NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

# DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

## SCHEME AND DETAILED SYLLABUS

(To be applicable for batches admitted from July, 2010 onwards)

## PREFACE

Curriculum document is a comprehensive plan of any educational programme. It is also one of the means for bringing about qualitative improvement in any programme. The objective of this curriculum is to enable the students to face present and future challenges in the field of Electronics and Telecommunication Engineering. To improve upon overall development and efficiency of the teaching-learning process, the contents of various subjects' communication skills, present quality standards etc. have been improved upon to suit present and future requirements by enriching the curriculum by adding conceptual, practical, industry-relevant and futuristic components.

The field of Electronics and Telecommunication Engineering has continued to evolve and expand, further blurring its boundaries with other disciplines. In particular the overlap with computer science continues to grow. In addition to becoming broader, Electronics Engineering has been strongly influenced by the rapid growth in information processing. Information technology has served both as a dominant consumer electronic technology, and provided the tools that drive further innovations. As a consequence, the complexity of the systems that our students deal with has grown exponentially. Our curriculum must provide them with not only the insights to understand the underlying technologies and theories associated with each level of complexity, but also the knowledge and skills to choose the appropriate abstraction level for each component, making the complexity work for them rather than against them.

Today's students have more exposure and background in software than hardware. Students are also used to dealing in a world with abundant information, and many distractions and they feel more comfortable in situations where the application for the information being taught is clear. Our current curriculum lays out the fundamentals first before getting to applications and is a "poor impedance match" to our students. In summary, we need to change our undergraduate curriculum to

- Motivate students to "sample" different areas,
- Emphasize how fundamental principles cut across different core areas,
- Arouse the students' interest and curiosity in "hardware,"
- Blur the boundary between "software" and "hardware,"
- Broaden the students' appreciation of system issues, and
- Familiarize students with different levels of system abstraction.

Unfortunately we need to implement these changes in a constrained environment. It may not be possible to teach everything essential in four year under graduate course. It may be left on the student which particular sub-field he/she is interested in. This curriculum first covers up the fundamental subjects before allowing the students to try a wide range of subjects in the form of electives. Eight numbers of electives have been offered in fields as diverse as Electronic system design to Quantum computing. We hope this curriculum to be useful for bringing out successful engineers and scientists of future.

Board of Studies
Department of Electronics & Telecommunication
NIT Raipur, 2010.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

# DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

## SEMESTER: III

| S. No | BoS | Sub Code | Subject Name | Periods/ week | | | Examination Scheme | | | | | Total Marks | Credits L+(T+P)/2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | TA | FE | SE | T.C.A. | ESE | | |
| 1 | Math | MA20311 | Mathematics-III | 3 | 1 | - | 20 | 15 | 15 | 50 | 70 | 120 | 4 |
| 2 | ETC | ET20311 | Signals and systems | 3 | 1 | - | 20 | 15 | 15 | 50 | 70 | 120 | 4 |
| 3 | ETC | ET20312 | Digital logic design | 3 | 1 | - | 20 | 15 | 15 | 50 | 70 | 120 | 4 |
| 4 | ETC | ET20313 | Electronic measurements and instrumentation | 3 | 1 | - | 20 | 15 | 15 | 50 | 70 | 120 | 4 |
| 5 | ETC | ET20314 | Network analysis and synthesis | 3 | 1 | - | 20 | 15 | 15 | 50 | 70 | 120 | 4 |
| 6 | ETC | ET20315 | Devices and circuits-I | 4 | 1 | - | 20 | 15 | 15 | 50 | 70 | 120 | 5 |
| 7 | ETC | ET20321 | Data structures lab | - | - | 3 | 30 | - | - | 30 | 20 | 50 | 2 |
| 8 | ETC | ET20322 | Devices and circuits-I lab | - | - | 3 | 30 | - | - | 30 | 20 | 50 | 2 |
| 9 | ETC | ET20323 | Digital logic design lab | - | - | 3 | 30 | - | - | 30 | 20 | 50 | 2 |
| 10 | EN | | Value Education | - | - | 2 | 25 | - | - | 25 | 0 | 25 | 1 |
| 11 | | | Discipline | - | - | - | 25 | - | - | 25 | 0 | 25 | 1 |
| | | | Total | 19 | 6 | 11 | 260 | 90 | 90 | 440 | 480 | 920 | 33 |

TCA = Total of Continuous Assessment, TA = Teacher's Assessment, FE = First Exam, SE = Second Exam, ESE = End Semester Exam.

**NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR**
**DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION**

**Semester: 3** **Code: MA20311**
**Subject: Mathematics – III**
**Credits: 4**
**Total Theory Periods: 30** **Total Tutorial Periods: 10**

**UNIT I**
SERIES SOLUTION OF DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS: Series solution of differential equations, The method of Frobenius, Bessel's differential equation, Bessel's function of the First Kind - recurrence relations, generating function, orthogonality, Legendre's differential equation, Legendre's polynomial - Rodrigue's formula, generating function, recurrence relations, orthogonality.

**UNIT II**
PARTIAL DIFFERENTIAL EQUATIONS: Formation, Solution of Lagrange's linear differential equation, homogeneous linear differential equation with constant coefficients, non-homogeneous linear differential equations, Method of separation of variables.

**UNIT III**
LAPLACE TRANSFORM: Definition, Linearity, shifting & scaling properties, Transform of elementary functions, Transform of derivatives and integrals, Multiplication by t & division by t. Inverse Laplace transform, Convolution theorem, Transform of periodic functions, Unit step function & Dirac delta function, Initial value & final value theorems, Application to solution of ordinary differential equations.

**UNIT IV**
COMPLEX VARIABLES: Limit, Derivative, Analytic function, Cauchy-Riemann equations, Harmonic functions, Application to flow problems. Complex integration, Cauchy's integral theorem and integral formula, Taylor's & Laurent's series, Singular point, Poles & residues, Residue theorem & its application to contour integration.

**UNIT V**
NUMERICAL METHODS: Solution of nonlinear algebraic equations, single and multistep methods for differential equation.

**Text Books:**

1. Engineering Mathematics, E Kreysig, John Wiley and Sons.
2. Higher Engineering Mathematics, B S Grewal, Khanna Publications.

**NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR**
**DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION**

**Semester: 3** **Code:ET20311**
**Subject: Signal and System**
**Credits:4**
**Total Theory Periods: 30** **Total Tutorial Periods: 10**

**UNIT I**
Signals and classification of signals ,basic continuous time and discrete time signals ,continuous LTI, discrete LTI systems ,impulse response stability etc. ,properties eigen values and eigen functions properties of discrete and continuous LTI systems ,systems described by difference and differential equations.

**UNIT II**
Laplace and Z-transforms ,Laplace transforms of common signals ,properties of Laplace transforms , inverse Laplace transforms , Z-transforms of common sequences ,properties of Z-transforms , inverse Z-transforms , relation between Z and Laplace Transform , analysing continuous time systems using Laplace and discrete time systems usig Z-transforms.

**UNIT III**
Fourier analysis of continuous time signals and systems, Fourier series representation of periodic systems, Fourier transforms , properties of CTFT ,frequency response of continuous time LTI, systems, Fourier transforms of power signals filter characteristics of LTI systems ,transmission of signals through LTI systems , filtering , bandwidth ,quadrature filter and Hilbert transforms .

**UNIT IV**
Fourier analysis of discrete time signals and systems ,discrete Fourier series ,DTFT, properties of DTFT, frequency response of discrete time LTI systems ,DFT.

**UNIT V**
State space analysis, concept of state, state space representation discrete time LTI systems , state space representation of continuous time LTI systems ,solutions of state equation for discrete time LTI systems , solutions of state equation for continuous time LTI systems ,FFT.

**Text books:**

1. Signals & Systems, 2nd Edition, by Alan Oppenheim, Alan Wilsky, S. Nawab. Prentice Hall, 1997.
2. Signals and Systems, by Simon Haykin and Barry Van Veen. Wiley, 1999.


**Reference books:**

1. Schaum's Outline of Signals and Systems – H Hsu, TMH.

**NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR**
**DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION**

**Semester: 3** **Code:ET20312**
**Subject: Digital Logic Design**
**Credits: 4**
**Total Theory Periods: 30** **Total Tutorial Periods: 10**

**UNIT I**
Weighted & Non-weighted codes, Sequential codes, self complementing codes, Cyclic codes, 8-4-2-1 BCD code, Excess-3 code, Gray code, Error detecting code, 2-out-of-5 code, Error correcting code: Hamming code, Alphanumeric codes. Representation of negative numbers in binary system, Binary arithmetic. Boolean algebra: Reduction of Boolean expressions using laws, theorems and axioms of Boolean algebra,

**UNIT II**
Expansion of a Boolean expression to SOP and POS forms, Minimization of completely & incompletely specified Boolean functions using Karnaugh Map and Quine-McCluskey Methods, Synthesis using AND-OR, NAND, NOR and XOR forms. Design examples.
Introduction to CAD tools: Introduction to VHDL, Programmable Logic Devices, Custom Chips, Standard Cells and Gate Arrays Practical Aspects, Transmission Gates, Implementation details for FPGAs

**UNIT III**
Combinational Circuit Building Blocks: Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Circuits, ROM, PLA, VHDL for Combinational Circuits. Design of any Boolean function, binary adders, subtractors, BCD adder and subtractor, magnitude comparators, etc., using above building blocks.

**UNIT IV**
Flip-Flops & Timing Circuit: S-R Latch; Gated S-R Latch; D Latch; J-K flip-Flop; T Flip-Flip: Edge Triggered S-R, D, J-K and T Flips-Flops; Master - Slave and Edge triggered Flip-Flops; Direct Preset and Clear Inputs. Shift Registers*:* PIPO, SIPO, PISO, SISO, Bi-Directional Shift Registers; Universal Shift register. Counter*:* Synchronous Counters: Design of synchronous counters, Ring counter, Johnson counter, Pulse train generators using counter, Design of Sequence Generators; Digital Clock using Counters. Meanly State Model, Design of Finite State Machines using CAD Tools, Serial Adder Example, Asynchronous Counter: Ripple Counters; Design of asynchronous counters, Effects of propagation delay in Ripple counters,

**UNIT V**
Implementation Technology**:** Transistor Switches, Basic features of DTL and ECL. TTL family gates: fan-in, fan-out and noise margin. MOS family: NMOS and CMOS Logic Gates, Negative Logic System, Comparison among various logic families.

**Text Books:**
1. An Engineering Approach to Digital Design, W. Fletcher, PHI Edition.
2. Fundamentals of Digital Logic with Verilog Design, S. Brown and Z. Vranesic, Tata McGraw Hill New Delhi, 2008.
3. Digital System Design using VHDL, C. H. Roth, Thompson Publications, Fourth Edition, 2002.

**Reference**:
1. Digital Logic and Computer Design, Morris Mano PHI
2. Digital Integrated Electronics, Taub B & Schilling, McGraw Hill

## DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

**Semester: 3** **Code:ET20313**
**Subject: Electronic Measurements and Instrumentation**
**Credits: 4**
**Total Theory Periods: 30** **Total Tutorial Periods: 10**

**UNIT I**

General Principles of Measurements-Standards- Absolute and Working Standards- Calibration of Meters- Qualities of Measurements- Characteristics- Errors in Measurement and its Analysis- Direct Deflecting Instruments - Moving Coil - Moving Iron, Dynamo Meter, Induction, Thermal, Electrostatic and Rectifier Type- Shunts and Multipliers- Various Types of Galvanometers.

**UNIT II**

Measurement of Current, Voltage and Resistance- Measurement of Insulation Resistance, Earth Resistance, Earth Tester- Measurement of Power and Energy - Dynamometer Type Wattmeter - Error and Compensation - Ampere Hour Meter - Single and Three Phase Energy Meters (Induction Type) - Calibration - Electronic Energy meter-Trivector Meter - Frequency Meters - Power Factor Meters - Energy / Harmonic Analyzer- Current Transformers and Potential Transformers.

**UNIT III**

Null Deflection Method - Measurement of Resistance, Current, Voltage and Power -Direct Current Potentiometer - Wheatstone Bridge - Kelvin Double Bridge - Carey Foster Slide Wire Bridge - Bridge Current Limitations - Localization of Cable Fault by Murray and Varley Loop Tests - A.C. Potentiometers - Various A.C. Bridges and Measurement of Inductance & Capacitance- Magnetic Measurements: Classification - Measurement of Flux and Permeability – Hibbert's Magnetic Standard - Flux Meter- Hall Effect- Gauss meter- Ballistic Galvanometer-Magnetic Measurements-B.H. Curve and Permeability Measurement - Hysteresis Measurement- Core Loss Measurement.

**UNIT IV**

Illumination- Laws of Illumination - Polar Curves - Photometry - Luminous Efficiency - Measurement of Illumination of Different Light Sources - Illumination of Surfaces - Levels of Illumination- Digital Measurements and Meters- Oscilloscopes - Basic Principle of Signal Display - Triggered Sweep CRO - Trigger Pulse Circuit - Delay Line in Triggered Sweep - Synchronous Selector for Continuous Sweep CRO - Dual Beam CRO -Dual Trace Oscilloscope - Applications.

**UNIT V**

Data Acquisition System: Introduction, instrumentation system, sample & hold circuit, configuration and objective of data acquisition system, single channel and multi channel data acquisition system, applications.

**Text Books:**


1. Electrical Measurements & Measuring Instruments, Golding E.W, Wheeler Pub.
2. Modern Electronics Instrumentation, Cooper W.D, Prentice Hall of India.


**Reference Books:**


1. Electronic Measurements & Instrumentation, Oliver & Cage, McGraw Hill.
2. Electronics & Electrical Measurements and Instrumentation, J B Gupta, Katson Publication.

**NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR**
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**Semester: 3** **Code: ET20314**
**Subject: Networks Analysis and Synthesis**
**Credits: 4**
**Total Theory Periods: 30** **Total Tutorial Periods: 10**

**UNIT I**

Introduction: The capacitance parameter, The inductance parameter , The resistance parameter, reference direction for current and voltage, active element convention , the dot convention for coupled circuits, Krichhoff's laws, the number of network equation, source transformation, example of the formulation of network equation loop variables analysis, node variables analysis, duality, network. Dependent sources.
Network graph theory: concept of network graph , terminology used in network graph, relation betweens Twigs and Links, properties of tree in a graph, formation of incidence Matrix[$A_i$], number of trees in a graph, cut-set matrix, tie set matrix, fundamental tie-set matrix, fundamental of cut-set.

**UNIT II**

Initial Conditions In Networks: Why Study Initial Conditions, Initial Conditions In Element, Geometrical Interpretation Of Derivatives, A Procedure for Evaluating Initial Conditions, initial State of a Network.
Transforms of other signal waveform: The shifted unit steep Function, The ramp- and Impulse functions, Wave forms, synthesis, the initial and final value of F(t) from f(s), the convolution integral, convolution as a summation.

**UNIT III**

Impedance function and Network theorems: The Concept of complex frequency, Transform Impedance an Transform Circuits, Series and Parallel combination of elements, Superposition and Reciprocating, Theremin's Theorem an Norton's Theorem.
Network function: poles and zeros, terminal pairs or ports, network function for one port and two port, the calculation of network function: ladder network , general network, poles and zeros of network function, restrictions on poles and zero location for driving point function, Restriction on poles and zero location for transfer function, time domain behavior from the pole and zero plot, stability of active network.

**UNIT IV**

Two port parameters: relation of two port variables, short circuit admittance parameters, the open circuit impedance parameters, Transmission parameters, the hybrid parameters, relation between parameter sets, parallel connection of two port network.
Input power, power transfer and insertion loss: energy and power, effective or root mean square values, average power and complex power, problem in optimizing power transfer, insertion loss, Tellegen's theorem.

**UNIT V**

Network synthesis: concept of network synthesis, reactive network , driving point immittance of LC network, LC network synthesis using foster and caurr form, RC and RL network synthesis by Foster and Caurr form.

**Text Books:**


1. Network analysis- M.E.Van Valkenbarg, PHI/ Pearson Education
2. Engineering circuit analysis-Hayt and Kimberley, TMH


**Reference books**:


1. Electric Circuit Analysis-Alexender and Sadique, TMH
2. Network Theory- D. Roy Chaudhary, Newage Asian

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**Semester: 3** **Code: ET20315**
**Subject: Devices and Circuits-I**
**Credits: 5**
**Total Theory Periods: 40** **Total Tutorial Periods: 10**

**UNIT I**
DIODE CIRCUITS: Review of diode fundamentals, Capacitance: Transition and Diffusion Capacitance. Rectifying circuits and DC Power Supplies: Load line analysis of diode circuit, Half wave rectifier: Voltage regulation, Ripple factor, ratio of rectification, Transformer Utilization factor. Full wave rectifier, Bridge rectifier. Filter circuits for power supply: Inductor filter, Capacitor filter, LC filter, Multiple LC filter, CLC filter. Zener diode: Break down mechanism, Characteristics, Specifications, Voltage multipliers clipping circuits ,double diode clippers, clamping circuits.

**UNIT II**
BIPOLAR JUNCTION TRANSISTORS: Review of transistor fundamentals, Current components, Early Effect. Ebers-Moll Model, Maximum Voltage Ratings.
Transistor Biasing and Thermal stabilization: The operating point, Bias stability, Stability factor, Emitter bias, Collector – to – base bias, Voltage divider bias with emitter bias, Emitter bypass capacitor. Bias compensation.

**UNIT III**
FIELD EFFECT TRANSISTORS: Introduction, Construction, Operation, V-I Characteristics, Transfer Characteristics, Drain Characteristics.
Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Introduction, Construction, Operation and characteristics, Depletion MOSFET, Enhancement MOSFET.

**UNIT IV**
UJTS AND THYRISTORS - Unijunction transistors-construction operation principle, current controllable devices, PNPN Diode – material, characteristics, silicon-controlled rectifier- V-I characteristics, gate triggering characteristics, DIAC and TRIAC, Thyristor parameters- repetitive peak reverse voltage, non- repetitive peak reverse voltage, repetitive peak OFF-state voltage, break-over voltage, critical rate of rise of ON-state current, critical rate of rise OFF-state voltage, holding current and holding voltage, latching current, amperes squared seconds ($I^2t$) rating.

**UNIT V**
LOW FREQUENCY TRANSISTOR AMPLIFIER: Graphical Analysis of CE amplifier; h-parameter Models for CB, CE, CC configurations and their Interrelationship; Analysis and Comparison of the three Configurations; Linear analysis of Transistor Circuits: Miller's Theorem: Cascading: Simplified Models and Calculation of CE and CC Amplifiers; Effect of emitter Resistance in CE amplifiers: Cascode amplifiers: Darlington Pair, analysis of Single stage FET amplifier-CS and CD Configuration, FET as VVR.

**Text books:**
1. Microelectronics circuits-Sedra/Smith,Oxford University Press.
2. Microelectronics – Millman and Grabel, TMH.

**Reference Books:**
1. Electronic Devices and Circuit Theory – Boylestad & Nashelsky, 8th Ed. PHI.
2. Art of Electronics , Cambridge University press.

**Semester: 3** **Code: ET20321**
**Subject: Data Structures Laboratory**
**Credits: 2**

Introduction**:** Data types, Abstract data types, data Structures, storage structure, Concept of 'O' notation, Time complexity & Space complexity issues. Arrays, Stacks & recursions, Queues, Linked list, Hashing, Trees Graphs & their Applications Linked representation of Graph, Adjacency Matrix, Adjacency list, Shortest path algorithm, Graph Traversal: BFS, DFS, BDD and its application ,Sorting Techniques **:** Bubble sort, Quick sort, selection sort, Heap sort, insertion sort, merge sort, radix sort & efficiency considerations. Searching Techniques**:** Sequential search, index sequential search, Binary search, Interpolation Search, Tree Searching, and Fibonacci Search. Files: properties of physical storage media, file organization techniques.

**Text Books:**

1. Introduction to Data Structures with applications, Tremblay & Sorenson, Tata-McGraw-Hill, 2nd Ed., 2006.
2. Data Structures and Algorithm Analysis in C, M. A. Weiss, Addison-Wesley, 3nd Ed., 2006.

**Reference Books:**

1. Data Structures, Algorithms and Applications in C++, S. Sahani, Silicon Press, 2004.
2. Structures and Algorithms, A. V.Aho, J. E. Hopcroft & J.D. Ullman, Data Addition-Wesley, 1998.
3. Data Structures and Algorithms: Concepts, Techniques and Applications, G. A. V. Pai, Tata McGraw Hill, 1st Ed, 2008.
4. Data Structures, D. Samanta, PHI, 2004.

**Semester: 3** **Code: ET20322**
**Subject: Devices and Circuits-I Laboratory**
**Credits: 2**

Lab assignments based on ET20315, ET20313 using trainer kits and Multisim/Orcad.

**Semester: 3** **Code: ET20323**
**Subject: Digital Logic Design Laboratory**
**Credits: 2**

Lab assignments based on ET20312 Digital logic design.