ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Guwahati
Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

B.TECH

ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

3rd SEMESTER

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Course Structure
(From Academic Session 2018-19 onwards)

B.Tech 3rdSemester: Electronics and Communication Engineering/
Electronics and Telecommunication Engineering

Semester III/ B. TECH/ECE/ETE

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	MA181301B	Mathematics III-B (for branches CSE and ECE/ETE)	2	1	0	3	30	70
2	ECE181302	Semiconductor Devices and Circuits	3	0	0	3	30	70
3	ECE181303	Digital Circuits	3	0	0	3	30	70
4	ECE181304	Network Theory	3	0	0	3	30	70
5	ECE181305	Signals and Systems	3	1	0	4	30	70
6	MC181306	Constitution of India	2	0	0	0 (PP/NP)	-	100
Practical								
1	ECE181317	Basic Electronics Lab	0	0	2	1	15	35
2	ECE181313	Digital Circuits Lab	0	0	2	1	15	35
3	ECE181314	Network Theory Lab	0	0	2	1	15	35
4	ECE181315	Signals and Systems Lab	0	0	2	1	15	35
5	SI181321	Internship-I (SAI - Social)	0	0	0	1	-	100
TOTAL			16	2	8	**21**	**210**	**690**
Total Contact Hours per week : 26								
Total Credits: 21								

N.B. MC181306 is a Mandatory Audit Course (No Credit). It will be evaluated as PP (Pass) or NP (Not Pass)

Detailed Syllabus

Course Code	Course Title	Hours per week L-T-P	Credit C
MA181301B	**Mathematics III-B** (for branches CSE and ECE/ETE)	**2-1-0**	**3**

Module 1: (25 hours)

Probability

Probability space, conditional probability, Bayes' Theorem, independence; Discrete random variables, Independent random variables, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Joint Distribution.

Continuous Probability Distributions:

Continuous random variables and their properties with special reference to normal distribution.

Test of significance, Chi-square Test, Elements of Markov Chain.

Module 2: (15 hours)

Statistics:

Measures of Central tendency: Moments, skewness and Kurtosis, Correlation and regression – Rank correlation, Curve fitting by the method of least squares- fitting of straight lines.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
7. Statistical Methods: An Introductory Text – J.Medhi, New Age International Publishers

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181302	Semiconductor Devices and Circuits	3-0-0	3

Course Outcome: At the end of this course students will be able to

CO1:
Explain the behaviour of semiconductor devices.
CO2:
Analyze the functioning of various solid- state devices, including diodes, BJTs and FETs.
CO3:
Illustrate the biasing techniques for BJTs and FETs
CO4:
Realize simple amplifier circuits using BJTs and FETs.
CO5:
Explain the behaviour of special semiconductor devices.

MODULE 1: Overview of Semiconductor Physics (6 Lectures)
Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams; Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors; Generation and recombination of carriers; Poisson and continuity equation.

MODULE 2: P-N junction (10 Lectures)
The open circuited junction, space charge region, the biased p-n junction, I-V characteristics, Piece-wise linear characteristics & equivalent circuits, Diode resistance, Capacitance, switching time, small signal switching models; Avalanche breakdown, Zener breakdown.

Half wave and Full wave single phase rectifiers, filtering and their analysis, peak inverse voltage, voltage multiplier circuits, Clipping and Clamping circuits. Zener diode and voltage regulator, Schottky diode, Varactor diode.

MODULE 3: Bipolar Junction Transistor (12 Lectures)
PNP and NPN junction transistors, various configurations of BJT and their input & output characteristics, different modes of operation, Ebers-Moll representation, Early effect, Avalanche breakdown & Punch through.

BJT biasing: Operating Point, DC & AC load lines, analysis of different biasing circuits and problems, Stabilization, Thermal runaway and thermal stability, BJT as a switch and amplifier.

MODULE 4: Field Effect Transistor (8 Lectures)
Structure and operation of JFET, the drain and transfer characteristics, Biasing of FETs.

MOSFET: Structures and operations of Depletion and Enhancement types of MOSFET, the drain and transfer characteristics, MOS capacitor, C-V characteristics, introduction to CMOS.

MODULE 5: Special Semiconductor Devices (4 Lectures)

An Introduction to Photonic devices: LED, LASER diodes, Photo detectors, Solar Cells.

An Introduction to Power Semiconductor Devices: Power BJT, Power MOSFET, UJT, CCD, Thyristor, Tunnel diode.

Textbooks/References:

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.
2. D. Neamen, D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley &Sons, 2006.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181303	**Digital Circuits**	**3-0-0**	**3**

Course outcomes: At the end of this course students will demonstrate the ability to

CO1:

Apply the Boolean algebra and K map to minimize logic function.

CO2:

Design and analyze combinational logic circuits.

CO3:

Design & analyze sequential logic circuits.

CO4:

Explain the logic families and memory devices.

MODULE 1: Introduction to Digital Circuits (5 Lectures)

Data and number system: Binary, Octal and Hexadecimal representations and their conversion, BCD, ASCII, EBDIC, Gray codes, code conversion, Representation of Signed binary numbers with 1's and 2's complement methods, Binary arithmetic.

Boolean algebra: DE Morgan's Theorem, Various logic gates and their truth tables and circuits, Representation in SOP and POS forms, Canonical forms, Minimization of logic expressions by algebraic method, Karnaugh maps up to 6 variables.

MODULE 2: Combinational logic circuits (8 Lectures)

Combinational logic circuit design using truth-table, Different Adders and Subtractors, Comparator, Encoder, Decoder, Multiplexer, Demultiplexer, Barrel shifter and ALU, Driver & Multiplexed Display.

MODULE 3: Sequential logic circuits (20 Lectures)

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts, Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator.

MODULE 4: Logic Families and Semiconductor Memories (7 Lectures)

Brief idea about DTL, TTL, ECL, MOS and CMOS families and their comparison based on Parameters: fan-in, fan-out, propagation delay, speed-power product, etc. TTL NAND gate, Tristate TTL, ECL, CMOS families and their interfacing. Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

Textbooks/References:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.

3. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd Edition,2006.
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989
5. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.
6. Anand Kumar,“Fundamentals of Digital Logic”, PHI.
7. Morris Mano and Michael D Ciletti, “Digital Design”, 4th Edition, Pearson, 2008
8. ZviKohavi and Niraj K Jha, “Switching and Automata Theory”, Cambridge

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181304	**Network Theory**	**3-0-0**	**3**

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1:
Apply network theorems in network analysis.

CO2:
Apply the frequency domain and time domain techniques for network analysis.

CO3:
Determine different network functions.

CO4:
Apply the knowledge of coupled circuits, Network Topology in system design.

CO5:
Design passive filters.

MODULE 1: An Overview of Network Theorems (10 Lectures)

Nodal and Mesh Analysis, matrix approach of network containing voltage sources, current sources and reactance, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Compensation and Tellegen's theorem as applied to AC circuits. Modified Nodal Analysis, three phase circuit analysis: three phase balanced and unbalanced circuit and power calculation.

MODULE 2: Trigonometric and Exponential Fourier series (4 Lectures)

Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra.

MODULE 3: Laplace Transform for Network Analysis (5 Lectures)

Complete response (steady state and transient response) of a network from the S-domain circuit, Linear constant co-efficient differential equation and continuous time domain analysis of RC, RL, and RLC networks with and without initial conditions using Laplace transform.

MODULE 4: Two Port Networks and Network Functions (8 Lectures)

General principle; Z, Y, Hybrid, Transmission and image parameters and equivalent circuits; Interrelationship between various parameters; Series, parallel and cascade connection of networks and parameters; Driving point and transfer Impedance and Admittance function; Pole-Zeros of Network function, Determination of time domain behavior from pole-zero plot; Magnitude and phase plot of network functions.

MODULE 5: Resonance and Coupled Circuits (4 Lectures)

Resonance – series and parallel; Q factor, BW; Analytical procedure for solving coupled circuits; Mutual Inductance, coefficient of coupling; Single tuned and double tuned circuits; Effects of over coupling and selectivity curve; Ideal transformer.

MODULE 6: Passive Filter **(4 Lectures)**

Filter fundamentals, Classification of filters—Low pass, High Pass, Band Pass and Band Reject Filters.

MODULE 7: Network Topology **(5 Lectures)**

Graph of a network; Concept of tree, co-tree link, chord, forest, co-forest; Planar and non-planar graph; Incidence matrix, tie set matrix, cut set matrix; Fundamental cut set and tie set schedule; Introduction to equation formulation graphically; Proofs of Nodal and Mesh Analysis; Duality of network.

Textbooks/References:

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181305	**Signals and Systems**	**3-1-0**	**4**

Course outcomes:
At the end of this course students will demonstrate the ability to
CO1:
Analyze different types of signals.
CO2:
Represent continuous and discrete systems in time and frequency domain using different transforms.
CO3:
Investigate the stability of a system.
CO4:
Apply sampling theorem for reconstruction of a signal.

MODULE 1: Introduction to Signals & Systems (5 Lectures)
Signals and systems as seen in everyday life, and in various branches of engineering and science.

Definitions and Classifications of different types of Signals and Systems; Some special signals of importance: unit step, unit impulse, sinusoid, complex exponential.

Signal properties: periodicity, absolute integrability, determinism and stochastic character.
Signal operations: scaling, shifting, inversion, etc.
System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, Realizability.

MODULE 2: Continuous time and Discrete time LSI systems (5 Lectures)
Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.

MODULE 3: Sampling and Reconstruction (5 Lectures)
The Sampling Theorem and its implications- Spectra of sampled signals.
Reconstruction: ideal interpolator, zero-order hold, first-order hold, Aliasing and its effects, Relation between continuous and discrete time systems.

MODULE 4: Fourier Analysis (10 Lectures)
The notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality, Discrete-Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT), Parseval's Theorem, The idea of signal space and orthogonal bases of signals.

MODULE 5: Laplace Transform (5 Lectures)
Definition and properties, notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system analysis with LT.

MODULE 6: The Z-Transform (5 Lectures)
Definition and properties, Eigen functions, region of convergence, z-domain analysis.

MODULE 7: System realization (5 Lectures)
State-space analysis and multi-input, multi-output representation, the state-transition matrix and its role.

Textbooks/References:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

Course Code	Course Title	Hours per week L-T-P	Credit C
MC181306	**Constitution of India**	**2-0-0**	**0 (PP/NP)**

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

MODULE 1: History of Making of the Indian Constitution:

a) History
b) Drafting Committee, (Composition & Working)

MODULE 2: Philosophy of the Indian Constitution:

a) Preamble
b) Salient Features

MODULE 3: Contours of Constitutional Rights & Duties:

a) Fundamental Rights
b) Right to Equality
c) Right to Freedom
d) Right against Exploitation
e) Right to Freedom of Religion
f) Cultural and Educational Rights
g) Right to Constitutional Remedies □Directive Principles of State Policy □Fundamental Duties.

MODULE 4: Organs of Governance:

a) Parliament
b) Composition
c) Qualifications and Disqualifications
d) Powers and Functions
e) Executive
f) President
g) Governor
h) Council of Ministers
i) Judiciary, Appointment and Transfer of Judges, Qualifications
j) Powers and Functions

MODULE 5: Local Administration:

a) District's Administration head: Role and Importance,
b) Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation.
c) Pachayati raj: Introduction, PRI: Zila Pachayat.
d) Elected officials and their roles, CEO Zila Pachayat: Position and role.
e) Block level: Organizational Hierarchy (Different departments),
f) Village level: Role of Elected and Appointed officials,
g) Importance of grass root democracy

MODULE 6: Election Commission:

a) Election Commission: Role and Functioning.
b) Chief Election Commissioner and Election Commissioners.
c) State Election Commission: Role and Functioning.
d) Institute and Bodies for the welfare of SC/ST/OBC and women.

Textbooks/References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181317	**Basic Electronics Lab**	**0-0-2**	**1**

Course Outcome: At the end of the course, the students will be able to

CO1:

Test the working of different diodes, transistors, CRO probes and measuring instruments.

CO2:

Design the circuits with basic semiconductor devices.

CO3:

Measure and record the experimental data, analyze the results, and prepare a formal laboratory report.

LIST OF EXPERIMENT

1. To study the different components and equipment of Electronics Laboratory.
2. To study V_D-I_D characteristics of Silicon Diode.
3. To study V-I Characteristics of Zener diode and Zener diode as a voltage regulator.
4. To study Half-Wave rectifier with and without filter
5. To study Full-Wave rectifier with and without filter
6. To study Bridge rectifier with and without filter
7. To plot the input and output characteristics of a transistor in CB Configuration
8. To plot the input and output characteristics of a transistor in CE Configuration
9. Comparison of Performance of Self Bias and Fixed Bias Circuits
10. To study Drain characteristics and Transfer characteristics of JFET

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181313	**Digital Circuits Lab**	**0-0-2**	**1**

Course Outcome: At the end of the course, the students will be able to

CO1:

Simplify, design and implement Boolean expression/half and full adders using basic/universal gates.

CO2:

Design and implement the various combinational circuits using MSI components.

CO3:

Design and implement the various sequential circuits

CO4:

Analyze the results, and prepare a formal laboratory report.

LIST OF EXPERIMENT

1. To familiarize with logic gate IC packages and to verify the truth tables of logic gates.
2. To verify Demorgan's theorem for 2 variables.
3. To design and set up half adder and half Subtractor using
   a. EXOR gates and gates
   b. NAND gates
4. To design and set up Full adder and Full Subtractor using
   a. EXOR gates and gates
   b. NAND gates
5. Design and implementation of parallel adder/Subtractor using IC7483
6. Design and implementation of
   a. BCD-to- excess-3code converter and vice versa.
   b. gray-to- binary and vice-versa.
7. Design and implementation of one bit, two-bit magnitude comparators.
8. Design and set up a Multiplexer (MUX) using gates and ICs.
9. Implementation and verification of truth table for J-K flip-flop, Master-slave J-K flip-flop, D flip-flop and T flip-flop.
10. Design and implementation of Mod-N synchronous counter using J-K flip-flops.
11. Design and implementation of shift register to function as
    a) SISO,
    b) SIPO
    c) PISO
    d) PIPO
    e) shift left and
    f) shift right operation
12. Design and implementation of
    a) Ring counter and
    b) Johnson counter using 4-bit shift register

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181314	**Network Theory Lab**	**0-0-2**	**1**

Course Outcome: At the end of the course, the students will be able to

CO1: Test for validity of the network theorems.

CO2: Determine the response of different circuits.

CO3: Measure and record the experimental data, analyze the results, and prepare a formal laboratory report.

LIST OF EXPERIMENT

1. Verification of principle of superposition with dc and ac sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits
3. Verification of Tellegen's theorem for two networks of the same topology.
4. Determination of transient response of current in RL and RC circuits with step voltage input.
5. Determination of transient response of current in RLC circuit with step voltage input for under damp, critically damp and over damp cases
6. Determination of frequency response of current in RLC circuit with sinusoidal ac input
7. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.
9. To study frequency response of Passive Filter circuit

Course Code	Course Title	Hours per week L-T-P	Credit C
ECE181315	**Signals and Systems Lab**	**0-0-2**	**1**

Course Outcome: At the end of the course, the students will be able to

CO1:
Utilize software tools to perform the basic operations on the signals.
CO2:
Experiment with various continuous and discrete time signals using software tools.
CO3:
Analyze the results, and prepare a formal laboratory report.

LIST OF EXPERIMENT

1. To perform different mathematical operations on matrices
2. Plotting of various signals
3. Operation on signals.
4. Transformation of the independent variable
5. Study of Convolution &Deconvolution techniques
6. Study of Fourier Series and Transform of Continuous and discrete time signal
7. Study of Laplace Transformation of Continuous Time Signal
8. Study of Z transform Discrete time signal
9. Study of Sampling and Reconstruction

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