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 Structure

Second Year Third Semester								
Theory								
Sl No	**Category**	**Code**	**Course Title**	**Contact hrs/wk**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Basic Science Courses	BS-M301	Mathematics –III (Probability, Transformations and Numerical Methods)	2	1	0	3	3
2	Professional Core Courses	PC-EI301	Network Analysis	3	0	0	3	3
3	Professional Core Courses	PC-EI302	Sensors and Transducers	3	0	0	3	3
4	Professional Core Courses	PC-EI303	Analog Integrated Circuit	3	0	0	3	3
5	Professional Core Courses	PC-EI304	Digital Electronic Circuits	3	0	0	3	3
6	Mandatory Courses	MC-ES301	Environmental Science	2	0	0	2	
Total Theory								15
Practical								
1	Professional Core Courses	PC-EI391	Circuits and Network Lab	0	0	3	3	1.5
2	Professional Core Courses	PC-EI392	Sensors and Transducers Lab	0	0	3	3	1.5
3	Professional Core Courses	PC-EI393	Analog Circuits Design Lab	0	0	3	3	1.5
4	Professional Core Courses	PC-EI394	Digital Circuits Design Lab	0	0	3	3	1.5
Total Practical								6
Total of Third Semester								21

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Second Year Fourth Semester								
Theory								
Sl No	**Category**	**Code**	**Course Title**	**Contact hrs/wk**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Core Courses	PC-EI401	Electrical & Electronic Measurement	3	0	0	3	3
2	Professional Core Courses	PC-EI402	Industrial Instrumentation	3	0	0	3	3
3	Professional Core Courses	PC-EI403	Microprocessor and Microcontroller	3	1	0	4	4
4	Engineering Science Courses	ES-CS401	Data Structure and algorithm	3	0	0	3	3
5	Basic Science Courses	BS-BIO401	Biology	3	0	0	3	3
6	Humanities and Social Sciences including Management Courses	HM-HU401	Values and Ethics in Profession	2	0	0	2	2
Total Theory								18
Practical								
1	Professional Core Courses	PC-EI491	Electrical & Electronic Measurement Lab	0	0	3	3	1.5
2	Professional Core Courses	PC-EI492	Microprocessor and Microcontroller Lab	0	0	3	3	1.5
3	Engineering Science Courses	ES-CS491	Data Structure and algorithm Lab	0	0	3	3	1.5
4	Humanities and Social Sciences including Management Courses	HM-HU481	Advanced Language Lab			2	2	1
Total Practical								5.5
Total of Fourth Semester								23.5

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Third Year Fifth Semester								
Theory								
Sl No	**Category**	**Code**	**Course Title**	**Contact hrs/wk**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Core Courses	PC-EI501	Control System	3	0	0	3	3
2	Professional Core Courses	PC-EI502	Communication Techniques	3	0	0	3	3
3	Professional Core Courses	PC-EI503	Electromagnetic Theory	3	0	0	3	3
4	Professional Elective Courses-I	PE-EI501/ PE-EI502	Fiber Optic Communication & Instrument/Introduction to MEMS	3	0	0	3	3
5	Open Elective Courses-I	OE-EI501/ OE-EI502	Embedded System/DBMS	3	0	0	3	3
6	Humanities and Social Sciences including Management Courses	HM-HU501	Economics for Engineers	2	0	0	2	2
Total Theory								17
Practical								
1	Professional Core Courses	PC-EI591	Control System Lab	0	0	3	3	1.5
2	Open Elective Courses -I	OE-EI591/OE-EI592	Embedded System Lab/DBMS Lab	0	0	3	3	1.5
3	Professional Core Courses	PC-EI593	Industrial Instrumentation Lab	0	0	3	3	1.5
4	Seminar	EI581	Seminar					2
Total Practical								6.5
Total of Fifth Semester								23.5

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(Applicable from the academic session 2018-2019)

Third Year Sixth Semester								
Theory								
Sl No	**Category**	**Code**	**Course Title**	**Contact hrs/wk**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Core Courses	PC-EI601	Process Control	3	0	0	3	3
2	Professional Core Courses	PC-EI602	Biomedical Instrumentation	3	0	0	3	3
3	Professional Elective Courses-II	PE-EI601/ PE-EI602	Power Electronics & Drives/Microelectronics and VLSI Technology	3	0	0	3	3
4	Open Elective Courses-II	OE-EI601/ OE-EI602	IoT/Artificial Intelligence	3	0	0	3	3
5	Open Elective Courses-III	OE-EI603/ OE-EI604	Digital signal Processing /Smart and Wireless Instrumentation	3	0	0	3	3
6	Mandatory Courses	MC-ES601	Indian Constitution and Cultures	1	0	0	1	
Total Theory								15
Laboratory								
1	Professional Core Courses	PC-EI691	Process Control Lab	0	0	3	3	1.5
2	Professional Core Courses	PC-EI692	Instrumentation System design Lab	0	0	3	3	1.5
3	Open elective -II	OE-EI691/ OE-EI692	IoT Lab/AI Lab	0	0	3	3	1.5
Total Practical								4.5
Total of Sixth Semester								19.5

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

(Applicable from the academic session 2018-2019)

Fourth Year Seventh Semester								
Theory								
Sl No	**Category**	**Code**	**Course Title**	**Contact hrs/wk**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Elective Courses-III	PE-EI701/ PE-EI702	Mechatronics/Digital Control System	3	0	0	3	3
2	Professional Elective Courses-IV	PE-EI703/ PE-EI704	Analytical Instrumentation/Robotics & Automation	3	0	0	3	3
3	Open Elective Courses-IV	OE-EI701/ OE-EI702	Non-Conventional Energy System/Non Destructive Testing	3	0	0	3	3
4	Engineering Science Courses	ES-CS701	Computer Networks	3	0	0	3	3
Total Theory								12
Practical								
1	Project Stage-I	PW-EI791	Project I					4
2	Industrial Training	EI781	Industrial Training Evaluation					1
Total Practical								5
Total of Seventh Semester								17

Fourth Year Eighth Semester								
Theory								
Sl No	**Category**	**Code**	**Course Title**	**Contact hrs/wk**				**Credit Points**
				L	**T**	**P**	**Total**	
1	Professional Elective Courses-V	PE-EI801/ PE-EI802	Power Plant Instrumentation/Nano Electronics	3	0	0	3	3
2	Open Elective Courses-V	OE-EI801/ OE-EI802	Digital Image Processing /Big Data Analysis	3	0	0	3	3
3	Humanities and Social Sciences including Management Courses	HM-HU801	Management Concept & Practice	2	0	0	2	2
Total Theory								8
Practical								
1	Project Stage-I	PW-EI891	Project II					8
2	Grand Viva	EI881	Grand Viva-Voce					1.5
Total Practical								9.5
Total of Eighth Semester								17.5

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Sl No	Category	Suggested Breakup of Credits (total 160)	
		Dept. of AEIE	**As per AICTE**
1	Humanities and Social Science including Management courses	10	**12**
2	Basic Science Courses	25	**25**
3	Engineering Science Courses including workshop, drawing basic of electrical/mechanical/computer etc.	23.5	**24**
4	Professional Core Courses	52	**48**
5	Professional Elective Courses relevant to chosen specialization/branch	15	**18**
6	Open subjects-Elective from other technical or emerging subject	18	**18**
7	Project work ,seminar and internship in industry or elsewhere	16.5	**15**
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]		**(non-credit)**
	Total	160	**160**

- Minor variation is allowed as per need of the respective disciplines.

SECOND YEAR 3rd SEMESTER PROPOSED SYLLABUS

Mathematics - III
Code: BS-M 301
Contacts: 2L+1T
Credits: 3
Total: 45

Course Content:

Module I

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.

[8L]

Module II

Continuous Probability Distributions: Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

[4L]

Module III

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. **[9L]**

Module IV

Fourier Transformation: Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation, Examples. Fourier Transform of Derivatives, Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Solution of integration by inverse Fourier transform. Examples.

[8L]

Module V

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. **[7L]**

Module VI

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.

[9L]

Note: For each module minimum two case studies

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. 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

Subject : Network Analysis
Code : PC-EI301
Contacts: 3L
Credit : 3
Total lectures: 45

Course Content:

Module I

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. **[8L]**

Module II

Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem, Reciprocity theorem, Solution of Problems with DC & AC sources.

[**8L**]

Module III

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.

[8L]

Module IV

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.

[**7L**]

Module V

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.

[**4L**]

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. [**5L**]

Module VI

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.

[5L]

Textbook:

1. AChakrabarty," Circuit Theory Analysis & Synthesis", DhanpatRai
2. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).

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

Course Name: Sensors and Transducers
Course Code: PC-EI302
Contacts: 3L
Credit: 3
Total lectures: 45

Course Content:

Module-I

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. **[8L]**

Module-II

Resistive transducers: Potentiometers: types, loading error, metal and semiconductor strain gauges, types, resistance measuring methods, strain gauge applications: Load and torque measurement. **[5L]**

Module-III

Inductive transducers: Transformer type, synchros, eddy current transducers, LVDT: Construction, material, input-output characteristics.
Optical Sensors: LDR, Photo Diode, Stroboscope, IR Sensor. **[8L]**

Module-IV

Capacitive transducers: Variable distance-parallel plate type, variable area- parallel plate type, cylindrical type, differential type, variable dielectric constant type, calculation of sensitivity. Capacitive microphone, fluid level measurement.
Piezoelectric transducers, proximity sensors.
Magnetic Transducer: Hall effect sensors, Magnetostrictive transducers, Seismic instrument.
[10L]

Module-V

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. **[7L]**

Module-VI

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) **[7L]**

Text Books:

1. Murthy D. V. S, “Transducers and Instrumentation”, Prentice Hall, New Delhi.
2. 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. WaldemarNawrocki, “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.

Subject: Analog Electronic Circuits
Code: PC-EI303
Contacts: 3L
Credit-3
Total lectures: 45

Course Content:

Module-I

Brief overview of semiconductor and junction diode. Introduction to BJT and FET (JFET & MOSFET). **[L-4]**

Transistor Biasing Circuits: Different types of biasing circuits for BJT and FET, stability factors, bias compensation, dc & ac load line analysis and thermal runaway. **[L-6]**

Module-II

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. **[L-8]**

Module-III

Feedback and Oscillator Circuits: Feedback concept, Feedback topologies, classification of amplifiers, Bark-hausen criteria, Oscillators- Wien bridge oscillator, Phase shift oscillator and Crystal oscillator. [**L-5]**

Module-IV

Operational Amplifier (OPAMP): Ideal OPAMP, Equivalent circuit, characteristics, Inverting and non-inverting configuration (ideal & Practical), summer, unity gain buffer, Differential amplifier, CMRR. **[L-6]**

Module-V

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. **[L-10]**

Module-VI

Introduction to multi-vibrator, IC555,NE565/NE566.
Linear Voltage Regulator: Series and Shunt, IC based, power supply design. [**L-6]**

Text Books:

1. D. Roy Choudhury&Shail B. Jain, Linear Integrated Circuits, New Age International Publishers Ltd., New Delhi.
2. Adel S. Sedra& Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, New Delhi.
3. 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.

Subject: Digital Electronic Circuits
Code : PC-EI304
Credit: 3
Total lectures: 45

Course Content:

Module-I

Number System and Codes [5L]

- 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.
- 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-II

Logic Gates and Boolean algebra [7L]

- 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.

Module-III

Combinational and arithmetic logic circuit [7L]

- 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 DEMUX, application of MUX and DEMUX
- 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
- 3bit and 4 bit EVEN and ODD Parity Generator and checkers, 1 bit,2 bit,4 bit Magnitude Comparators with equation and circuit diagram
- 4:2 Encoders and Priority Encoders equation with circuit diagram. Application of DECODER and ENCODER
- 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-IV

Sequential Logic Circuits [12L]

- 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.
- 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.
- 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,

Module-V

Analog - Digital Conversion [6L]

- Introduction to analog- digital data conversion, specification of 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.

Module-VI

Memory and Programmable Logic Devices & Families [8L]

- 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;

Textbook:

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

References:

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)

Subject: Basic Environmental Engineering & Elementary Biology
Code: MC-ES301
Contacts: 2L
Credit: NIL
Total lectures: 30

Course content:

Module-I

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. **[4L]**

Module -II

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. **[4L]**

Module-III

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 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). **[8L]**

Module-IV

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 **[6L]**

Module-V

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).

[3L]

Module-VI

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood 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. **[5L]**

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.

CIRCUITS AND NETWORK LAB
Code : PC-EI 391
Contacts : 3P
Credits :1.5
List of 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. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals and simulation of difference equations using MATLAB
8. Representation of poles and zeros in z-plane, determination of partial fraction expansion in z-domain and cascade connection of second order system using MATLAB
9. Determination of Laplace transform and inverse Laplace transformation using MATLAB
10. Spectrum analysis of different signals.
11. Mandatory Design and Implementation of Mini Project.

SENSORS AND TRANSDUCERS LAB
Code : PC-EI 392
Contacts : 3P
Credits :1.5

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.

ANALOG CIRCUITS DESIGN LAB
Code : PC-EI 393
Contacts : 3P
Credits : 1.5

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&astablemultivibrator.
7. Construction & study of Bistablemultivibrator 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 D.A.C & A.D.C.
12. Mandatory Design and Implementation of Mini Project.

DIGITAL CIRCUITS DESIGN LAB
Code : PC-EI394
Contacts : 3P
Credits : 1.5

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.

Note: An Institution/College may opt for some other software or hardware simulation wherever possible in place of MATLAB.