Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

SECOND YEAR 3rd SEMESTER PROPOSED SYLLABUS

Course Code : BS-M 301	**Category: Basic science Courses**
Course Name : Mathematics - III	**Semester : Third**
L-T-P :2-1-0	**Credit: 3**
Total Lectures: 45	
Pre-Requisites: Knowledge of limit, continuity and derivative. Knowledge of Integration, especially definite integral and improper integral. Knowledge of basic probability.	

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 to engineers.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	**Basic Probability:** 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.	8
2	**Continuous Probability Distributions:** Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.	4
3	**Laplace Transformation:** Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of $\frac{f(t)}{t}$, LT of $t^n f(t)$, LT of derivatives of $f(t)$, L.T. of $\int f(u)du$. Evaluation of improper integrals using LT, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT.	9
4	**Fourier Transformation:** Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation,	8

	Examples. Fourier Transform of Derivatives, Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Solution of integration by inverse Fourier transform. Examples.	
5	**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.	7
6	**Numerical integration and Numerical solution of equations:** Trapezoidal rule, Simpson's 1/3 rule for Integration. Bisection method, Newton-Raphson method and Regular Falsi method algebric and transcendental equation. Euler's method, Runge-Kutta methods for ordinary differential equation.	9

Note: For each module minimum two case studies

Course Outcomes:

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:

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.
2. Find the Laplace transform of a function by definition and by use of a table and the inverse Laplace transform of a function.
3. Describing the techniques of Fourier transform and using them to transform a problem into one that can be more easily solved.
4. Apply numerical methods to obtain approximate solutions of mathematical problems.

Text Books:

1. AP Baisnab and Jas M-Elements of Probability and Statistics.
2. R. J. Beerends -Fourier and Laplace Transforms.
3. S. Ali Mollah-Numerical Analysis and Computational Procedures.
4. Balagurusamy-Numerical Methods.
5. R.S. Salaria, Computer Oriented Numerical Methods, Khanna Publishing House, New Delhi.
6. C.Xavier: C Language and Numerical Methods.

Reference Books:

1. D. C. Sanyal, K. Das: A Text Book of Numerical Analysis.
2. Dr. S.K. Sarkar & Dr. D.N. Ghosh: Numerical Methods and Programming.
3. HK Dass-Advanced Engineering Mathematics
4. Chadrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI301	**Category: Professional Core Courses**
Course Name : Network Analysis	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
Pre-Requisites: No-prerequisite	

Objectives:

1. To understand circuit analysis techniques using fundamental network theorems.
2. To model and solve electric circuits in the frequency domain.
3. To find the relevance of graph theory in electric networks.
4. To understand the properties of magnetic coupling.
5. To perform network analysis with different types of two port network.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	**Introduction:** Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals. Network equations: Kirchoff's Voltage Law & Current Law, Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis.	8
2	**Network theorem:** Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem, Reciprocity theorem, Solution of Problems with DC & AC sources.	8
3	**Resonant Circuits:** Analysis of R-C, R-L and R-L-C circuits under AC excitation using phasors. Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Resonant voltage rise, Transform diagrams, Solution of Problems.	8
4	**Laplace transforms:** Transient analysis of R-C, R-L and R-L-C circuits with step excitation. Laplace transform and representation of periodic and periodic signals in Laplace domain. Application of Laplace transform for the analysis of R-C, R-L and R-L-C circuits with step, impulse and ramp input. AC and DC transient analysis of R-L, R-C & RLC circuits.	7
5	**Coupled circuits:** Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits, Solution of problems. **Graph of Network**: Concept of Tree, Branch, Tree link, junctions, Incident matrix, Tie-set matrix and loop currents, Cut-set matrix and node pair potentials, duality, solution of problems.	9

6	**Two port networks analysis**: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems with DC & AC sources.	5

Course Outcomes:

1. To apply the knowledge of various components in circuit analysis.
2. To solve and analyze the circuits using different network theorems.
3. To solve electrical circuits using graph theory.
4. To analyze the electrical circuits containing passive elements under resonance conditions.
5. To use mathematical tools to analyze electrical networks in time domain and frequency domain.
6. To find solutions of electrical circuits applying the knowledge of two port parameters.

Learning Resources

Textbook:

1. Asfaq Husain, Networks and Systems, Khanna Publishing House, New Delhi
2. AChakrabarty," Circuit Theory Analysis & Synthesis", DhanpatRai
3. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
4. D. Roy Choudhary, Networks and Systems, Newage Publications, New Delhi

Reference book:

1. S P Ghosh, "Circuit Theory and Networks", Tata McGraw Hill.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Networks- Analysis and Synthesis", McGraw Hill Education, (2015).
3. D. Chattopadhyay and P.C. Rakshit: "Fundamentals of Electrical Circuit Theory", S. Chand

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI302	**Category: Professional Core Course**
Course Name : Sensors and Transducers	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
Pre-Requisites: No-prerequisite	

Objectives:

Throughout their careers as professional engineers and scientists in leading industries and institutions, students will be required to use measurement systems to collect field data for sensors and transducers. The goal of this course is to provide graduate students with a well-founded background in the theory of engineering measurements using sensor technology. With this in mind, this course focuses on principle of measurement, various types of Sensors & Transducers and their working principle for measuring typical physical quantities in solid and fluid mechanical systems.

To gain knowledge about the measuring instruments, the methods of measurement and the uses of different transducers following concepts have to be covered

1. Classification and descriptions of transducers
2. Optical, mechanical, thermal, magnetic, chemical and smart sensors
3. Sensor characteristics
4. The properties of a number of useful sensors for measuring position, temperature, strain, force, light etc.
5. Design instrumentation that senses desired quantities, transducers to an analogous electrical signal, and amplifies and filters that signal for interfacing to a microcomputer

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction, Definition, significance of measurement and instruments, General concepts and terminology of measurement systems, Static & dynamic characteristics of instruments, Different types of instruments, Types of errors, Limiting error with examples. Principle of sensing & transduction, transducer classification, emerging fields of sensor technologies.	**8**
2	**Resistive transducers:** Potentiometers: types, loading error, metal and semiconductor strain gauges, types, resistance measuring methods, strain gauge applications: Load and torque measurement.	5
3	**Inductive transducers:** Transformer type, synchros, eddy current transducers, LVDT: Construction, material, input-output characteristics. **Optical Sensors:** LDR, Photo Diode, Stroboscope, IR Sensor.	8
4	**Capacitive transducers:** Variable distance-parallel plate type, variable area- parallel plate type, cylindrical type, differential type, variable dielectric constant type, calculation of sensitivity.	10

	Capacitive microphone, fluid level measurement. Piezoelectric transducers, proximity sensors. **Magnetic Transducer:** Hall effect sensors, Magnetostrictive transducers, Seismic instrument.	
5	**Thermal sensors:** Resistance temperature detector (RTD): principle, materials and types; Thermistor: principle, materials and types; Thermocouple, Thermoelectric effects, laws of thermocouple, thermocouple types, construction. IC temperature sensor.	7
6	**Micro-sensors and smart sensors:** Construction, characteristics and applications. Standards for smart sensor interface. **Recent Trends in Sensor Technologies:** Introduction; Film sensors (Thick film sensors, thin film sensor)	7

Course Outcomes:

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

1. Apply basic concepts to distinguish different sensors and transducers and also compare the methods of measurements
2. Identify suitable transducer by comparing different industrial standards and procedures for most complex measurement of several physical parameters
3. Estimate the performance of different transducers and interpret the data accurately
4. Develop the skill to identify and analyze the complex technical problems and also capable to give a socio-economic solution to that problem
5. Acquire the knowledge of independent thinking to design real life electronics and instrumentation measurement systems helpful for humanities
6. Build the fundamental concept of latest technological trends like smart sensors, bio-sensors, PLC and Internet of Things.

Learning Resources

Text Books:

1. Murthy D. V. S, “Transducers and Instrumentation”, Prentice Hall, New Delhi.
2. D. Patranabis, “Sensors and Transducers”, 2nd Edition, Prentice Hall India Pvt. Ltd.
3. Doebelin E.O, “Measurement Systems - Application and Design”, 4th Edition, McGraw-Hill, New York, 2003

Reference Books:

1. Neubert H.K.P, “Instrument Transducers - An Introduction to their Performance and Design”, 2nd Edition, Oxford University Press, Cambridge.
2. Waldemar Nawrocki, “Measurement Systems and Sensors”, Artech House.
3. S.M. Sze, “Semiconductor sensors”, John Wiley & Sons Inc., Singapore.
4. B. C. Nakara&Chaudhry, “Instrumentation Measurement and Analysis”, TATA McGraw-Hill, New Delhi.
5. Smart Sensors and Sensing Technology, Daniel E. Suarez, Nova Science Publishers.

Course Code : PC-EI303	**Category: Professional Core Course**
Course Name : Analog Integrated Circuits	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
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 Integrated Circuit, which form the building blocks of almost any electronic system.

The subject aims to provide the student with:

1. In-depth understanding of different biasing arrangement in transistor circuits and also the calculation of operating point or Q-point in different biasing circuits.
2. An extensive knowledge and perception of h-model and high frequency model of transistors.
3. The concepts of both positive and negative feedback in electronic circuits.
4. The broad knowledge of the operation of Transistor amplifiers, oscillators and power supplies.
5. The theoretical & circuitry details of the design of an Op-amp, which is the backbone for the basics of Linear integrated circuits.
6. Some useful applications of Operational Amplifiers in the field of electronics and instrumentation.
7. The functional block diagram of NE565/NE566 and an application of IC 555 timer as monostable and astable multivibrators.
8. An overview of series and shunt voltage regulator, 78xx and 79xx series.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Brief overview of semiconductor and junction diode. Introduction to BJT and FET (JFET & MOSFET). **Transistor Biasing Circuits:** Different types of biasing circuits for BJT and FET, stability factors, bias compensation, dc & ac load line analysis and thermal runaway.	10
2	**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, CB and CC type RC coupled amplifier using hybrid-π and T model, determination of voltage gain, current gain, input impedance and output impedance, analysis of high frequency model. Frequency response of a RC coupled amplifier.	8
3	**Feedback and Oscillator Circuits:** Feedback concept, Feedback topologies, classification of amplifiers, Bark-hausen criteria,	5

	Oscillators- Wien bridge oscillator, Phase shift oscillator and Crystal oscillator.	
4	**Operational Amplifier (OPAMP):** Ideal OPAMP, Equivalent circuit, characteristics, Inverting and non-inverting configuration (ideal & Practical), summer, unity gain buffer, Differential amplifier, CMRR.	6
5	**OPAMP Applications**: Instrumentation amplifier and its application, comparator (zero crossing & Schmitt trigger), V-I and I-V converter, log and anti-log amplifier, precision rectifier (half & full wave), integrator and differentiator (ideal & Practical), IC 555 timer in monostable and astable mode.	10
6	Introduction to multi-vibrator, IC555, NE565/NE566. Linear Voltage Regulator: Series and Shunt, IC based power supply design.	6

Course Outcomes:

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

1. Apply the knowledge more effectively during the study of analog integrated circuits.
2. Analyze and design simple circuits containing non-linear elements such as Transistors using the concepts of load lines, operating points and incremental analysis.
3. Understand the Mid – band analysis of RC coupled amplifier circuits using small - signal equivalent circuits to determine gain, input impedance and output impedance.
4. Learn how operational amplifiers are modelled and analysed.
5. Design Op-Amp circuits to perform operations such as amplification, integration and differentiation on electronic signals
6. Learn how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator
7. Acquire experience in building and trouble-shooting simple analog electronic circuits.
8. Analyze where and how analog components are used.

Learning Resources

Text Books:

1. A.K. Maini, Analog Electronics, Khanna Publishing House, New Delhi
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.

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&LouisNashelsky, 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

Course Code : PC-EI304	**Category: Professional Core Course**
Course Name : Digital Electronic Circuits	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
Pre-Requisites: No-prerequisite	

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 any 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 Quine-McClausky (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 Content:

Module No.	Description of Topic	Contact Hrs.
1	**Number System and Codes :** o Introduction to Digital system, Data and number systems, Decimal, binary, octal and hexadecimal number systems and their arithmetic operations; conversion of one number system to another. o 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. o Signed binary number representation with 1's and 2's complement methods, Binary arithmetic	5
2.	**Logic Gates and Boolean algebra :** o 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. o All Postulates and laws of Boolean algebra with proof, De Morgan's theorem. Minimization of Logic Expressions using Algebraic method. o Canonical forms of expressions, minterms and maxterms, SOP and POS forms. o Simplification and minimization of Logic Expressions using K-	7

	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 o Limitation of K-map and Quine-McClausky (Q-M) method of minimization of logic functions and concept of PI, EPI, RPI, SPI.	
3	**Combinational and arithmetic logic circuit:** o Introduction to combinational circuits, Design procedure o Adders: Half Adder, Full Adder, Binary parallel adder, Composite adder, Carry look ahead adder, BCD adder. o 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 DEMUX, application of MUX and DEMUX o 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 o 3bit and 4 bit EVEN and ODD Parity Generator and checkers, 1 bit,2 bit,4 bit Magnitude Comparators with equation and circuit diagram o 4:2 Encoders and Priority Encoders equation with circuit diagram. Application of DECODER and ENCODER o 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	7
4.	**Sequential Logic Circuits:** o 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. o Introduction to different types of Flip-Flop(S-R, D, J-K, T) with characteristic table, truth table, Excitation table, equation and circuit diagram. o Triggering of flip-flops, Asynchronous inputs in FF, race around condition, Master-slave configuration; Conversion of Flip-flop and application of FF. o 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. o Asynchronous 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.	12
5.	**Analog - Digital Conversion:** o Introduction to analog- digital data conversion, specification of D/A converter.	6

	○ 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.	
6	**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 non volatile 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.	8

Course Outcomes:

On completion of this course, the student will be able to
1. Apply different type of codes and number systems which are used in digital computing and communication systems.
2. Develop different types Logic circuit simplification using various mapping and mathematical methods.
3. Analyze, design and implement combinational including arithmetic logic circuits.
4. Analyze, design and implement sequential logic circuits.
5. Built the fundamental knowledge and analyze the operation of various A/D and D/A converters.
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.

Learning Resources

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, Rishabh Anand (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)

Course Code : MC-ES301	**Category: Mandatory Courses**
Course Name : Environmental Science	**Semester : Third**
L-T-P :2-0-0	**Credit: NIL**
Total Lectures: 30	
Pre-Requisites: No-prerequisite	

Course Content:

Module No.	**Description of Topic**	**Contact Hrs.**
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
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 Hot-spot, Threats to biodiversity, Conservation of biodiversity.	4
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, earth as albedo], Problems. Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and	8

	marine food.Global warming and its consequence, Control of Global 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 reference).	
4	Hydrosphere, Hydrological cycle and Natural water. 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	6
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

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, $L_{10}(18\,\text{hr Index})$, Ld_n. Noise pollution control. Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	5

Learning Resources
References:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi, 2018
3. De, A. K., "Environmental Chemistry", New Age International.
4. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi 2019

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI391	**Category:** Professional Core Course
Corse Name : Circuits and Network Lab	**Semester : 3rd**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

Laboratory Experiments :	
1	Transient response in R-L and R-C Network: Simulation/hardware
2	Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware
3	Determination of Impedance (Z) and Admittance(Y) parameters of two port network
4	Frequency response of LP and HP filters
5	Frequency response of BP and BR filters
6	Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
7	Determination of Laplace transform and inverse Laplace transformation using MATLAB
8	Spectrum analysis of different signals
9	Mandatory Design and Implementation of Mini Project

Course Outcomes:

1. To identify various circuit components for their appropriate use in the experiments.
2. To apply the concepts of circuit laws and theorems for analysis and verification of laboratory measurements.
3. To develop the software skill for analysis and design of circuit based simulations.
4. To acquire technical writing skill for effective representation of experimental works.
5. To effectively communicate among fellow group members for proper distribution and execution of laboratory assignments.

Course Code : PC-EI392	**Category: Professional Core Course**
Corse Name : Sensors and Transducers Lab	**Semester : Third**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

Laboratory Experiments :	
1	Temperature measurement using AD590 IC sensor.
2	Displacement measurement by using a capacitive transducer.
3	Pressure and displacement measurement by using LVDT.
4	Study of a load cell with tensile and compressive load.
5	Torque measurement Strain gauge transducer.
6	Speed measurement using magnetic proximity sensor.
7	Speed measurement using a Stroboscope.
8	Study of the characteristics of a LDR.
9	Mandatory Design and Implementation of Mini Project.

Course Outcomes:

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

1. Identify standard experimental methods and apply the theoretical knowledge to evaluate performance characteristics of different transducers.
2. Determine experimental procedures for different types of sensors and transducers.
3. Evaluate probable reasons of irregularity between experimental data and theoretical values and also interpret the experimental data.
4. Apply appropriate techniques to connect different types of sensors and source and sink devices keeping in mind technical, economical, safety issues.
5. Analyse graphical presentations of experimental data and solve different complex technical problems.
6. Design sensor based mini instrumentation systems.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI393	**Category: Professional Core Course**
Corse Name : Analog Circuits Design Lab	**Semester : Third**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

Laboratory Experiments :	
1	Introduction: Study of characteristics curves of B.J.T &F.E.T .
2	Construction of a two-stage R-C coupled amplifier & study of its gain & Bandwidth.
3	Study of class A & class B power amplifiers.
4	Study of class C & Push-Pull amplifiers.
5	Realization of current mirror & level shifter circuit using Operational Amplifiers.
6	Study of timer circuit using NE555 & configuration for monostable &astable multivibrator.
7	Construction & study of Bistable multivibrator using NE555.
8	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
9	Construction of a simple function generator using IC.
10	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
11	Study of DAC & ADC.
12	Mandatory Design and Implementation of Mini Project.

Course Outcomes:

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

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

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI394	**Category: Professional Core Course**
Corse Name : Digital Circuits Design Lab	**Semester : Third**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

Laboratory Experiments :	
1	Realization of basic gates using Universal logic gates.
2	Code conversion circuits- BCD to Excess-3 & vice-versa.
3	4-bit parity generator & comparator circuits.
4	Construction of simple Decoder & Multiplexer circuits using logic gates.
5	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6	Construction of simple arithmetic circuits-Adder, Subtractor.
7	Realization of RS-JK & D flip-flops using Universal logic gates.
8	Realization of Universal Register using JK flip-flops & logic gates.
9	Realization of Universal Register using multiplexer & flip-flops.
10	Construction of Adder circuit using Shift Register & full Adder.
11	Realization of Asynchronous Up/Down counter.
12	Realization of Synchronous Up/Down counter.
13	Design of Sequential Counter with irregular sequences.
14	Realization of Ring counter & Johnson's counter.
15	Construction of adder circuit using Shift Register & full Adder.
16	Mandatory Design and Implementation of Mini Project.

Course Outcomes:

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

1. Identify the operation of various basic logic gates ICs to implement different digital circuits.
2. Implement logic circuits for various code conversion, magnitude comparator and parity bit generator.
3. Demonstrate the basic operation of different combinational circuits including arithmetic circuits.
4. Demonstrate the basic operation of different flip-flops as a basic element of sequential circuits.
5. Evaluate the applications of flip-flops as binary registers and counters used in large digital integrated circuits.
6. Design mini digital electronic circuit based systems.