

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**Course Structure for Electronics & Instrumentation Engineering**  
**B. Tech Course**  
**(2015-16)**

**II B. Tech – I Sem**

<b>S.No.</b>	<b>Course Code</b>	<b>Subject</b>	<b>T</b>	<b>Tu</b>	<b>Lab</b>	<b>C</b>
1	15A54301	Mathematics-III	3	1	-	3
2	15A04301	Electronic Devices and Circuits	3	1	-	3
3	15A04302	Switching Theory and Logic Design	3	1	-	3
4	15A04303	Signals and Systems	3	1	-	3
5	15A02306	Electrical Technology	3	1	-	3
6	15A10301	Sensors and Transducers	3	1	-	3
7	15A04305	Electronic Devices and Circuits Lab	-	-	4	2
8	15A04308	Electrical Technology Lab	-	-	4	2
<b>Total</b>			<b>18</b>	<b>06</b>	<b>08</b>	<b>22</b>

6 Theory + 2 Laboratories

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech I-Sem (EIE)

<b>T</b>	<b>Tu</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>3</b>

## (15A54301) MATHEMATICS-III

### OBJECTIVES:

- This course aims at providing the student with the concepts of Matrices, Numerical Techniques and Curve fitting.

### OUTCOMES:

- The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods

### UNIT – I

Elementary row transformations-Rank – Echelon form, normal form – Consistency of System of Linear equations. Linear transformations. Hermitian, Skew-Hermitian and Unitary matrices and their properties. Eigen Values, Eigen vectors for both real and complex matrices. Cayley – Hamilton Theorem and its applications – Diagonalization of matrix. Calculation of powers of matrix and inverse of a matrix. Quadratic forms – Reduction of quadratic form to canonical form and their nature.

### UNIT – II

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method.

### UNIT – III

**Interpolation:** Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

### UNIT – IV

Curve fitting: Fitting of a straight line – Second degree curve – Exponential curve-Power curve by method of least squares. Numerical Differentiation for Newton's interpolation formula. Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

### UNIT – V

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods. Numerical solutions of Laplace equation using finite difference approximation.

**TEXT BOOKS:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

**REFERENCES:**

1. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S. Chand publication.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech I-Sem (EIE)

T	Tu	C
3	1	3

## (15A04301) ELECTRONIC DEVICES AND CIRCUITS

### Course Objectives:

To give understanding on semiconductor physics of the intrinsic, p and n materials, characteristics of the p-n junction diode, diode's application in electronic circuits, Characteristics of BJT, FET, MOSFET, characteristics of special purpose electronic devices. To familiarize students with dc biasing circuits of BJT, FET and analyzing basic transistor amplifier circuits.

### Course Outcomes:

Upon completion of the course, students will:

- Analyze the operating principles of major electronic devices, its characteristics and applications.
- Design and analyze the DC bias circuitry of BJT and FET.
- Design and analyze basic transistor amplifier circuits using BJT and FET.

### UNIT- I

**Junction Diode Characteristics** : Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

**Special Semiconductor Diodes:** Zener Diode, Breakdown mechanisms, Zener diode applications, LED, LCD, Photo diode, Varactor diode, Tunnel Diode, DIAC, TRIAC, SCR, UJT. Construction, operation and characteristics of all the diodes is required to be considered.

### UNIT- II

**Rectifiers and Filters:** Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, L- section filter,  $\Pi$ - section filter, Multiple L- section and Multiple  $\Pi$  section filter, comparison of various filter circuits in terms of ripple factors.

### UNIT- III

#### Transistor Characteristics:

**BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

**FET:** FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

#### **UNIT- IV**

**Transistor Biasing and Thermal Stabilization :** Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in  $V_{BE}$ ,  $I_c$ , and  $\beta$ , Stability factors, ( $S$ ,  $S'$ ,  $S''$ ), Bias compensation, Thermal runaway, Thermal stability.

FET Biasing- methods and stabilization.

#### **UNIT- V**

##### **Small Signal Low Frequency Transistor Amplifier Models:**

**BJT:** Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

**FET:** Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

#### **TEXT BOOKS:**

1. J. Millman, C. Halkias, "Electronic Devices and Circuits", Tata Mc-Graw Hill, 4<sup>th</sup> Edition, 2010.
2. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2009.
3. Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", Tata Mc-Graw Hill, Second Edition

#### **REFERENCES:**

1. Jacob Millman, C. Halkies, C.D. Parikh, "Integrated Electronics", Tata Mc-Graw Hill, 2009.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", Pearson Publications, 9<sup>th</sup> Edition, 2006.
3. BV Rao, KBR Murty, K Raja Rajeswari, PCR Pantulu, "Electronic Devices and Circuits", Pearson, 2<sup>nd</sup> edition.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech I-Sem (EIE)

T	Tu	C
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## (15A04302) SWITCHING THEORY AND LOGIC DESIGN

### Course Objectives:

- To provide fundamental concepts used in the design of digital systems and learn the methods for the design of digital circuits.

### Course Outcomes:

- To introduce basic postulates of Boolean algebra and the methods for simplifying Boolean expressions
- To illustrate the concepts and study the procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concepts of programmable logic devices.

### UNIT I

#### Number System & Boolean Algebra:

Digital Systems, Binary Numbers, Number base conversions, Complements of numbers, Signed binary numbers, Binary codes.

Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, other logic operations & Logic gates.

### UNIT II

#### Gate Level Minimization:

The map method, four variable & Five variable K-map, POS & SOP Simplification, Don't care conditions, NAND & NOR Implementation, Other two level Implementation, Ex-or Function, Tabular Method- Simplification of Boolean function using tabulation Method.

### UNIT III

#### Combinational Logic Circuits:

Combinational circuits, Analysis & Design procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Multiplexers.

### UNIT IV

#### Sequential Logic Circuits:

Sequential Circuits, Latches, Flips-Flops - RS, JK, Master-Slave JK, D & T flip flops, Analysis of Clocked sequential circuits, State Reduction & Assignment, Design procedure, Registers & Counters – Registers, Shift Registers, Ripple Counters, Synchronous counters, asynchronous counters.

Asynchronous sequential circuits - Introduction, Analysis Procedure, Design Procedure, Reduction of State flow tables, Race-free State Assignment, Hazards.

### UNIT V

#### Programmable Devices:

Memory organization, classification of semiconductor memories, ROM, PROM, DROM, EPROM, EEPROM, RAM, expansion of memory, CCD, Flash memories, content

addressable memory, programmable logic devices, PROM at PLD, programmable logic array (PLA) programmable array logic (PAL), field programmable gate array (FPGA).

**Text Books:**

1. M.Morris Mano & Michel D. Ciletti, "Digital Design", 5<sup>th</sup> Edition Pearson.
2. Zvi Kohavi and Nirah K.Jha, "Switching theory and Finite Automata Theory", 3<sup>rd</sup> Edition Cambridge.

**References:**

1. Subratha Goshal, "Digital Electronics", Cambridge
2. Comer, "Digital & State Machine Design", Third Indian edition, OXFORD

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech I-Sem (EIE)

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## (15A04303) SIGNALS AND SYSTEMS

### *Course objectives:*

- To study about signals and systems.
- To do analysis of signals & systems (continuous and discrete) using time domain & frequency domain methods.
- To understand the stability of systems through the concept of ROC.
- To know various transform techniques in the analysis of signals and systems.

### *Learning Outcomes:*

- For integro-differential equations, the students will have the knowledge to make use of Laplace transforms.
- For continuous time signals the students will make use of Fourier transform and Fourier series.
- For discrete time signals the students will make use of Z transforms.
- The concept of convolution is useful for analysis in the areas of linear systems and communication theory.

### **UNIT I**

**SIGNALS & SYSTEMS:** Definition and classification of Signal and Systems (Continuous time and Discrete time), Elementary signals such as Dirac delta, unit step, ramp, sinusoidal and exponential and operations on signals. Analogy between vectors and signals-orthogonality-Mean Square error-Fourier series: Trigonometric & Exponential and concept of discrete spectrum

### **UNIT II**

**CONTINUOUS TIME FOURIER TRANSFORM:** Definition, Computation and properties of Fourier Transform for different types of signals. Statement and proof of sampling theorem of low pass signals

### **UNIT III**

**SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS:** Linear system, impulse response, Response of a linear system, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, Relationship between bandwidth and rise time. Energy and Power Spectral Densities

### **UNIT IV**

**DISCRETE TIME FOURIER TRANSFORM:** Definition, Computation and properties of Fourier Transform for different types of signals.

## **UNIT V**

**LAPLACE TRANSFORM:** Definition-ROC-Properties-Inverse Laplace transforms-the S-plane and BIBO stability-Transfer functions-System Response to standard signals-Solution of differential equations with initial conditions.

**The Z-TRANSFORM:** Derivation and definition-ROC-Properties-Linearity, time shifting, change of scale, Z-domain differentiation, differencing, accumulation, convolution in discrete time, initial and final value theorems-Poles and Zeros in Z -plane-The inverse Z-Transform-System analysis-Transfer function-BIBO stability-System Response to standard signals-Solution of difference equations with initial conditions. .

### **TEXT BOOKS:**

1. B. P. Lathi, "Linear Systems and Signals", Second Edition, Oxford University press,
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", Pearson, 2nd Edn.
3. A. Ramakrishna Rao, "Signals and Systems", 2008, TMH.

### **REFERENCES:**

1. Simon Haykin and Van Veen, "Signals & Systems", Wiley, 2nd Edition.
2. B.P. Lathi, "Signals, Systems & Communications", 2009,BS Publications.
3. Michel J. Robert, "Fundamentals of Signals and Systems", MGH International Edition, 2008.
4. C. L. Philips, J. M. Parr and Eve A. Riskin, "Signals, Systems and Transforms", Pearson education.3rd

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

**II B.Tech I-Sem (EIE)**

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## **(15A02306) ELECTRICAL TECHNOLOGY**

### **Objective:**

Electrical Technology contains Single phase transformers, Induction motors, DC generators and motors which are widely used in industry are covered and their performance aspects will be studied.

### **UNIT- I DC GENERATORS**

D.C. Generators – Principle of Operation – Constructional Features – E. M.F Equation– Numerical Problems – Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F - Critical Field Resistance and Critical Speed - Load Characteristics of Shunt, Series and Compound Generators- Applications

### **UNIT – II D.C. MOTORS**

D.C Motors – Principle of Operation – Back E.M.F. –Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors-Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Three Point Starter-Losses – Constant & Variable Losses – Calculation of Efficiency - Swinburne’s Test.

### **UNIT-III SINGLE PHASE TRANSFORMERS**

Single Phase Transformers - Constructional Details- Emf Equation - Operation on No Load and on Load - Phasor Diagrams-Equivalent Circuit - Losses and Efficiency-Regulation-OC and SC Tests – Sumpner’s Test - Predetermination of Efficiency and Regulation.

### **UNIT-IV 3-PHASE INDUCTION MOTORS**

Polyphase Induction Motors-Construction Details of Cage and Wound Rotor Machines- - Principle of Operation – Slip- Rotor Emf and Rotor Frequency - Torque Equation- Torque Slip Characteristics.

### **UNIT – V SYNCHRONOUS MACHINES**

Principle And Constructional Features of Salient Pole and Round Rotor Machines – E.M.F Equation- Voltage Regulation by Synchronous Impedance Method- Theory of Operation of Synchronous Motor.

### **OUTCOME:**

After going through this course the student gets a thorough knowledge on DC Motors & Generators, Transformers and Induction motors with which he/she can able to apply the above conceptual things to real-world problems and applications.

**TEXT BOOKS:**

1. Electric Machines –by I.J.Nagrath & D.P.Kothari,Tata Mc Graw Hill, 7<sup>th</sup> Edition.2005
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.

**REFERENCE BOOKS:**

1. Electrical and Electronic Technology, Hughes, Pearson Education.
2. Electrical Machines, P. S. Bimbhra, Khanna Publishers, 2011.
3. Basic Electrical Engineering, 2<sup>nd</sup> Edition, V.N. Mittle and Aravind Mittal, Mc Graw hill Education, 2006.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech I-Sem (EIE)

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## (15A10301) SENSORS & TRANSDUCERS

### *Course Objective:*

- *To provide basic knowledge about sensors and transducers used in Process industry, manufacturing industry and Automated plants.*

### *Learning Outcome:*

- *Upon completion of the subject, students shall be able to understand the sensors, transducers and their applications in Process control industry, manufacturing industry and Automation plants.*

### **UNIT-1**

Definition, principle of sensing & transduction , classification, parameters-Characteristics : static and Dynamic, Characterization, performance characteristics of Instrumentation system.

**Mechanical and Electromechanical sensor:** Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes. Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis. LVDT: Construction, material, output input relationship, I/O curve, discussion. Proximity sensor.

### **UNIT-II**

Capacitive sensors: variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity. Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.

### **UNIT-III**

**Thermal sensors:** Material expansion type: solid, liquid, gas & vapor, Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification. Thermoemf

sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT type. **Radiation sensors:** types, characteristics and comparison. Pyroelectric type.

#### **UNIT-IV**

**Magnetic sensors:** Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics. Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive celltypes, materials, construction, response. Geiger counters, Scintillation detectors.

#### **UNIT-V**

Introduction to smart sensors, MEMS Applications, Nano sensors, on-board automobile sensors, home appliance sensors, aerospace sensors.

*Text books:*

- 1. Sensor & transducers, D. Patranabis, 2nd edition, PHI*
- 2. Instrumentation Devices & systems, C.S.Rangan, G R Sarma, V S V Mani, 2<sup>nd</sup> Edition McGraw Hill*
- 3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill.*

*Reference:*

- 1.Sensors and Signal Conditioning, Ramon Pallas-Areny, John G.Webster, 2nd Edition*
- 2. Sensor Technology Hand Book – Jon Wilson, Newne 2004.*
- 3. Instrument Transducers – An Introduction to their Performance and design – by Herman K.P.Neubrat, Oxford University Press.*
- 4. Electronic Instrumentation by H.S.Kalsi.*

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech. I-Sem (EIE)

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## (15A40305) ELECTRONIC DEVICES AND CIRCUITS LABORATORY

### Objectives:

- This Lab provides the students to get an electrical model for various semiconductor devices. Students can find and plot V<sub>I</sub> characteristics of all semiconductor devices. Student learns the practical applications of the devices. They can learn and implement the concept of the feedback and frequency response of the small signal amplifier

### Outcomes:

- Students able to learn electrical model for various semiconductor devices and learns the practical applications of the semiconductor devices

### PART A: Electronic Workshop Practice

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

### PART B: List of Experiments

(For Laboratory Examination-Minimum of Ten Experiments)

1. P-N Junction Diode Characteristics  
Part A: Germanium Diode (Forward bias & Reverse bias)  
Part B: Silicon Diode (Forward bias only)
2. Zener Diode Characteristics  
Part A: V-I Characteristics  
Part B: Zener Diode act as a Voltage Regulator
3. Rectifiers (without and with c-filter)  
Part A: Half-wave Rectifier  
Part B: Full-wave Rectifier
4. BJT Characteristics(CE Configuration)  
Part A: Input Characteristics  
Part B: Output Characteristics
5. FET Characteristics(CS Configuration)

Part A: Drain (Output) Characteristics

Part B: Transfer Characteristics

6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

**PART C: Equipment required for Laboratory**

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components
10. Bread Boards
11. Connecting Wires
12. CRO Probes etc.

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

II B.Tech. I-Sem (EIE)

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### (15A04308) ELECTRICAL TECHNOLOGY

#### PART-A

1. Magnetization Characteristics of D.C.Shunt Generator. Determination of Critical Field Resistance.
2. Swinburne's Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
3. Brake Test on DC Shunt Motor. Determination of Performance Characteristics.
4. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors and Determination of Equivalent Circuit).
5. Load Test on Single Phase Transformer.

#### PART-B

##### List of Experiments:

1. Generation of Various signals and Sequences (Periodic and Aperiodic), Such as Unit Impulse, Unit Step, Square, Saw Tooth, Triangular, Sinusoidal, Ramp, Sinc.
2. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Convolution between Signals and Sequences.
4. Autocorrelation and Cross correlation between Signals and Sequences.
5. Verification of Linearity and Time Invariance Properties of a Given Continuous / Discrete System.
6. Finding the Fourier Transform of a given Signal and plotting its Magnitude and Phase Spectrum.
7. Waveform Synthesis using Laplace Transform.
8. Generation of Gaussian Noise (Real and Complex), Computation of its Mean, M.S.Values and its Skew, Kurtosis, and PSD, Probability Distribution Function.
9. Sampling Theorem Verification.
10. Removal of Noise by Auto Correlation / Cross correlation in a given signal corrupted by noise.
11. Impulse response of a raised cosine filter.
12. Checking a Random Process for Stationary in Wide Sense.

**Note: Any 8 of the Experiments from Part-B are to be Conducted**