Bode plots.
	CO5	Design or develop basic control systems.
Data Structure & C Lab (EC594B)	CO1	capable of understanding the data structures, their advantages and drawbacks
	CO2	implement data Structure ideals in C and overcome the drawbacks
	CO3	Apply the understanding of data structures
	CO4	learn about the data structures/ methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a program
THIRD YEAR : 6TH SEMESTER		
Principles of Management (HU601)	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.
Digital Communicati on (EC601)	CO1	Apply statistical parameter values of random signals in analysis of digital communication systems.
	CO2	Apply signal space representation in analysis of digital communication systems.
	CO3	Analyze various source coding and line coding systems.
	CO4	Explain the phenomena of inter symbol interference in digital base

		band transmission and the need of pulse shaping filters.
	CO5	Analyze various digital modulation systems.
	CO6	Compute band width requirement and probability of error in various digital modulation systems
Digital Signal Processing (EC602)	CO1	Classify discrete time signals/systems.
	CO2	Apply Z-transform and Fourier transform for different type of signals and systems.
	CO3	Determine the convolution of discrete time signals using graphical and analytical methods.
	CO4	Compute DFT/IDFT for discrete time signals and find circular convolution.
	CO5	Develop FFT algorithms and design of analog/digital filters.
	CO6	Compute the frequency response of digital filters and hence apply for different signal processing applicationse.g. DSP processors/FPGA platform.
Telecommunication Systems (EC603)	CO1	State the emerging technologies in Telecomm. Systems.
	CO2	Demonstrate the standards adopted in switching System.
	CO3	Explain the Signaling techniques, integrated telecommunication network and Internet protocol telephony.
	CO4	Analyze and infer on digital switching systems that are in day-to- day use.
	CO5	Plan, design and develop telecommunication network to meet the latest demands.
Antenna Theory & Propagation (EC604A)	CO1	explain different characteristics of an antenna and determine radiation fields of a Hertzian dipole based on fundamental principles and laws of electromagnetics.
	CO2	analyze radiation field characteristics of λ/2 dipole antenna, λ/4 monopole antenna, and different antenna arrays and demonstrate the characteristics of end fire, broad side and phased array antennas.
	CO3	demonstrate the working principle and engineering of travelling wave antenna, helical antenna, folded dipole, Yagi-Uda array, loop antenna, electrically short antennas, log periodic antenna, and microstrip patch antenna.
	CO4	demonstrate the working principle, design, and applications of various horn and reflector antennas.
	CO5	illustrate various methods of radio wave propagation and explain different propagation parameters/terms such as virtual height, critical frequency, maximum usable frequency (MUF), skip distance, sporadic reflections, tropospheric scatter, ducting super refraction, and sub refraction.
	CO6	deduce the Friss Transmission Formula and explain different effects of medium on radio wave propagation such as absorption, refraction and radio horizon, diffraction, multipath propagation and fading, noise, doppler effect.
Information	CO1	describe and qualify a message and a random source in terms of

Theory & Coding (EC604B)		information content and entropy.
	CO2	demonstrate source coding and solve problems on Huffman Coding.
	CO3	determine mutual information in a binary channel with transitional probabilities.
	CO4	determine the capacity of a channel with given BW & SNR.
	CO5	analyze as well as solve problems on coding/decoding as per linear block codes & cyclic codes and convolutional code.
	CO6	describe the BCH code.
	CO7	Analyze components of Turbo coding.
Seminar EC681	CO1	Explain and illustrate an engineering idea/solution.
	CO2	Asses and evaluate and engineering solution in context of its application in modern communication engineering.
Digital Signal Processing Lab (EC692)	CO1	Analyze various discrete time signals.
	CO2	Examine the properties of convolution, Z transform and twiddle factors.
	CO3	Determine the circular convolution of two sequences.
	CO4	Prepare different algorithms for filtering long data Sequences.
	CO5	Compute the magnitude and phase response of Butterworth filter and FIR filter with different specifications.
	CO6	Employ DSP processor (TMS320C 5416/6713) for the execution of small programs like arithmetic operations and convolution.
FOURTH YEAR : 7TH SEMESTER		
Group Discussion HU-781	CO1	Introduce different models and topics in terms of skills, content mastery, attitudes, or values.
	CO2	Explore live recorded sessions for mending attitude/ approach and take remedial measures.
	CO3	Select Strategies and standard practices of seminar presentation.
	CO4	Conduct SWOT analysis and fixing targets.
	CO5	Participate and succeed in competitive examinations.
	CO6	Formulate strategies or framework to complete the specific tasks.
Wireless Communication and Networks (EC701)	CO1	Explain different wireless communication systems and their components.
	CO2	Explain the characteristics of wireless channel and propagation path loss models.
	CO3	Explain different multiple access techniques in cellular Communication.
	CO4	Explain different standards of cellular network, WLAN family and wireless broadband networks.
	CO5	Explain the functionalities of mobile network layer and transport layer.
	CO6	Describe the fundamental concepts of mobile internet Protocol.
Microelectronics & VLSI	CO1	State the types of integration like SSI, MSI, VLSI also understand the integration concept of ULSI, design domain of different ASIC structure, can able to design any IC by HDL .

Designs (EC 702)	CO2	Demonstrate the standards in VLSI fabrication technology by photolithography, masking concept as well as IC making technology and able to design CMOS layout .
	CO3	Develop advanced VLSI systems like SOC, SON technology, able to develop any recent technological devices in nanoscale ranges.
	CO4	Explain the CMOS digital design structure like CMOS full adder, Flip flops .
	CO5	Develop any advanced CMOS memory systems in recent trends like RAM, ROM, EEPROM.
	CO6	Prepare various low power, low cost, less space oriented projects in VLSI and its allied field.
RF & Microwave Engg (EC703A)	CO1	Cite RF and microwave components in detail.
	CO2	Explain wave-guides, microstrip lines as well as microwave tube in detail.
	CO3	Solve RF circuit Problems.
	CO4	Distinguish between different RF passive components.
Radar Engineering (EC704A)	CO1	Demonstrate the basic principle of radar engineering, general radar block diagram, and radar cross section.
	CO2	Compute the radar equation considering the signal degradation due to noise and the probability of detection and false alarm.
	CO3	Classify different antenna parameters and system losses of a radar system and different tracing radars and their operating principle.
	CO4	Analyze different types of radar systems like pulse radar, CW radar and MTI radar and their principle of operation.
	CO5	Analyze generation and processing of different radar signals like non-linear FM, phase codes etc.
	CO6	Design a complete radar system consists of RF components and antennas.
Database Management System (EC705C)	CO1	Identify and define the information that is needed to design a database management system for a business information problem.
	CO2	Create conceptual and logical database designs for a business information problem.
	CO3	Build a database management system that satisfies relational theory and provides users with business queries, business forms, and business reports.
	CO4	Understand the core terms, concepts, and tools of relational database management systems.
	CO5	Work in teams and utilize effective group techniques to manage a complex project.
Project Part I (EC782)	CO1	Identify the problem statement through literature survey for project work.
	CO2	Arrive at conceptual project design through brainstorming.
	CO3	Develop design strategy for the project work.
	CO4	Apply appropriate modern tools to execute the project work.

	CO5	Evaluate the outcome of the project work.
	CO6	Evaluate application of project work with appropriate societal consideration.
	CO7	Develop presentation and interpersonal communication skills through project work.
VLSI Design Lab (EC792)	CO1	Analyze transient and VTC response of different CMOS logic gates.
	CO2	Evaluate the DRC and LVS of layout of different CMOS circuits.
	CO3	Apply Xilinx soft ware using VHDL and design different hardware logic.
	CO4	Design some advanced low power CMOS circuit and hardware design.
RF & Microwave Engineering Lab (EC793A)	CO1	Able to understand basic waveguide theory.
	CO2	Able to measure the unknown impedance using shift in minima technique using a waveguide test bench.
	CO3	Able to understand the operation of different microwave sources (i.e. Reflex Klystron, Gunn Diode).
	CO4	Able to understand characterize passive devices (i.e. Direction Coupler) in terms of scattering matrix.
	CO5	Able to understand basic characteristics of Microwave Filters.
	CO6	Able to measure the dielectric constant of a material using waveguide test bench at X-band.
Database management System Lab (EC795C)	CO1	Understand, appreciate and effectively explain the underlying concepts of database technologies.
	CO2	Design and implement a database schema for a given problem-domain
	CO3	Normalize a database
	CO4	Populate and query a database using SQL DML/DDL commands.
	CO5	Declare and enforce integrity constraints on a database using a state-of- the-art RDBMS.
	CO6	Programming PL/SQL including stored procedures, stored functions, cursors, packages.
	CO7	Design and build a GUI application using a 4GL
Industrial Training (EC 781)	CO1	Asses and appraise engineering practices.
	CO2	Follow and practice industrial norms.
FOURTH YEAR : 8TH SEMESTER		
Organizational Behavior (HU801)	CO1	Identify the importance and intricacies of organizational behavior.
	CO2	Describe personality, attitudes and perception to motivate employees.
	CO3	Implement effective communication skills to handle group behavior.
	CO4	Resolve organizational conflicts and politics through negotiations.
	CO5	Monitor human resources through effective leadership.
	CO6	Create a congenial and cohesive ambience within the framework of

		organizational structure in achieving the organizational goals.
Digital Image Processing (EC801B)	CO1	describe the basic concepts of 2-D signal acquisition, sampling and quantization.
	CO2	demonstrate the image transforms and the spectral filtering techniques (linear).
	CO3	explain the 2D FT concepts and special/frequency domain filtering using image enhancement algorithm.
	CO4	describe the human visual system and its effect on image properties.
	CO5	illustrate the formulating solutions to general IP problems using programming skill.
	CO6	describe different morphological 'image-transformations' and the effects of morphological algorithm operations on images.
Neural network & applications EC802A	CO1	Student will be able to obtain the fundamentals of neural networks.
	CO2	The student will have a broad knowledge in developing the different algorithms for neural networks.
	CO3	Student will have an understanding of a variety of neural networks techniques, including: error backpropagation learning; support vector machines; recurrent networks; self-organizing maps; Hopfield network.
	CO4	Student will be able to analyze a problem for NN solution in terms of these methods.
	CO5	Student will have an awareness of the computational theory underlying NNs.
Design Lab / Industrial problem related practical training (EC881)	CO1	Design an electronic circuit starting with a given Specifications.
	CO2	Conceive the optimum design out of many available options.
	CO3	Determine values and specifications of the components required for a design.
	CO4	Integrate a circuit on PCB to get a final product.
	CO5	Examine the designed circuit to check its performance.
Project II (EC 882)	CO1	Identify the problem statement through literature survey for project work.
	CO2	Arrive at conceptual project design through brainstorming.
	CO3	Develop design strategy for the project work.
	CO4	Apply appropriate modern tools to execute the project work.
	CO5	Evaluate the outcome of the project work.
	CO6	Evaluate application of project work with appropriate societal consideration.
	CO7	Develop presentation and interpersonal communication skills through project work.
Grand Viva (EC893)	CO1	Able to gain comprehensive knowledge on all subjects related to B. Tech covered in four years.
	CO2	Able to understand on basic concepts of core subjects of B. Tech.
	CO3	Able to focus to apply the knowledge and ideas gained in real world

		problems and issues.
	CO4	Able for efficient oral communication and presentation skills.
	CO5	Able to gain the confidence and versatility in answering the varieties of questions posed by a group of faculty members in a moderately short duration.

PSOs and POs of Information Technology Department

Program Specific Outcomes (PSOs)

The PSOs of Information Technology engineering program supported by the curriculum are given below. The students will be able to

PSO1: apply principles of Technology, computer science; basic science, mathematics (including differential equations, discrete mathematics and linear algebra) and laboratory skills for building, testing, operation and maintenance of Software and Hardware. <br.

PSO2: Design and analysis of algorithms and computer science theory of modelling and processes related to IT industry.

PSO3: Be prepared to work professionally in IT industry, able to achieve higher studies and develop the modern tools in Information Technology field.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriateconsideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
4. Conduct investigations of complex problems: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Department of Information Technology
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: B.Tech. in Information Technology

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	To impart advanced skills of technical communication in English.
	CO2	To enable them to communicate confidently and competently in English language in all spheres.
	CO3	To develop writing competence- technical report, business letters, job applications etc.
	CO4	To develop reading comprehension skill through non-technical texts.
	CO5	To conduct conversation practice: face to face and via media.
Physics-I (PH101)	CO1	Reproduce the requirements of simple harmonic motion and can differentiate between damped and forced vibration analytically and apply the knowledge in the analysis of operation of various LCR circuits.
	CO2	Understand theory of optical interference and diffraction and can apply the knowledge in understanding thin film interference in films of equal thickness and wedge shaped films, can essentially differentiate between two diffraction types and Fraunhofer diffraction through single, double and multiple slits and can also be familiar with functioning of various optical instruments.
	CO3	Understand about the true nature of light as an electromagnetic wave, can apply the knowledge in understanding working of polarimeter and polaroid of different kinds.
	CO4	Also, they will be able to understand the production and principle of working of LASERs at the atomic level. apply the knowledge in designing many modern devices and technologies based on lasers and optical fibres and holography.
	CO5	To understand the basic concepts and experiments of modern physics and can understand the basic differences between Newtonian mechanics and quantum mechanics, wave-particle duality, Heisenberg's uncertainty principle. Understand seven types of crystal systems, unit cell properties of different cubic, HCP and diamond structures, identify Miller indices of given crystal planes and draw planes using Miller indices, important orientation of crystal planes in cubic

		systems and inter-planar spacing and can also gather knowledge about how X-rays are produced in laboratory using Coolidge tube, types of X-rays and application in crystallography.
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.
Physics-I Laboratory (PH191)	CO1	Apply 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	Apply the concepts of elasticity of materials by finding Rigidity Modulus of a metallic rod and accordingly verifying Hook's Law.
	CO3	Apply 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	Apply the idea of dispersion and minimum deviation of light for prism by finding out dispersive power of the material of a prism.
	CO5	Apply 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-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.
Workshop Practice (ME 192)	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.
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.
Chemistry-I (CH 201)	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. Develop conceptual and analyzing skills in solving broad range

		problems.
	CO6	The skills will ultimately help students to initiate scientific research in the field of nano science, superconductivity and innovate technologies that benefit society.
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 &	CO1	Design a document using MS_WORD.
	CO2	Demonstrate and compute the data using Spread Sheet.

Principles of Computer Programming Laboratory (CS291)	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.
Chemistry-I Laboratory (CH291)	CO1	Determine hardness of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO2	Evaluate redox potential and apply in day to day life as well as in industry.
	CO3	Calculate the alkalinity of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO4	Measure the viscosity of liquid helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO5	Measure the pH and conductance with the help of instruments of given samples e.g. tea, fruit juices, soil etc.
	CO6	Differentiate two heterogeneous liquid solutions and determine the distribution of solvent among them.
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.
Engineering Drawing & Computer Graphics (ME292)	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.
SECOND YEAR : 3RD SEMESTER		

Values & Ethics in Profession (HU301)	CO1	To define ethical issues.
	CO2	To describe confidentiality, professional behavior to ethical dilemmas and determine appropriate approach.
	CO3	To apply fundamental ethical principles of integrity, objectivity, professional competence, due care.
	CO4	To analyze the role of ethics within profession fields.
	CO5	To develop proper relations with respect to the concept of social responsibility.
	CO6	To judge have the knowledge of ethics in operations of business and governance.
Physics-2 (PH301)	CO1	To state various advanced concepts of physics.
	CO2	To explain real world problems using broad theoretical insight
	CO3	To solve real world problems using classical and modern engineering physics analysis
	CO4	To compare electro magnetism, statistical mechanics and quantum mechanics.
	CO5	To develop conceptual and analytic skills to solve a broad range of problems
	CO6	To recommend various models for real life applications
Basic Environmental Engineering & Elementary Biology (CH301)	CO1	To define fundamental knowledge of scientific discipline and engineering principles
	CO2	To describe the ability to work effectively as a member of an interdisciplinary team on complex problems involving multiple competing stakeholders and agendas.
	CO3	To apply effectively about complex environmental problems
	CO4	To analyze emerging environmental issues that are sustainable
	CO5	To design solutions for both specialist and general audiences with equal facility.
	CO6	To justify air, water and land resources, health and environmental restoration.
Analog & Digital Electronics (CS301)	CO1	To state differences between number systems and describe some different codes.
	CO2	To explain the function of basic digital combinatorial circuits and sequential circuits.
	CO3	To demonstrate the behavior of digital components.
	CO4	To analyze and construct both combinational and sequential networks.
	CO5	To design different types of programmable logic devices.
	CO6	To judge the functions, characteristics and structure of different memory systems.
Data Structure & Algorithm (CS302)	CO1	To remember data types, array, pointers, memory allocation Techniques.
	CO2	To understand the concepts of linear, non-linear data structure such as stacks, queues, trees and graphs.
	CO3	To implement various data structure to solve computing problems using C-programming language
	CO4	To compare different algorithms, their advantages and disadvantages, choose appropriate data
	CO5	To compare different algorithms, their advantages and disadvantages, choose appropriate data structure as applied to specified problem definition
	CO6	To evaluate the best case, average case and worst case time complexities of

		different algorithms.
Computer Organisation (CS303)	CO1	Recognize and manipulate representations of numbers stored in digital computers.
	CO2	Recall the history and development of modern computers, developing an appreciation for the potential and directions for future changes.
	CO3	Explain the computations of the functional units of the processor. Implement the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main components.
	CO4	Compare cost performance and design trade-offs in designing and constructing a computer processor including memory.
	CO5	Analyze the basics of, and develop the ability to determine the applicability of single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.
	CO6	Evaluate elementary quantitative performance of computer systems. Design elementary problems by assembly language programming.
Physics-2 (PH391)	CO1	To state various advanced concepts of physics.
	CO2	To explain real world problems using broad theoretical insight
	CO3	To solve real world problems using classical and modern engineering physics analysis
	CO4	To compare electro-magnetism, statistical mechanics and quantum mechanics.
	CO5	To develop conceptual and analytic skills to solve a broad range of problems
	CO6	To recommend various models for real life applications
Analog & Digital Electronics (CS391)	CO1	To define differences between the combinational and sequential circuits.
	CO2	To explain the merits and demerits of the different amplifiers and must be able ;
	CO3	To solve various transistors related applications
	CO4	To compare various number systems
	CO5	To design multi-vibrator circuits using 555 timers
	CO6	To justify problems related to Boolean algebra, minimization problems etc.
Data Structure & Algorithm (CS392)	CO1	To remember basic C Programming such as Array, Structure, Pointer and File etc.
	CO2	To understand implementation concepts of linear and non-linear data structures.
	CO3	To analyze the concepts of static and dynamic data structure algorithms.
	CO4	To apply different sorting and searching algorithms.
	CO5	To evaluate time complexity of different data structure algorithms.
	CO6	To create different Data Structures, which play a vital role in real world applications.
Computer Organisation (CS393)	CO1	Able to know basic gates and their truth tables and to implement using bread board.
	CO2	Able to know various IC chips and their pin diagram and truth tables.
	CO3	Able to implement adder subtractor composite unit
	CO4	Able to implement various ALU operations using Multiplexer and Decoder.

	CO5	Able to design Arithmetic Logical Unit for multi-bit Arithmetic operation.
	CO6	Able to implement RAM chips.
SECOND YEAR : 4TH SEMESTER		
Object Oriented Programming & UML (IT401)	CO1	To remember fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
	CO2	To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
	CO3	To apply JAVA features such as composition of objects, method overloading, inheritance, Polymorphism etc.
	CO4	To analyse software problems using the object-oriented techniques and produce well-documented and elegant programs written in Java
	CO5	To evaluate the object-oriented modelling and design patterns to provide solutions to the real-world software design problems.
	CO6	To create a software application using the Java programming language.
Numerical Methods (M(CS)401)	CO1	Explain the consequences of finite precision and the inherent limits of the numerical methods considered.
	CO2	Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.
	CO3	Demonstrate the mathematics concepts underlying the numerical methods considered.
	CO4	Demonstrate understanding applied to the following classes of problems like finding roots of equations, solving systems of algebraic equations, interpolation, numerical integration of data and functions, solutions of ordinary differential equations.
	CO5	Design algorithms and corresponding codes for implementation of numerical solution of the above problems.
	CO6	Perform an error analysis for a given numerical method.
Mathematics-3 (M401)	CO1	To define mathematical models
	CO2	To explain the needs of mathematical tool in various fields to use enhanced mathematical knowledge.
	CO3	To analyze various probabilistic use
	CO4	To design statistical methods or models
	CO5	To judge the application areas of different abstract models.
Communication Engg & Coding Theory (CS401)	CO1	To state different communication processes based on these two methods and appreciate their relative merit and demerit
	CO2	To describe the carrier and message frequencies from the expression for AM signals and Angle modulated signals
	CO3	To apply the type of modulation and explain each and every block of the PCM system must be acquired.
	CO4	To differentiate between base-band transmission and modulation and compute antenna size from knowledge of carrier frequency
	CO5	To design the coding efficient binary and decimal coding systems
	CO6	To judge between the channel capacity in case of channels of varying band-width

		and SNR value and predict the maximum data rate possible.
Formal Language & Automata Theory (CS402)	CO1	To differentiate and manipulate formal descriptions of languages, automata and grammars with focus on regular and context-free languages, finite automata, push down automata and regular expressions, Turing machine.
	CO2	To design recognizer and grammars for different formal languages and identify the language accepted by an automaton or a grammar.
	CO3	To transform between equivalent deterministic and non-deterministic finite automata, and regular expressions.
	CO4	To construct minimize finite automata and grammar of context free language
	CO5	To explain the power and the limitations of regular languages and context-free languages and compare different system.
	CO6	To design Turing Machine for simple computable functions and know the fundamental concepts of tractability and decidability of computational problems.
Technical Report Writing & Language Lab Practice (HU481)	CO1	To label their skills in English speaking and listening
	CO2	To describe overall personality development,
	CO3	To handle group discussions and public speaking, awareness of body language.
	CO4	To handle interviews, practice of preparing
	CO5	To empower themselves to present project report, etc.
	CO6	To handle power point presentations.
Numerical Methods (M(CS)491)	CO1	Be aware of the mathematical background for the different numerical methods introduced in numerical theory.
	CO2	Understand the different numerical methods to solve the algebraic equations and to solve system of linear and non linear equations.
	CO3	Understand the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations.
	CO4	Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.
	CO5	Demonstrate they understand the mathematics concepts underlying the numerical methods considered.
	CO6	Identify and classify the numerical problem to be solved and understand the characteristics of the method to correctly interpret the results.
Communication Engg & Coding Theory (CS491)	CO1	To identify different communication processes based on these two methods and appreciate their relative merit and demerit
	CO2	To explain the carrier and message frequencies from the expression for AM signals and Angle modulated signals.
	CO3	To compute the coding efficiency of binary and decimal coding systems; The relative merits and demerits of the different digital modulation techniques and capability to calculate signal power in digital systems to be understood clearly.
	CO4	To categorize the types of modulation. The ability to explain each and every block of the PCM system must be acquired.
	CO5	To design various base-band transmission and modulation systems and compute antenna size
	CO6	To judge the importance of digital modulation over analog modulation in respect of

		noise immunity concept
Software Tools (CS492)	CO1	Describing the basic of design, create, build, and debug Visual Basic applications.
	CO2	Explaining variables and data types used in program development and also the arithmetic operations for displaying numeric output.
	CO3	Implementing one and two dimensional arrays for sorting, calculating, and displaying of data.
	CO4	Structuring decision structures for determining different operations and loop structures to perform repetitive tasks. Also organizing procedures, sub. procedures, and functions to create manageable code.
	CO5	Monitoring Visual Basic programs using object. oriented programming techniques including classes, objects, methods, instance variables, composition, and inheritance, and polymorphism and that will help to design projects on VB Programming.
	CO6	Designing Windows applications using forms, controls, and events.
Object Oriented Programming & UML (IT491)	CO1	Able to learn the practical concept of OOP and various aspect of OOP in through programming.
	CO2	It helps to learn about , how to write, compile & execute basic java program which are essential for programming.
	CO3	It helps to learn about the effective program writing in the environment of Object Oriented Concept.
	CO4	Understand that how to use OOP to simplify complex programs and also got knowledge about the advantage of using Object Oriented Programming over Process Oriented Programming.
	CO5	It provides practical exposure about the use of threads, handle exceptions and write applets and also about the use of interfaces and inner classes, wrapper classes, generics and that will help to develop projects over OOP(on Java).
	CO6	It will help to get sense about the web project that will be helpful for them in future to develop the web application.
THIRD YEAR : 5TH SEMESTER		
Economics for Engineers (HU501)	CO1	Recognise financial statements, their importance and usages.
	CO2	Understand major principles of financial accounting, cost accounting and financial management.
	CO3	Utilise 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.
Design & Analysis of Algorithm (IT501)	CO1	To Know various advanced design and analysis techniques such as greedy algorithms, dynamic programming & know the concepts of tractable and intractable problems and the classes P, NP and NP complete problems
	CO2	To Understand how the worst case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms, the difference between the lower and upper bounds of various problems and their importance in deciding the optimality of an algorithm.

	CO3	To Solve the problem related to Divide and Conquer, Dynamic programming, Backtracking and Greedy method, solve problem related to String matching, problem related to network flow with the help of Ford Fulkerson algorithm, matrix multiplication problem with the help of Strassen's matrix manipulation algorithm, problem related to Clique decision problem, the problem related to vertex cover problem, travelling salesman problem.
	CO4	To Analyze the complexity/performance of different algorithms using different computational models, order notation and various complexity measures.
	CO5	To Evaluate different algorithms related to Divide and Conquer, Dynamic programming, Backtracking and Greedy method, Ford Fulkerson algorithm for network flow and vertex cover problem, travelling salesman problem.
	CO6	To Design efficient algorithms by comparing existing algorithms with their problems for fundamental problems in computer science and engineering work.
Computer Architecture (IT502)	CO1	To define the Flynns classification of computer architecture SISD, SIMD, MISD, MIMD.
	CO2	To explain how computer hardware has evolved to meet the needs of multi-processing systems.
	CO3	To construct a wide variety of memory technologies both internal and external and also able to Compute CPU and memory performance.
	CO4	To compare array processor and vector processors both in terms of parallelism in SIMD architecture.
	CO5	To evaluate different types of systems: pipelined, super-scalar, super- pipelined, super, scalar–super, pipelined architecture.
	CO6	To design the hardware of multiprocessors including cache coherence and synchronization.
Operating System (IT503)	CO1	To know the basic principles of operating systems and compare different styles of operating systems.
	CO2	To understand the main principles and techniques for the implementation of processes, threads as well as the different algorithms for process scheduling and inter process communication
	CO3	To solve the main problems related to concurrency and the different synchronization mechanisms.
	CO4	To explain the device and I/O management functions in operating systems as part of a uniform device abstraction.
	CO5	To formulate the rationale view for virtual memory abstractions and explain the disk organization and file system structure
	CO6	To evaluate security risks in operating systems and justify the role of operating systems in establishing security.
Programming Practices using C++ (IT504F)	CO1	To be able to Define an object oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.
	CO2	To be able to understand the code and write the classes which work like built.in types.
	CO3	To be able to develop applications which are easier to debug, maintain and extend.
	CO4	To be able to Compare object-oriented concepts in real world applications.
	CO5	Able to Justify the philosophy of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism

	CO6	Able to Design, implement, and test the implementation of "is-a" relationships among objects using a class hierarchy and inheritance.
Algorithm Lab (IT591)	CO1	Students are able to understand basic data structures for searching and sorting, trees, heaps, and the computational complexity of the searching and sorting algorithms that use these structures.
	CO2	Students should be able to understand basic graph algorithms and their computational complexity.
	CO3	Students should be able to prove the correctness and analyse the running time of the basic algorithms for those classic problems in various domains.
	CO4	Students are able to compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem..
	CO5	Students are able to implement an algorithm in any programming language by choosing the appropriate data structure.
	CO6	Students are able to design a new algorithm or they can modify the existing algorithm by choosing exact data structures to support specific applications.
Computer Architecture Lab (IT592)	CO1	To define the detailing of VHDL simulation and internal configuration of FPGA.
	CO2	To explain major syntactic elements of VDHL entities, architectures, processes, functions, common concurrent statements, and common sequential statements.
	CO3	To construct user defined subprograms, packages using VHDL program.
	CO4	To compare behavioural and structural coding styles of VHDL program.
	CO5	To evaluate the VDHL test bench and use it to test/verify a sequential VHDL designs of moderate complexity.
	CO6	To design combinational logic and sequential logic circuit by using VHDL programming, as well as an awareness of timing and resource usage.
Operating System Lab (IT593)	CO1	To use (utilize) basic UNIX/LINUX Commands
	CO2	To create the codes in the Shell Programming
	CO3	To program on process creation synchronization, Inter process communication including shared memory, pipes and messages.
	CO4	To develop the codes using UNIX/LINUX System calls.
	CO5	To simulate of CPU Scheduling Algorithms like FCFS, RR, SJF, Priority, Multilevel Queuing and Banker's Algorithm for Deadlock Avoidance, Prevention.
	CO6	To program the FIFO, LRU, and OPTIMAL page replacement algorithms.
Programming Practices using C++ (IT594F)	CO1	To be able to Define an object oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.
	CO2	To be able to understand the code and write the classes which work like built.in types.
	CO3	To be able to develop applications which are easier to debug, maintain and extend.
	CO4	To be able to Compare object-oriented concepts in real world applications.
	CO5	Able to Justify the philosophy of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism.
	CO6	Able to Design, implement, and test the implementation of "is-a" relationships among objects using a class hierarchy and inheritance.
THIRD YEAR : 6TH SEMESTER		

Principles of Management (HU601)	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 organisational structure, organizational conflict, negotiation, politics, and change.
	CO3	Apply the principles of decision making through planning, organising, staffing, directing and controlling.
	CO4	Analyse 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.
Data Base Management System (IT601)	CO1	Define the terminology, features, classifications, and characteristics embodied in database systems.
	CO2	Demonstrate an understanding of relational database using normalization theory.
	CO3	Transform an information model into a relational database schema and to apply a data definition language, data manipulation language and/or utilities to implement the schema using a SQL.
	CO4	Analyze an information storage problem and derive an information model expressed in the form of an entity relationship diagram and other optional analysis forms, such as a data dictionary.
	CO5	Evaluate the query optimization and transaction processing schemes.
	CO6	Design a broad range of query problems using relational algebra and relational calculus solutions.
Computer Networking (IT602)	CO1	To know the concepts of protocols, network interfaces, network models and design/performance issues in local area networks and wide area networks.
	CO2	To understand basic computer network technology, explain Data Communications System and its components and to identify the different types of network devices and their functions within a network.
	CO3	To solve the main problems related to error control, flow control, MAC and addressing, routing.
	CO4	To analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
	CO5	To justify why networks need security and control, what errors might occur, and how to control network errors.
	CO6	To Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
Software Engg (IT603)	CO1	Demonstrate knowledge of the distinction between critical and non-critical systems.
	CO2	Demonstrate the ability to manage a project including planning, scheduling, and testing and risk assessment/management.
	CO3	Author a software requirements document and demonstrate an understanding of the proper contents of a software requirements document.
	CO4	Demonstrate an understanding of the differences between real-time and non-real time systems.
	CO5	Identify specific components of a software design that can be targeted for reuse.

	CO6	Author a software testing plan and demonstrate proficiency in software development cost estimation.
Pattern Recognition (IT604C)	CO1	Understand the basics of patterns.
	CO2	Introduce distinct procedures of decision making in realtime.
	CO3	Apply different models for analysis and estimation.
	CO4	Analyse classifier and clustering techniques.
	CO5	Design algorithms using metric and non-metric methods.
	CO6	Evaluate linear and non-linear patterns for machine learning.
Compiler Design (IT605C)	CO1	Know and Understand different components of a compiler and their functioning.
	CO2	Understand the role of a lexical analyzer, use of regular expression and finite automata to design lexical rules for a programming language, semantic errors, recovery techniques, and precise meaning of programming construct.
	CO3	Construct parser and identify the similarities and differences among various parsing techniques and grammar transformation techniques.
	CO4	Examine various code optimization techniques to improve the performance of a program in terms of speed & space.
	CO5	Explain instruction scheduling and register allocation techniques during the code generation.
	CO6	Design different types of compiler tools to meet the requirements of the realistic constraints of compilers, and recognize the need for continuing education, research and professional development.
Artificial Intelligence (IT605D)	CO1	To remembering the basics of theory and practice of Artificial Intelligence as a discipline, about intelligent agents
	CO2	To understand different AI algorithm, knowledge representation scheme
	CO3	To apply knowledge representation techniques and problem solving strategies to various AI application
	CO4	To analyze different knowledge representation scheme, search algorithm, learning algorithm
	CO5	To design a problem, and identify and define the computing requirements appropriate to its solution
	CO6	To construct simple application to experiment with various AI concepts and analyze results
Data Base Management System Lab (IT691)	CO1	To develop conceptual understanding of database management system. Ability to create database tables
	CO2	Ability to formulate SQL queries based on the problems given
	CO3	To solve time effective solutions. Ability to apply PL/SQL
	CO4	To develop understanding of different applications and constructs of SQL PL/SQL
	CO5	To understand how a real world problem can be mapped to schemas. Embedded and Nested Queries.
	CO6	To develop understanding of different applications and constructs of SQL PL/SQL to recommend various industry oriented and real life applications. Handling online Transactions.

Computer Networking (IT692)	CO1	Students are able to identify and use various networking components and able to learn various networking commands.
	CO2	Students should be able to understand different transmission media and design cables for establishing a network.
	CO3	Students are able to install a network system consists of various computers using NIC, networking cables, connector, hubs and switches.
	CO4	Students are able to understand the basic concepts of network and application layer protocol design; including client/server models, peer to peer models and able to implement inter process communication and message passing.
	CO5	Students should be able to implement networking in software using various socket programming and also able to learn how to implement various networking protocols. Students should be able to learn the major software and hardware technologies used on computer networks and able to implement device sharing on network.
	CO6	Students should be able to learn the major software and hardware technologies used on computer networks and able to implement device sharing on network.
Software Engineering (IT693)	CO1	Indicate, design and construct application using CASE tools.
	CO2	Translate a requirement specification into an implementable design, following a structured and organized process
	CO3	Identify some of the main risks of software development use it in development process.
	CO4	Employ group working skills including general organization, planning and time management and inter group negotiation.
	CO5	Formulate testing strategy for a software system, employing techniques such as unit testing, test driven development and functional testing.
	CO6	Develop software applications in a development environment that makes use of commonly supported tools.
Seminar (IT681)	CO1	Understand the past and present of the disciplines by exploring their purpose, practice, and philosophy.
	CO2	Gain an understanding of advanced research methodologies in the field, including theory, interdisciplinary approaches, and the analysis of available primary sources
	CO3	Demonstrate through short written assignments and critical reviews the ability to synthesize and assess the arguments of scholarly articles and monographs at the level of professionals in the field.
	CO4	Understand the privileges and obligations associated with a career as a professional.
	CO5	Understand historical and recent trends in theory and method and be able to identify and explain major trends and issues in industry and research.
	CO6	Learn to write a scholarly book review.
FOURTH YEAR : 7TH SEMESTER		
Internet Technology (IT701)	CO1	Able to remember & understand the concepts and architectures of the Internet and its applications.
	CO2	Able to understand various threats and challenges of the underlying system and its architecture.
	CO3	Able to understand & analyze real time and complexity Analysis.

	CO4	Able to analyze and implement various security aspects.
	CO5	Able to understand and apply communications among various heterogeneous systems.
	CO6	Able to design and implement various industry oriented and real life applications.
Multimedia (IT702)	CO1	To provide the foundation knowledge of multimedia computing, e.g. media characteristics .Describe the basic concept of multimedia information representation. Develop the requirement of multimedia communication in today's digital world.
	CO2	To explain the various multimedia information representations. Describe different multimedia data in digital formats. Compare text, audio, image and video data.
	CO3	To describe data compression principle. Compute Arithmetic, Huffman, RLE, Summarize Joint Photographic Expert Group (JPEG). Describe MPEG, H.26X compression standards.
	CO4	To provide programming training in multimedia computing, multimedia system design and implementations.
	CO5	To describe the examples of web-based multimedia applications and multimedia databases.
	CO6	To describe different multimedia applications used in real life
E-Commerce (IT703A)	CO1	Demonstrate an understanding of the foundations and importance of E-Commerce.
	CO2	Understand legal, privacy and payment issues in an E-Commerce system.
	CO3	Analyze the impact of E-Commerce on business models and strategy.
	CO4	Apply Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
	CO5	Design security mechanism associated with an E-Commerce system
	CO6	Evaluate Internet based technological aspects of an E-Commerce system
Cloud Computing (IT704B)	CO1	Understand The principles of cloud based services.
	CO2	Introduce computing services and storage resources through access to data and business applications stored on servers at remote locations.
	CO3	Apply service based knowledge in software, infrastructure and platform.
	CO4	Analyze system performance of distributed networks in respect of services.
	CO5	Design web service components maintaining security.
	CO6	Evaluate service oriented architecture and its applications.
Data Warehousing & Data Mining (IT704C)	CO1	Understand the basic principles, concepts and applications of data warehousing and data mining
	CO2	Introduce the task of data mining as an important phase of knowledge recovery process
	CO3	Apply the knowledge of the fundamental concepts that provide the foundation of data mining
	CO4	Analyze the Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
	CO5	Design a data warehouse or data mart to present information needed by management in a form that is usable for management client

	CO6	Research about the complex problems of data mining.
Bio Informatics (BI) (IT705A)	CO1	To know the basic principles and concepts of biology, computer science and mathematics. To understand or explain which type of data is available from the most common protein sequence and structure databases (UniProt, GenBank, Protein Data Bank, CATH) and explain the theories underlying the most common methods for sequence searches and sequence alignments.
	CO2	To apply the most appropriate bioinformatics sequence or structure database to retrieve or search data given a specific question in molecular biology and to select and apply the most appropriate method for aligning sequences, visualizing and analyzing protein structures, predicting secondary structure elements and modeling protein. Structures from sequence. To apply Hidden Markov Model in Bio Informatics.
	CO3	To analyze different protein or nucleotide sequences to reach meaningful conclusions using different bioinformatics tools.
	CO4	To evaluate applications of techniques & software of bioinformatics to facilitate biotechnological advancement and innovations.
	CO5	To develop a project in bioinformatics using databases, current data analysis techniques and the development of appropriate computer software.
Group Discussion (HU781)	CO1	Teaching strategies of group discussion
	CO2	Introducing different models and topics of group discussions
	CO3	Exploring live recorded GD sessions for mending students' attitude/ approach and for taking remedial measures.
	CO4	Strategies and standard practices of seminar presentation
	CO5	SWOT analysis and its application in fixing targets
Internet Technology (IT791)	CO1	To define the concepts over the architectures of the Internet and it's applications.
	CO2	To explain and implement various threats an challenges of the underlying system and its architecture.
	CO3	To solve time effective solutions.
	CO4	To analyze various security aspects.
	CO5	To develop communications among various heterogeneous systems.
	CO6	To recommend various industry oriented and real life applications.
Multimedia Lab (IT792)	CO1	To identify a range of concepts, techniques and tools for creating and editing the interactive multimedia applications.
	CO2	To identify both theoretical and practical aspects in designing multimedia systems surrounding the emergence of multimedia technologies using contemporary hardware and software technologies.
	CO3	Examine multimedia applications in several areas
	CO4	Examine the examples of web-based multimedia applications.
E-Commerce (IT793A)	CO1	Demonstrate an understanding of the foundations and importance of E-Commerce
	CO2	Understand legal, privacy and payment issues in an E-Commerce system.
	CO3	Analyze the impact of E-Commerce on business models and strategy.
	CO4	Apply Internet trading relationships including Business to Consumer, Business-to-

		Business, Intra-organizational.
	CO5	Design security mechanism associated with an E-Commerce system
	CO6	Evaluate Internet based technological aspects of an E-Commerce system
Industrial training (IT794)	CO1	The students will be able to demonstrate the use, interpretation and application of an appropriate international engineering standard in a specific situation.
	CO2	The students will be able to analyse a given engineering problem, identify an appropriate problem solving methodology, implement the methodology and propose a meaningful solution.
	CO3	The students will be able to apply prior acquired knowledge in problem solving.
	CO4	The students will be able to identify sources of hazards, and assess/identify appropriate health & safety measures.
	CO5	The students will be able to take initiatives, communicate, work in a team and manage a project within a given time frame.
	CO6	The students will be able to adopt a factual approach to decision engineering making.
Project-1 (IT795)	CO1	Understand programming language concepts, particularly Java and object-oriented concepts or go through research activities.
	CO2	Plan, analyze, design and implement a software project or gather knowledge over the field of research and design or plan about the proposed work.
	CO3	Demonstrate the ability to locate and use technical information from multiple sources.
	CO4	Demonstrate the ability to communicate effectively in speech and writing.
	CO5	Learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project.
	CO6	Learn about and go through the software development cycle with emphasis on different processes - requirements, design, and implementation phases.
FOURTH YEAR : 8TH SEMESTER		
Organisational Behaviour (HU801A)	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	Monitor human resources through effective leadership.
	CO6	To create a congenial and cohesive ambience within the framework of organizational structure in achieving the organizational goals.
Cryptography & Network Security (IT801D)	CO1	To Acquire knowledge in security issues, services, goals and mechanism.
	CO2	To understand the basic concept of Cryptography and Network Security, their mathematical models.
	CO3	To evaluate Encryption and decryption of messages using block ciphers. Sign and verify messages using well.known signature generation and verification algorithms.
	CO4	To Describe and analyze existing authentication protocols for two party communications and Analyze key agreement algorithms to identify their weaknesses.

	CO5	To Determine the ethical issues related to the misuse of computer security.
	CO6	To Develop code to implement a new cryptographic algorithm or write an analysis report on any existing security product.
Cyber Law & Security Policy (IT802B)	CO1	To understand the social and intellectual property issues emerging from 'cyberspace.
	CO2	To introduce responsibility and accountability for information security in organizations.
	CO3	To apply various forensic tools and security standards and security testing techniques.
	CO4	To analyze on various case studies on real time cyber crimes.
	CO5	To evaluate information technology act and legal frame work of right to privacy, data security and data protection.
	CO6	To design security procedures and policies to secure cyber ecosystem in the country, generate adequate trust and confidence in IT systems.
Design Lab (IT891)	CO1	Formulate the requirements from a given problem
	CO2	Synthesize and employ knowledge from Software Engineering and Project Management
	CO3	Create, design, develop and deploy a solution, according to the Software Development Life Cycle
	CO4	Incorporate good design principles in solution
	CO5	Plan and execute a project
	CO6	Conform to a designated quality standard & Employ industry best practices and tools
Project-2 (IT892)	CO1	Understand programming language concepts, particularly Java or C# along with object oriented concepts as well as software engineering principles or go through the research work and gather knowledge over the field and develop an ability to apply them to software design of real life problems in an industry/ commercial environment or propose methodology in the field of research.
	CO2	Plan, analyze, design a software project and demonstrate the ability to communicate effectively in speech and writing.
	CO3	Introduce with major software engineering topics and position them to lead medium sized software projects in industry or propose any new model over the selected field of research that will be useful for future activities.
	CO4	Learn about and go through the software development cycle with emphasis on different processes -requirements, design, and implementation phases and also learn details about different artefacts produced during software development.
	CO5	Learn about different software development process models and how to choose an appropriate one for a project.
	CO6	Gain confidence at having conceptualized, designed, and implemented a working, medium sized project with their team.
Grand Viva (IT893)	CO1	Explore their field of knowledge, which includes a critical awareness of current problems and/or new insights at the forefront of that field. Understand of techniques applicable to their own area of professional practice.

	CO2	Demonstrate originality in the application of knowledge, together with a practical understanding of how established techniques professional enquiries are used to create and interpret knowledge in their discipline.
	CO3	Evaluate current professional practice in Computer Science and Engineering, to evaluate methodologies and develop critiques of them and, where appropriate, to propose new forms of practice or knowledge.
	CO4	Demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level.
	CO5	Advance their knowledge and to develop new skills to a high level with complex issues both systematically and creatively, make sound judgments in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences.

PSOs and POs of Mechanical Engineering Department

PPROGRAM SPECIFIC OUTCOME (PSOs)

Mechanical Engineering graduates will be able to
PSO 1: Apply knowledge of basic engineering, mechanical engineering, mathematics, physical sciences and engineering management to develop simple to complex mechanical engineering systems.

PSO 2: Identify, investigate, model and analyze engineering challenges and problems in the diverse fields of mechanical engineering e.g. thermo-fluid, manufacturing, design, industrial management and in interdisciplinary fields including research, with career options in the fields as stated.

PSO 3: Smoothly dovetail into the real world of Mechanical Engineering as a finished product.

Program Outcomes (POs)

Mechanical Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriateconsideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
4. Conduct investigations of complex problems: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one?s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Department of Mechanical Engineering
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: B.Tech. in Mechanical 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	CO1	Demonstrate and explain electrical components, electrical circuits and DC network theorems.

Engineering-I (ES101)	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	Determine hardness of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO2	Evaluate redox potential and apply in day to day life as well as in industry.
	CO3	Calculate the alkalinity of water helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO4	Measure the viscosity of liquid helps students to learn the basics of experiments to apply in day to day life as well as in industry.
	CO5	Measure the pH and conductance with the help of instruments of given samples e.g. tea, fruit juices, soil etc.
	CO6	Differentiate two heterogeneous liquid solutions and determine the distribution of solvent among them.
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	Analyze 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	Apply 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	Apply the concepts of elasticity of materials by finding Rigidity Modulus of a metallic rod and accordingly verifying Hook's Law.
	CO3	Apply 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	Apply the idea of dispersion and minimum deviation of light for prism by finding out dispersive power of the material of a prism.
	CO5	Apply 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	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-

Engineering-II Laboratory (ES 291)		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		
Values & Ethics in Profession (HU 301)	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-2 (PH 301)	CO1	
	CO2	
	CO3	
	CO4	
	CO5	
	CO6	
Basic Environmental Engineering & Elementary Biology (CH 301)	CO1	Explain the basics of environment, ecology, sustainable development and Environmental degradation
	CO2	Describe the different components of ecosystem, bio geocycle and importance of biodiversivity.
	CO3	Analyze the Indian Environmental law, atmospheric chemistry, soil chemistry, material balances.
	CO4	Explain the different types of pollution like air, water, soil and others.
	CO5	Analyze the causes of pollution and its prevention.
	CO6	Solve and manage different environmental problems like waste disposal and others.
Applied	CO1	To apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.

Thermodynamics (ME 301)	CO2	To identify and formulate power production based on the fundamentals laws of thermal engineering.
	CO3	To instil upon to envisage appropriate experiments related to heat engines.
	CO4	To investigate the effectiveness of energy conversion process in mechanical power generation for the benefit of mankind.
	CO5	To appreciate concepts learnt in fundamentals laws of thermodynamics from which learning ideas how to sustain in energy crisis and think beyond curriculum in the field of alternative and renewable sources of energy.
	CO6	To communicate effectively the concepts of internal combustion engines and try to think beyond curriculum in alternative sources of energy.
Strength of Materials (ME 302)	CO1	Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials and classify the theories of failure for static loading.
	CO2	Calculate the stresses and strains in axial loading, bending of bars, circular torsion members, and members subject to flexural loadings and members subjected to combined loading.
	CO3	Draw Shear Force and Bending Moment diagrams of various types of beams subjected to different loads.
	CO4	Determine the slope and deflections produced by the three fundamental types of loads: axial, torsional, and flexural.
	CO5	Compute and illustrate the principal stresses, maximum shearing stress, and the stresses acting on a structural member.
	CO6	Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels and classify and describe the theories of colums for different types of loading
Engineering Materials (ME 303)	CO1	Understand and apply the knowledge of relationships that exist between the structure and properties of engineering materials.
	CO2	Analyze and evaluate various methods of the production, properties and application of the major groups of steels.
	CO3	Understand and evaluate the phase diagrams of metals and alloys and use them in thermal processing of the materials
	CO4	Understand and apply the basic principles involved in materials selection based on the properties of materials and failure in service.
	CO5	Understand and analyse the properties of ceramic materials
	CO6	Design and evaluate material processing methods to attain desired mechanical properties
Technical Report Writing & Language Lab Practice (HU 381)	CO1	
	CO2	
	CO3	
	CO4	
	CO5	
	CO6	
Physics Lab-2 (PH 391)	CO1	
	CO2	
	CO3	
	CO4	
	CO5	

	CO6	
Machine Drawing –I (ME391)	CO1	Differentiate between the isometric projection and orthographic projection.
	CO2	Construct Isometric projection of components.
	CO3	Justify and prepare Assembly and detailed drawings of a mechanical assemblysuch as a Plummer block, tool head of a shaping machine, tailstock of a lathe.
	CO4	Classify and Prepare different sectional views of machine components.
	CO5	Draw and prepare different Schematic product symbols for standard components in mechanical, electrical and electronic systems, welding symbols and pipe joints.
	CO6	Differentiate between the isometric projection and orthographic projection.
Workshop Practice-II (ME 392)	CO1	Find various operations, accessories and work holding devices in lathe.
	CO2	Produce typical products involving milling /shaping operations and finishing process (es);
	CO3	Practice various welding fabrication processes: Resistance Spot Welding, Gas welding
	CO4	Practicing Gas Welding.
	CO5	Understand the principle of sheet metal and various forming processes.
Applied Mechanics Lab (ME 393)	CO1	To compare Stress-Strain diagram, the fundamental property of the material for brittle and ductile material with the help of Tension Test
	CO2	To find yield strength,ultimate strength, modulus of elasticity, percentage elongation and percentage reduction in areas, observation of fractured surfaces.
	CO3	To calculate Modulus of Rigidity for brittle and ductile material with the help of Torsion Test.
	CO4	To study the hardness of a material and to discriminate between ductile and brittle material with the help of Hardness Tests: Brinnel/ Vickers and Rockwell tests,
	CO5	To detect the bending stresses with the help of Bend and rebend test of flat test pieces.
	CO6	To test spring stiffness under tension and compressive loads
SECOND YEAR : 4TH SEMESTER		
Numerical Methods (M(CS) 401)	CO1	
	CO2	
	CO3	
	CO4	
	CO5	
Mathematics-3 (M 402)	CO1	
	CO2	
	CO3	
	CO4	
	CO5	
	CO6	
Fluid Mechanics & Hydraulic Machines (ME 401)	CO1	An overall idea about fluid properties and calculation of hydrostatic forces on flat or curved surfaces.
	CO2	Understand the concept of pressure, velocity and discharge measuring devices.
	CO3	Explain the basic concepts and different calculation procedures of viscous flow, turbulent flow, open channel flow and compressible flow problems.
	CO4	Understand the concept of boundary layer theory, pipe flow, flow over submerged bodies, dimension and model analysis.

	CO5	An overall idea about fluid machinery and the knowledge about the calculation of efficiency, power developed by a turbines and power required by a pump.
	CO6	Able to understand basic working principles of various hydraulic machines.
Mechanisms (ME 402)	CO1	Describe the principles of kinematic pairs, chains and their classification, DOF, inversions, equivalent chains and planar mechanisms
	CO2	Study the planar mechanisms for position, velocity and acceleration.
	CO3	Synthesize planar four bar and slider crank mechanisms for specified kinematic conditions
	CO4	Monitor gear tooth geometry and select appropriate gears for the required applications.
	CO5	Design cams and followers for specified motion profiles
	CO6	Explain the Law of Belting and Design different types of Belts and Pulleys
Primary Manufacturing Processes (ME 403)	CO1	Able to know the various basic Manufacturing processes used in industry for converting raw materials into finished products.
	CO2	Able to know the principles and science of various basic manufacturing processes.
	CO3	Able to acquire fundamental knowledge on widely used and very important primary manufacturing processes such as casting, joining and forming.
	CO4	Able to gather knowledge about the various tools, equipment, machinery and operations required for these basic manufacturing processes.
	CO5	Understanding the application, advantages and limitations of various manufacturing processes.
	CO6	Able to introduce to recent emerging areas in primary manufacturing process.
Numerical Methods Lab (M(CS) 491)	CO1	
	CO2	
	CO3	
	CO4	
	CO5	
	CO6	
Fluid Mechanics & Hydraulics Lab (ME 491)	CO1	Evaluate coefficient of discharge for venturimeter, orificemeter.
	CO2	Evaluate the Reynolds number and conclude the flow regime as laminar and turbulent.
	CO3	Understand and analyze the performance characteristics of various turbomachine like centrifugal pump, reciprocating pump, pelton wheel.
	CO4	Analyze the performance characteristics of reciprocating pump and compressor.
	CO5	Analyze and Verify Bernoullies Theorem.
Manufacturing Technology Lab (ME 492)	CO1	Build practical knowledge about Pattern Making; pattern material, pattern allowances and types of patterns casting processes
	CO2	Apply practical understanding for use of moulding tools: green sand moulding, gating system, risering system, core making;
	CO3	Plan and create jobs using forging processes;
	CO4	Understand and plan for machining of gears.
	CO5	Relate the job manufactured from practical relevance point of view.
Material Testing Lab	CO1	To compare fracture toughness data from ductile and brittle material from Charpy test.
	CO2	To construct S-N curve from Fatigue test of a typical sample.

(ME 493)	CO3	To carryout Sample preparation and etching of ferrous and non-ferrous metals and alloys for metallographic observation
	CO4	To find the effect of heat treatment on carbon steels.
	CO5	To study the different rates of cooling process after heat treatment including quenching on microstructural changes through metallographic studies
	CO6	To test presence of surface/ sub-surface cracks using different non-destructive techniques, such as dye penetration (DP)test, magnaflux test, ultrasonic or eddy current test.
Machine Drawing-II (ME 494)	CO1	Identify and select various types of Auto-CAD commands.
	CO2	Sketch and prepare assembly and detailed drawings of a mechanical assembly using Auto-CAD.
	CO3	Draw and prepare Orthographic projections of different components.
	CO4	Sketchand generate Isometric projections of different components.
	CO5	Convert isometric projection to orthographic projection of various mechanical components.
THIRD YEAR : 5TH SEMESTER		
Principles & Practices of Management (HU 511)	CO1	Explain the historical backdrop and fundamentals of management thoughts vital for understanding the conceptual framework of management as a discipline in a pluralistic society that propels the organized work for the civilized society.
	CO2	Discern the evolutionary managerial concepts over the time horizon with changing taste and demands for goods and services within an economic bound.
	CO3	Discuss various concepts of planning, cases and complexities in decision making and controlling as a prerequisite for a successful strategic plan.
	CO4	Understand and internalize the code of engineering ethics, values of coordination.
	CO5	Study and understand managerial dictum in the globalised scenario.
	CO6	Develop a deeper understanding of the emerging issues of complex global management.
Dynamics of Machines (ME 501)	CO1	Understand free and forced vibrations of single degree freedom systems.
	CO2	Explain Inertia force and inertia torque in reciprocating engine & Equivalent dynamical system.
	CO3	Analyze balancing problems in rotating and reciprocating machinery.
	CO4	Characterize and design flywheels.
	CO5	Understand the gyroscopic effects in ships, aero planes and road vehicles..
	CO6	Analyze and design centrifugal governors
Heat Transfer (ME 502)	CO1	To understand the basic laws of heat transfer and account for the consequences of heat transfer in thermal analysis of engineering systems, analyse problems involving steady state heaqt conduction in simple geometries.
	CO2	To develop solutions for transient heat conduction in simple geometries, without heta generation.
	CO3	Understand the fundamentals of convective heat transfer process; evaluate heat transfer coefficients for natural and forced convection; deriving and analysing momentum and energy equations in two dimensions. Analysis of dimensionless quantities of heat transfer.
	CO4	Evaluate performance of heat exchangers by LMTD method and also by Ɛ-NTU methods.
	CO5	To calculate radiation heat transfer between black body surfaces and evaluate radiation heat exchange between GDI surfaces by radiation network and radiosity network.

Design of Machine Elements (ME 503)	CO1	Develop ability to utilizing knowledge of mathematics, science and engineering outcomes.
	CO2	Explaining the fundamentals of stress analysis, theories of failure and material science in the design of machine components.
	CO3	Make proper assumptions with respect to material, factor of safety, static and dynamic loads for various machine components.
	CO4	Develop an ability to design a system, component or process to meet desired needs within realistic constraints.
	CO5	Use the techniques, skills and modern engineering tools necessary for engineering practice.
	CO6	Develop an ability to identify, formulate and solve engineering problems.
Metrology & Measurement (ME 504)	CO1	Understand the various methods of measurements and measurement techniques.
	CO2	Able to identify various measuring instruments, combination of instruments and working principles and their application.
	CO3	Able to select and apply the proper selection of instruments for the suitable application.
	CO4	Recognize and apply the knowledge of limits, fits, tolerances and various gauges in manufacturing and measurement practices.
Applied Fluid Mechanics (ME 505B)	CO1	Understand and explain fluid-flow phenomena observed in mechanical engineering systems, such as flow in turbomachinery, compressible flows in ducts, and flows in capillaries.
	CO2	Analyze the fluid fluid flow through propellers and windmills, jet propulsion.
	CO3	Understand and explain the Mechanical, hydraulic volumetric losses and efficiencies of turbomachines.
	CO4	Understand, analyze and study the performance characteristics of hydraulic machines.
	CO5	Carry out model studies for fluid flow problems.
Seminar-I (ME 581)	CO1	Recognize and examine ethical situations that affect engineering.
	CO2	Identify and anticipate professional issues as a mechanical engineer.
	CO3	Prepare for management of ethical and legal issues that mechanical engineers face as Professionals.
	CO4	Understand the need to be knowledgeable of contemporary issues.
	CO5	Identify areas of legal concern in engineering.
	CO6	Examine graduate study for timely decision in undergraduate options.
Applied Thermodynamics & Heat Transfer Lab (ME 592)	CO1	To apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.
	CO2	Apply principles of heat and mass transfer to basic engineering systems
	CO3	Analyse heat transfer by conduction, convection; radiation
	CO4	Heat exchangers: Working principles and basic geometries.
	CO5	Analyse and design heat exchangers.
Design Practice-I (ME 593)	CO1	An ability to identify, formulates, analyzes and solves Engineering Problems in Optimum time.
	CO2	An Ability to understand and apply the knowledge of machine drawing as a system of Communication in which ideas are expressed clearly and all information fully conveyed.
	CO3	Design, analyze and prepare of Knuckle and Cotter joint.

	CO4	Design, analyze and prepare of riveted and welded joint.
	CO5	Design, analyze and prepare of shaft couplings.
	CO6	Design, analyze and prepare of belt pulley drive.
Metrology & Measurement Lab (ME594)	CO1	Identify various gauges for measurement.
	CO2	Demonstrate linear and angular measurement using precision instruments.
	CO3	Apply the load cell to measure the force and torque
	CO4	Use thermocouple and vibrometer for taking measurement.
	CO5	Measure pressure and surface roughness
	CO6	Measure length and angles using line-graduated instruments, i. e. vernier callipers, micrometers, bevel protractor, sine bar and surface plates;
Applied Fluid Mechanics (ME 595)	CO1	Understand and Verify the stoke's law.
	CO2	Understand and analyze the various losses through pipes and fittings.
	CO3	Understand and evaluate performance test of pumps in series & parallel.
	CO4	Explain and analyze the various phenomenons of open channel flow like hydraulic jump.
	CO5	Understand and visualize the phenomenon of cavitation and cavitation characteristics of pump.
THIRD YEAR : 6TH SEMESTER		
Production & Operations Management (HU 611)	CO1	Familiarize with actual reality of the competitive business world particularly with reference to production, supply and operations management.
	CO2	Learn the concept of strategic management-production and operations management as a building block of the strategy and business stretch.
	CO3	Understand the complexity beneath the production ans service phenomena and what it needs to succeed.
	CO4	Learn the concept of mathematical modeling for decision making.
	CO5	Understand the concept of value creation, capture and value retention by the firms including concomitant value destruction as a phenomena.
	CO6	Derivation of comparative competitive advantage of the organization as a major thrust.
	CO7	Strategy, products, capacity, design of products and services together with project management, strategic capacity planning form the core of the concept.
IC Engines and Gas Turbines (ME 601)	CO1	Understand the engine, gas turbine and their working principle.
	CO2	Apply the knowledge for cooling the engine.
	CO3	Evaluate the efficiency of internal combustion engine.
	CO4	Develop internal combustion engine model.
	CO5	Distinguish different type of internal combustion engine.
	CO6	Understand the effect of internal combustion engine on environment.
Machining Principles & Machine Tools (ME 602)	CO1	Understand the theory of metal cutting.
	CO2	Identify the mechanism of metal cutting process in general and various machining processes.
	CO3	Recognize the working principles of machine tools and various operations performed
	CO4	Explain various finishing processes and gear manufacturing.
	CO5	Thorough knowledge and evaluate tool geometry and tool materials
	CO6	Know and appraising about advanced manufacturing processes.
	CO7	Follow certain advancements of finishing process like honing copying in the field of machining principles and machine tools

Machine Design (ME 603)	CO1	Formulate and analyze stresses and strains in machine elements and structures in 3-D subjected to various loads.
	CO2	Tolerance analysis and specify appropriate tolerances for machine design applications.
	CO3	Apply multidimensional static failure criteria in the analysis and design of mechanical components.
	CO4	Apply multidimensional fatigue failure criteria in the analysis and design of mechanical components.
	CO5	Analyze and design structural joints and mechanical springs.
	CO6	Analyze and design power transmission shafts carrying various elements with geometrical features.
Air Conditioning & Refrigeration (ME 604A)	CO1	To understand the principles of refrigeration and air conditioning.
	CO2	To calculate the cooling load for different applications.
	CO3	To select the right equipment for a particular application.
	CO4	To design and implement refrigeration and air conditioning systems using standards.
	CO5	Energy Conservation and Management
Mechatronics (ME 604B)	CO1	Explain the definition and role of Mechatronics in the basic areas of Mechanical engineering namely Design and Manufacturing.
	CO2	Understand and apply the knowledge of frequency domain, time domain and frequency time domain to evaluate various types of signals.
	CO3	Construct mathematical models for various simple mechanical and electrical systems and apply the basics of control systems.
	CO4	Understand and explain the working of Some Electric, Mechanical, Pneumatic and Hydraulic drives.
	CO5	Apply the fundamentals of Electronics and explain the working of various sensors and transducers.
	CO6	Design and construct simple Mechatronics systems.
Materials Handling (ME 605A)	CO1	Identify the importance of material handling.
	CO2	Identify variety of load & classify material handling based on application through general analysis procedure
	CO3	Apply the design procedures of various material handling equipment & components
	CO4	Make model load lifting & load movement attachments with proper design consideration & plan for appropriate material storage.
	CO5	Understand the use of automation in material handling.
	CO6	Identify the importance of material handling.
Turbo Machinery (ME 605C)	CO1	Give examples of the main applications of turbo-machines.
	CO2	Explain the working principles of turbo-machines and apply it to various types of machines.
	CO3	Determine the velocity triangles in turbo-machinery stages operating at off-design conditions.
	CO4	Use dimensional Analysis to compare homologous Machines.
	CO5	Classify and explain the function of dimensionless number and their use in design of Prototype from Model.
Machining & Machine	CO1	Evaluate the cutting forces (Pz and Px or Py) in straight turning at different feeds and velocities
	CO2	Test and experimenting the average cutting temperature in turning under different

Tools Lab (ME 691)		speed – feed combinations
	CO3	Recognize chip formation mechanism and relevant matters (type, color & thickness) in turning mild steel and evaluate the role of variation of cutting velocity and feed on chip reduction coefficient /cutting ratio and shear angle.
	CO4	Measurement of tool – wear and evaluation and analysis of tool life in turning mild steel by HSS or carbide tool
	CO5	Geometrical and kinematic test of a centre lathe or a drilling machine
	CO6	Plan and produce i) job on shaping machine (like cast iron vee - block); ii) job on milling machine (like gear tooth cutting)
IC Engine Lab (ME 692)	CO1	To evaluate by experiment the water equivalent of a bomb calorimjeter and thereby calculate the calorific value of any unknown fuel.
	CO2	To understand the working of a Catalytic converter.
	CO3	Evaluate the exhaust smoke and exhaust emission by ORSAT Apparatus and understand the preventive measures.
	CO4	To perform test in a single cylinder diesel engine and determine the performance parameters like fuel consumption, BP, Fuel efficiency, air consumption, etc.
	CO5	To determine the performance parameters of a multi cylinder petrol engine and also perform the morse test to evaluate the power of an invidual cylinder.
	CO6	Understand the different parts and working of a single cylinder diesel Engine.
Design Practice-II (ME 693)	CO1	Convert isometric projection to orthographic projection of various mechanical components.
	CO2	Convert orthographic projection of various mechanical components to 3D model in Auto-CAD.
	CO3	Design and prepare spur gear using codes.
	CO4	Select, design and sketch of rolling element bearing frommanufacturers' catalogue.
	CO5	Design and analysis of mechanical components using software package Creo3.0.
Dynamics of Machines Lab (ME 694)	CO1	Recall and study the motion of different mechanisms
	CO2	Study the effect of dynamics on vibrations in single and multi degree of freedom systems.
	CO3	Understand the working principle of governor and gyroscope and demonstrate the effect of forces and moments on their motion.
	CO4	Analyze the motion and the dynamical forces acting on cams.
	CO5	Demonstrate the effect of unbalances resulting from rotary motions.
Air Conditioning & Refrigeration Lab (ME 695A)	CO1	Calculate the COP of a Refregiration test rig
	CO2	Calculate the COP of a Air Conditioning test rig
	CO3	Understand the working of a thermo electric cooler and calculate the its COP
	CO4	Analyse the working of Domestic Air Conditioning Systems with respect to the design and working fluids.
	CO5	Understand the working of demestic refregiration systems.
Mechatronics Lab (ME 695B)	CO1	Construct a PID circuit and evaluate the effects of various parameter a DC stepper motor
	CO2	Construct different types of logic gates
	CO3	Write programs for solving simple mathematical calculations on Microprocessor 8085
	CO4	Design programs for simple applications of a PLC
	CO5	Understand the construction of hydraulic, pneumatic and linear actuator and

		perform simple operations.
	CO6	Understand the applications of Servo motors
FOURTH YEAR : 7TH SEMESTER		
Power Plant Engineering (ME 701)	CO1	Demonstrate Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
	CO2	Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
	CO3	Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
	CO4	Explain the basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
	CO5	Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
	CO6	Discuss environmental and safety aspects of power plant operation.
Advanced Manufacturing Technology (ME 702)	CO1	Recognize different Manufacturing systems & their applications in different types of production, automation, FMS, transfer lines.
	CO2	Understand the the functions of the CNC machine control, axes of CNC turning and machining centers & importance of various positions of machine and parts and the basic programming codes.
	CO3	Identify different axes, machine zero, home position, systems and controls CNC machines & Develop part programs for given component on turning and milling machine.
	CO4	Built/prepare/create part programmes using ISO format for different components with and without use of CANNED CYCLE and SUBROUTINE.
	CO5	Identify the background behind the development of unconventional machining processes and to understand the basic principles, equipment, merits, demerits and applications of various non-traditional machining processes.
	CO6	Analyse the influence of process parameters in various non-traditional machining process.
Renewable Energy Systems (ME 703B)	CO1	Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the environment.
	CO2	Analyse the characteristics of a PV system, explain maximum power point tracking algorithm, and design residential grid connected PV systems, standalone PV systems, and PV based water pumping systems.
	CO3	Explain and identify different components of a wind power generation systems and analyse the output power characteristics and estimate wind power resources for a specific wind resource site using probability density functions.
	CO4	Explain the basic working principles of wave, tidal, micro-hydro, concentrated solar, fuel cell and energy storage system in electrical aspects.
	CO5	Describe the biomass and bio fuels
	CO6	An ability to identify, formulate, and solve engineering problems on different types of renewable energy.
Quantity Production	CO1	Understand Engineering Production levels and types of production; piece, batch, lot, mass and quantity production.
	CO2	Recognize and understand the need, degrees and types of automation and role of

Method (ME 704A)		automation in industrial production.
	CO3	Understand the concepts of various Quantity Production methods.
	CO4	Plan, schedule, design and use jigs and fixtures for batch production in machine shops.
	CO5	Analyse Productivity and quality enhancement in Quantity production
	CO6	Understand the use of some modern technologies / Non-conventional manufacturing in the area of Quantity Production Methods.
Advanced Welding Technology (ME 704B)	CO1	Understand Influences of input parameters on various types of welding.
	CO2	Recognize and understand the application of different types of equipment, power sources, arc characteristics, electrode selection.
	CO3	Understand the basics of welding of plastics, ceramics, composites and some critical and precision welding processes.
	CO4	Explain types of welding defects and Alanyse the causes, inspection and remedies.
	CO5	Analyse Productivity and quality enhancement in Quantity production
	CO6	Understand and analyze the Weldability of plain carbon steels, stainless steel, cast iron, aluminium and its alloys
Operations Research (ME 705C)	CO1	Identify necessity and development of mathematical models for various industries.
	CO2	Describe basic optimization and simulation techniques applied to various industries.
	CO3	Carry out investment analysis and game theory.
	CO4	Determine and analyse the industrial systems under the conditions of certainty, uncertainty and risk.
	CO5	Propose a queuing model based upon given data.
	CO6	Construct and solve the network models and to understand the concept of reliability concept.
Advanced Manufacturing Lab (ME 791)	CO1	Understand and recognize constructional features and modes of operations of CNC.
	CO2	Identify different axes, machine zero, home position, systems and controls of CNC machines.
	CO3	Create and simulate CNC turning part program and to identify errors and to make components on CNC turning centre.
	CO4	Develop and simulate CNC milling part program and identify errors and to manufacture components on CNC milling machine.
	CO5	Study geometry of robot manipulator, actuators and grippers.
	CO6	Study the various process parameters and their effect on the component machined on ECM & EDM.
Project : Part 1 (ME 781)	CO1	Be able to propose an engineering based project in a clear and concise manner.
	CO2	Be able to identify and summarize an appropriate list of literature review, analyse previous researchers' work, and relate them to current project.
	CO3	Be able to formulate clearly a work plan and procedures.
	CO4	Be able to present the project outlining the approach and expected results using good oral and written presentation skills.
	CO5	Be able to organise, record and compile work done throughout the project.
	CO6	Be able to write a appropriate synopsis of the project.
ME 782 Viva Voce on Vacational Training	CO1	Be able to bridge the gap between class room teaching and corporate experience.
	CO2	Be able to observe the industrial environment.
	CO3	Be able to understand the methods of quantity production.
	CO4	Be able to get an exposure of real life industrial projects.

	CO5	Be able to prepare one for the campus placement drives.
Group Discussion (ME783)	CO1	Be able to inculcate team spirit, problem solving skills, interactive body language through group discussion session.
	CO2	Be able to introduce different model topics of group discussion, thereby creating awareness of the socio-economic-psychological environment.
	CO3	Be able to explore live recorded GD sessions for mending students' attitude/approach and for taking remedial measures. Mock interview sessions arranged to develop technical communication and inter-personal skills.
	CO4	Be able to equip the students to deliver group/corporate presentations through power point slides.
	CO5	Be able to develop self-knowledge and managerial skills for professional fields through SWOT analysis.
FOURTH YEAR : 8TH SEMESTER		
Economics for Engineers (ME 801 (HU))	CO1	Recognize the complexity in a decesion making problem.
	CO2	Compare between a sinple and a complex problem and to carry out economic decesion making process.
	CO3	Place them in a position to identify and analyse appropriate criteria for use with varieties of economic complexities.
	CO4	Recognize ethical issues in engineering economic decesion making, realize the full implication of their value of money.
	CO5	Build up the concept of present worth, concept of revenue & cost depreciation and use of analytics for solving critical engineering problems.
CAD/CAM (ME 802A)	CO1	Describe and understand the fundamental theory and concepts of the CAD/CAM and to gain knowledge about the benefirs of CAD and graphics standards.
	CO2	Build up the knowledge of the underlying theory of modeling and the usage of models in different engineering applications.
	CO3	Compare the different types of modeling techniques and create transformations for 2D geometric modeling and also to understand the basics of Finite Element Methods in the context of modelling.
	CO4	Understand the basic concepts of CNC programming and machining.
	CO5	Recognize and analyze Computer Aided Designing systems; Geometric modeling, solid modeling, and feature-based design modeling.
Quality & Reliability Engineering (ME802D)	CO1	Understand the concept of total quality management
	CO2	Identify, plan and apply appropriate techniques in consistent with customer needs, as well as the quality impact that will be used as inputs in TQM methodologies.
	CO3	Evaluate the cost of poor quality and process effectiveness and efficiency to track quality performance and to identify areas for improvement.
	CO4	Choose a framework to evaluate the performance excellence of an organization and to determine the set of performance indicators that will align people with the objectives of the organization.
Water Resource Engineering (ME 803C)	CO1	Understand the application of fluid mechanics model studies and computers in solving a host of problems in hydraulic engineering
	CO2	The student is exposed to the application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
	CO3	Various components of hydrologic cycle that affect the movement of water in the earth

	CO4	Various Stream flow measurements technique
	CO5	The concepts of movement of ground water beneath the earth
	CO6	Apply math, science, and technology in the field of water resource engineering.
Automobile Engineering (ME 803D)	CO1	Undersatand the working principle of automobile.
	CO2	Understand and analyze the fuel injection system,lighting,lubrication, steering system and cooling process of a automobile.
	CO3	Understand and apply the knowedge of flyweel,clutch,gear box ,universal joint in a automobile.
	CO4	Understand and analyze the knowledge of suspension system and design of the front and rare axle of automobile.
	CO5	Evaluate the power system of automobile.
	CO6	Understand about the maintainance of automobile.
Deign of a Mechanical System (ME 881)	CO1	An ability to analyze and model physical systems or components using (apply knowledge of) mathematics, basic science and engineering.
	CO2	Develop knowledge of combined loading behavior in structural systems
	CO3	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
	CO4	An ability to identify, formulate, and solve engineering problems.
	CO5	An ability to function on multidisciplinary teams.
	CO6	Work professionally in the area of mechanical systems.
Project : Part II (ME 882)	CO1	Be able to present, analyse, and discuss the outcome of research carried.
	CO2	Show correct attitude towards achieving the goals and objectives in FYP.
	CO3	Be able to organize, compile, and record all work details in an efficient manner.
	CO4	Be able to present the research outcome effectively using good presentation skills.
	CO5	Be able to compile, analyse and present the research carried out in the form of a thesis.
	CO6	Be able to produce project outcome of good quality.
Comprehensive viva (ME 883)	CO1	To provide evidence of the value addition that has taken place over the years.
	CO2	To fathom the depth of knowledge in different areas of science and engineering.
	CO3	To review various value addition process through multiple laboratories and workshops.
	CO4	To help gauge the overall skill and personality development at the end of the VA process.
	CO5	Help assess the capability in expressing them for various fora.
	CO6	To satisfy the students desire to excel and place in an techno academic panaroma.

PSOs and POs of MBA Department

Program Outcomes (POs)

1. Interpret, evaluate, and advocate the theories, principles, and practices that form the foundation of Management Science.
2. Interpret, evaluate and promote the use of information resources, technologies and services.
3. Demonstrate competency in communication, leadership, and management skills.
4. Utilize critical thinking, professional judgment, and analytical skills.
5. Contribute to the development of the professions through team work and knowledge-sharing.
6. Engage actively in communities of practice and professional networks.
7. Pursue opportunities for life-long learning and professional development.
8. Articulate the cultural, social, political, and economic implications of the role of information within and outside India, and the importance of communication across ethnic, cultural, and social boundaries.

Program Specific Outcomes (PSOs)

1. The students will be instilled with qualities of future managers with a life ? long sense of participation, involvement and satisfaction as contributors to the wider developmental endeavor.
2. The students will be enriched with sound management concepts, analytical tools, practical and general managerial skills.
3. The students will be able to demonstrate professional attitudes regarding professional ethics, intellectual freedom, and access to information in a democratic society.

Department of MBA
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: MBA

FIRST YEAR : 1ST SEMESTER		
Course Name (Code)	**Course Outcomes (COs)**	
	On completion of the course, the students will be able to:	
Business Economics – I (MB 101)	CO1	Understand the overall economic scenario at micro level as well as realise that economics is about the allocation of scarce resources, that scarcity forces choice, trade offs exist and that every choice has an opportunity cost.
	CO2	Determine the factors such as demand, supply and production for pricing criteria
	CO3	Acquire knowledge, tools and techniques to make effective economic decisions, and to appreciate the role of economic systems in directing economic behaviour.
	CO4	Determine the cost and profit conditions to cover up for the benefits of different types of markets.
	CO5	Understand different types of pricing policies prevalent in the markets, and to understand externalities and market failure.
Business Communication (MB 102)	CO1	Understand the fundamentals, scope and importance of communication in business.
	CO2	Develop individual reading and listening skills
	CO3	Develop an ability to communicate correctly and effectively on matters having relevance to day-to-day business operations.
	CO4	Transform their communication abilities by honing their oral, written, and non verbal communication skills.
	CO5	Develop effective public relations, write resumes, reports and face interviews.
Management Information System (MB 103)	CO1	Understand and apply the concept of MIS with problem articulation.
	CO2	Understand different models and different computer assisted environment using MIS.
	CO3	Learn MIS methods with the analysis of strength and weaknesses.
	CO4	Apply the MIS and its principles to software project development.
	CO5	Apply the design and testing principles to software project development.
	CO6	Learn and apply MIS to software project development through the use of different diagrams.
Organisational Behavior - I	CO1	Understand and learn the effective interpersonal, team building and leadership skills.

	CO2	Familiarized to adjust better in organizational settings (by developing an understanding of how and why others behave in a particular manner).
	CO3	Improved the organizational performance through the effective management of human resources.
	CO4	Familiarised with the theoretical and practical literature relating to studying organisational behaviour.
Quantitative Methods I (MB 105)	CO1	Understood the basic concept of Set theory, Functions, Derivative and Partial derivatives and optimized the function.
	CO2	Learnt about the application of Integration, Matrices and combinatorics in economics
	CO3	Learnt about the application of probability techniques in economics
	CO4	Students are exposed to the basic statistical concept useful in various statistical application particularly in manufacturing sector where mass production of discrete items are required.
	CO5	Student can appreciate with their acquired knowledge the basic utility of various distributions, shape of the distribution and their implication in practical industrial/commercial application.
Fundamentals of Accounting (MB 106)	CO1	Recognize and understand the role of different branches of accounting i.e. Financial Accounting, Cost Accounting and the purposes of financial statements in decision making.
	CO2	Organize accounting records with reference to GAAP.
	CO3	Classify financial transactions and cost elements according to their nature.
	CO4	Arrange the transactions under appropriate heads of accounts.
	CO5	Compose Profit & Loss Accounts and Balance Sheet in accordance to the legal requirements.
	CO6	Interpretation of Final Accounts
ISS & VA (MB 107)	CO1	Identify the existing inequalities and pluralistic nature of his/her society and recommend the need of sociological reasoning rather than common sense understanding
	CO2	Differentiate between community and association and various social groups and analyse the role of industrialization in the making of sociology
	CO3	Define and list various systems of social stratification
	CO4	Define social institutions and explain the functionalist and conflict views of social institutions
	CO5	Identify and list the different aspects of culture
	CO6	Comprehend the idea of social change and evaluate the features of urbanisation

Business Law (MB 108)	CO1	Define the provisions of Law of Contract and Sale of Goods Act.
	CO2	Understand the fundamental provisions of Company Law
	CO3	Acquaint with basic negotiable instruments.
	CO4	Comprehend the basics of Taxation.
	CO5	Analyze various case studies on all related topics.
FIRST YEAR : 2ND SEMESTER		
Business Economics II (MB 201)	CO1	Understand how the aggregate levels of production, employment, income and prices are determined in a market driven global economy.
	CO2	Understand the role and functions of government using fiscal and monetary policy in a market driven global economy.
	CO3	Understand what is meant by inflation and be able to describe the causes and effects of inflation.
	CO4	Describe the nature and magnitude of the various components which constitute the Indian economic system today.
	CO5	Understand the interrelationships between the Indian economy and the economies of other nations.
Organisational Behavior (MB 202)	CO1	Understand and learn the effective interpersonal, team building and leadership skills.
	CO2	Familiarized to adjust better in organizational settings (by developing an understanding of how and why others behave in a particular manner).
	CO3	Improved the organizational performance through the effective management of human resources.
	CO4	Familiarised with the theoretical and practical literature relating to studying organisational behaviour.
Quantitative Methods – II (MB 203)	CO1	Empowering the students through familiarization with various probability distribution and quality assurance through Hypothesis Testing via estimation and Analysis of Variance.
	CO2	Students are further enabled to recognize the capability of statistical estimation to decide on the adoption of sampling technique
	CO3	Students are also exposed to the need and methods of forecasting including Multivariate data analysis as a necessary corollary of managerial decision making.
	CO4	Another statistical tool like Non-parametric test would be useful for the learner when he cannot zero in on any particular theoretical probability distribution.
Production & Operations Management (MB 204)	CO1	Understand and appreciate the concept of Production and Operations Management.
	CO2	Recognise the scope of Production and Operations Management and its role in creating competitive advantage for business organisations.
	CO3	Understand the concept and contribution of various constituents of production operations (both manufacturing and service) viz. Product design, Process design, Location planning, Layout planning, Capacity planning, Work study, Quality management, Purchasing management

		and Inventory management towards effective production and operations management.
	CO4	Acquaint with Tools viz. TQM, JIT Six Sigma, Value analysis and their contribution towards production and operations management.
	CO5	Conversant with the modern virtual factory concept.
Management Information System (MB 205)	CO1	Understand and apply the concept of MIS with problem articulation.
	CO2	Understand different models and different computer assisted environment using MIS.
	CO3	Learn MIS methods with the analysis of strength and weaknesses.
	CO4	Apply the MIS and its principles to software project development.
	CO5	Apply the design and testing principles to software project development.
	CO6	Learn and apply MIS to software project development through the use of different diagrams.
Financial Management (MB 206)	CO1	Understand the goals of Financial Management.
	CO2	Calculate Time Value of money and ascertain value of securities.
	CO3	Analyze and illustrate the trade-off between risk and return of various investment opportunities available
	CO4	Appraise various sources of funds and rank them considering cost of each one.
	CO5	Evaluate different investment opportunities and rank them according to benefits they yield.
	CO6	Make Investment decisions, Financing decisions and Dividend decisions.
Marketing Management (MB 208)	CO1	Describe key marketing concepts, theories and techniques for analysing a variety of marketing situations.
	CO2	Develop an understanding of the dynamic nature of the environment in which marketing decisions are taken and appreciate the implications for marketing strategy determination and implementation.
	CO3	Execute the concepts related to STP, product attributes, and pricing strategies prevalent in domestic and international scenario
	CO4	Integrate various tools and techniques of promoting the products in ethical manner.
	CO5	Detect emerging concepts of marketing in the emerging global markets.
	CO6	Create and synthesize ideas into a marketing plan.
SECOND YEAR : 3RD SEMESTER		
Management Accounting (MB 301)	CO1	Understand the role of different financial, cost and statistical statements.
	CO2	Prepare various statements suitable for management decision using various tools like ratio analysis, fund flow and cash flow, etc.
	CO3	Calculate job cost and process cost, compute break-even Point, prepare

		budgets.
	CO4	Compare actual outcomes with the budgeted outcomes.
	CO5	Determine Variances and instil control measures.
	CO6	Make decisions with regard to 'Make or Buy', Transfer Pricing, Total Costing, Activity Based Costing, Life Cycle Costing
Operations Research (MB 302)	CO1	Students enables to recognize the import of various mathematical models and utilize them for solving real life optimization problem
	CO2	Students can draw help for making decisions by application and analysis of various decision support systems including simulation, goal programming and Markov process.
	CO3	The learner can utilize the knowledge of queuing theory to advise setting of service counters in commercial establishment
Sales & Distribution Management (MM 301) (Specialization)	CO1	Demonstrate an understanding of the role that a sales force plays in marketing strategies
	CO2	Describe the selling process and understand the factors that affect sales force success.
	CO3	Identify and explain the processes involved in recruiting, selecting, training, motivating, compensating, and retaining salespeople.
	CO4	Design sales presentation that is tailored to a potential buyer's needs
	CO5	Create a sales force strategy that takes into account organizational strategies, salesperson characteristics, structural relationships, product characteristics, and compensation/reward systems
	CO6	Evaluate the success of a sales force through effective use of distribution network partners' participation.
Advertising & Sales Promotion (MM 302) (Specialization)	CO1	Identify advertising decision areas and applying marketing communications functions such as advertising, direct marketing, the Internet, interactive media, and sales promotion.
	CO2	Research and evaluate a firm's marketing and promotional situation.
	CO3	Develop effective marketing communication strategies and programs
	CO4	Understand the implications of current trends in advertising and promotion.
	CO5	Use critical marketing factors that influence advertising decisions.
	CO6	Develop an advertising campaign plan that reflects an integrated marketing communications (IMC) perspective.
Marketing Research (MM 303) (Specialization)	CO1	Comprehend the objectives of research and the steps involved in research process.
	CO2	Use different data collection methods and sampling design techniques in their own research.
	CO3	Analyze the collected and processed data with the help of statistical tools.
	CO4	Generalize and interpret the data and prepare a research report.
Corporate Taxation & Tax Planning	CO1	Define and understand Direct taxes and Indirect taxes.
	CO2	Classify assesses, Individual, HUF & Corporate according to their residential status.

(FM 301) (Specializatio n)	CO3	Apply critical thinking and problem-solving skills related to taxation of individuals, and corporations recognizing potential opportunities for tax savings
	CO4	Identify the appropriate Return Form to be submitted.
	CO5	Determine the records to be prepared for submission with the Return.
	CO6	Make Tax plans well in advance.
Corporate Finance (FM 302) (Specializatio n)	CO1	Ability to explain the concepts of compounding and discounting and utilize these tools to calculate future values & present values of annuities & uneven cash flow streams.
	CO2	Estimate the relevant cash flows and appropriate discount rates in making capital budgeting decisions.
	CO3	Calculate various measures of project profitability using traditional capital budgeting techniques such as payback period, NPV, IRR.
	CO4	It explains the concepts of cost of capital, how it is affected by the farm's capital structure and the application of these concepts to capital budgeting.
	CO5	It enhances the ability to determine the expected rate of return & risk of an individual investment as well as portfolio of assets and the trade of between risk & return.
	CO6	Ability to examine the factors that drive a company's need for external financing and for determining optimal mix of date and equity.
Corporate Finance (FM 303) (Specializatio n)	CO1	Understand the basic structure and working of primary and secondary financial markets
	CO2	Use security valuation model to ascertain their worthiness.
	CO3	Identify market risks and industry risks.
	CO4	Appraise investment portfolios using fundamental and technical tools.
	CO5	Determine the optimum portfolio through diversification.
	CO6	Revise investment portfolio with the help of portfolio revision techniques.
Employment & Compensation Adninistration (HR 301) (Specializatio n)	CO1	Able to outline basic requirement of compensation administration.
	CO2	Inter relate the social and personal requirement
	CO3	Organize pay programs.
	CO4	Subdivide & analyze direct and indirect compensation.
	CO5	Evaluate the compensation and market trends.
Human Resource Management (HR 302)	CO1	Define link between organizational and HR goals.
	CO2	Summarize the real needs of manpower.
	CO3	Prepare a basic plan for future needs
	CO4	Breakdown the plan in different levels.
	CO5	Determine the final layout for organizational success.
Labour Laws (HR 303)	CO1	Define labour laws
	CO2	Distinguish other social / criminal and labour laws.
	CO3	Select and apply required law based on situation.
	CO4	Analyze labour law in-depth.

	CO5	Appraise situations and support administration to run the organisation amicably
SECOND YEAR : 4TH SEMESTER		
Project Management & Entrepreneurship Development (MB 401)	CO1	It leads to think creatively for new business opportunities to sustain individual as well as social goals.
	CO2	It provides frame work of successful business world with relation to agencies to promote employment opportunities.
	CO3	It enhances the practical exposure of Project Management in formulation of strategies allowing organizations to achieve strategic goals.
	CO4	It leads to addressing of concepts of specific Project Management needs at the individual and organizational level.
	CO5	It develops critical thinking and analytical decision making capabilities to investigate complex business problem to propose project based solutions.
Strategic Management (MB 402)	CO1	Explain the Historical background and concepts vital for understanding Strategic Management.
	CO2	Identify the role of Vision and Mission in determining Organizational success.
	CO3	Identifying the innovative strategies adopted by organizations to enhance their Strategic position.
	CO4	Define various techniques adopted by the organizations to consolidate and have strategic advantage at global front.
	CO5	Study recent developments in the field of Strategic Management
International Marketing (MM404)	CO1	Identify the key factors related to creating a global marketplace.
	CO2	Research and identify profitable foreign markets
	CO3	Discuss the impact of different cultural values and belief systems on marketing products.
	CO4	Select and justify an appropriate marketing strategy and evaluate the financial, human resource operational and logistical implications of different strategies.
	CO5	Determine marketing strategies appropriate and identify the relevant sources of information and analysis to support the appropriate strategy.
	CO6	Discuss the key elements of ethical global marketing.
Service Marketing (MM 405)	CO1	Develop understanding among students about various concepts and importance of Services Marketing.
	CO2	Understand the contribution of service sector in solving marketing problems.
	CO3	Identify the role and impact of services on the customers and employees.
	CO4	Understand the communication strategies adopted by the organisations at Global front.
	CO5	Enhance knowledge about emerging issues in the service sector.
Consumer Behavior (MM 406)	CO1	Identify the historical background and concepts vital for the understanding of consumer behaviour.
	CO2	Understand the role of various variables that determine consumer

		behaviour in cross-cultural domain.
	CO3	Apply the key concepts used in the study of consumer behaviour.
	CO4	Analyze the trends in consumer behaviour, and apply them to the marketing of an actual product or service
	CO5	Critically evaluate the effectiveness of various advertisement and promotions and their attempts to influence the behaviour of individuals.
	CO6	Design and construct a project that demonstrates both your working knowledge and analytical skills in assessing the consumer decision-making process.
Financial Institutes & Markets (FM 404)	CO1	Understand the role, scope & growing contribution & financial services of the economy.
	CO2	Understand the structure & regulatory framework of banks in India including the RBI.
	CO3	Knowledge of banking operations in general & the role of technology in modern banking.
	CO4	Acquaint with the various banking facilities for businesses available with the modern day banks
	CO5	Study the role, types of mutual funds & computation of NAV.
	CO6	Know the impact & role of credit rating in the corporate world.
	CO7	Analyse the contribution of merchant banks & venture capital in the promotion of the business.
International Finance (FM 405)	CO1	Apply & critically evaluate finance & investment theory with particular reference to the operations of financial markets.
	CO2	Comprehend the various factors contributing to international flow of fund and impact of balance of payment (BOP) of the country & the corporate world.
	CO3	Analyse the movement in foreign exchange market & its influence on the business world.
	CO4	It enhances ability to manage the translation exposure, transaction exposure & economic exposure.
	CO5	Understand the role of international sources of finance specially ADRs, GDRs, Bonds, EXIM bank, Factoring.
	CO6	It enables to understand and apply the process and application of risk in international business.
Derivatives & Risk Management (FM 406)	CO1	Understand the basic derivatives Forwards, Futures, Options, Swaps.
	CO2	Understand the various types of market risks.
	CO3	Able to use tools for managing associated risks.
	CO4	Identify the volatility of these risk factors.
	CO5	Assess the effects of applying various hedging tools.
	CO6	Revise hedging strategies with the change financial market scenario.
Industrial Relations (HR 404)	CO1	Define the context of Industrial Relations.
	CO2	Explain the relation of society, employee and employer.
	CO3	Judge the organisational situations.
	CO4	Identify the root causes of disturbance.
	CO5	Appraise human touch in industrial exchange.

Organisational Development (HR 405)	CO1	Outline the organization changes and components of organisational development.
	CO2	Understand the characteristics and foundation of OD process.
	CO3	Apply action research in OD process.
	CO4	Analyze OD interventions.
	CO5	Conclude the system transfer.
Human Resource Development (HR 406)	CO1	State the needs for development of human resources.
	CO2	Illustrate the potential of individual as an employee.
	CO3	Organize the methods of potential development
	CO4	Analyse the interface between the employee's goal and the goal of the organization.
	CO5	Defend stigma on spending for human resource development

Department of CSE
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: M.Tech in Computer Science & Engineering

FIRST YEAR : 1ST SEMESTER		
Course Name (Code)	**Course Outcomes (COs)**	
	On completion of the course, the students will be able to:	
Advanced Engineering Mathematics (PGCSE101)	CO1	Understand the use of periodic signals and Fourier series to analyze circuits.
	CO2	Demonstrate Fourier Transform as a tool for solving Integral equations.
	CO3	Apply various probability distributions to solve practical problems
	CO4	Choose appropriate Numerical methods to solve Algebraic and Transcendental Equations.
	CO5	Demonstrate the concept of Graph Theory (such as BFS, DFS etc.) and apply it in Data Structure and Algorithm.
	CO6	Apply Z Transform to solve Difference Equation.
Advance Operating Systems (PGCSE102)	CO1	To understand the basic principles of operating systems and compare different styles of operating systems.
	CO2	To explore the main principles and techniques for the implementation of processes, threads as well as the different algorithms for process scheduling and inter-process communication.
	CO3	To investigate the main problems related to concurrency and the different synchronization mechanisms.
	CO4	To explain the device and I/O management functions in operating systems as part of a uniform device abstraction.
	CO5	To evaluate the rationale view for virtual memory abstractions and explain the disk organization and file system structure and justify the role of operating systems in establishing security.
	CO6	To formulate the state of the art in operating systems and distributed systems, and engage in systems research to investigate novel ideas in systems through a semester-long research project.
Advanced Computer Architecture (PGCSE 103)	CO1	To Define Architectural principles with respect to Flynn's classification of Computer Architecture ----- SISD,SIMD,MISD,MIMD
	CO2	To Explain the evolution of Multiprocessor /Multicomputer system features for computational needs of divergent computational areas.
	CO3	To Apply/Construct different architectures like UMA,NUMA,COMA,NORMA and their variations and various

		related interleaved memory technologies.
	CO4	To Analyse/Compare the performances of different Multiprocessor/Multicomputer architectures and examine their limiting performance criteria.
	CO5	To Evaluate different types of concurrent processing architectures: Pipelined, RISC, CISC, Superpipelined, VLIW, Data Flow etc.
	CO6	To Design different performance enhancing features for Cache memory organizations.
Advanced Algorithm (PGCSE104)	CO1	Argue the correctness of algorithms using inductive proofs and invariant and Analyse worst-case running times of algorithms using asymptotic analysis.
	CO2	Describe the divide-and-conquer paradigm, Describe the dynamic-programming paradigm and Greedy method and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesise and analyse them
	CO3	Explain the major graph and tree algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them
	CO4	Explain the different ways to analyze randomized algorithms (expected running time, probability of error). Recite algorithms that employ randomization. Explain the difference between a randomized algorithm and an algorithm with probabilistic inputs
	CO5	Explain what amortised running time is and what it is good for. Describe the different methods of amortised analysis (aggregate analysis, accounting, potential method). Perform amortised analysis.
	CO6	Compare between different data structures. Pick an appropriate data structure for a design situation.
Software Engineering and Case Tools (PGCSE105E)	CO1	Understand and apply the concept of software engineering and also the concept of software development life cycle with problem articulation.
	CO2	Understand different models and different computer assisted environment using Object Oriented Programming and Visual Basic.
	CO3	Learn software development methods and different case tools with the analysis of strength and weaknesses.
	CO4	Apply the project management and analysis principles to software project development.
	CO5	Apply the design and testing principles to software project development.
	CO6	Learn and apply object modeling and design to software project development through the use of different UML diagrams.
Advanced	CO1	To utilize basic UNIX/LINUX Commands.

Operating System Lab (PGCSE191)	CO2	To create the codes in the Shell Programming
	CO3	To program on process creation synchronization, Inter process communication including shared memory, pipes and messages.
	CO4	To develop the program on UNIX/LINUX System calls.
	CO5	To simulate of CPU Scheduling Algorithms like FCFS, RR, SJF, Priority, Multilevel Queuing and Banker's Algorithm for Deadlock Avoidance, Prevention.
	CO6	To compose the POSIX signal programs
Advanced Programming Lab (PGCSE192E)	CO1	Understand and prepare the SRS document for standard application problem.
	CO2	Prepare Software Design Document through ERD, DFD & structure chart.
	CO3	Understand project schedule preparation and UML diagram using software case tools.
	CO4	Understand and evaluate the project size using Function Point calculation.
	CO5	Apply the design and testing principles to software project development through the use of Black box and White box approaches.
	CO6	Understand and estimate the product cost by cost estimation model like COCOMO and also study on variations of COCOMO model.
Seminar – Based on literature survey (PGCSE193)	CO1	Show competence in identifying relevant information regarding the topic.
	CO2	Gain an understanding of the theoretical concept of the given topic (which will clearly explain the topic, problem solving methodologies in the given field and its merits and demerits).
	CO3	Develop persuasive speech, present information in a compelling, well-structured, and logical sequence.
	CO4	Make use of visual, audio and audio-visual material to support their presentation, and will be able to speak cogently with or without notes.
	CO5	Reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to solve the problems related to the field and engage with important questions that stimulate discussion and debate.
	CO6	Demonstrate that they have paid close attention to what others say and can respond constructively.
FIRST YEAR : 2ND SEMESTER		
Advanced DBMS (PGCSE201)	CO1	Explain DBMS architecture, query processing and query optimization in detail.
	CO2	Understand Distributed Database principles, its reference architecture, levels of transparencies and its design principles.
	CO3	Apply knowledge of query optimization in distributed environment to solve distributed query processing problems, access strategies and other related issues.

	CO4	Analyze and realize the distributed concurrency control and reliability techniques.
	CO5	Characterizethe parallel database and distributed database, study and compare different existing distributed databases.
	CO6	Implement a distributed database through designing distributed transparencies, access strategies, query processing techniques, concurrency control and reliability issues.
Advanced Computer Network & Security (PGCSE202)	CO1	Will gain a thorough understanding of the design of computer networks and protocols, including the Internet.
	CO2	Will understand the workings of at least one actual TCP/IP protocol stack, and will be able to apply this understanding in modifying it or implementing additional protocols.
	CO3	To encourage a performance perspective towards analysis of computer and communications networks and skill.
	CO4	Identify the different types of network devices and their functions within a network and understand and building the skills of sub-netting and routing mechanisms.
	CO5	will understand and execute almost all modern networking techniques and protocol.
	CO6	will understand the basics of computer security and some modern security protocols.
Theory of Computation (PGCSE203)	CO1	Acquire a full understanding and mentality of Automata Theory as the basis of all computer science languages design - Have a clear understanding of the Automata theory concepts such as RE's, DFA's, NFA's, Stack's, Turing machines, and Grammars
	CO2	Evaluating :Prove or disprove theorems in automata theory using its properties and apply theorems to solve analytical problems on designing Pushdown automata, Finite automata, Turing Machine.
	CO3	Analyze problems intuitively for solving situations in related areas of theory in computer science.
	CO4	Creating : To design Turing Machine for simple computable functions and know the fundamental concepts of tractability and decidability of computational problems.
	CO5	Applying : To design FAs, NFAs, Grammars, languages modelling, small compilers basics and - Be able to design sample automata.
Distributed System Principle (PGCSE 205E)	CO1	To Define Distributed Systems, Major System Architectures supporting Distributed Systems—UMA, NUMA, NORMA—H/W, OS, S/W features, Memory Consistency models
	CO2	To Explain the design issues of Distributed Systems, the requirements & uses of Physical, Logical & Vector Clocks.
	CO3	To Apply/Construct various algorithms for Distributed Shared Memory Access, Distributed mutual exclusion.
	CO4	To Analyse/Compare various algorithms for Distributed mutual exclusion, Election algorithms etc.

	CO5	To Evaluate different types of distributed message passing models in different application environments, Distributed deadlock models, Distributed processor allocation models.
	CO6	To Design different application dependant setup for distributed file systems, fault tolerant systems etc.
Computer Networking & DBMS Laboratory (PGCSE291)	CO1	Develop conceptual understanding of distributed database management system.create tables for global schema.develop conceptual understanding of distributed database management system.create tables for global schema.
	CO2	Create fragmented schema fulfilling all constraints of completeness, reconstruction and disjoint-ness.understand different transmission media and design cables for establishing a network.
	CO3	Solve time effective solutions and apply PL/SQL programs for distributed query processing.install a network system consists of various computers using NIC, networking cables, connector, hubs and switches.
	CO4	Develop understanding of different applications and constructs of SQL PL/SQL in distributed environment.develop understanding of different applications and constructs of SQL PL/SQL in distributed environment.
	CO5	Understand how a real world problems can be mapped to schemas by practicing Embedded and Nested Queries for distributed environment.implement networking in software using various socket programming and also able to learn how to implement various networking protocols.
	CO6	Develop understanding of different applications and constructs of SQL PL/SQL to recommend various industry oriented and real life applications includinghandling of online Transactions for distributed database.learn the major software and hardware technologies used on computer networks and able to implement device sharing on network.
Seminar – Term paper leading to project (PGCSE292)	CO1	Explore the proposed area of research and acquire relevant information in this area.
	CO2	Gain an in depth understanding of the area of research field including theoretical concept, advanced research methodologies in the field, and interdisciplinary approaches related to the field from the gathered information.
	CO3	Prepare a consolidated report to integrate schools of thought from several established fields in order to show a well-rounded understanding.
	CO4	Present the topic and demonstrate its complexity, insight, cogency, independent thought, relevance, and persuasiveness.
	CO5	To compare the several existing strategies and judge their merits and demerits by supporting and connecting with the relevant information.

	CO6	Engage with works that are widely held to be significant in the field of study.
SECOND YEAR : 3RD SEMESTER		
Project management & Entrepreneurship (PGCSE301A)	CO1	Use theories, models and concepts within project organization and the implementation of projects.
	CO2	Develop, plan and implement projects.
	CO3	Analyse the conditions for entrepreneurship and how a business plan is drawn up.
	CO4	Reflect on the importance of cooperation and leadership within a project group.
	CO5	Critically account for scientific literature within the fields of project management,strategy, entrepreneurship and organizational theory.
	CO6	Projects in both planning perspectives and learning and collaboration perspectives.
Bioinformatics (PGCSE 302B)	CO1	To gather knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics.
	CO2	To describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge.
	CO3	To develop problem-solving skills including the ability to develop new algorithms and analysis methods.
	CO4	To create computer programs those facilitate biological data analysis.
	CO5	To conduct basic bioinformatics research.
	CO6	To interpret relationships among living things and analyze and solve biological problems, from the molecular to ecosystem level using basic biological concepts, grounded in foundational theories.
Project – Part 1 (Dissertation I + Defence of Project - I) (PGCSE393)	CO1	Propose an engineering based project proposal in a clear and concise manner.
	CO2	Identify and summarize an appropriate list of literature review.
	CO3	Analyse previous researchers' work, compare and contrast among the existing techniques to find out their advantages and disadvantages. and relate them to current project.
	CO4	Formulate clearly a work plan and procedures.
	CO5	Organize, record and compile work done throughout the project
	CO6	Present the project outlining the approach and expected results using good oraland written presentation skills.
SECOND YEAR : 4TH SEMESTER		
Project – Part 2 (Dissertation II + Defence of Project - II)	CO1	Present, analyse and discuss the outcome of research carried.
	CO2	Show correct attitude towards achieving the goals and objectives in previous semester project.
	CO3	Organize, compile and record all work details in an efficient manner.

	CO4	Present the research outcome effectively using good presentation skills.
	CO5	Compile, analyse and present the research carried out in the form of a thesis.
	CO6	Produce project outcome of good quality (a good research paper, a patent).

Department of Electronics & Communication Engineering
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: M.Tech in Communication Engineering

FIRST YEAR : 1ST SEMESTER		
Course Name (Code)	**Course Outcomes (COs)**	
	On completion of the course, the students will be able to:	
Advanced Digital Communication (MCE 102)	CO1	Apply statistical parameter values of random signals in analysis of digital communication systems
	CO2	Apply signal space representation in analysis of digital communication systems
	CO3	Analyze various source coding and line coding systems
	CO4	Explain the phenomena of inter symbol interference in digital base band transmission and the need of pulse shaping filters
	CO5	Analyze various digital modulation systems
	CO6	Compute band width requirement and probability of error in various digital modulation systems.
Advanced Digital Signal Processing (MCE 103)	CO1	Classify discrete time signals/systems.
	CO2	Apply Z-transform and Fourier transform for different type of signals and systems.
	CO3	State FFT, identify DSP processors and reproduce in FPGA platform.
	CO4	Compute the frequency response of digital filters and apply in different signal processing applications.
	CO5	Explain multirate signal processing
	CO6	Explain wavelet transform.
Advanced Microwave Communication Engineering (MCE 104)	CO1	Demonstrate the operating principle of different vacuum-tube devices for microwave and mm-wave
	CO2	Demonstrate the operating principles of different microwave and mm-wave solid-state devices like IMPATT diode, Gunn diode, Tunnel diode, BARITT and TRAPAT and illustrate their various applications.
	CO3	Apply the scattering matrix concept in the light of vector network analyzer, impedance matching network, couplers, power dividers, resonators and filters.
	CO4	Demonstrate different microwave and mm-wave circuits and their application to design detectors, mixers, attenuators, phase shifters, amplifier and oscillator ferrite-based circuits
	CO5	analyze the characteristics of Hertzian dipole, loop antenna, helical antenna, frequency independent antennas, waveguide slot

		antenna, microstrip antenna, horn antenna, parabolic reflector, antenna arrays and phased array antenna and explain the antenna measurement techniques
	CO6	Demonstrate the radio wave propagation techniques in microwave and mm-wave frequencies for understanding Friis transmission formula, plane earth propagation model, troposcatter systems, ionosphere propagation, duct propagation, and describe the effects on radio wave propagation due to rain, fog, snow, ice, atmospheric gases, Earth's magnetic field.
Computer Communication & Networking (MCE 105A)	CO1	describe a data communication system with its components, Protocols and standards, network criteria, physical structure and categories of network.
	CO2	explain the layering structure of OSI & TCP/IP reference model and to make their comparative study.
	CO3	Analyze the components of physical layer – different types of transmission media, switching and multiplexing.
	CO4	Analyze the functions of data link layer and its sub layers.
	CO5	Analyze the functions of network layer and transport layer.
	CO6	Analyze application layer protocols and modern technologies such as ISDN, ATM, ADSL, WLAN & Bluetooth.
FIRST YEAR : 2nd SEMESTER		
Photonics and Optical Communication (MCE 201)	CO1	Analyze fiber optic communication system performance in terms of attenuation and dispersion
	CO2	Apply different Photonic materials and Photonic Devices for optical communication systems
	CO3	Analyze the performance of different sources, detectors and amplifiers used for optical communication system
	CO4	Determine the performance parameters of optical communication systems and diagnose their system and link design limitations.
	CO5	Demonstrate WDM and coherent optical communication systems
	CO6	Illustrate different optical network topologies and systems
Error control coding (MCE 202)	CO1	Analyze different components of a digital communication system and classify different type of errors.
	CO2	Explain fundamentals of linear algebra.
	CO3	analyze as well as solve problems on coding/decoding linear block codes
	CO4	analyze as well as solve problems on coding/decoding as per cyclic codes
	CO5	analyze as well as solve problems on BCH code
	CO6	analyze as well as solve problems on coding/decoding as convolutional code and to analyze components of Turbo coding
Mobile Communication (MCE 203)	CO1	Explain different wireless communication systems and their components.
	CO2	Analyze the characteristics of wireless channel and propagation path loss models.
	CO3	Comparing different multiple access techniques in cellular

		communication.
	CO4	Comparing different standards of cellular network, WLAN family and wireless broadband networks.
	CO5	Analyze the functionalities of mobile network layer and transport layer
	CO6	Describe the fundamental concepts of mobile internet protocol.
Microwave measurement Techniques (MCE 204D)	CO1	Describe measurement techniques and working principles to measure microwave and mm-wave power
	CO2	Describe different measurement techniques to measure microwave frequency and unknow load impedance of a transmission line
	CO3	Illustrate the distortion measurement techniques in microwave frequencies and describe the frequency translation techniques
	CO4	Demonstrate the working principle of different microwave detectors & sensors and give examples of practical applications
	CO5	Demonstrate the working principle of vector network analyzer (VNA), scalar network analyzer (SNA), and spectrum analyzer with their practical applications
	CO6	Explain the working principle electrometer to measure reflection coefficient and Time Domain Electrometer (TDR)
Cryptography & Network Security (MCE 204A)	CO1	Explain Principles of security, Overview of network security & cryptography and classification of attacks.
	CO2	Analyze different types of Symmetric ciphers.
	CO3	Analyze different types of Public Key Cryptography systems
	CO4	Analyze Message Authentication and Hash Functions
	CO5	Analyze and compute different types of Hash Algorithms
	CO6	Explain different types of common as well as advanced Network Security Applications
Satellite Communication (MCE 205A)	CO1	describe the general mechanism of Satellite Communication System and explain the Orbital Mechanisms to understand Orbits, look angle, orbital period and velocity, azimuth and orbital inclination, coverage angle slant range.
	CO2	Demonstrate Satellite Subsystems like telemetry, tracking & command, power, altitude control, tracking, antenna subsystems and satellite launching techniques.
	CO3	Understand antenna tracking, power amplifier, low noise amplifier, up converter, down converter, transponder hopping, polarization hopping, redundancy configuration in earth station systems and compute the parameters like antenna gain, pointing loss, G/T ratio and their analysis and measurement
	CO4	Analyze satellite link design, performance, rain attenuation and demonstrate the satellite transponder model, transponder channelization, frequency plans, and processing transponders.
	CO5	illustrate different multiple access techniques such as FDMA, TDMA etc.
	CO6	Compute the propagation effects and their impact on satellite earth link and demonstrate VSAT and MSAT systems.

EMI/EMC (MCE 302A)	CO1	Define and Explain the concept of electro-magnetic interference (EMI) and electro-magnetic compatibility (EMC)
	CO2	Illustrate different sources of EMI and demonstrate radiated emission, radiated susceptibility, conducted emission, conducted susceptibility
	CO3	Recite requirements of EMC for electronic systems set by FCC, CISPR etc. and define Class-A & class-B devices
	CO4	Demonstrate different mitigation techniques such as grounding, shielding for preventing EMI and illustrate EMC system design techniques
	CO5	Predict non-ideal behavior of different electronic components and describe different EMI-EMC measurement techniques
	CO6	Describe different antenna characteristics and the radiation properties

Department of Electrical Engineering
Netaji Subhash Engineering College

COURSE OUTCOMES (COs)

Program Name: M. Tech In Power Systems

FIRST YEAR : 1ST SEMESTER		
Course Name (Code)	**Course Outcomes (COs)**	
	On completion of the course, the students will be able to:	
Advanced Engineering Mathematics (EMM-101)	CO1	*explain basic principles of Mathematics.*
	CO2	*classify problem solving methods of numerical and complex variable problems.*
	CO3	*demonstrate understanding of the concept of vector space, subspace, linear independence, span, basis and linear transformation and solve related problems.*
	CO4	*apply problem solving techniques of numerical analysis, complex variable , eigen values and eigen vectors in engineering field.*
	CO5	*create mathematical models based on optimization technique*
Advanced Power System Analysis (PSM-101)	CO1	build the bus-admittance matrix of a general power system network and, when required, update it for any change in the network parameter and configuration.
	CO2	learn the existing methods for load-flow study of a power system and apply them to determine the steady state voltage profile and the power-flow scenario of the system.
	CO3	get familiarized with analysis of different kinds of stability problems and learn methods for assessing the system behaviour during the stability transients.
	CO4	decide on measures to be for enhancing the stability limit.
High Voltage Transmission System (PSM-102)	CO1	**Apply** the knowledge of HVAC and HVDC transmission in Power networks
	CO2	**Analyze** the different modes of operation for six pulse & twelve pulse converter unit in the context of HVDC system

	CO3	**Determine** and **select** the appropriate HVDC transmission line parameters under different physical conditions
	CO4	**Explain** the Corona loss characteristics and **interpret** the limitation of audio noise in design of EHV transmission line
	CO5	**Estimate** the field intensity at any point in EHV system with help of different computational method
Power System Apparatus – (PSM 103 (b))	CO1	**Analyze** the functional operation and control aspects of VCB and SF6 circuit breaker [PO1]
	CO2	**Select** suitable Circuit breaker, Surge arrester and Surge absorber and **design** of protection scheme with proper insulation coordination.
	CO3	**Appraise** the importance of controlling network parameters using FACTS devices and **select** appropriate Shunt or Series or combined Shunt-Series FACTS controllers for a particular application.
	CO4	**Assess** the controllability and operating flexibility of SVC and STATCOM under steady state and transient condition.
	CO5	**Evaluate** the performance of SVC and STATCOM under different stability condition with suitable model.
	CO6	**Examine** the basic operation and control characteristics of GCSC, TSSC, TCSC, SSSC, TCVR, TCPAR and UPFC.
Soft Computing Technique – (PSM 104 (b))	CO1	Acquire knowledge of physical system with mathematical modeling and analyze in time domain considering linearization of nonlinear model with effect of parametric variation and disturbance.
	CO2	Demonstratethe state space based representation of SISO and MIMO system and solve problems on transformation of state vector and investigate the controllability and observability.
	CO3	Illustrate the idea of Z transform, pulse transfer function and able to apply that concept for digital system analysis.
	CO4	Designof PID Controller using various tuning methods,
	CO5	Design of Compensator in frequency domain and observer based on state feedback.

Laboratory I (PSM-191)	CO1	Analyze knowledge of various transients that could occur in power system
	CO2	Determine FFT plot and its Applications
	CO3	Interpret abnormal switching transients, Three-phase circuits and transients for transient analysis in Power System
	CO4	Estimate the Quality Power factor based on Fuzzy Logic
	CO5	Classify the different Power factor for non-sinusoidal situations.
Laboratory II (PSM-192)	CO1	determine of the generalized constants and power circle diagram of transmission line.
	CO2	handle DC distribution by network analyzer and earth tester for measurement of earth resistance
	CO3	study the different types of insulators
	CO4	comprehend dielectric strength test of insulating oil; determination of breakdown strength of solid insulating material and dielectric constant, tan delta, resistivity test of transformer oil.
	CO5	handle modern software for analyzing electrical transmission line.
	CO6	perform the active and reactive power control of an alternator.
Seminar I (PSM-193)	CO1	**Achieve** skill to write technical documents and **deliver** oral presentation of the completed project, which in turn shall **develop** his communication skills.
	CO2	**Approach** ethically any multidisciplinary engineering challenges with economic, environmental and social contexts so that they are able to explain their work clearly and that helps them to set as a potential employers.
	CO3	**Identify and apply** appropriate steps to solve problems they have met during implementation of their project.
	CO4	**develop** skills towards discerning problems in the organisation, if any, and to **plan** for resolving it.
	CO5	**evaluate** the severity and consequences of the problems in the organisation and to take **steps** to address the problem.
	CO6	**design** simulation model for performing the validity tests of new approach towards the problem solving.

FIRST YEAR : 2ND SEMESTER		
Power System Operation and Control (PSM-201)	CO1	Interpret power flow scheduling using economic load dispatch, Lagrange multiplier method and other methods.
	CO2	Identify the types of alternator exciters and automatic voltage regulators for generator excitation control and understand the static and dynamic performance of AVR loop.
	CO3	Demonstrate security analysis, security assessment, contingency analysis, apply algorithm to determine system security following contingency analysis procedure using ac power flow model.
	CO4	Understand least square and weighted least square estimation along with bad data detection and analyze the suppression of bad data
	CO5	Select load forecasting techniques and estimate the periodic components along with stochastic part of load using time series approach.
	CO6	Develop unit commitment solution methods and analyze optimal power flow solution using Newton Raphson method.
Power System Instrumentation (PSM-202)	CO1	Demonstrate power generating station to acquire knowledge of Thermal, Hydel, Nuclear, Wind and integrate their functional characteristics as processes and components of power grid.
	CO2	Identify the instrumentation and develop the control strategies of thermal power plant and Hydel power plant.
	CO3	Interpret the grid synchronization process for a wind power plant.
	CO4	Select the measurement and identify instrumentation related to transmission lines.
	CO5	Outline the process of data transmission and estimate the tariff system for transmission line.
	CO6	Relate the international specifications of power system instrumentation.
Advanced Power System Protection (PSM-203)	CO1	Distinguish the operating principles and application of Electro-magnetic, Static and digital relay [BT-4]
	CO2	Apply overcurrent, distance and differential relays for protection of Generator, Transformer, Transmission lines and feeders.[BT-3]
	CO3	Develop an ability and skill to design the feasible protection systems needed for each main part of a power system. [BT-3]
	CO4	Identify the various types of comparators and their realization using

		all types of relays. [BT-3]
	CO5	Explain thefunction and application of differentprotective relays for high voltage industrial motors and capacitor banks. [BT-5]
Power System Transient (PSM 204 (a))	CO1	**Survey** the effect of various types of transients on Power System and interpret the stability of the EHV system under different transient
	CO2	**Analyze** the effect of Lightning surges on Power equipment
	CO3	**Distinguish** effect of internal surges on system apparatus and **identify** the consequences of harmonics.
	CO4	**Develop** a concept of the transmission line design based on electromagnetic wave
	CO5	**Design** and **develop** the Power station, Substation and transmission line based on different insulation level.
Advanced Control System- (PSM 205 (a))	CO1	Acquire in-depth knowledge of mathematical models of various systems and understand their functional and operational dynamics with respect to relative stability aspects in control systems.
	CO2	Design (both in Time and Freq domain) and fine tune: PID controllers and understand the roles of P, I and D in feedback and delay control systems. Lag, Lead & lag-Lead compensators and justify the necessity for each type of compensator.
	CO3	Analyze and design nonlinear control system using phase plane and describing function.
	CO4	Design pole-assignment controller, full order and reduced order observers for specific application.
	CO5	Analyze and design sampled-data control system both in Time and Freq domain.
	CO6	To study and demonstrate the analytical procedures of optimal control theory.
Laboratory III (PSM-291)	CO1	Student able to **check** the quantities CT and PT
	CO2	Student able to conduct **testing** about the various electromagnetic relay
	CO3	Student able to apply appropriate technique for load flow analysis and its **Comparing**
	CO4	Student able to do **Experiment** on various protection methods on induction motor

	CO5	Student able to **verify** the differential relay used for transformer protection
	CO6	Student able to do **Experiment** in various protection of generator ,feeder and transmission line using relays and circuit breakers
Laboratory IV (PSM-292)	CO1	Analyze the different simulated transmission line fault wave form.
	CO2	Examine the operational effect of a Static Var Compensator (SVC) in Power system.
	CO3	Apply and examine the effect of advanced signal processing technique in simulated multi frequency Power system signal.
	CO4	Analyse the Voltage stability using PV and QV curves.
	CO5	Determine effect of FFT plot and its Applications in Power System
Seminar II (PSM-293)	CO1	**Achieve** skill to write technical documents and **deliver** oral presentation of the completed project, which in turn shall **develop** his communication skills.
	CO2	**Approach** ethically any multidisciplinary engineering challenges with economic, environmental and social contexts so that they are able to explain their work clearly and that helps them to set as a potential employers.
	CO3	**Identify and apply** appropriate steps to solve problems they have met during implementation of their project.
	CO4	**develop** skills towards discerning problems in the organisation, if any, and to **plan** for resolving it.
	CO5	**evaluate** the severity and consequences of the problems in the organisation and to take **steps** to address the problem.
	CO6	**design** simulation model for performing the validity tests of new approach towards the problem solving.
SECOND YEAR : 3RD SEMESTER		
Introduction	CO1	Sources of error in computation and its propagation.

to Management (EMM-301)	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 RegulaFalsi and Newton-Raphson methods.
	CO6	Euler, RK4, Predictor-Corrector for 1st order ODE and Finite Difference methods for simple ODE's.
Power System Harmonics (PSM 301 (b))	CO1	Develop mathematical models of electrical circuits and analyze harmonic distortions/ effects in voltage, current and power signals with Fourier Transform techniques in single and three phase systems.
	CO2	Comprehend and analyze the effects of harmonic distortion in electrical machines with particular reference to inrush phenomenon in Transformers and winding arrangements in rotating electrical machines.
	CO3	Comprehend and analyze the effects of harmonic distortion in electrical power systems due to capacitor bank switching, non-sinusoidal emf in synchronous generators, fault conditions and non-linear load variation/ switching.
	CO4	Recall and relate different standards with regard to harmonic distortion as per IEEE, IEC and NORSOK statutory bodies.
	CO5	Study and analyze different passive and active filters in the elimination of harmonics from electrical systems.
Pre-submission Defense of Dissertation (PSM 391)	CO1	Analyze different types of filters and regulators.
	CO2	Determine quiescent point, gain, input and output impedance of common emitter and common collector amplifiers.
	CO3	Explain principal of operation of various basic oscillators and feedback amplifiers.
	CO4	Analyze input/output relation for various simple applications of OP-Amp in analog circuits.
	CO5	Explain performance of basic class-A, class-B and class-C power amplifiers.
	CO6	Describe operating principle of 555 timer IC based monostablemultivibrator, 555 timer IC based astablemultivibrator and VCO, PLL.
Dissertation (Part I) (PSM 392)	CO1	State the types of digital devices and its applications in different domain, Conversion of different number systems as example conversion from binary to other number systems, implementation of different codes and

		conversions ,addition and subtraction of 1's and 2's complement numbers.
	CO2	Demonstrate the standard Boolean algebra and different minimization technique by stating different Boolean algebra. Explain SOP and POS, develop K-map for 2/3/4 variables.
	CO3	Explain different combinational circuits as adder, Substractor, MUX, DeMUX. Develop different combinational circuit by truth table and K-map, State the different important combinational circuit such as decoder, encoder and parity.
	CO4	Explain the memory system and develop the designating process of different memory.
	CO5	Explain the basic differences of combinational and sequential circuits, Develop flip flops as SR,JK,D flip flop, Develop register and counters and other advanced sequential circuits ,Prepare different conversion techniques from digital domain to analog domain and vice versa.
Dissertation (Completion) (PSM-491)	CO1	Demonstrate a sound technical knowledge of their selected project topic.
	CO2	Undertake problem identification, formulation and solution by considering ethical responsibility.
	CO3	Design engineering solutions to complex problems utilizing as system approach.
	CO4	Conduct an engineering project that has environmental impact
	CO5	Communicate with engineers and the community at large in written and oral forms
	CO6	Demonstrate the knowledge, skills and attitudes of a professional engineer.
Post submission defense of	CO1	Demonstrate a sound technical knowledge of their selected project topic.

Dissertation (PSM-492)	CO2	Undertake problem identification, formulation and solution by considering ethical responsibility.
	CO3	Design engineering solutions to complex problems utilizing as system approach.
	CO4	Conduct an engineering project that has environmental impact
	CO5	Communicate with engineers and the community at large in written and oral forms
	CO6	Demonstrate the knowledge, skills and attitudes of a professional engineer.
Comprehensive Viva-Voce (PSM-493)	CO1	Ability to apply the basic technical & engineering knowledge.
	CO2	Explain different type of theorem, laws and application.
	CO3	Apply the knowledge to solve engineering problems.
	CO4	Identify real life engineering problems and economic solution.
	CO5	Justify the application of different type of technical knowledge.
	CO6	Understanding of ethical responsibility and professional integrity issues related to the practice of electrical engineering.