APPLIED ELECTRONICS AND INSTRUMENTATION DEPARTMENT B.TECH CURRICULUM STRUCTURE

UNDER AUTONOMY

HALDIA INSTITUTE OF TECHNOLOGY

HALDIA
EAST MEDINIPUR

AFFILIATED TO

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

2ND YEAR 1ST SEMESTER

THEORY

Sr. No.	Categories	Course code	Course Title	Hours / Week L:T:P	Credit	Marks
1	Basic Science	BS-M 301	Mathematics -III	2-1-0	3	100
2	Professional Core	PC-EI 301	Circuit Theory and Network Analysis	2-1-0	3	100
3	Professional Core	PC-EI 302	Sensors &Transducers	3-0-0	3	100
4	Professional Core	PC-EI 303	Analog Electronic Circuits	3-0-0	3	100
5	Professional Core	PC-EI 304	Digital Electronic Circuits	3-0-0	3	100
6	Mandatory Course	MC-ES 301	Environmental Science	2-0-0	0	100
			Total		**15**	**600**

PRACTICAL

Sr. No.	Categories	Course code	Course Title	Hours / Week L:T:P	Credit	Marks
7	Professional Core	PC-EI 391	Circuit Theory Lab	0-0-3	1.5	100
8	Professional Core	PC-EI 392	Sensors &Transducers Lab	0-0-3	1.5	100
9	Professional Core	PC-EI 393	Analog Electronics Lab	0-0-3	1.5	100
10	Professional Core	PC-EI 394	Digital Electronics Lab	0-0-3	1.5	100
11	Basic Science	BS-M 391	Numerical Methods Lab	0-0-2	1.0	100
			Total		**7.0**	**500**

3rdSemester Total	**22**	**1100**

THIRD SEMESTER SYLLABUS

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Mathematics-III

Course Name: Mathematics-III (Mathematical Methods)	Category: Basic science Courses
Course Code: BS-M301	Semester: 3rd
L-T-P: 2-1-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 2 hrs./week	Continuous Assessment: 25Marks
Tutorial: 1	Attendance: 5 Marks
Total Lectures: 40	End Semester Exam.: 70 Marks
Pre-Requisites: (10+2) Mathematics	

Objectives:

1. Providing the core concepts of higher Engineering Mathematics and describing the Techniques, this works as an essential tool to solve the problems in their field of applications.

2. To provide an overview of probability and Statistics to engineers.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate the following knowledge, skills and attitudes. Student will be able to:

CO.1. Learn the concepts of the theory of Probability with the purpose of providing mathematical models of situations affected or even directed by chance effects. Solve the problems related to Probability distribution, both discrete and continuous.

CO.2. Solve the problems related to basic statistics, Correlation-Regression and curve fitting.

CO.3. Find the Fourier Series of a function by definition.

CO.4. Describing the techniques of Fourier transform and using them to transform a problem into one that can be more easily solved.

CO.5. Understand the concept of interpolation, find interpolation polynomial and compute functional values.

CO.6. Apply numerical methods to obtain approximate solutions of mathematical problems.

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Basic Probability & Statistics:** Probability spaces, conditional probability, independence; Bayes theorem. Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.	8	CO1

Module: 2	**Data statistics:** Basic Statistics, Measures of Central tendency, measures of dispersions: Moments, skewness and Kurtosis, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	6	CO2
Module: 3	**Fourier Series:** Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period $2l$, Dirichlet's conditions, Sum of Fourier series. Theorem for the convergence of Fourier Series (Without Proof). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (Without Proof).	6	CO3
Module: 4	**Fourier Transform:** Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Convolution Theorem (statement only), Inverse of Fourier Transform.	4	CO4
Module: 5	**Numerical Methods-I:** Error & Interpolataion: Approximation in numerical computation and Interpolation: Truncation and rounding errors, Fixed and floating-point arithmetic. Calculus of finite differences, Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	6	CO5
Module: 6	**Module Name: Numerical Methods-II:** Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. Numerical solution of nonlinear equation: Bisection method, Regula-Falsi method, Newton-Raphson method. Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods.	6	CO6
Total		36	

Text Books:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
4. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
5. Gupta & Kapoor, Fundamentals of Mathematical Statistics,Gupta (Sultan Chand & SOns).
6. S. Ali Mollah-Numerical Analysis and Computational Procedures.
7. Schaum's Outline of Fourier Analysis and Applications to Boundary Value Problems.

Reference Books:

1. R. J. Beerends -Fourier and Laplace Transforms.
2. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.
3. AP Baisnab and Jas M-Elements of Probability and Statistics.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
5. Chadrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi
6. HK Dass-Advanced Engineering Mathematics

Circuit Theory and Network Analysis

Course Name: Circuit Theory and Network Analysis	Category: Professional Core
Course Code: PC-EI 301	Semester: 3rd
L-T-P: 2-1-0	Credit: 3
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Continuous Assessment: 25 Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 45	End Semester Exam.: 70 Marks
Pre-Requisites: Knowledge of matrix, KCL, KVL, Laplace Transformation (basic level) and concept of Resistance, Inductor, Capacitor.	

Objectives:

This course aims to introduce with the time domain and frequency domain analysis of various electrical circuits for real time uses and also helps to solve complex networks in simpler way.

Course Outcomes (COs):

At the end of the course, a student will be able to:

CO.1. **Remember** the basic concepts of DC and AC circuit behavior and network theorems.
CO.2. **Understand** the transient response, active filters, the fundamental concepts of network analysis and synthesis of two-port passive networks and the self-inductance, mutual inductance and coefficient of coupling using dot convention of coupled circuit.
CO.3. **Apply** the Thévenin, Norton, nodal, mesh analysis and graph theory to express complex circuits in their simpler equivalent forms.
CO.4. **Analyze** transient response of RL, RC, and RLC circuits and resonant circuits in time and frequency domains.
CO.5. **Compare** the different network solving techniques and solve the complex network problems by applying suitable method.
CO.6. **Design** and **characterize** the active filters.

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Introduction Signal & System** Network, Circuit, System, Signal, Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal and Damped Sinusoidal, Square, Saw tooth signals.	3	CO 1

Module: 2	**Electrical circuit analysis** **Analysis of DC & AC Circuits:** Kirchoff's Voltage Law & Current Law, Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis, Concept of Super-mesh and Super-node. **Network Theorem:** Superposition, Thevenin's, Norton's, Maximum power transfer theorem, Millman's theorem, Tellegen's theorem and its application in circuit analysis and energy distribution system. Solution of Problems with DC & AC sources along with Dependent sources. Coupled Circuits: Coupling, Types of coupling, Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, and Solution of problems.	10	CO 1, 2, 3, 5
Module: 3	**Time and frequency domain analysis** **Circuit Transients:** DC Transient in R-L & R-C circuits with and without initial charge, R-L-C circuits, Transient analysis of different electrical circuits with and without initial conditions, solution of problems. **Laplace Transforms:** Concept of complex frequency, transformation of step, exponential, over-damped surge, critically damped surge, damped sine, un-damped sine functions of Laplace Transform, linearity, real-differentiation, real-integration, Initial Value Theorem and Final Value Theorem, Inverse Laplace Transform, applications in circuit analysis, Partial Fractions expansion, Heaviside's Expansion Theorem, Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Order of the electrical circuit, Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources. **Fourier Transform:** Fourier series and Fourier Transform, Application, Difference between Laplace Transform and Fourier Transform.	12	CO 1, 2, 4
Module: 4	**Graph Theory** Concept of Tree, Branch, Connected and Unconnected graph, planer and non-planer graph sub-graph, rank, Tree link, junctions, Incident	3	CO 3, 5

	matrix, Tie-set matrix, Cut-set matrix, solution of problems.		
Module: 5	**Two port networks analysis** Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations and interconnection. Solution of Problems with DC & AC sources.	4	CO 2, 3, 5
Module: 6	**Filter Circuits** Concept of Filter, Passive filter and Active filter, Analog filter and Digital filter, Radio frequency filter and Audio frequency filter. Analysis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems.	4	CO 1, 2, 6
Total		36	

Text Books:

1. Network and Systems, D. Roychowdhury, (New Age International)
2. Network Analysis and Synthesis, S.P Ghosh, A.K. Chakraborty (McGraw Hill)

Reference Books:

1. Network Analysis, M.E.Van Valkenburg (Prentice Hall)
2. Network and Systems, Ashfaq Husain, (Khanna Book Publisher)
3. Circuit Theory, A. Chakrabarty (Dhanpat Rai & Co.)
4. Network, Lines and Fields - John D. Ryder

Sensors and Transducers

Course Name: Sensors and Transducers	**Category: Professional Core**
Course Code: PC-EI 302	**Semester: 3rd**
L-T-P: 3-0-0	**Credit: 3**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 40	End Semester Exam.: 70 Marks
Pre-Requisites: To understand this course, the learner must have idea of elementary physics and mathematics, Basic Electrical Engineering.	

Objectives: This course aims to familiarize the students with different types of sensor and transducers, their working principle, applicability in measurement and instrumentation systems. The general concept and characteristics of measurement system are also discussed so that learner can appreciate the pertinence of sensors and transducers in instrumentation systems.

Course Outcomes (COs):

After completing the course the student should be able to

CO.1. **Understand** the function of sensors and transducers inmeasurement systems and **define** various performance characteristics of measurement system.

CO.2. **State and explain** the working principle of various types of sensors and transducers i.e. Mechanical, Electromechanical, Resistive, Inductive, Capacitive, Piezoelectric, Thermal, Magnetic etc.

CO.3. **Choose** a suitable sensor/transducer for a particular industrial application.

CO.4. **Differentiate** various sensors/transducers based on their utility for a particular application.

CO.5. **Develop** the skill to **identify and analyze** the complex technical problems and also capable to give a socio-economic solution to that problem.

CO.6. **Design** simple sensing/transduction system for a small industrial application.

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Introduction:** General concepts and terminology of measurement systems, transducer classification, general input-output configuration, static and dynamic characteristics of a measurement system, Definition, principles of sensing and transduction, classification	3	1

Module: 2	**Resistive sensors:** **Potentiometric type:** Forms, materials, resolution, accuracy, sensitivity **Strain Gauges:** theory, types, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesives, rosettes, applications-force, velocity and torque measurements **Resistance Temperature detector:** review of materials, construction, types; measuring circuits, ranges, errors and minimization of errors Thermistor: materials, types, constructions, ranges	9	2-6
Module: 3	**Inductive sensors:** common types- reluctance change type, mutual inductance change type, transformer action type, - brief discussion with respect to materials, construction and input output variables, Ferromagnetic plunger type-short analysis; proximity measurement LVDT: Construction, materials, output-input relationship, I/O curve, discussion	4	2-6
Module: 4	**Capacitive sensors:** Variable distance- parallel plate type, Variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type: calculation of sensitivities; proximity measurement Stretched Diaphragm type microphones, response characteristics	5	2-6
Module: 5	**Piezoelectric elements:** piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, Modes of mechanical deformation: TEM, LEM, FSM, TSM, VEM: force and stress sensing, Bimorphs and Multimorphs; piezoelectric accelerometer **Industrial weighing systems :** Link–lever mechanism, Load cells – pneumatic, piezoelectric, elastic and magneto-elastic types - their mounting, pressductor, different designs of weighing systems, conveyors type, weighfeeder type.	6	2-6
Module: 6	**Magnetic sensors:** Sensors based on Villari effect for assessment of force, torque, rpm meters **Tachometers –** Stroboscopes, Encoders, **Seismic accelerometer:** Measurement of vibration. **Optical sensors:** LDR, Solar Cell, Photo diode, Photo Transistor, Photo Darlington Pair	9	2-6

	Hall effect: Hall drive, performance characteristics		
	Total	**36**	

Text Books:

1. D Patranabis, Sensors and Transducers, PHI, 2nded.
2. E. A. Doebelin, Measurement Systems: Application and Design, McGraw Hill, New York
3. H. K. P. Neubert, Instrument Transducers, Oxford University Press, London and Calcutta

Reference Books:

1. D.V.S. Murty, Transducers and Instrumentation, PHI, 2nded.
2. K. Krishnaswamy and S. Vijayachitra, Industrial Instrumentation, New Age International Publishers, 2nded.
3. B. G. Liptak, Instrument Engineers' Handbook – Process Measurement and Analysis, Vol. 1, 4th Edition, CRC Press.

Analog Integrated Circuits

Course Name: Analog Integrated Circuits	**Category:** Professional Core Course
Course Code: PC-EI303	**Semester:** 3rd
L-T-P: 3-0-0	**Credit: 3**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: 1 hr/week	Attendance: 5 Marks
Total Lectures:45	End Semester Exam.: 70 Marks
Pre-Requisites: No-prerequisite	

Objectives:

The objective of this course is to introduce the student to familiarize and develop skills in the design and analysis of Analog Electronic Circuit, which form the building blocks of almost any electronic system.

Course Outcomes (COs):

CO.1. To **understand** various semiconductor devices and subsequently different biasing arrangement in transistor circuits and also the calculation of operating point or Q-point in different biasing circuits.

CO.2. To **acquire** extensive knowledge and perception of h-model and high frequency model of transistors.

CO.3. To **study** the concepts of both positive and negative feedback in electronic circuits and feedback oscillators

CO.4. To **explore** the theoretical & circuitry details of the design of an Op-amp, which is the backbone for the basics of Linear integrated circuits.

CO.5. To realize the functional block diagram of NE565/NE566 and an application of IC555 timer as monostable and astable multivibrators.

CO.6. To **learn** design guide lines of power supply after understanding series and shunt voltage regulator, 78xx and 79xx series.

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Semiconductor devices** Brief overview of semiconductor and junction diode. Introduction to BJT and FET (JFET & MOSFET). Major applications of diode, JFET,MOSFET	3	1
Module: 2	**Biasing of BJT** Transistor Biasing Circuits: Different types of biasing circuits for BJT , stability factors, bias compensation, dc & ac load line analysis and	3	1

	thermal runaway. stability factors		
Module: 3	**Transistor Amplifier** Small Signal Analysis of BJT: Transistor hybrid model, derivation of voltage gain, current gain, input impedance and output impedance, trans-conductance, low frequency small signal analysis of CE, RC coupled amplifier using hybrid-π model and determination of voltage gain, current gain, input impedance and output impedance, Frequency response of a RC , Over view of Power Amplifiers	7	2
Module: 4	**Feedback and Oscillator Circuits:** Feedback concept, Feedback topologies, classification of amplifiers, Bark-Hausen criteria. Oscillators- Wien bridge oscillator, Phase shift oscillator and Crystal oscillator.	4	3
Module: 5	**Operational Amplifier** Operational Amplifier (OPAMP): Ideal OPAMP, Block diagram of the internal circuit of OP amp, Equivalent circuit, characteristics, Inverting and non-inverting configuration (ideal & Practical), Different parameters like CMRR, slew rate, offset voltage & current, offset minimizing techniques etc. **Applications of OP AMP** **Linear applications OPAMP**: Inverting & Non inverting amplifier, differential amplifier, Instrumentation amplifier and its application, Summing amplifier, adder, scaling amplifier, subtractor , V-I and I- V converter, log and anti-log amplifier, precision rectifier (half & full wave), Analog multiplier, integrator and differentiator (ideal & Practical), AC amplifier, Wave generation using opamp, Analog Computation techniques :solution of differential equation & simultaneous equations , Practical problems using OP AMP **Nonlinear applications OPAMP**: Comparator, Zero crossing detector , Schmitt Trigger	13	4
Module: 6	**Multi-vibrator, PLL & Regulators** Introduction to multi-vibrator, IC555, Introduction to VCO & PLL, NE565/NE566. Linear Voltage Regulator: Series and Shunt, IC based, power supply design.	6	5 & 6

Text Books:

1. Electronic circuits : Discrete and Integrated . by Donald Schilling , Charles Belove , Tuvia Apelewicz , Raymond Saccardi
2. D. Roy Choudhury & Shail B. Jain, Linear Integrated Circuits, New Age International Publishers Ltd., New Delhi.
3. Adel S. Sedra & Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, New Delhi.
4. Jacob Millman & Christos C. Halkias, Integrated Electronics, McGraw Hill.
5. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, PHI Learning,New Delhi.

Reference Books:

1. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition, McGraw Hill.
2. Robert   L.   Boylestad & Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson/PHI, New Delhi.
3. Theodore F. Bogart, Jeffrey S. Beasley, & Guillermo Rico, Electronic Devices and Circuits, Pearson/PHI, New Delhi.
4. Operational Amplifiers & Linear Integrated Circuits - R. F. Coughlin and F. F. Driscoll

Digital Electronic Circuits

Course Name: Digital Electronic Circuits	**Category: Professional Core Courses**
Course Code: PC EI 304	**Semester: 3RD**
L-T-P: 3-0-0	**Credit: 3**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Continuous Assessment: 25Marks
Tutorial: Nil	Attendance: 5 Marks
Total Lectures: 45	End Semester Exam.: 70 Marks
Pre-Requisites: Basic Electronics Engineering	

Objectives:

The objective of this course is to acquire the basic knowledge of digital logic circuits and its applications useful to design and implementation of real time digital system.

The subject aims to encourage the students with the followings:-

1. Introduce the concept of digital and binary systems.
2. The concept of Boolean algebra and simplification of logic circuits with K-map and QuineMcClausky (Q-M) method.
3. Design and analysis of combinational & arithmetic logic circuits.
4. Design and analysis of sequential logic circuits.
5. The theoretical & circuitry details of various A/D and D/A converters.
6. Basic knowledge of various memory and programmable logic devices & Families using in digital system.

Course Outcomes (COs):

On completion of this course, the student will be able to

CO.1. **Apply** different type of codes and number systems which are used in digital computing and communication systems.
CO.2. **Develop** different types Logic circuit simplification using various mapping and mathematical methods.
CO.3. **Analyze, design and implement** combinational including arithmetic logic circuits.
CO.4. **Analyze, design and implement** sequential logic circuits.
CO.5. **Built** the fundamental knowledge and analyze the operation of various A/D and D/A converters.
CO.6. **Identify** various types of memory elements, PLDs, digital logic families and apply the knowledge in different types of digital circuits for real world application.

Module No.	Description of Topics	Contact Hrs.	CO
Module: 1	**Number System and Codes** Introduction to Digital system, Data and number systems,	4	1

	Decimal, binary, octal and hexadecimal number systems and their arithmetic operations; conversion of one number system to another.		
	Binary codes, natural BCD codes, weighted, non-weighted, sequential, self-complementing, cyclic, Excess-3, Alphanumeric, EBCDIC and Gray codes, Code conversion-from one code to another.		
	Signed binary number representation with 1's and 2's complement methods, Binary arithmetic		
Module: 2	**Logic Gates and Boolean algebra** Logic Operation-NOT, AND, OR, NAND, NOR, XOR and XNOR –operations, truth tables and universal gates; commonly used 7400 series IC's, standard and IEEE symbols of logic gates. All Postulates and laws of Boolean algebra with proof, De Morgan's theorem. Minimization of Logic Expressions using Algebraic method. Canonical forms of expressions, minterms and maxterms, SOP and POS forms. Simplification and minimization of Logic Expressions using K-map method (up to 6 variables (focussing mainly up to 4 variables)). Concept of don't care and use of don't care terms in K-map method Limitation of K-map and Quine-McClausky (Q-M) method of minimization of logic functions and concept of PI, EPI, RPI, SPI.	6	2
Module: 3	**Combinational and arithmetic logic circuit:** Introduction to combinational circuits, Design procedure **Adders:** Half Adder, Full Adder, Binary parallel adder, Composite adder, Carry look ahead adder, BCD adder. **Multiplexers and Demultiplexer:** basic 2:1, 4:1, 8:1 multiplexer equation and circuit diagram. Implementation of higher order MUX using lower order MUX, function implementation using MUX, basic 1:2 and 1:4 DEMUX equation and circuit diagram. function implementation using	6	3

	DEMUX, application of MUX and DEMUX		
	Encoder & Decoders: basic 2:4, 3:8, 4:16 decoder equation and circuit diagram. Implementation of higher order decoder using lower order decoder, function implementation using decoder. Application of Decoder		
	4:2 Encoders and Priority Encoders equation with circuit diagram. Application of DECODER and ENCODER		
	3 bit and 4 bit EVEN and ODD Parity Generator and checkers, 1 bit,2 bit,4 bit Magnitude Comparators with equation and circuit diagram		
	Code converter: Binary to Gray and Gray to Binary, BCD to XS-3 and XS-3 to BCD, BCD to Binary and Binary to BCD		
Module: 4	**Module Name: Sequential Logic Circuits** Concept of Sequential circuit, difference between combinational and sequential circuit, Introduction to latches (S-R Latch, NOR based S-R latch, NAND based S'-R' latch) with characteristic table, truth table, equation and circuit diagram. Introduction to different types of Flip-Flop (S-R, D, J-K, T) with characteristic table, truth table, Excitation table, equation and circuit diagram. Triggering of flip-flops, Asynchronous inputs in FF, race around condition, Master-slave configuration; Conversion of Flip-flop and application of FF. **Asynchronous & Synchronous counters** - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter Synchronous counters - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter, Truncated Counter, Arbitrary sequence counter. **Registers:** left, right, serial and parallel shift registers (SISO, SIPO, PIPO, PISO), Bi-directional and universal shift registers, Ring and Johnson (twisted ring) counters, application of register.	10	4
Module: 5	**Module Name: Analog - Digital Conversion** Introduction to analog- digital data conversion, specification of	4	5

	D/A converter. D/A conversion- R-2R ladder type, weighted resistor type. Specification of A/D converter; ~~A/D conversion- Flash type~~ A/D conversion- Flash type, successive approximation type and dual-slope type, **sigma delta converters (introduction)**		
Module: 6	**Module Name: Memory and Programmable Logic Devices & Families** Types of Memory and basic definition – Register, Main memory, secondary memory, sequential access memory, random access memory, static and dynamic memory, volatile and nonvolatile memory, magnetic and semiconductor memory, ROM, PROM, EPROM, EEPROM, RAM, DRAM, SRAM Memory decoding, Memory expansion Design of combinational logic circuit using ROM PLA, PAL **Introduction to Digital Logic Families:** classification of Digital Logic Families; characteristics of Digital ICs. TTL: characteristics, Totem-Pole output, Open Collector output, Tri-state output, ECL: characteristics, OR/NOR gate. MOS: characteristics, PMOS, NMOS. CMOS: characteristics NAND, NOR, logic circuit realization.	6	6

Text Books:

1. Digital Fundamentals by T.L. Floyd &R.P.Jain (Pearson).
2. Fundamental of digital circuits by A. Anand Kumar (PHI).
3. Digital Electronics, RishabhAnand (Khanna Publishing House)
4. Digital Integrated Electronics by H. Taub& D. Shilling (TMH).

Reference Books:

1. Digital Circuit & Design by S. Aligahanan&S.Aribazhagan (Bikas Publishing)
2. Digital Electronics by A.K. Maini (Wiley-India)
3. Digital Circuits-Vol-I & II by D. RayChaudhuri (Platinum Publishers)
4. Modern Digital Electronics by R.P. Jain (McGraw Hill)
5. Digital Principles and Applications - Albert P. Malvino and Donald P. Leach

Environmental Science

Course Name : Environmental Science	Category: Mandatory Courses
Course Code : MC-ES301	Semester: 3rd
L-T-P: 2-0-0	Credit: 0
Teaching Scheme	Examination Scheme
Theory: 2 hrs./week	Continuous Assessment: 25
Tutorial: Nil	Attendance: 5
Total Lectures: 30	End Semester Exam: 70
Pre-Requisites: No-prerequisite	

Objective:

1. Be able to understand the natural environment and its relationships with human activities.
2. Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
3. Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
4. Be able to solve scientific problem-solving related to air, water, noise & land pollution

Course Outcome:

CO.1. Understand the components of natural environment, its relationships with human activities and also analyze human impacts on the environment.

CO.2. Understand key current environmental problems as well as be conversant with basic environmental legislation.

CO.3. Identify and value the effect of the pollutants on the environment: atmosphere (air and noise), water and soil.

CO.4. Analyze the mathematical principles for successful solution of practical environmental engineering problems which in turn helps to solve any environmental issue arose during core industrial process or final uncontrolled as well as unplanned discharge.

CO.5. Analyze an industrial activity and identify the environmental problems related to that activity as well as apply the basics of an Environmental Management System (EMS) to a core industrial activity.

CO.6. Plan strategies to monitor different types of pollution along with selection of the most appropriate technique to purify, reduce and/or control the emission of pollutants.

Module No.	Description of Topics	Contact Hrs.	CO

Module: 1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.	4	1
Module: 2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hotspot, Threats to biodiversity, Conservation of biodiversity.	4	2
Module: 3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earthasalbedo], Problems. global climate and consequently on sea water level, agriculture and warming. Earth's heat budget.Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur,particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief references	8	3
Module: 4	Hydrosphere, Hydrological cycle and Natural water.	6	4

	Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic		
Module: 5	Lithosphere; Internal structure of earth, rock and soil Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).	3	5
Module: 6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighborhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18hrIndex), Ld_n .Noise pollution control. Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	5	6

References:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.

Numerical Methods Lab

Name of the Course: Numerical Methods Lab	Category: Basic science Courses
Course Code: BS-M 391	Semester:3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination scheme: Maximum marks:
Tutorial: Nil	External Assessment:60
Practical: 2 hrs./week	Internal Assessment:40
Credit Points: 1	

Course Outcomes:	
CO. 1	To solve problems with Newton forward /backward, Lagrange's interpolation.
CO. 2	To solve problems of numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule
CO. 3	To find numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
CO. 4	To find numerical solution of Algebraic Equation by Regula-Falsi and Newton Raphson methods.
CO. 5	To Find the numerical solution to ordinary differential equation by Euler's and Runga-Kutta methods.
CO. 6	Use Software packages like MATLAB, SCILAB, LABVIEW, PYTHON, MATHEMATICA to solve numerical problems
Pre-Requisite:	
1	BS-M101, BS-M202, BS-M301

Experiment No.	Laboratory Experiments	COs
1	Assignments on Newton forward /backward, Lagrange's interpolation.	CO.1
2	Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.	CO.2
3	Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations	CO.3
4	Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.	CO.4
5	Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.	CO.5
6	Introduction to Software Packages: Matlab / Python/ Labview / Mathematica	CO.6

Text and reference books:

1. C.Xavier: C Language and Numerical Methods.
2. E. Balagurusamy: Numerical Methods, Scitech.
3. R.S. Salaria: Numerical Methods, Khanna Publishing House
4. Rudra Pratap, Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers,Oxford University Press.
5. Mark Lutz and David Ascher, Learning Python, Published by O'Reilly & Associates.

Circuit Theory Lab

Name of the Course: Circuit Theory Lab	Category: Professional Core
Course Code: PC-EI 391	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination scheme:
Tutorial: Nil	External Assessment:60
Practical: 3 hrs./week	Internal Assessment:40
Credit Points:1.5	

Course Outcomes: *At the end of the course, a student will be able to:*	
CO. 1	To understand basic concepts of DC and AC circuit behavior.
CO. 2	To apply the concepts of circuit laws for analysis of different circuit performance and determination of different circuit parameters.
CO. 3	To understand the requirement of frequency response of any practical circuit.
CO. 4	To develop the software skill for analyzing different transformation tool and design of electrical circuit based simulations.
CO. 5	To measure and record the experimental data, analyze the results, and prepare a technical laboratory report.
CO. 6	To design circuits with appropriate instruments and safety precautions.
Pre-Requisite:	
1	Knowledge of various passive and active components are required.
2	Concepts of basic electrical parameters and their measuring technique are needed.
3	Theories of different circuit laws are essential.

Experiment No.	Laboratory Experiments	COs
1	Transient response in R-L and R-C Network: Simulation/hardware	CO 1, 2, 5, 6
2	Transient response in R-L-C Series circuits Network: Simulation/hardware	CO 1, 2, 5, 6
3	Determination of Impedance (Z) and Admittance(Y) parameters of two port network	CO 2, 5
4	Frequency response of LP and HP filters	CO 1, 2, 3, 5, 6
5	Frequency response of BP and BR filters	CO 1, 2, 3, 5, 6
6	Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, and Ramp signals using MATLAB in both discrete and analog form.	CO 4, 5

7	Determination of Laplace transform and inverse Laplace transformation using MATLAB	CO 4, 5
8	Design and Implementation of Mini Project.	CO 5, 6

Text and reference books:

- Network and Systems, D. Roychowdhury,(New Age International)
- Network Analysis, M.E.Van Valkenburg (Prentice Hall)

Special Remarks (If any):

Student can learn PSPICE simulation also to buildup software knowledge.

Sensors and Transducers Lab:

Name of the Course: Sensors and Transducers Lab	Category: Professional Core
Course Code: PC-EI 392	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination scheme:
Tutorial: Nil	External Assessment:60
Practical: 2 hrs./week	Internal Assessment:40
Credit Points: 1.5	

Course Outcomes: At the end of the course, learner will be able to	
CO. 1	Identify different types of sensors & transducers which are used for temperature, speed, torque, displacement, light intensity measurement in industry as well as home appliances.
CO. 2	Demonstrate the operations of different sensors and transducers based measurement systems.
CO. 3	Select the appropriate sensor depending on application criteria.
CO. 4	Characterize different types of sensors and draw the related curves.
CO. 5	Understand the safety and maintenance issues related to different sensor based systems.
CO. 6	Function effectively as an individual and as a member in teams at the time of executing laboratory experiments.
Pre-Requisite:	
1	Theoretical knowledge of Sensors and Transducers and awareness of laboratory safety issues.

Experiment No.	Laboratory Experiments	COs
1	Displacement measurement by using a capacitive transducer.	1 - 6

2	Displacement measurement by using LVDT.	1 - 6
3	Study of a load cell with tensile and compressive load.	1 - 6
4	Torque measurement using Strain gauge transducer.	1 - 6
5	Displacement measurement using Hall proximity sensor.	1 - 6
6	Study of the characteristics of a LDR.	1 - 6
7	Speed measurement using a Stroboscope.	1 - 6
8	Temperature measurement using RTD.	1 - 6
9	Mandatory Design and Implementation of Mini Project.	CO1-6

Analog Circuits Design Lab

Name of the Course: Analog Circuits Design Lab	Category: Professional Core Course
Course Code: PC-EI393	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination scheme:
Tutorial: Nil	External Assessment:60
Practical: 3 hrs./week	Internal Assessment:40
Credit Points: 1.5	

Course Outcomes:	
CO. 1	Set up standard experimental methods and select proper instruments to evaluate performance characteristics of different electronic circuits
CO. 2	Determine experimental procedures for different types of electronic circuits.
CO. 3	Evaluate possible reasons of inconsistency between experimental observations and theoretical values and interpret the experimental data.
CO. 4	Investigate different types of instruments connections keeping in mind technical, economical, safety issues.
CO. 5	Analyze graphical presentations of experimental data and solve different complex technical problems.
CO. 6	Design mini electronic based systems.
Pre-Requisite:	
1	Basic Electronics

Experiment No.	Laboratory Experiments	COs
1	Introduction: Study of characteristics curves of B.J.T &F.E.T	1-5
2	Construction of a two-stage R-C coupled amplifier & study of its gain & Bandwidth.	1-5
3	Study of class A & class B power amplifiers.	1-5
4	Study of class C & Push-Pull amplifiers.	1-5
5	Realization of current mirror & level shifter circuit using Operational Amplifiers.	1-5

6	Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.	1-5
7.	Construction & study of Bistable multivibrator using NE555.	1-5
8.	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.	1-5
9.	Construction of a simple function generator using IC.	1-5
10.	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).	1-5
11.	Study of DAC & ADC.	1-5
12.	Mandatory Design and Implementation of Mini Project.	6

Text and reference books:

1. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, PHI Learning, New Delhi.
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition, McGraw Hill.
3. Robert L. Boylestad & Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson/PHI, New Delhi.
4. Theodore F. Bogart, Jeffrey S. Beasley, &Guillermo Rico, Electronic Devices and Circuits, Pearson/PHI, New Delhi.
5. L.K. Maheshwari, Analog Electronics, Laxmi Publications, New Delhi

Digital Electronics Lab

Course Name: Digital Electronics Lab	Category: Professional Core
Course Code: PC-EI 394	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination scheme:
Tutorial: Nil	External Assessment:60
Practical: 3 hrs./week	Internal Assessment:40
Credit Points: 1.5	

Course Outcomes:	
CO. 1	Have a thorough **understanding** of the fundamental concepts and techniques used in digital electronics.
CO. 2	To **understand and examine** the structure of various number systems and its application in digital design.
CO. 3	The ability to **understand, design and analyze** various combinational and sequential circuits
CO. 4	**Develop** competence in Combinational and Sequential Logic Problem formulation and Logic Optimization
CO. 5	**Develop** skill to build, and troubleshoot digital circuits.
CO. 6	Ability to **identify** basic requirements for a design application and propose a cost effective solution.

Pre-Requisite:	
1	Mathematics Fundamentals

Experiment No.	Laboratory Experiments	COs
1.	Realization of basic gates using Universal logic gates.	CO1,2
2.	Code conversion circuits- BCD to Excess-3 & vice-versa.	CO1-6
3.	Construction of simple arithmetic circuits-Adder, Subtractor.	CO1-6
4.	4-bit parity generator & comparator circuits.	CO1-6
5.	Construction of simple Decoder & Multiplexer circuits using logic gates.	CO1-6
6.	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.	CO1-6
7.	Realization of RS-JK & D flip-flops using Universal logic gates.	CO1-6
8.	Realization of Asynchronous Up/Down counter.	CO1-6
9.	Realization of Synchronous Up/Down counter.	CO1-6
10.	Realization of Universal Register using JK flip-flops & logic gates.	CO1-6
11.	Realization of Universal Register using multiplexer & flip-flops.	CO1-6
12.	Construction of Adder circuit using Shift Register & full Adder.	CO1-6
13.	Realization of Ring counter & Johnson's counter.	CO1-6
14.	Construction of adder circuit using Shift Register & full Adder.	CO1-6
15.	Mandatory Design and Implementation of Mini Project.	CO1-6