# DELHI TECHNOLOGICAL UNIVERSITY

# SCHEME OF EXAMINATION AND COURSE OF READING FOR

# B.TECH. (ELECTRONICS AND COMMUNICATION ENGINEERING)

| | | | | |
|---|---|---|---|---|
| **Semester** | **I** | **Examination** | **November,** | **2010** |
| **Semester** | **II** | **Examination** | **May,** | **2011** |
| **Semester** | **III** | **Examination** | **November,** | **2011** |
| **Semester** | **IV** | **Examination** | **MAY,** | **2012** |
| **Semester** | **V** | **Examination** | **November,** | **2012** |
| **Semester** | **VI** | **Examination** | **MAY,** | **2013** |
| **Semester** | **VII** | **Examination** | **November,** | **2013** |
| **Semester** | **VIII** | **Examination** | **MAY,** | **2014** |

Syllabus is applicable to the students seeking admission to the B.TECH. (ELECTRONICS & COMMUNICATION ENGINEERING) Course in the academic year 2010.

# ELECTRONICS AND COMMUNICATION ENGINEERING

**Summary of** Scheme of Examination

Total Credits for B.TECH. degree : 240

Semester wise : I-30, II-30, III-30, IV-30, V-30, VI-30, VII-30, VIII-30

Classification of Subjects

| Subjects | H | A | C |
|---|---|---|---|
| I | 19 | 11 | 00 |
| II | 14 | 16 | 00 |
| III | 00 | 10 | 20 |
| IV | 00 | 03 | 27 |
| V | 00 | 00 | 30 |
| VI | 04 | 02 | 24 |
| VII | 00 | 04 | 26 |
| VIII | 00 | 04 | 30 |
| Total Credits 240 | 37 | 54 | 161 |
| Percentage Contents of H, A, C | 16% | 23% | 61% |

H Humanities, Social Studies and Basic Sciences

A Allied Engineering

C Core (include major project and practical training also)

## Industrial training of 10 weeks durations during summer vacations after 6th semester and 4 weeks after 5th semester.

VS (Evaluation of sessional courses have been converted in the form of regular theory or practical course with End Semester Examination)

**SUGGESTED SCHEME FOR B.TECH. FIRST SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S.No. | Course No. | Subject | LTP | Evaluation Sessional | Evaluation End | Total Marks | Credit Type |
|---|---|---|---|---|---|---|---|
| TH1 | MA 101 | Mathematics-1 | 310 | 30 | 70 | 100 | 4H |
| TH2 | HU 102 | Communication skills | 210 | 30 | 70 | 100 | 3H |
| TH3 | PH 103 | Applied Physics | 310 | 30 | 70 | 100 | 4H |
| TH4 | CH 104 | Applied Chemistry | 310 | 30 | 70 | 100 | 4H |
| TH5 | EE 105 | Electrical sciences | 310 | 30 | 70 | 100 | 4A |
| TH6 | IT 106 | Fundamentals of Information Technology | 210 | 30 | 70 | 100 | 3A |
| PR1 | PH 107 | Applied Physics Lab | 002 | 30 | 70 | 100 | 2H |
| PR2 | CH 108 | Applied Chemistry Lab | 002 | 30 | 70 | 100 | 2H |
| PR3 | EE 109 | Electrical Sciences Lab | 002 | 30 | 70 | 100 | 2A |
| PR4 | IT 110 | Information Technology Lab | 002 | 30 | 70 | 100 | 2A |
| | TOTAL | | 30 hrs | | | 1000 | 30 |

**SUGGESTED SCHEME FOR B.TECH. SECOND SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S.No. | Course No. | Subject | LTP | Evaluation Sessional | Evaluation End | Total Marks | Credit Type |
|---|---|---|---|---|---|---|---|
| TH1 | MA 111 | Mathematics-II | 310 | 30 | 70 | 100 | 4H |
| TH2 | EN 112 | Environmental Sciences | 200 | 30 | 70 | 100 | 2H |
| TH3 | AS 113 | Engineering Physics | 400 | 30 | 70 | 100 | 4H |
| TH4 | AS 114 | Engineering Materials | 400 | 30 | 70 | 100 | 4H |
| TH5 | ME 115 | Mechanical Sciences | 310 | 30 | 70 | 100 | 4A |
| TH6 | COE 116 | Principle of programming Language | 200 | 30 | 70 | 100 | 2A |
| PR1 | ME 117 | Engineering Graphics | 003 | 30 | 70 | 100 | 3A |
| PR2 | COE 118 | Programming Lab | 002 | 30 | 70 | 100 | 2A |
| PR3 | PH119 | Applied Physics-II(lab) | 002 | 30 | 70 | 100 | 2A |
| PR4 | PE 120 | Mechanical Workshop | 003 | 30 | 70 | 100 | 3A |
| | TOTAL | | 30 hrs | | | 1000 | 30 |

**SUGGESTED SCHEME FOR B.TECH. THIRD SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S.NO | Course No | Subject | LTP | Evaluation | | | Total | Credit type |
|---|---|---|---|---|---|---|---|---|
| | | | | A | MS | End | | |
| TH-1 | EC-201 | Analog Electronics | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH2 | EC-202 | Probability and Stochastic Processes | 4 0 0 | 10 | 20 | 70 | 100 | 4C |
| TH3 | EC-203 | Digital Electronics | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH4 | EC-204 | Network Analysis and Synthesis | 3 1 0 | 10 | 20 | 70 | 100 | 4A |
| TH5 | EC-205 | Signals and Systems | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH6 | EC-206 | Electronics Instrumentation & measurement | 3 0 0 | 10 | 20 | 70 | 100 | 3A |
| PR1 | EC-207 | Analog Electronics- Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR2 | EC-208 | Digital Electronics Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR3 | EC-209 | Signal and System Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| VS1 | EC-210 | Self Study | 0 0 1 | - | - | 100 | 100 | 1C |
| | Total | | 30 Hrs | | | | 1000 | 30 |

**SUGGESTED SCHEME FOR B.TECH. FOURTH SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S.NO | Course No | Subject | LTP | Evaluation | | | Total | Credit Type |
|---|---|---|---|---|---|---|---|---|
| | | | | A | MS | End | | |
| TH-1 | EC-211 | Analog Integrated Circuits | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH2 | EC-212 | Digital System Design | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH3 | EC-213 | Electromagnetic Theory | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH4 | EC-214 | Communication Systems | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH5 | EC-215 | Computer Architecture | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH6 | HU-216 | Engineering Economics | 3 0 0 | 10 | 20 | 70 | 100 | 3H |
| PR1 | EC-217 | Digital System Design Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR2 | EC-218 | AIC Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR3 | EC-219 | Communication Systems Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| VS1 | EC-220 | Self Study | 0 0 1 | - | - | 100 | 100 | 1C |
| | Total | | 30 Hrs | | | | 1000 | 30 |

**SUGGESTED SCHEME FOR B.TECH. FIFTH SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S.NO | Course No | Subject | LTP | Evaluation | | | Total | Credit type |
|---|---|---|---|---|---|---|---|---|
| | | | | A | MS | End | | |
| TH-1 | EC-301 | Information Theory and Coding | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH2 | EC-302 | Digital Signal Processing | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH3 | EC-303 | Antenna and Wave Propagation | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH4 | EC-304 | Digital Communication | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH5 | EC-305 | Microprocessors and interfacing | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| PR1 | EC-306 | Computer Architecture & Micro processor Interfacing Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR2 | EC-307 | Digital Signal Processing Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR3 | EC-308 | Digital Communication Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR4 | EC-309 | Minor Project-I | 0 0 4 | 50 | - | 150 | 200 | 4C |
| | Total | | 30 Hrs | | | | 1000 | 30 |

**SUGGESTED SCHEME FOR B.TECH. SIXTH SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)**

| S.NO | Course No | Subject | LTP | Evaluation | | | Total | Credit type |
|---|---|---|---|---|---|---|---|---|
| | | | | A | MS | End | | |
| TH-1 | EC-311 | Micro wave Engineering | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH2 | EC-312 | VLSI Design | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH3 | EC-313 | Control Systems | 3 1 0 | 10 | 20 | 70 | 100 | 4A |
| TH4 | EC-314 | Computer Communication Networks | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH5 | EC-315 | Embedded Systems | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| PR1 | EC-316 | Microwave Engg Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR2 | EC-317 | Embedded systems Lab | 0 0 2 | 10 | 20 | 70 | 100 | 2C |
| PR4 | EC-318 | Minor Project-II | 0 0 6 | 50 | - | 150 | 200 | 4C |
| PR3 | EC-319 | Industrial Training | - | | - | 100 | 100 | 2A |
| | Total | | 30 Hrs | | | | 1000 | 30 |

## SUGGESTED SCHEME FOR B.TECH. SEVENTH SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)

| S.NO | Course No | Subject | LTP | Evaluation | | | Total | Credit type |
|---|---|---|---|---|---|---|---|---|
| | | | | A | MS | End | | |
| TH-1 | EC-401 | Digital Image Processing | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH2 | EC-402 | Digital System Testing and Diagnosis | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH3 | EC-403 | Elective-I | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH4 | EC-404 | Open Elective-I | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| PR1 | EC-405 | Digital Image Processing Lab | 0 0 3 | 10 | 20 | 70 | 100 | 3C |
| PR2 | EC-406 | Lab based on Elective I | 0 0 3 | 10 | 20 | 70 | 100 | 3C |
| PR3 | EC-407 | Major Project (Part-I) | 0 0 8 | 50 | - | 150 | 300 | 4C |
| PR4 | EC-408 | Industrial Training-II | | - | - | 100 | 100 | 4A |
| | Total | | 30 Hrs | | | | 1000 | 30 |

## SUGGESTED SCHEME FOR B.TECH. EIGHTH SEMESTER (ELECTRONICS AND COMMUNICATION ENGINEERING)

| S.NO | Course No | Subject | LTP | Evaluation | | | Total | Credit type |
|---|---|---|---|---|---|---|---|---|
| | | | | A | MS | End | | |
| TH-1 | EC-411 | Mobile Communication systems | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH2 | EC-412 | Elective II | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| TH3 | EC-413 | Elective III/Open Elective | 3 1 0 | 10 | 20 | 70 | 100 | 4C |
| PR1 | EC-414 | Elective-II/III Lab | 0 0 3 | 10 | 20 | 70 | 100 | 3C |
| PR2 | EC-415 | Mobile Communication and Networks Lab | 0 0 3 | 10 | 20 | 70 | 100 | 3C |
| PR3 | EC-416 | Seminar | 0 0 2 | | - | 100 | 100 | 2C |
| PR4 | EC-417 | Major project (Part II) | 0 0 10 | 100 | - | 300 | 400 | 10C |
| | Total | | 30Hrs | | | | 1000 | 30 |

**List of Electives:**

| Departmental Elective – I | Departmental Elective – III |
|---|---|
| EC- 403-1 Selected Topics in Sensors and Instrumentation<br>EC- 403-2 Advanced Computer Architecture<br>EC- 403-3 Information Security<br>EC- 403-4 Modern Filter Design<br>EC- 403-5 Statistical Signal Processing<br>EC-403-6 Radar and Statistical Communication Theory<br>EC-403-7 Satellite Communication<br>EC-403-8 Optical Communication | EC -413-1 Fault Tolerant Computing<br>EC- 413-2 Audio and Video Engineering<br>EC -413-3 Pattern Recognition<br>EC-413-4 Information Security<br>EC-413-5 Wireless Sensor Networks<br>EC-413-6 Nano Electronics<br>EC- 413-7 Speech Processing<br>EC-413-8 Bio-Medical Engineering and Instrumentation |
| **Departmental Elective – II** | **Open Electives** |
| EC-412-1 Nonlinear Circuits and Systems<br>EC-412-2 Microwave Integrated Circuits<br>EC-412-3 Optical Networks<br>EC -412-4 Selected Topics in VLSI<br>EC -412-5 Detection and Estimation Theory<br>EC -412-6 High Speed Networks<br>EC -412-7 Selected Topics in Signal Processing<br>EC-412-8 CMOS Analog IC<br>EC-412-9 Robotics and Object tracking | EC -413-9 Soft Computing<br>EC-413-10 Computer Vision<br>EC-413-11 Neuro Electronics<br>EC-413- 12 Power Electronics |

# Course Curriculum

**B.TECH. I- Year,I Semester Examination**
**Theory Paper – I (Common to all Branches)**
**EE/COE/EC/IC/ME/PE/MPA/CE/ENE/PT/IT/BT**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## MA-101 Mathematics – I

**Unit I: Infinite series**: Tests for convergence of series (comparison, ratio, root, integral, Raabe's, logarithmic), Alternating series, Absolute convergence, Conditional convergence. (**5L**)

**Unit II: Calculus of single variable:** Taylor's & Maclaurin's expansion, Radius of curvature, applications of definite integral to area, arc length, surface area and volume (in Cartesian, parametric and polar co-ordinates). (**8L**)

**Unit III: Calculus of several variables**: Partial differentiation, Euler's theorem, total differential, Taylor's theorem, Maxima-Minima, Lagrange's method of multipliers, Application in estimation of error and approximation. (**7L**)

**Unit IV: Multiple Integrals**: Double integral (Cartesian and polar co-ordinates), change of order of integration, triple integrals (Cartesian, cylindrical and spherical co-ordinates), Gamma and Beta functions. Applications of multiple integration in area, volume, centre of mass, and moment of inertia. (8**L**)

**Unit V: Vector Calculus**: Continuity and differentiability of vector functions, Scalar and vector point function, Gradient, Directional Derivative, divergence, curl and their applications. Line integral, surface integral and volume integral, applications to work done by the force . Applications of Green's, Stoke's and Gauss divergence theorems. (**8L**)

**Unit VI: Function of Complex Variable:** Definition of complex function. Circular, Hyperbolic, and Logarithmic functions. Inverse of Circular, and Hyperbolic functions. (**4L**)

Suggested Text Books:


1. "Advanced Engineering Mathematics" by Alan Jeffery ; Academic Press
2. "Calculus and Analytic Geometry" by Thomas/Finney; Narosa.


Suggested Reference Books:


1. "Advanced Engineering Mathematics" by Kreyszig; Wiley.
2. "Advanced Engineering Mathematics" by Taneja ; I K international
3. "Advanced Engineering Mathematics" by Jain/Iyenger; Narosa.

# Course Curriculum

**B.TECH. I- Year,I Semester Examination**
**Theory Paper –II (Common to all Branches)**
**EE/COE/EC/IC/ME/PE/MPA/CE/ENE/PT/IT/BT**

| L | T | P | Credit |
|---|---|---|---|
| 2 | 1 | 0 | 3 |

## HU-102 Communication Skills

### Unit I: Functional English:

(A) Parts of speech; Tense and concord; Conditional clauses**;** Question tags & short responses; Punctuation; Common errors.
(B) Vocabulary and Usage: Synonyms & Antonyms; One word substitutions; Words often confused; Idioms / Idiomatic expressions.

### Unit II: Basics of Writing:

(A) Presentation of Technical Information: Technical description of simple objects, tools, appliances; Processes and operations; Scientific Principles; Definitions ; Interpretation of Visual Data (graph, charts etc)
(B) Writing of: Paragraph; Summary and Abstract; Taking and Making Notes.
(C) Comprehension of Unseen Passages based on reading exercises like Skimming, Scanning and Inference making.

### Unit III: Oral Communication:

Phonetics: Speech Sounds and their articulation; Phonemes, syllable, Stress, Transcription of Words and Simple Sentences; Presentation and Seminar; Language Lab Practice for Oral Communication.

### Unit IV: Texts for Appreciation and Analysis:

(A) *Wings of Fire* by APJ Abdul Kalam
(B) *The Fortune at the Bottom of the Pyramid by C.K. Prahalad.*
(C) *The Branded (Uchalya)* by Laxman Gaikwad
(D) *Geetanjali by Ravindranath Tagore.*

Suggested Readings:


1. Day, Robert A. *Scientific English: A Guide for Scientists and Other Professionals*. UP.
2. Maison Margaret , *Examine Your English*, New Delhi: Orient Longman.
3. Tikoo M.L., A.E. Subramaniam and P.R. Subramaniam. *Intermediate Grammar Usage and Composition.* Delhi: Orient Longman.
4. Weiss, Edmond H. *Writing Remedies: Practical Exercises for Technical Writing*. University Press.
5. Lesikar and Flatley. *Business Communications*. New Delhi, Biztantra Press.
6. O'Connor, *Better English Pronunciation,* Cambridge: Cambridge University Press.
7. Gaikwad, Laxman, *The Branded*, Delhi: Sahitya Akademi.
8. Kalam, APJ Abdul, *Wings of Fire*, Delhi: University Press.
9. *C.K. Prahalad, The Fortune at the Bottom of the Pyramid, Wharton School Publishing.*
10. *Rabindranath Tagore, Gitanjali, Filiquarian Publishing, LLC.*

# Course Curriculum

**B.TECH.I –year, I- Semester Examination**
**Theory Paper – III (Common to all Branches)**
**EE/COE/EC/IC/ME/PE/MPA/CE/ENE/PT/IT/BT**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**PH – 103 Applied Physics**

### Unit I: Relativity:
Review of concepts of frames of reference and Galilean transformation equation, Michelson – Morley experiment and its implications, Einstein's special theory of relativity, Lorentz transformation equations, Law of addition of velocities, Mass variation with velocity, Concept of energy and momentum, Mass energy relation.

### Unit II: Oscillations, waves:
Damped and forced oscillations, Resonance (amplitude and power), Q – factor, Sharpness of resonance. Equations of longitudinal and transverse waves and their solutions, Impudence, Reflection and transmission of waves at a boundary, Impedance matching between two medium.

### Unit III: Physical optics:
Interference by division of wave front and amplitude, Multiple beam interference and Fabry-Perot interferometer, Fresnel diffraction through a straight edge, Fraunhoffer diffraction, Zone plate, single slit and N-slit / grating, Resolving power of telescope, prism and grating. Polarization by reflection and by transmission, Brewster's law, Double refraction, elliptically and circularly polarized light, Nichol prism, Quarter and half wave plates.

### Unit IV: Optical Instruments:
Cardinal points of co-axial lens systems, spherical and chromatic aberrations and their removal, Huygens and Ramsden's eyepiece.

### Unit V: Laser optics:
Coherence and coherent properties of laser beams, Brief working principal of lasers, Spontaneous and stimulated emission, Einstein's co-efficient, Ruby laser, He-Ne laser.

### Unit VI: Optical Fiber:
Classification of optical fibers, Refractive index profile, Core cladding refractive index difference, Numerical aperture of optical fiber, Pulse dispersion in optical fiber (ray theory).

### Suggested Text Books:


1. "Physics of Vibrations and Waves" by H.J. Pain.
2. "Vibrations and Waves" by A.P. French.
3. "Perspective of Modern Physics" by Authors Beiser.


### Suggested Reference Books:


4. "Optics" by A. Ghatak.
5. Berkley Physics Course Vol – 1.

# Course Curriculum

## B.TECH. I year, I- Semester Examination
## Theory Paper – IV (Common to all Branches)
## EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## CH-104 Applied Chemistry

**Unit I: (a) Conventional Analysis:** Volumetric Analysis, Types of titrations, Theory of indicators. **2L**

**(b) Spectral Analysis:** Electromagnetic radiation, Lambert-Beer's Law, UV-VIS, IR, instrumentation & applications. **4L**

**Unit II: Thermal Methods of Analysis:** principle, working and applications of Thermogravimetry, Differential thermal analysis and Differential scanning calorimetry. **4L**

**Unit III: (a) Polymers:** Monomer & polymer, functionality and Degree of Polymerization. Mechanism of polymerization. Molecular weights of polymers. Methods of polymerization. Industrial production of PE and PF resins. Industrial applications of polymers. **6L**

**(b) Bio-molecules:** Classification, Structure, physical and chemical properties of Amino-acids, Peptides and Proteins, Carbohydrates, Cellulose and its derivatives, RNA, DNA. Introduction to Bio-degradable Polymers. **6L**

**Unit IV: Electrochemistry:** Electrochemical cells: components, characteristics of batteries. Primary and Secondary battery systems: Zinc-Carbon cells, Lead storage and lithium batteries. Fuel Cells, Electro-deposition: Electrical and chemical requirements. Electroplating bath and linings. Agitation, Circulation and filteration equipment. Plating of copper, gold and rhodium. **8L**

**Unit V: Phase Equilibrium:** Definitions of Phase, component and degree of freedom, Gibb's phase rule. One component systems: Water and sulphur. Two component systems: Pb-Ag and Cu-Ni system. **6L**

**Univ VI: Green Chemistry:** Introduction, Goals & Significance of Green Chemistry. Reagents, solvents and catalysts for green synthesis. Principles of Green Chemistry, Evaluation of feedstocks, reaction types and methods. Future trends in Green Chemistry. **4L**

**Suggested Text Books:**


1. **"**Thermal Analysis" by T. Hatakeyama, F.X. Quinn; Wiley.
2. " Inorganic Quantitative Analysis" by A.I. Vogel.
3. "Instrumental Method of Analysis" by Skoog D.A.; HRW International.


**Suggested Reference Books:**


4. "Green Chemistry: Theory & Practice" by P.T. Anastas & JC Warner; Oxford Univ Press.
5. "Polymer Science and Technology" by Billmeyer; John Wiley.
6. "Polymer Science and Technology" by Fried; Prentice Hall.

# Course Curriculum

**B.TECH.I year, I Semester Examination**
**Theory Paper-V (Common to all Branches)**
**EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**EE – 105 Electrical Sciences**

## Unit I: Introduction:

Role and importance of circuits in Engineering, concept of fields, charge, current, voltage, energy and there interrelationship. V-I characteristics of ideal voltage and ideal current sources, various types of controlled sources. Passive circuit components: V-I characteristics and ratings of different types of R, L, C elements.

## Unit II: DC Network:

Series circuits and parallel circuits, power and energy, Kirchoff's Laws. Delta-star conversion, Superposition Theorem, Thevenin's Theorem, Norton's theorem, Maximum Power Transfer Theorem, Tellgen Theorem.

## Unit III: Single Phase AC Circuits:

Single phase EMF generation, average and effective values of sinusoids, complex representation of impedance, series and parallel circuits, concept of phasor, phasor diagram, power factor, power in complex notation, real power, reactive power and apparent power. Resonance in series and parallel circuits, Q-factor, bandwidth and their relationship, half power points.

## Unit IV: Three-Phase AC Circuits:

Three phase EMF generation, delta and Y connection, line and phase quantities. Solution of three phase circuits: balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits.

## Unit V: Magnetic Circuits & Transformers:

Amperes circuital law, B-H curve, concept of reluctance, flux, MMF, analogies between electrical and magnetic quantities solution of magnetic circuits. Hysteresis and eddy current losses, application of magnetic force, mutual inductance and dot convention. Single phase Transformer construction, principle of working, auto transformer and their applications.

## Unit VI: Three Phase Induction Motor:

Construction, Principle of operation, types of motors applications.

## Unit VII: Equipment and Machine Power supply basics:

Electric wiring, power distribution and utilization: Neutral, grounding & phase definitions, colour coding, of cable, IS standards for domestic and industrial cable/wiring, conduct and cable wiring, MCB, ELCB, industrial and domestic sockets, plug, etc. Fuses, their types characteristics, introduction to energy efficient lighting and energy conservation.

## Unit VIII: Measuring Instruments:

Analog indicating instruments, devices, Damping devices, PMMC ammeters and voltmeters, shunt and multipliers, Moving iron ammeter and voltmeters, dynamometer type wattmeters, multimeters, AC watt-hour meters. Digital electronic voltmeters, digital electronic ammeters and wattmeters.

**Suggested Text Books:**


1. **"**Basic electrical Engineering" by C.L. Wadhwa, 4th Edition; New Age International.
2. "Basic Electrical Engineering" by Fitzereld, Higgenbotham & Grabel; McGraw Hill International.

**Suggested Reference Books:**

**3.** "Electrical Engineering Fundamentals" by Vincent Deltoro; Prentice Hall International (EEI).
**4.** Relevant Indian Electricity Supply rules & BIS codes.

# Course Curriculum

## B.TECH.I year, I Semester Examination
## Theory Paper-VI (Common to all Branches)
## EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE

| L | T | P | Credits |
|---|---|---|---|
| 2 | 1 | 0 | 3 |

## IT – 106 Introduction to Information Technology

**Unit – I : Fundamental Concepts of Information:** Definition of information, Data Vs Information, Introduction to Information representation in Digital Media, Text, image, graphics, Animation, Audio, Video etc., Need, Value and Quality of information

**Unit – II : Concepts in Computer & Programming:** Definition of Electronic Computer, History, Generations, Characteristic and Application of Computers, Classification of Computers, Memory, different types of memory, Computer Hardware - CPU, Various I/O devices, Peripherals, Firmware and Humanware.

**Unit – III : Programming Language Classification & Program Methodology:** Computer Languages, Generation of Languages, Translators, Interpreters, Compilers, Flow Charts, Dataflow Diagram, Assemblers, Introduction to 4GL and 5GL.

**Unit – IV : Digital Devices and Basic Network Concepts: Digital Fundamentals:** Various codes, decimal, binary, hexa-decimal conversion, floating numbers gates, flip flops, adder, multiplexes, Introduction to Data Transmission.

**Unit – V : Data Communication & Networks:** Computer Networks- Introduction of LAN, MAN and WAN. Network Topologies, Client-server Architecture.

**Unit – VI : Internet and Web Technologies:** Hypertext Markup Language, DHTML, WWW, HTTP, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email, Safety of Business Transaction on web. Elementary Concepts of E-Learning and E-Commerce, Electronic Payment Systems, Digital Signatures, Firewall.

**Suggested Text Books:**


1. **"**Using Information Technology: A Practical Introduction to Computers & Communications" by William Sawyer & Hutchinson; Publisher: Tata McGraw-Hill.
2. 'Introduction to Computers' by Peter Norton; Tata McGraw-Hill.
3. "Introduction to Computers" by Rajaraman; PHI.


**Suggested Reference Books:**


4. "Data Compression" by Nelson; BPB.
5. "Internet, An introduction"by CIS Tems; Tata McGraw Hill.
6. "Information Technology: Breaking News" by Curtin; TMH.
7. "Fundamentals of Information Technology" by Leon & Leon; Vikas.
8. "Internet 101" by Lehngart; Addison Wesley.

## Course Curriculum

**B.TECH.I year, I Semester Examination**
**Practical Paper I (Common to all Branches)**
**EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE**

**PH-107 Physics Lab**

**Based on course work corresponding PH-103**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH.I year, I Semester Examination**
**Practical Paper II (Common to all Branches)**
**EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE**

**CH-108 Chemistry Lab**

**Based on course work corresponding CH-104**

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| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH.I year, I Semester Examination**
**Practical Paper III (Common to all Branches)**
**EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE**

**EE-109 Electrical Sciences Lab**

**Based on course work corresponding EE-105**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH.I year, I Semester Examination**
**Practical Paper IV (Common to all Branches)**
**EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE**

**IT-110 Fundamental of IT Lab**

**Based on course work corresponding IT-106**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

# Course Curriculum

**B.TECH.I year, II Semester Examination**
**Theory Paper-I (Common to all Branches)**
**EE/COE/EC/IC/ MPA/CE/ENE/PT/IT/BT ME/PE**

**MA 111 MATHEMATICS - II L T P**

3 1 0

**Matrices**: Rank of a matrix, inverse of a matrix using elementary transformations, consistency of linear system of equations; Eigen-values and eigenvectors of a matrix, Cayley Hamilton theorem, diagonalization of matrix. (**8L**)

**Ordinary differential equations-I:** Bernoulli's equation, Second & higher order linear differential equations with constant coefficients, General solution of homogenous and non-homogenous equations.
(**8L**)

**Ordinary differential equations-II:** Method of variation of parameters. Euler-Cauchy equation, simultaneous linear equations, power series method, Frobenious method, Legendre equation, Legendre polynomials, Bessel equation.

(**8L**)

**Laplace Transforms**: Basic properties, Laplace transform of derivatives and integrals, Inverse Laplace transform, Differentiation and Integration of Laplace transform, Convolution theorem, Unit step function, Periodic function, Laplace transform solution of IVP and system of linear differential equations.
(**6L**)

**Fourier series**: Fourier series, Dirichlet conditions, Even and odd functions, half range series, harmonic analysis, (**4L**)

**Fourier Transforms:** Fourier Transforms, Sine and Cosine Transforms, Transforms of derivatives and integrals, Applications to boundary value problem in ordinary differential equations (simple cases only).
(**6L**)

**Suggested Text Books:**

1. Advanced engineering mathematics: Greenberg; Pearson Education
2. Advanced engineering mathematics: Kreyszig; Wiley.

**Suggested Reference Books:**

3. Advanced engineering mathematics: Taneja ; I K international
4. Advanced engineering mathematics: Jain/Iyenger; Narosa.

**EN 112 ENVIRONMENTAL SCEINC E** **L T P**

2 0 0

**UNIT I** :Introduction to Environment: Origin & evolution of earth, segments of environment- lithosphere, hydrosphere, atmosphere & biosphere, Biogeochemical cycles- geologic, hydrological, oxygen, nitrogen, carbon & phosphate cycles.

**UNIT II:** Ecosystems: Concept of ecosystem biotic & abiotic components, types of ecosystems, functional components of ecosystem- biodiversity, productivity, food chains & food webs, material cycling and energy flow, different ecosystems- forest, grassland, desert, aquatic.

**UNIT III:** Water Pollution: Water quality, physical, chemical & biological characteristics of water & waste water, ground water pollution, water borne diseases.

**UNIT IV :** Air & Noise Pollution: Primary & secondary air pollutants, sources, effects & control of- carbon monoxide, nitrogen oxides, hydrocarbons, sulphur dioxide & particulates,

**UNIT V :**Air quality standards, global warming, acid rain, El Nino, ozone hole. Classification and measurement of noise, effects of noise pollution on human, control of noise pollution.

**UNIT VI:** Energy & Solid Waste Management: Conventional energy resources- coal, thermal, petroleum, hydroelectricity, nuclear power, wood, non conventional sources- solar, biogas, wind, ocean & tidal energy, geothermal energy. Hazardous and non hazardous solid waste management. Environmental laws and acts.

**Suggested Text Books:**

1. De Anil Kumar & De Arnab Kumar, Environmental Studies, New Age International (P) Ltd.

2. Basak Anindita, Environmental Studies, Pearson Education South Asia.

**Suggested Reference Books:**

3. Subramanian. V., A Text Book of Environmental Science, Narosa Publishing House.

4. Rana. S.V.S., Essentials of Ecology & Environment Science, PHI Publications.

**PH 113 APPLIED PHYSICS-II L T P**

4 0 0

**UNIT--- I: Quantum Physics.**

Failure of classical physics ,Compton effect , Pair production de-broglie relation, wave function, Probability density, Schrodinger wave equation operators, expection values and eigen value equation, particle in a box, simple harmonic oscillator problem, concept of degeneracy.

**UNIT—II: Clasical Statistic.**

Statistical physics : Microscopic macroscopic systems, concept of phase space basic postulates of statistical mechanics, Maxwell—Boltzmann distribution law.

**UNIT—III: Quantum statistic.**

Quantum Statistics: Fermi—Dirac and Bose –Einstein Distribution, Fermi- Dirac probability function, Fermi energy level.

**UNIT—IV: Nuclear Physics.**

Nuclear properties, constituent of the nucleus, binding energy, stable nuclei, radioactive decay law (alpha and beta spectrum), Q-value of nuclear reaction , nuclear models-liquid drop and shell model, nuclear fission and fusion, elementary ideas of nuclear reactors.

**UNIT—V: Electrodynamics.**

Maxwell's equations, concept of displacement current, Derivation of wave equation for plane electromagnetic wave,

**UNIT—VI: Poynting theorem**

Poynting vector. Poynting theorem, Energy density, wave equation in dielectric & conducting media.

**Suggested Text Books:**

1. Nuclear Physics: Erwin Kaplan.
2. Concept of Nuclear Physics: Cohen.

**Suggested Reference Books:**

3. Electrodynamics: Griffith.
4. Electricity & magnetism: Rangawala & Mahajan.
5. Perspective of Modern Physics: Arthur Beiser.

**AS 114 ENGINEERING MATERIALS** **L T P**

**PART-A (PHYSICS)** 4 0 0

**Crystal Structure**: Bravis lattices; Miller indices, simple crystal structures, Different kind of bending.

**Metallic Conduction:** Energy distribution of electrons in a metal, Fermi level, Conduction process.

**Semi Conductors :**Band theory of solids , P and N type of semiconductors , Statistics of holes and electrons , Hall effect , Effect of temperature on conductivity , Life time and recombination ,draft and diffusion in PN junction .

**Dielectric and Optical properties of Materials**: Dielectric polarization and dielectric constant, optical absorption process.

**Magnetism and Superconducting Materials :** Dia-para , Ferro-magnetism , Antiferro , Ferro-magnetism ferrites, Superconducting materials , Properties , Type of superconducting materials , Meissner effect , High- Tc superconductor , application.

**PART – B (CHEMISTRY)**

**Water treatment**: Impurities in water, hardness of water, determination and removal of hardness, boiler feed water, boiler troubles and prevention, numerical based on hardness removal.

**Composite materials**: Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fiber-reinforced composites, environmental effects on composites, applications of composites.

**Speciality Polymers**: Conducting polymers-Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrole, applications of conducting polymers, Ion-exchange resins and their applications.

**Ceramic & Refractory**: Introduction, classification, properties, raw materials, manufacturing and applications.

**NOTE**: Two hrs per week load for Applied Physics Department.

Two hrs per week load for Applied Chemistry Department.

**Suggested Text Books(PHYSICS)**


1. Kittel, Solid State Physics, 7th edition, J. W .& Sons Publication
2. Wahab M.A. Solid State Physics @ Narosa Publishing House.
3. Ali OmerM, Elementry Solid State Physics, Pearson Education (Singapore) pvt. Ltd. India branch, New delhi.

**Suggested Reference Books**


4. Kenneth G. Budinski, Budinshi, Engineering Materials ; Properties and Selection , 7th edition, Pearson Singapor (Prentice Hall ).
5. Pillai S.O. Solid State Physics, New Age International Publication.


**Suggested Text Books (CHEMISTRY)**


1. Donald R. Askeland, Pradeep P. Phule, Essentials of Material Science and Engineering; Thomson.
2. R.W.Dyson, Speciality Polymers; USA: Chapman and Hall, New York
3. A.P.Gupta, M.C.Gupta, Polymer composites; New Age publication.


**Suggested Reference Books**


4. R.N.Goyal, H.Goel, Engineering Chemistry; Ane Books India.
5. S.S.Dara, Engineering Chemistry; S.Chand
6. Raghupati Mukhopadhyay, Sriparna Datta, Engineering Chemistry; New Age International
7. P.C.Jain, Monica Jain, Engineering Chemistry; Dhanpat Rai

**ME 115 BASIC MECHANICAL ENGINEERING**
**L T P** 4 0 0

## (PART A)

Unit 1: Introduction to Thermodynamics, Concepts of systems, control volume, state, properties, equilibrium, quasi-static process, reversible & irreversible process, cyclic process. Zeroeth Law and Temperature, Ideal Gas. Heat and Work.

Unit II: First Law of Thermodynamics for closed & open systems. Non Flow Energy Equation. Steady State, Steady Flow Energy Equation.

Second Law of Thermodynamics – Kelvin and Plank's Statements, Clausius inequality, Definition of Head Engines, Heat pumps, Refrigerators. Concept of Energy and availability. Carnot Cycle; Carnot efficiency, Otto, Diedel, Dual cycle and their efficiencies.

Unit III: Properties & Classification of Fluids, Ideal & real fluids, Newton's law of viscosity, Pressure at a point, Pascal's law, Pressurevariation in a static fluid, Introduction to Bio-fluid Mechanics General description of fluid motion, stream lines, continuity equation, Bernoulli's equation, Steady and unsteady flow.Turbines and pumps.

## (PART-B)

**Unit IV: Introduction to engineering materials for mechanical construction.**

Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminum and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

**Unit V: Introduction to Manufacturing processes for various machine elements.**

Introduction to Casting & Welding processes. Fabrication of large & small components and assemblies- example Nuts and Bolts, Water turbine rotors, Large Electric Generators, introduction to turning milling, shaping, drilling & boring processes.

**Unit VI: Introduction to quality measurement for manufacturing processes**; standards of measurements, line standards and, end standards, precision measuring instruments and gauges: vernier calipers, height gauges, micrometers, comparators, dial indicators, and limit gauges.

**Suggested text books:**


1. Engineering Thermodynamics by P. K. Nag.
2. Fundamentals of Classical Thermodynamics by G. J. Van Wyle and R. E. Santag.
3. Introduction to Fluid Mechanics and Fluid Machines by S. K. Som and G. Biswas.
4. Fluid Mechanics by V. L. Streeter and E. B. Wylie.
5. Fluid Mechanics and Hydraulic Machines by R. K. Bansal.


**Suggested reference books:**

6. Manufacturing Processes : Kalpakjian
7. Fluid Mechanics : Modi and Seth,
8. Workshop Practics : A. K. Hazara Chowdhary
9. Workshop Technology : W. A. J. Chapman
10. Production Engineering : P.C. Sharma
11. Production Engineering : R. K. Jain

**COE 116 PROGRAMMING FUNDAMENTALS L T P**

2 0 0

**UNIT I: Introduction:**, Concepts of algorithm, flow chart, Introduction to different Programming Languages like C, C++, Java etc.

**UNIT II:Elementary Programming:** Data types, assignment statements, conditional statements and input/output statements. Iterative programs using loops.Concept of subprograms. Coding style: choice of names, indentation, documentation, etc**. [8 hrs]**

**UNIT III:Arrays:** Array representation, Operations on array elements, using arrays, multidimensional arrays.

**Structures& Unions**: Declaration and usage of structures and Unions.

**UNIT IV:Pointers:** Pointer and address arithmetic, pointer operations and declarations, using pointers as function argument,

**File:** Declaration of files, different types of files. File input/output and usage. **[8 hrs]**

**UNIT V: Object Oriented Programming:** Functional and data decomposition, Characteristics of Object-Oriented Languages: Abstraction, Encapsulation, Information hiding, abstract data types,

**Classes and Objects:** Concept of Object & classes, attributes, methods, C++ class declaration, private and public memberships, Constructors and destructors, instantiation of objects. Introduction to Class inheritance and operator overloading. **[10 hrs]**

**UNIT VI:** Files: Streams and files, error handling, over view of Standard Template Library. **[2 hrs]**

**Suggested text books:**


1. Jeri R. Hanly, Elliot B. Koffman ,"Problem Solving and Program Design in C", Pearson Addison-Wesley, 2006.
2. Behrouz A.Forouzan, Richard F. Gilberg, "A Structured Programming Approach Using C", Thomson Computer Science- Third Edition [India Edition], 2007.
3. A K Sharma, "Data structure using C, Pearson


**Suggested reference books:**


1. Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.
2. E. Balagurusamy, "Object Oriented Programming using C++", TMH. R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.
3. D . Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
4. Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.

**ME 117 ENGINEERING GRAPHICS** **L T P**

0 0 3

**General:**Importance, Significance and scope of engineering drawing Lettering, Dimensioning, Scales, Sense of Proportioning, Different types of Projections, B.I.S. Specification, line symbols, rules of printing.

**Projections of Points and Lines:** Introduction of planes of projection, Reference and auxiliary planes, projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance, intersecting and non-intersecting lines.

**Planes Other than the Reference Planes:** Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points lines in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.

**Projections of Plane Figures:** Different cases of plane figure (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.

**Projection of Solids:** Simple cases when solid is placed in different positions, Axis, faces and lines lying in the faces of the solid making given angles.

**Isometric and Orthographic:** First and Third angle of system of projection sketching of Orthographic views from pictorial views and vice –versa principles and type of sectioning.

**Development of Surface.**

**Suggested text books:**


1. Narayana, K.L. and Kannaiah, P., "Engineering Graphics", Tata McGraw Hill, New Delhi, 1988.
2. Bhatt N.D., "Elementary Engineering Drawing", Charotar Book Stall, Anand, 1998.


**Suggested reference books:**


3. Lakshminarayaan, V. and Vaish Wanar, R.S., "Engineering Graphics", Jain Brothers, New Delhi, 1998.
4. Chandra, A.M. and Chandra Satish, "Engineering Graphics", Narosa, 1998.

**COE 118 PROGRAMMING LAB** **L T P**

0 0 2

Laboratory Practical using C++ Based on course work corresponding **COE-116.**

**PH 119 APPLIED PHYSICS-II (LAB)** **L T P**

0 0 2

Based on course work PH 113

**PE 120 MECHANICAL WORKSHOP** **L T P**

0 0 3

**Fitting shops**: Introduction to various fitting tools- fabrication methods & job work assigned by workshop superintendent.

**Welding shops:** Introduction to welding shop-welding principles & classifications, arc welding processes & related tools/equipments.

**Foundry Shops**: Introduction to molding sands, molding tools-pattern making, miscellaneous work.

# Course Curriculum

**B.TECH. (EC) II-Year, III-Semester**

**Theory Paper I**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-201 Analog Electronics

**Unit-1**

Semiconductors & p-n Junction diode: Review of semiconductor physics, Physical operation of p-n diode and its characteristics, p-n diode modeling (Large-signal/small-signal), p-n diode capacitances (depletion/diffusion), Breakdown in p-n diodes, Zener diode.

**Unit-2**

Rectifier circuits, voltage regulation by Zener diode, limiting and clamping circuits, voltage multipliers

Switching behavior of p-n diode, High frequency model of p-n diode, SPICE model of p-n diode, An example of p-n diode data sheet.

**Unit-3**

Bipolar Junction Transistor(BJT): Physical structure and modes of operation, BJT current components and its physical operation(exponential-$v_{BE}$ / $i_C$ behavior), The Ebers-Moll representation of the BJT, Graphical representation of BJT characteristics, BJT equivalent circuits(large-signal/small-signal), Biasing the BJT for Discrete-Circuit Design, Basic single- stage BJT amplifier configurations, BJT as a switch, SPICE BJT model and simulation examples.

Unit-4

Field Effect Transistors (FETs): The Junction Field Effect Transistor (JFET), , modeling

and DC/AC analysis.

Unit-5

MOSFET: Characteristics Structure and physical operation of Enhancement/Depletion- type MOSFETs(n/p-channel) MOSFET circuits at DC, Biasing in MOS amplifier circuits, Small-signal equivalent circuit of MOSFET, Basic configurations of single-stage IC MOS amplifier circuits, MOSFET as an analog switch, the MOSFET internal capacitances and high-frequency model.
SPICE MOSFET models and simulation examples.

Unit-6

Multistage Amplifiers: Analysis of multistage amplifier using BJT and MOSFETs, Significance of Coupling and bypass capacitor, types of coupling: DC, RC, Transformer, SPICE examples.

**Text Books**

1) "Microelectronics circuits" by Sedra and Smith; Oxford university press
2) "Microelectronics circuits" by Rashid; PWS publishing company.
3) "Electronic Devices and Circuits", B Kumar and Shail Bala Jain, PHI

**Reference Books:**

1)"Microelectronics" by Millman and Grabel; Tata McGraw Hill.

# Course Curriculum

**B.TECH. (EC-202) II-Year, III-Semester**
**Theory Paper VI**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## EC-202: Probabibility and Stochastic Processes

1. Introduction ,Axioms of Probability - I ,Axioms of Probability - II ,Introduction to Random Variables ,Functions, Conditional ,Function of a Random Variable ,Function of a Random Variable (Cont .)
2. Mean and Variance of a Random Variable ,Moments ,Characteristic Function ,Two Random Variables,Function of Two Random Variables ,Function of Two Random Variables (Cont.)
3. Correlation Covariance and Related Innver ,Vector Space of Random Variables ,Joint Moments ,Joint Characteristic Functions ,Joint Conditional Densities - I ,Joint Conditional Densities - II
4. Sequences of Random Variables - I ,Sequences of Random Variables - II ,Correlation Matrices and their Properties ,Correlation Matrices and their Properties ,Conditional Densities of Random Vectors ,Characteristic Functions and Normality ,Thebycheff Inquality and Estimation ,Central Limit Theorem
5. Introduction to Stochastic Process ,Stationary Processes ,Cyclostationary Processes ,System with Random Process as Input ,Ergodic Processes ,Introduction to Spectral Analysis ,Spectral Analysis Contd.
6. Spectrum Estimation - Non Parametric Methods ,Spectrum Estimation - Parametric Methods ,Autoregressive Modeling and Linear Prediction ,Linear Mean Square Estimation - Wiener (FIR) ,Adaptive Filtering - LMS Algorithm

## Text Books


1. Probability and stochastic processes by Roy D Yates and David Goodman, Wiley
2. Probability and stochastic processes for engineers by Carl W Hellstorm, Wiley
3. Random Processes and Probability by Poupolis


## Reference Books:


1. Applied Probability and Stochastic Processes by **Feldman**, Richard M., **Valdez-Flores**, Ciriaco published by PWS Publishing/Thomson Publishing, USA
2. Random Signal theory by Peebles.

# Course Curriculum

**B.TECH. (EC) II-Year, III-Semester**

**Theory Paper II**

| L | T | P | Credits |
|---|---|---|---|
| 4 | 0 | 0 | 4A |

## EC : Control Systems

### UNIT I

**Introduction to Control System:**

Linear, Non Linear, Time Varying and Linear Time Invariant System, Servomechanism, Historical Development of Automatic Control and Introduction to Digital Computer Control, Mathematical Models of Physical Systems, Differential Equations of Physical Systems, Transfer Functions, Block Diagram Algebra and Signal Flow Graphs.

Feedback and Non-feedback Systems Reduction of Parameter Variations By Use of Feedback Control Over System Dynamics By Use of Feedback Control of Effects of Disturbance Single By Use of Feedback and Regenerative Feedback.

### UNIT II

**Control Systems and Components:**

DC and AC Servomotors, Synchro Error Detector, Tacho Generator and, Stepper Motors etc.

### UNIT III

**Time Response Analysis:**

Standard Test Signals, Time Response of First-order Systems, Time Response of Second-Order Systems, Steady-State Error and Error Constants, Effect of Adding a Zero to a System, P, PI and PID Control Action and Their Effect, Design Specifications of Second-Order Systems and Performance Indices.

### UNIT IV

**Frequency Response Analysis:**

Correlation Between Time and Frequency Response, Polar Plots, Bode Plots, and All Pass and Minimum-Phase Systems.

### UNITV

The Concept of Stability, Necessary Conditions for Stability, Hurwitz Stability Criterion, Routh Stability Criterion and relative Stability Analysis. The Root Locus Concept, Construction of Root Loci, Root Contours, Systems with Transportation Lag, Sensitivity of the Roots of the Characteristic equation, MATLAB : Analysis and Design of Control Systems.

**Stability in Frequency Domain:**

Mathematical Preliminaries, Nyquist Stability Criterion, Definition of Gain Margin and Phase Margin, Assessment of Relative Stability Using Nyquist Criterion and Closed-Loop Frequency Response.

### UNIT VI

The Design Problem, Preliminary Considerations of Classical Design, Realization of Basic Compensators, Cascade Compensation in Time Domain Cascade Compensation in Frequency Domain, Tuning of PID Controllers. MATLAB based Frequency domain analysis of control system.

### Text Books:


1. "Control Systems Engineering" by Nagrath & Gopal; New Age International. Publishers
2. "Automatic Control System" by Kuo B.C.


### Reference Books


1. "Modern Control Engineering" by Ogata

2. “Linear Control Systems” by Scheultz & Melsa.
3. “Linear Control Systems - Analysis & Design” by D’ Azzo & Houpis.

# Course Curriculum

**B.TECH. (EC) II-Year, III-Semester**
**Theory Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC 203: Digital Electronics

**UNIT 1**

Introduction to Number Systems and Codes. Switching properties of Diodes, BJT and FET, Logic gates, DTL, TTL, ECL, $I^2L$, CMOS Gates and their parameters and comparisons, Applications of switching transistors in bistable, monostable, astable and Schmitt trigger circuits.

**UNIT 2**

Boolean algebra, Switching Function, minimization of switching function: Karnaugh map method and Tabulation Method don't care terms and applications w.r.to code converters and Digital Comparators, etc.

**UNIT 3**

Gated Flip Flops, Master Slave Flip Flop, Ripple and Parallel Counter, Up-Down Counter, Shift Registers and Ring Counter, designing the combinational circuits of the counters through Excitation Table.

**UNIT 4**

Introduction to the circuits for Arithmetic Unit: Serial and parallel Binary Adders, 2's compliment and principle of subtraction, Carry-Look Ahead Adder, and BCD adder: Principles of multiplication, division in ALU

**UNIT 5**

Semiconductor memories: ROM, PROM, EPROM, EEPROM, Bipolar RAM, static and dynamic RAM. Encoder and Decoder/Demultiplexer, multiplexer, Designing combinational circuits with multiplexer, ROM and PLA. Introduction to advanced memory concepts.

**UNIT 6**

Analog-to-Digital conversion:, dual slope integration method and voltage to frequency conversion, principal of DVM. , counter type, successive approximation type, Flash ADC ,

D-A converter: weighted resistors type, R-2-R ladder type.

### Text Books:


1. "Digital Integrated Electronics" by H.Taub & D. Schilling(TMH).
2. "Digital Principles and Application" by Malvino & Leach (TMH).
3. "Digital Electronics And Logic Design" by M.Mano (PHI)


### References:


1. "Introduction To System Design Using Integrated Circuits" by B.S.Sonde (New Age International).
2. "Switching And Finite Automata Theory" by Z. Kohavi (TMH).
3. "Modern Digital Electronics" by R. P. Jain (TMH).
4. "Digital Electronics" by Gothman (PHI).

# Course Curriculum

**B.TECH. (EC) II-Year, III-Semester**
**Theory Paper IV**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-204: Network Analysis and Synthesis

### UNIT- I
Review of network elements: Linear versus nonlinear, time-variant and time invariant, passive verses active, causal and non-anticipated, stable and unstable networks, Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation.

### UNIT- II
Network graph theory, notations and definitions, incidence matrix, cutsets and fundamental loops, fundamental cutsets matrix, Kirchoff voltage law, Kirchoff current low, interrelation ship between matrices of a graph, Tellegen's theorem and its application.

### UNIT III
Analysis of linear time invariant networks, transform methods in circuit analysis, Laplace transform of common signals, concept of transformed impedance, network functions, poles and zeros, impulse response, step response, convolution.

### UNIT IV
Two-port network parameters: driving point and transfer functions. conversion, various interconnections, analysis using various two port parameters.

### UNIT V
State equations for networks. State variable analysis of circuits, formulation of state equations, solution of state equations. Transient Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace Transform. Steady state sinusoidal analysis.

### UNIT VI
Passive /Active network synthesis, positive real functions, driving point synthesis(RC, RL, LC, ) Introduction to passive filter.

### Text Books:


1. "Network Analysis" by M.E. Van Valkenburg, Third Edition; Prentice Hall, 1986
2. "Fundamentals of Network Analysis & Synthesis" by Behrouz Peikari; Jaico Publishing house, 2006.


### Reference Books:


1. "Network Analysis & Synthesis" by F.F.Kuo; John Wiley & Sons Inc
2. "Engineering Circuit analysis" by Hyat Jr. & Kemmerly, McGraw Hill

# Course Curriculum

**B.TECH. (EC) II-Year, III-Semester**

**Theory Paper V**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## EC-205: Signals and Systems

**Unit-1**

Introduction of signals and systems; classification of signal, continuous time and discrete time signals, operations performed on them, even and odd signals, periodic and non periodic signals, deterministic and random signals, energy signals, power signals, elementary signals; impulse, unit step, ramp and exponentials, classification of systems. Properties of Systems; linearity, causality, stability, linear time-invariant (LTI) systems, convolution integral for continuous-time systems, convolution sum for discrete time systems, properties of linear time-invariant systems, system described by differential and difference equations.

## Unit-2

**Fourier series representation of periodic signals:** Representation of periodic signals by trigonometric and exponential series, properties of continuous time Fourier series, discrete time Fourier series and its properties, continuous and discrete time filtering.

## Unit-3

**Continuous time Fourier transform:** Definition of Fourier transform and its inverse, properties of the transform, common transform pairs, convolution and multiplication theorems.

**Discrete time Fourier transform:** Definition and properties, Convolution theorem, frequency response corresponding to difference equations.

**Unit-4**

**Laplace Transform:** Definition, region of convergence, properties, analysis of LTI systems, solution of differential equations, system functions, poles and zeros, stability.

**Z-Transform:** Definition, region of convergence, inversion, basic properties, solution of difference equations, system functions, poles and zeros and stability.

## Unit-5

**Discrete Fourier transform:** Properties of discrete Fourier transform, relation between discrete Fourier transform, Z and Laplace transform. Convolution of sequences, circular convolution theorem, overlap add and overlap save methods of convolution.

**Sampling:** Uniform sampling, sampling theorem, aliasing, decimation, interpolation.

**Unit-6**

Mathematical background: Representation of signals using ortho-normal basis functions.. Power and Energy spectral density. Correlation functions. Hilbert transform and its properties. Pre-envelope and complex envelope. Band pass signals and Band pass systems.

**Text Books:**


1) "Signals & Systems" by Oppenheim, Willsky and Nawab, Pearson, PHI
2) "Signal & systems" by Simon Haykins; PHI


**Reference Books:**


1) "Fundamentals of Signal & Systems using the Web and Matlab", By Kamen : Pearson
2) Linear systems and signals by B.P.Lathi, Oxford Publication
3) Fundamentals of signals and systems, by Roberts, TMH
4) " Digital Signal Processing", by Proakis : Pearson.

# Course Curriculum

## B.TECH. (EC) II-Year, III-Semester
## Theory Paper VI

| L | T | P | Credits |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

### ECE-206: Electronic Instrumentation and Measurements

**Unit-1**

System of units: fundamental and derived units, system International (S.I.) units, Dimension.Potentiometers andMeasuringInstruments D.C.Potentiometer; Crompton and vernier types and their applications, Self balancing (automatic) potentiometers, A.C. potentiometer, Co-ordinate and polar types and their applications.

**Unit-2**

Operation and construction of galvanometer, (d.c and ac) Ammeters and voltmeters (Moving iron, moving coil and thermal) and wattmeter's (Dynamometer; and induction types) induction type energy meters, testing and compensation, Frequency-meters (Electrical resonance type), single phase and power factor meters, Megger and multimeters.

**Unit-3**

Measurement of Resistance, Inductance and Capacitance

Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

Instrument Transformers: Current and Potential transfers, ratio and phase angle errors, design considerations and testing.

**Unit-4**

Electronic Measurements: Electronic voltmeter, multimeter wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO, Spectrum & Wave analyzer, Digital counter, frequency meter, Digital voltmeter, multimeter and storage oscilloscope. B-H curve and measurement of dielectric loss D.C. & AC. voltmeters, Differential voltmeters. A/D and D/C converters.

Magnetic measurement: Ballistic galvanometers and fluxmeter, Measurement of flux by Ballistic galvanometer and flux meter, Determination of B-H curve and hystersis loop, Separation of hysterisis and eddy current by using Lloyd Fisher square.

**Unit-5**

**Instrumentation:** Transducers, classification & selection of transducers, strain gauges, inductive & capacitive transducers, piezoelectric and Hall-effect transducers, thermisters, thermocouples, photo-diodes & photo-transistors, encoder type digital transducers, signal conditioning and telemetry, basic concepts of smart sensors and application. Data Acquisition Systems.

**Unit-6**

**Unit Measurement of Non-electrical quantities**: Primary sensing elements, classification of transducers, Displacement transducers, strain gauges, Temperature transducers and photo-electric transducers, Measurement of strain, temperature and pressure.

### Text Books:


1. "Modern Electronic Instrumentation and Measurement Techniques" by Helfrick and Cooper; Prentice- Hall of India, Reprint1988.
2. "Electrical Measurement and Measuring Instruments" by Golding, E.W., 3rd Edition; Sir Issac Pitman and Sons, 1960.


### Reference Books


1. "Instrumentation Measurement and Feedback" by Jones, B.TECH.; Tata McGraw-Hill, 1986.
2. "Measurments and Instrumentation" by A.K Sawhney; Dhanpatrai & Sons, IV Edition 1987

**B.TECH. (EC) II-Year, III-Semester Practical Papers**

**PR1: EC-207: Analog Electronics Lab LTP 002, Credit :2**

Based on course work corresponding EC-201

**PR2: EC-208: Digital Electronics Lab LTP 002, Credit :2**

Based on course work corresponding EC-203

**PR3: EC-209: Signal and Systems/NAS Lab LTP 002, Credit :2**

Based on course work corresponding EC-205

**VS1: EC-210: Self Study LTP 001, Credit :1**

# Course Curriculum

**B.TECH. (EC) II-Year, IV-Semester**
**Theory Paper I**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-211: Analog Integrated Circuits

### Unit-1
Operational Amplifier: The ideal Op-amp, Analysis of inverting and non-inverting configurations using ideal op-amp, effect of open loop gain on circuit performance.

### Unit-2
Frequency Response: s-Domain analysis: Poles, Zeros, and Bode plots, the amplifier transfer function, Low-frequency/high-frequency response of common-source/common-emitter amplifiers, common-base/common-gate amplifier, frequency-response of emitter and source follower.

### Unit-3
Frequency response of cascaded stages: Cascode configurations, the common-collector and common-emitter cascade, frequency response of the differential amplifier. SPICE simulation example.

### Unit-4
Feedback: Properties of feedback amplifiers, basic feedback topologies, analysis and characteristics of various feedback amplifier circuits. Loop gain, stability problem, effect feedback on the amplifier poles, stability study using bode plots, frequency compensation.

### Unit-5
Principles of oscillations and various types of oscillators using BJTs, Crystal oscillators.
Output stage and Power Amplifiers: Classification of output stages, class A, B and AB output stages, Biasing the class AB circuit, Power BJTs, variations on the class AB configuration, IC power amplifiers, MOS power transistors, SPICE examples

### Unit-6
IC timer 555, basic operational modes, stable, mono stable modes, VCO using op-amps and timers IC voltage regulators, IC PLL and their applications, IC function generators, analog switches, analog multiplexers and their applications, Integrated-Circuit Fabrication.

### Text Books


1) "Microelectronics circuits" by Sedra and Smith; Oxford University Press.
2) "Microelectronics circuits" by Rashid; PWS Publishing Company.


### ReferenceBooks


1) "Design of analog CMOS Integrated circuits" by Behzad Razavi; Tata McGraw Hill
2) "Microelectronics" by Millman and Grabel; Tata McGraw Hill.
3) Applications and Design with Analog Integrated Circuits, J. Michel Jacob, PHI

# Course Curriculum

## B.TECH. (EC) II-Year, IV-Semester

## Theory Paper II

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-212: Digital System Design

**UNIT I**

Digital system design with Verilog: Introduction, language fundamentals, Verilog Primitives, User Primitives, Data Types, Operators, Design examples. High level description of standard combinational and sequential modules.

OR

Digital design using VHDL.

**UNIT II**

Introduction to finite state machine: pulse and fundamental mode of operation, realization of state table from verbal description, state diagram & Transition matrix, Mealy and Moore model machine,

**UNIT III**

Reduction of flow tables of completely and incompletely specified sequential machines, concept of secondary state assignment and realization of circuits of FSM.

**UNIT IV**

Decomposition of FSM & composite machine equivalence between Mealy and Moore model machine. Race and Hazard problems with asynchronous sequential machine,

**UNIT V**

Introduction to design with the programmable modules:
ROM, PAL, and GAL based circuits. Introduction to CPLD & FPGA.

**UNIT VI**

Algorithmic state machine: ASM Chart, data and control subsystem and implementation of ASM.
Introduction to ASM designing with microprogramming.

**Text Books:**


1. "A Verilog HDL Primer" by J.Bhaskar; BS Publication.
2. "Switching And Finite Autometa Theory" by Z. Kohavi; TMH.
3. "Verilog Digital Systems Design" by Z. Navabi; Tata McGraw Hill.
4. "Fundamental of Logic Design" by Roth ; Cengage learning.
5. Advanced Digital design with Verilog HDL by Michael D Ciletti


**Reference Books:**


1. "Digital Design" by M.M. Mano; Pearson Edition.
2. "Digital Logic State Machine Design" by D.J. Comer; Oxford University Press.
3. "Contemporary Logic Design" by R.H.Katz, G.Borriello; PHI.
4. "Introduction To Digital Systems" by M.Ercegovac, T. Lang and J.H.Morcno; Wiley Int.
5. "Verilog HDL" Palnitkar ; Pearson

# Course Curriculum

## B.TECH. (EC) II-Year, IV-Semester

## Theory Paper III

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-213: Electromagnetic Theory

**UNIT-1**

Vector Analysis: Coordinate systems and Tranformations – Cartesian, Circular and Spherical coordinates and Transformations. Vector Calculus – Differential length, Area and Volume; Line, Surface and Volume Integrals; Del Operator, Gradient of a Scalar, Divergence of a vector and Divergence theorem, Curl of a vector and Stokes theorem, Classification of vector fields.

**UNIT-2**

Electrostatics: Coulomb's law and field intensity, Electric fields due to continuous charge distributions, Electric flux density, Gauss's law and its applications, Electric Potential, Relationship between E and V, Electric dipoles and flux lines, Energy density in Electrostatic fields; Electric fields in material space – Properties of materials, Convection and conduction currents, Conductors, Polarization in Dielectrics, Dielectric constant and strength, Linear, Isotropic and Homogeneous Dielectrics, Continuity equations and Relaxation time, Electric Boundary conditions; Electrostatic Boundary value problems – Poisson's and Laplace equations, Uniqueness theorem, Resistance and capacitance, Method of images.

**UNIT – 3**

Magnetostatics: Magnetostatic fields – Biot savart's law, Ampere's circuit law and its applications, Magnetic flux density, Maxwell's equations for static EM fields, Magnetic scalar and vector potentials, Magnetic Forces, Materials and Devices – Forces due to magnetic fields, Magnetic torque and moment, Magnetic dipole, Magnetization in materials, Classifications of magnetic materials, Magnetic boundary conditions, Inductors and Inductances, Magnetic energy

**UNIT 3**

Maxwell's Equation: Faraday's law, Transformer and motional EMFs, Displacement current, Maxwell equations in final forms, Time varying potentials, Time-Harmonic Fields.

**UNIT -4**

Electromagnetic Wave Propagation: Waves in general, Wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, Plane waves in free space, Plane waves in good conductors, Power and Poynting vector, Reflection of a plane wave at normal and oblique incidence.

**UNIT - 5**

Transmission Lines: Transmission line parameters and equations; Input impedance, SWR, and Power; Smith Chart, Some applications of Transmission lines, Transients on transmission lines, Microstrip transmission lines.

**UNIT-6**

Waveguides: Rectangular waveguides, Transverse Magnetic modes, Transverse Electric modes, Wave propagation in the guide, Power transmission and attenuation, Waveguide current and mode excitation, Waveguide resonators.

**TEXT BOOKS:**


1. Elements of Electromagnetics by M. N. O. Sadiku, Oxford University Press (India).
2. Engineering Electromagnetics by Hayt and Buck, TMH.


**REFERENCE BOOKS**:


1. Fields and Waves in Communications Electronics by Ramo, Whinnery and Van Duzer, John Wiley & Sons.
2. Field and Wave Electromagnetics by David K Cheng, Pearson Education (India).

# Course Curriculum

## B.TECH. (EC) II-Year, IV-Semester

## Theory Paper IV

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-214: Communication Systems

**Unit-1**

Linear modulation: Time and frequency domain expression of AM (including intensity modulation of light), DSB, SSB and VSB; generation of linearly modulated signals. Coherent demodulation and envelope detection. Squaring and Costas loop. Angle modulation: Instantaneous frequency; phase and frequency modulation. Single tone FM and its spectral analysis. NBFM and WBFM. Bandwidth requirements of angle modulated signals. Demodulation of angle modulated signals.

**Unit-2**

Radio and Television broadcasting: AM radio broadcasting and FM radio and TV broad casting. Frequency division multiplexing, radio transmitters and receivers, sampling theory, pulse modulation and demodulation.

**Unit-3**

Review of probability and random variables, Cumulative density functions, Probability density functions, Moments , Strict Sense Stationary, Wide Sense Stationary,Correlation and independency,orthogonality.

**Unit-4**

Random processes, Specification of random process, stationary and ergodicity, Correlation functions and power Spectra. Gaussian processes, Rayleigh Process, Wiener Process, Poisson Process, Stationary & Non-Stationery Process, Brownian Motion, Strict Sense Stationary, Wide Sense Stationary. Application of Random Signal theory.

**Unit-5**

Noise in Communication systems, Thermal noise, shot noise and white noise. Noise equivalent bandwidth , noise figure and noise temperature. Time domain representation of narrowband noise. Properties of narrowband noise. Noise in CW modulation systems.

**Unit-6**

Figure of merit, Noise performance of linear and exponential modulation. Pre-emphasis and de-emphasis in FM. Comparison of the noise performance of CW modulation schemes.

**Text Books :**

1.”Probability, random variables, and stochastic processes” by Papoulis; Tata McGraw Hill.
2. “Communication System” by Simon Haykin; John Wiley & sons.

**Reference Books:**

4. “Principles of Communication System” by Taub & Schilling; TMH.
2. “Communication Systems” by Proakis; John Wiley & sons.

# Course Curriculum

**B.TECH. (EC) II-Year, IV-Semester**
**Theory Paper VI**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**EC-215: Computer Architecture**

**Unit-1**

Overview of Digital Fundamentals, Register Transfer and Micro operation: Register Transfer Language, Register Transfer, Bus and Memory Transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations.

**Unit-2**

**Computer Organization and Design:** Instruction Codes, Computer Registers, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, , Timing & Control, Instruction Cycle, Memory Reference Instructions, Input-Output and Interrupt related instruction cycle , Design of ALU, Design of Control Unit and microprogramming.

**Unit-3**

**Input – Output Organization:** Peripheral devices, Input – Output interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, Input – Output Processor.

**Unit-4**

**Memory**: Memory hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware, Quantitative evaluation of performance gain using memory, cache miss/hits.

**Unit-5**

**Computer Arithmetic:** Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operation, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

**Unit-6**

Introduction to Pipelining and Parallel processing, Case study: 8086 architecture

**Text books:**


1. "Computer System and Architecture" by PHI, Mano M.
2. " Computer Systems Organization and Architecture" by Carpinelli; Pearson Education.
3. "Computer Architecture and Organization" by Hayes. J.P.; TMH.


**Reference books**


1. "Computer Organization & Design" by Pal Chaudhuri, P; PHI.
2. "Computer Organization & Architecture", by Stallings, W; PHI.
3. "Parallel Processing and Architecture", by K.Hwang and F.Briggs; McGraw Hill, 1984.
4. "Computer Architecture: A Quantitative Approach" by D. Patterson and J. Hennessy, Second Edition; Morgan.

# Course Curriculum

**B.TECH. (EC) II-Year, IV-Semester**
**Theory Paper VI**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**HU-216: Engineering Economics**

**B.TECH. (EC) II-Year, IV-Semester Practical Papers**

**PR1: EC-217: Digital System Lab LTP 002, Credit :2**

Based on course work corresponding to EC-212

**PR2: EC-218: AIC Lab LTP 002, Credit :2**

Based on course work corresponding to EC-211

**PR3: EC-219: Communication Systems Lab LTP 002, Credit :2**

Based on course work corresponding to EC-219

**VS1: EC-220: Self Study LTP 002, Credit :2**

# Course Curriculum

## B.TECH. (EC) III-Year, V-Semester
## Theory Paper I

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-301 Information Theory and Coding

**Unit-I**

Source: Memory-less, Information Entropy, Extended Sources, Sources Coding, Mutual information, entropy for discrete ensembles;

**Unit-2**

Shannon`s noiseless coding theorem; Encoding of discrete sources. Code length for Markov Sources, Shannon's IInd Theorem for calculation Probability of error.

**Unit-3**

Channel Modeling: Binary Symmetrical Channel, Binary Erase Channels, Representation of Signals, Symmetrical /Linear Channels, Un-Symmetrical/Non-linear channels, Shannon's Ist theorem for Code Length.

**Unit-4**

Galois Fields (FG (23) , GF (24) Block Codes, General Expression for Coded message in terms of Generator Matrix.

**Unit-5**

Cyclic Redundancy Codes- BCH Codes Golay Code, Reed- Solomon Code, Reed – Muller Codes, Convolution Codes, Majority Logic Decoding,

**Unit-6**

Tree-Trellis, Viterbi Decoding, LDPC Codes, Turbo Codes, Space-time ,Code Quasi-LDPC Codes.

**Text Books:**


1. " Information and Coding" by N. Abramson; McGraw Hill, 1963.
2. " Introduction to Information Theory" by M. Mansurpur; McGraw Hill, 1987.


**Reference Books:**


1. "Error Control Coding" by Shu Lin and D.J. Costello Jr.; Prentice Hall, 1983.
2. " Information Theory" by R.B. Ash; Prentice Hall, 1970.


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# Course Curriculum

**B.TECH. (EC) III-Year, V-Semester**
**Theory Paper II**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-302: Digital Signal Processing

**UNIT-1**

**Review:** Basic elements of a DSP system, Analog to digital conversion, Digital processing of Analog signals, Z-Transform.

**Implementation of Discrete Time Systems:** Structure of FIR systems: Direct form, Cascade form. Structure of IIR systems: Direct form, Cascade form, Lattice, Ladder Lattice Structure.

**UNIT-2**

**Computation of DFT:** Review of DFT and its properties, Decimation in time, Algorithm, Decimation in frequency algorithm, Chirp z and Goertzel Algorithm, Implementation of FFT Algorithms

**UNIT-3**

**Design of Digital Filters:** FIR Filters: Design of FIR filters using windows, Design of FIR filters using frequency sampling method, Design of FIR differentiator.

**Design of IIR Filter:** Impulse Invariance Method, Bilinear method, Frequency transforming in analog and digital domain, Matched-z transformation. Design of filter based on Least square method.

**UNIT-4**

**Deconvolution:** Minimum phase,Maximum phase and mixed phase system, cepstrum, deconvolution- homomorphic, concept of pole –zero on z-plane, comb filter, notch filter, digital resonator.

**UNIT-5**

**Multirate Digital Signal Processing**: Decimation, Interpolation, sampling Rate conversion, polyphase representation, multistage implementation, 2 channel maximally decimated perfect reconstruction filter banks, 2 channel Para unitary filter banks. Applications.

**UNIT-6**

Introduction to Digital Signal Processors Fixed point and Floating point processors, architectures. TMS 320C54XX and TMS320C67XX Architecture, Memory, Addressing Modes, filter implementation on fixed and floating point processors.

**Text Books:**


1. " Digital signal Processing" by Oppenhiem and Schafer, PHI
2. " Digital signal Processing-Principles, algorithms, and applications" , J G Proakis, D G Manolakis and D. Sharma.: Pearson Education India


**Reference Books**


1. "Digital Signal Processing Matlab Based Approach" , Ingle: Cengage Learning.
2. "Digital signal Processor: Architectures Implementations and Applications by Sen M. Kuo and Woon-Seng Gan, Pearson Education India.
3 Digital Signal Processing: Fundamentals and Applications by Li Tan: Elsevier Publications

# Course Curriculum

**B.TECH. (EC) III-Year, V-Semester**
**Theory Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-303: Antenna and Wave Propagation

**Unit-1**
Antenna as a terminated line, Short dipole -Vector potential of short dipole, Electric and magnetic field components, Far and near field components. Linear dipole- Current distribution, Electric and magnetic field components. Radiated power and antenna radiation resistance.

**Unit-2**
Radiation Pattern of Antenna- E-plane and H-plane pattern, three dimensional pattern. Power pattern of antenna. Classification of antenna based on pattern. Beam solid angle of antenna.

**Unit-3**
Antenna directivity, Antenna gain, Antenna efficiency, Effective length and aperture of antenna. Beamwidth and bandwidth of antenna, Antenna polarization.

**Unit-4**
Antenna array- Broadside antenna array, End-fire antenna array, Increased directivity end-fire antenna array. pattern multiplication theorem. Grounded and ungrounded antenna, Resonant and non-resonant antenna.

**Unit-5**
Folded dipole, Loop antenna, Helix, YAGI-UDA, LPDA, Aperture Antenna; Horn, Parabolic reflector antenna, Corner reflector antenna. Microwave antenna: Lens antenna and Microstrip antenna

**Unit-6**
Classification of RF waves, RF Propagation in free space, Path loss, Different modes of wave propagation. Surface wave- Field strength, Effect of ground and polarization, Range. Space wave-Direct and reflected wave, Range, Field strength ,Effect of change in refractive index. Sky wave-Effect of ionization, Refractive index of different layers of ionosphere, Critical Frequency, MUF, LUF, OWF.

**TEXT BOOK:**

1. Antenna Theory- C.Ballanis
2. Antennas: For All Applications - Kraus, JohnD & Mashefka, Ronald J - Tata McGraw Hill, 3rd Ed.

**REFERENCE BOOKS**:

1. Antennas and Wave Propagation – R.E.Collin
2. Field and Wave Electromagnetics, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.
3. Antenna Handbook – Collin and Zucker

# Course Curriculum

**B.TECH. (EC) III-Year, V-Semester**
**Theory Paper IV**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-304: Digital Communications

### Unit- I

Analog Pulse Modulation: Sampling theorem for band-pass signals, Pulse Amplitude modulation: generation and demodulation, PAM/TDM system, PPM generation an demodulation, PWM, Spectra of Pulse modulated signals, SNR calculations for pulse modulation systems.

### Unit-II

Waveform coding: quantization, PCM, DPCM, Delta modulation, Adaptive delta modulation- Design of typical systems and performance analysis.

### Unit- III

Pulse Shaping, Nyquist criterion for zero ISI, Signalling with duobinary pulses, Eye diagram, Equalizer, Scrambling and descrambling.

### Unit-IV

Signal space concepts: geometric structure of the signal space, L2 space, distance, norm and inner product, orthogonality,- Base band pulse data transmission: Matched filter receiver, Inter symbol interference, Gram-Schmidt Orthogonalization Procedure.

### Unit- V

Review of Gaussian random process, Optimum threshold detection, Optimum Receiver for AWGN channel, Matched filter and Correlation receivers, Decision Procedure: Maximum a-posteriori probability detector- Maximum likelihood Detector, Probability of error, Bit error rate.

### Unit- VI

Digital modulation schemes:

Coherent Binary Schemes : ASK, FSK, PSK, MSK,GMSK. Coherent M-ary Schemes, Incoherent Schemes, Calculation of average probability of error for different modulation schemes, Power spectra of digitally modulated signals, Performance comparison of different digital modulation schemes.

### Text books:


1. "Communication Systems" by Simon Haykin; John Wiley & Sons.
2. "Modern Digital and Analog Communication", 3rd Edition by B.P. Lathi; Oxford University Press.


### References:


1. "Digital Communication", 2E by Sklar; Pearson Education.
2. "Digital and Analog Communication Systems" by K.Sam Shanmugham; John Wiley & Sons
3. "Principles of Communications" by R.E. Ziemer and W.H. Tranter; JAICO Publishing House.
4. "Principles of Communication Systems" by H.Taub and Schilling; TMH.
5. "Digital Communications" by John G.Proakis; McGraw Hill.
6. "Fundamental Concepts in Communication" by Pierre Lafrance; Prentice Hall India.
7. "Analog and Digital Communication" by Couch.

# Course Curriculum

**B.TECH. (EC) III-Year, V-Semester**
**Theory Paper V**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-305 Microprocessors and Interfacing

Unit-1

Introduction to microprocessor, history of computers, timing and control, memory devices-semiconductor memory organization, category of memory, 8-bit microprocessor (8085):Architecture, Instruction set, Addressing mode, assembly language programming

Unit-2

16-bit microprocessor (8086):architecture, physical address ,segmentation, memory organization, bus cycle, addressing modes, introduction to 80186/80286,assembly language programming of 8086.

Unit-3

Data transfer scheme: introduction, types of transmission, 8257(DMA), 8255(PPI), serial data transfer (USART 8251), keyboard- display controller (8279), programmable priority controller ( 8259)

Unit-4

Programmable interval timer/ counter (8253/8254): introduction , modes, interfacing of 8253, application. ADC/DAC: introduction DAC methods, ADC converters, Types of ADC, ADC IC ( 0808/0809) , DAC and ADC interfacing and applications.

Unit-5

Advance microprocessor: introduction to 32-bit and 64-bit microprocessor, power PC, microcontroller (8051) : introduction, Architecture

Unit-6

Alphanumeric displays, LCD, Graphic Displays, high power Devices. Communication Bus protocols :RS 232,RS 485,SPI, Inter integrated circuits interfacing I2C standard.

Text books:


1. D.V. Hall : Microprocessor interfacing, TMH second edition

2.” The Intel Microprocessor 8086/8088. 80186, 80286, 80386 and 80486 Architecture Programming and Interfacing ”Barry.B.Brey , PHI


Reference books:


1. Y.C.Liu and G. A. Gibson: microcomputer systems : the 8086/ 8080A family architecture programming and design, PHI 2nd edition
2. John P. Hayes : digital system design and microprocessors, mcgrawhill publication

## Course Curriculum

**B.TECH. (EC) II-Year, V-Semester Practical Paper I**

### EC-306: Computer Architecture and Microprocessor Interfacing Lab

**Based on course work corresponding EC-216 & EC-305**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH. (EC) II-Year, V-Semester Practical Paper II**

### EC-307: Digital Signal Processing Lab

**Based on course work corresponding EC-302**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH. (EC) II-Year, V-Semester Practical Paper III**

### EC-308: Digital Communication Lab

**Based on course work corresponding to EC-304**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH. (EC) II-Year, V-Semester Practical Paper IV**

### EC-309: Minor project-1

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 4 | 4 |

# Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester**

**Theory Paper I**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-311: Microwave Engineering

**UNIT-1**

Microwave Network Theory and Passive Devices: S-matrix representation of multiport networks, Properties of S-Parameters and shifting reference planes, Microwave cavities, Microwave Hybrid circuits: Waveguide tees, Hybrid tees, Hybrid rings, waveguide corners, bends and twists, Directional couplers, Circulators, Isolators, Matched load and terminations, Coaxial line to waveguide adapters, Coupling loops, Coupling aperture, Short circuit plunger, Attenuators, Phase shifters, Waveguide discontinuities, Windows, Irises and Tuning screws.

**UNIT-2**

Microwave Vaccum Tube Devices : Conventional vaccum devices, Klystrons, Multicavity Klystron amplifiers, Reflex Klystron amplifiers, Helix Travelling Wave Tubes (TWT), Coupled cavity Travelling wave Tubes, Magnetron Oscillators, Forward Wave and Backward Wave Amplifiers; their principles of operation, performance characteristics and application.

**UNIT-3**

Microwave Semiconductor Diodes: Microwave IMPATT devices, TRAPATT diodes, BARITT diodes, Transfer Electron Devices (Gunn diodes), Tunnel diodes, Schottkey Barrier diodes; their principles of operation, characteristics and applications.

**UNIT-4**

Microwave Transistors: Microwave Bipolar Transistors, Heterojunction Transistors, JFETs, Metal Semiconductor FETs, High Electron Mobility Transistors, MOSFETs, MOS transistors and Memory devices, Charge Coupled devices; their principles of operation, characteristics and applications.

**UNIT-5**

Strip Lines and Monolithic Microwave Integrated Circuits: Microstrip lines, Parallel strip lines, Coplanar and Shielded strip lines, MMIC: Materials, Growth, MOSFET fabrication, Thin film formation and Hybrid IC fabrication.

**UNIT-6**

Microwave Measurements: Tunable detector, Slotted line carriage, VSWR meter, Spectrum analyser, Network analyser, Power measurements, Insertion loss and attenuation measurements, VSWR measurements, Impedance and frequency measurements, Dielectric constant measurements and other passive components measurements.

**TEXT BOOKS**:


1. Microwave Devices and Circuits by S.Y.Liao, PHI.
2. Microwave Engineering by Das and Das, TMH.
3. Microwaves by K. C. Gupta, New Age International.


**REFERENCE BOOK:**


1. Microwave Engineering by D. M. Pozar, John Wiley and Sons.
2. Microwave Engineering: Passive Circuits by Rizzi, PHI.

# Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester**

**Theory Paper II**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-312: VLSI Design

**Unit-1**

Introduction to VLSI, Manufacturing process of CMOS integrated circuits, CMOS n-well process design rules, packaging integrated circuits, trends in process technology. MOS transistor, Energy band diagram of MOS system, MOS under external bias, derivation of threshold voltage equation, secondary effects in MOSFETS,

**Unit – 2**

MOSFET scaling and small geometry effects, MOS capacitances, Modeling of MOS transistors using SPICE, level I II and equations, capacitance models.

**The Wire:** Interconnect parameters: capacitance, resistance and inductance.

Electrical wire models: The ideal wire, the lumped model, the lumped RC model, the distributed RC model, The transmission line model, SPICE wire models.

**Unit-3**

**MOS inverters:** Resistive load inverter, inverter with n type MOSFET load, CMOS inverter: Switching Threshold, Noise Margin, Dynamic behavior of CMOS inverter, computing capacitances, propagation delay, Dynamic power consumption, static power consumption, energy, and energy delay product calculations, stick diagram, IC layout design and tools.

**Unit-4**

Designing Combinational Logic Gates in MOS and CMOS: MOS logic circuits with depletion MOS load.

Static CMOS Design: Complementary CMOS, Ratioed logic, Pass transistor logic, BICMOS logic, pseudo nMOS logic, Dynamic CMOS logic, clocked CMOS logic CMOS domino logic, NP domino logic, speed and power dissipation of Dynamic logic, cascading dynamic gates.

**Unit-5**

Designing sequential logic circuits: Timing matrices for sequential circuits, classification of memory elements, static latches and registers, the bistability principle, multiplexer based latches , Master slave Edge triggered register , static SR flip flops, dynamic latches and registers, dynamic transmission gate edge triggered register, the $C^2$ MOS register,

**Unit -6**

Pulse registers, sense amplifier based registers, Pipelining, Latch verses Register based pipelines, NORA-CMOS. Two phase logic structure; VLSI designing methodology – Introduction, VLSI designs flow, Computer aided design technology: Design capture and verification tools, Design Hierarchy Concept of regularity, Modularity & Locality, VLSI design style, Design quality.

**Text Books**


1) "Digital integrated circuits a design perspective" by Jan M Rabaey, Anantha Chadrakasan Borivoje Nikolic; Pearson education.

2) "CMOS digital integrated circuits" by Sung MO Kang Yusuf Leblebici; Tata McGraw Hill Publication.


**Reference Book**


1) "Principle of CMOS VLSI Design" by Neil E Weste and Kamran Eshraghian; Pearson education

# Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester**
**Theory Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-313: Control Systems

### UNIT I

**Introduction to Control System:**

Linear, Non Linear, Time Varying and Linear Time Invariant System, Servomechanism, Historical Development of Automatic Control and Introduction to Digital Computer Control, Mathematical Models of Physical Systems, Differential Equations of Physical Systems, Transfer Functions, Block Diagram Algebra and Signal Flow Graphs.

Feedback and Non-feedback Systems Reduction of Parameter Variations By Use of Feedback Control Over System Dynamics By Use of Feedback Control of Effects of Disturbance Single By Use of Feedback and Regenerative Feedback.

### UNIT II

**Control Systems and Components:**

DC and AC Servomotors, Synchro Error Detector, Tacho Generator and, Stepper Motors etc.

### UNIT III

**Time Response Analysis:**

Standard Test Signals, Time Response of First-order Systems, Time Response of Second-Order Systems, Steady-State Error and Error Constants, Effect of Adding a Zero to a System, P, PI and PID Control Action and Their Effect, Design Specifications of Second-Order Systems and Performance Indices.

### UNIT IV

**Frequency Response Analysis:**

Correlation Between Time and Frequency Response, Polar Plots, Bode Plots, and All Pass and Minimum-Phase Systems.

### UNITV

The Concept of Stability, Necessary Conditions for Stability, Hurwitz Stability Criterion, Routh Stability Criterion and relative Stability Analysis. The Root Locus Concept, Construction of Root Loci, Root Contours, Systems with Transportation Lag, Sensitivity of the Roots of the Characteristic equation, MATLAB : Analysis and Design of Control Systems.

**Stability in Frequency Domain:**

Mathematical Preliminaries, Nyquist Stability Criterion, Definition of Gain Margin and Phase Margin, Assessment of Relative Stability Using Nyquist Criterion and Closed-Loop Frequency Response.

### UNIT VI

The Design Problem, Preliminary Considerations of Classical Design, Realization of Basic Compensators, Cascade Compensation in Time Domain Cascade Compensation in Frequency Domain, Tuning of PID Controllers. MATLAB based Frequency domain analysis of control system.

## Text Books:


1. "Control Systems Engineering" by Nagrath & Gopal; New Age International. Publishers
2. "Automatic Control System" by Kuo B.C.


## Reference Books


1. "Modern Control Engineering" by Ogata
2. "Linear Control Systems" by Scheultz & Melsa.

3. “Linear Control Systems - Analysis & Design” by D’ Azzo & Houpis.

# Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester**
**Theory Paper IV**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-314: Computer Communication Networks

**UNIT – I**

Introduction to computer networks, layered architecture-OSI reference model, TCP/IP architecture, circuit switching networks, Data link layer- ARQ protocols, framing, point –to-point protocol, HDLC data link control

**UNIT – II**

Medium Access Control – ALOHA. Slotted ALOHA, CSMA , CSMA-CD, polling, token passing ring, reservation, channelization.

LANs- Ethernet, token ring, LAN Bridges & Ethernet switches.

**UNIT – III**

Network Layer: ARP and RARP, Routing algorithms and protocols, Congestion control algorithm, Router Operation, Internet Routing Protocols, IPv6 (an overview).
Transport Layer: UDP, TCP (Flow Control, Error Control, Connection Establishment)

**UNIT – IV**

Session layer & Application layer: DNS, SNMP, Electronic Mail, WWW, ISDN, Frame Relay, ATM

**UNIT – V**

Network Security: Firewalls (Application and packet filtering), Cryptographic algorithms –DES, AES, RSA

**UNIT – VI**

Introduction to Adhoc Networks, Routing Protocols- AODV, DSR, Advances in computer communication

### Text Books:


1. "Computer Communication Networks" by W. Stallings; PHI, 1999.
2. "Communication Networks:Fundamental Concepts and key Architectures" by Alberto Leon Garcia, Indra Widjaja; TMH
3. "TCP/IP Protocol Suite", 2nd Ed. 2004, by B. A. Forouzan; TMH.
4. "Computer Networks", 3rd Ed. 1999, by A. S. Tananbaum; PHI.


**Reference Books:**


1. "Introduction to Cisco Router Configuration" by Laura Chappell (ed); Techmedia, 1999.
2. "Computer Networks-Protocols, Standards and Interfaces" by U. Black; PHI, 1996.
3. "Data Networks" by Dimitri P, Bertsekas, Robort G, Gallagher ; Longman higher Education.

# Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester**
**Theory Paper V**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC 315: Embedded Systems

**UNIT – I**

Introduction to Embedded system and project management, Microcontroller, Memory Devices, ESD and Co-design issues in System development Process, Design cycle for an embedded system development phase, Target system or its emulator and In-circuit emulator usage.

**UNIT – II**

Inter-process Communication and Process Synchronization, Tasks and Threads, Methods of Sharing Data among Multiple Tasks, Real Time Operating Systems: OS Services, I/O Subsystems, RTOS Task Scheduling model, Interrupt Routines in RTOS Environment, Interrupt Latency and Response times of the tasks.

**UNIT – III**

Microcontroller and Embedded Processors, Overview of AVR and ARM microcontroller, 8051 Microcontroller family: Architecture, Addressing Modes, Instruction Set, basic assembly language programming concepts, The program Counter and ROM Spaces in the 8051, Data types, 8051 status Register, 8051 Register Banks and Stack Instruction set, Program Control Instructions,

**UNIT – IV**

Time delay generations and calculations, I/O port programming, Single-bit instruction programming, Reading input pins vs. port Latch, 8051 Timers and Counter Programming.

Basics of Communication, Overview of RS-232, $I^2C$ Bus, UART, USB, 8051 connections to RS-232, 8051 serial communication programming,

**UNIT – V**

8051 interrupts, Programming of timer interrupts, Programming of External hardware interrupts, Programming of the serial communication interrupts, Interrupt priority in the 8051.

Case study: Architecture and programming of MSP 430 and 3205X series processors and design of hybrid architectures using the DSP processors and the FPGAs.

**UNIT – VI**

"Interfacing of ADC", "LCD, stepper motor", keyboard and sensor with 8051.
Interfacing a DAC to the 8051, 8255 Interfacing with 8031/51, 8051/31,
Interfacing to external memory

## Text Books:


1. "The 8051 Microcontroller and Embedded Systems" by M.A. Mazidi and J. G. Mazidi; PHI, 2004.
2. "Embedded Systems" by Raj Kamal; TMH, 2004.


**Reference Books**


1. "An Embedded Software Primer" by David E. Simon; Pearson Education, 1999.
2. "The 8051 Microcontroller" by K.J. Ayala' Penram International, 1991

## Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester Practical Paper1**

**EC-316: Antenna & Microwave Lab**

**Based on course work corresponding EC-311 & EC-303**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester Practical Paper II**

**EC-317: Embedded Systems Lab**

**Based on course work corresponding EC-315**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

## Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester Practical Paper III**

## EC-318: Minor Project-II

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 4 | 4C |

## Course Curriculum

**B.TECH. (EC) III-Year, VI-Semester Practical PaperIV**

## EC-319: Industrial Training

**Viva-voce based on Industrial training**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2A |

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester**
**Theory Paper I**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-401: Digital Image Processing

**Unit-I**

Digital image fundamentals: image digitization, sampling and quantization, image resolution, colour perception & processing, image processing: pixel based transformation, geometric transformation, region segmentation & representation: split & merge algorithm,

**Unit-2**

Region growing, image filtering histogram modification, linear and Gaussian filters, contours digital curves, polyline splitting, Hop_Along algorithm, Conic & Splines description, textures: statistical syntactic and model based methods,

**Unit-3**

Unitary Discrete Transformation, DFT, Cosine Transform, Sine Transform, Slant Transform, Hadamard Transform, Walsh Transform, K-L Transform, Wavelets.

**Unit-4**

Image Enhancement, Local processing, edge detection, sub-pixel location estimation, Image Restoration, Wiener filtering, Deconvolution filters, Multi-spectral Analysis. Deblurring & De-noising techniques Classification.

**Unit-5**

Thersholding, distance transforms, Hough transform Morphological operation, Vector Quantization.

**Unit-6**

Object representation and description, object recognition.

## Text Books:


1. "Digital Image Processing" by R. C. Gonzales and R. E. Woods; Addison Wesley, 1992.
2. "Fundamentals of Digital Image processing" by Anil K. Jain; Prentice Hall India, 1989.
3. "Two Dimensional Signal and Image Processing" by Jae S. Lim; Prentice Hall Inc., Englewood Cli_s, New Jersey, 1990.


## Reference Books:


1. "Digital Image Processing" by William K. Pratt; Wiley Interscience, New York, 2nd edition,1991.
2. "Digital Picture Processing", 2nd edition by Rosenfield and A. C. Kak, Vols. 1 & 2, Academic Press, New York, 1982.
3. "Digital Image Processing and Computer Vision," by R. J. Schalkoff; John Wiley & Sons.

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester**

**Theory Paper II**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-402: Digital System Testing and Diagnosis

**UNIT 1**

Faults in Digital Circuits: Stuck-At- Faults, Bridging Faults, Stuck-Open Faults, test generation for combinational logic circuits: Path Sensitization, Boolean difference etc.

**UNIT 2**

Computer aided testing scheme for combinational digital circuits: D-Algorithm, PODEM and FAN Algorithm.

**UNIT 3**

Test generation for sequential circuits: state identification experiments, checking experiments and machine identification. Easily Testable Design and Diagnosis Sequential Machine,

**UNIT 4**

Self Checking and Fail Safe Logic: Design of Totally Self Checking Checkers. Fail safe design. Totally Self Checking PLA design.

**UNIT 5**

Random testing, transition count testing, signature analysis, LSSD, built in test BILBO and BIDCO,

**UNIT 6**

Design for autonomous self test, controllability and observability, RMC and Syndrome Testable Design.Fault Detection in RAM and Microprocessor.

**Text Book**:

1. "Fault Tolerant and Testable Hardware Design", P. K. Lala: prentice hall USA, & BS publication INDIA.
2. "Digital Circuit and Logic Design", S. C. Lee, (PHI).

**Reference Books**:

1. "Digital System Testing and Testable Design" by M.Abramovici, M. A. Breuer, A. D. Friedman, IEEE press USA; & JYCO, INDIA.
2. "Checking Experiments in Sequential Machine" by A. Bhattacharyya Wiley Easton (New Age International, INDIA).

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester Theory**
**Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-403 : Advanced Topics in Communication Engineering

(Advanced topics related to this field will be offered)

## EC-403-1 : Advanced Topics in Sensors and Instrumentation

(Advanced topics related to this field will be offered)

## EC 403-2 Advanced Computer Architecture

**Unit-1**
Introduction to Computer Architecture. Basic Parallel Processing Architecture, SISD. MISD, SIMD, MIMD structures, CISC Vs RISC, Instruction Set Design.

**Unit-2**
Basic Concepts of pipelining, Instruction pipelining. Hazards, Branch Penalty Problems Reservation Tables, Collision, Latency, Dynamic pipeline. Superscalar Processors, VLIW/EPIC architectures.

**Unit-3**
Memory Systems: Cache Memory, main memory design, and Virtual Memory I/O Systems: Design Issues, Performances Measures. Loosely Coupled & Tightly Coupled Systems, Concurrency & Synchronization,

**Unit-4**
Interconnection Network Design Principles Classification of interconnection networks, basic switching techniques, virtual channels. Collective Communication Support Deadlock, Livelock, and Starvation;

**Unit-5**
Routing Algorithms for direct, indirect, and switch-based networks; System support and hardware implementations

**Unit-6**
Design of Shared-Memory Multiprocessors, Cache Coherence, Memory Consistency, Snooping Protocols, Protocol Design Tradeoffs, Synchronization, and Implications on Software, Systolic processors. Mapping design & Optimization, Array processor. Multi-core Architecture

## Text Books

1. "Parallel processing and Architecture" by K.Hwang and F.Briggs; McGrawHill.

**Reference Books:**

1."Computer architecture: A Quantitative approach" by John Hennessy and David

Patterson; Morgan Kaufmann Publishers Inc., Second Edition, 1996.

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester Theory**
**Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-403-3: Recent Advances in Communication – I

(Advanced topics related to this field may be offered)

## EC-403-4: Modern Filter Design

**Unit-1**

Frequency response of bilinear transfer function, Design & Synthesis of first and $2^{nd}$ order filter.

**Unit-2**

Butterworth Low Pass filter – Response, Pole locations, Specifications Sallen Key circuit, RC-CR Transformation.

Unit-3

Butterworth Filter – frequency transformation

Unit-4

Delyiannis Friend Circuit, Stagger tuned bandpass

Chebyshev and Eliptic Response.

**Unit-5**

Circuit structure and analysis of operational trans impedance Amplifier (OTIA) and various generations of current Conveyers

**Unit-6**

OTIA, current conveyer, switch capacitor filter MOSFET C Filters, log domain filters, sensitivity analysis,Transfer function synthesis using state variable methods

**Text Books**


1) Rolf Schaumann and Mac E. Van Valkenberg, Oxford Indian Edition, 2008.
2) "Principles of active network synthesis and design" by Gobind Daryanani; Wiley, 2003.

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester Theory**
**Paper II**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-403-5: Statistical Signal Processing

**Unit-1**
Review of random signal theory and linear algebra.
Linear Signal Models: All-pole models (AR), All-zero models (MA), Pole-zero models (ARMA).

**Unit-2**
Linear Prediction and Optimum Linear Filters: Forward and backward linear prediction, Levinson-Durbin algorithm (Toeplitz matrix inversion and Cholesky decomposition), minimum-phase property of the linear prediction-error filters,

Unit-3
AR lattice structure, ARMA lattice-ladder filter, Orthogonality principle in linear mean-square estimation, IIR Wiener filter, Non-causal Wiener filter.

**Unit-4**
Power Spectrum Estimation: Estimation of spectra from finite-duration observations of signals, Nonparametric methods (The Bartlett method, The Welch method, The Blackman and Tukey method) and their performance characteristics,

**Unit-5**
Parametric methods (Yule-Walker method, Burg method, Unconstrained least square method, Sequential estimation methods, Selection of AR model order), Minimum variance spectral estimation, Eigen-analysis algorithms (Pisarenko harmonic decomposition method, MUSIC algorithm, ESPIRIT algorithm, Order selection criteria).

**Unit-6**
Adaptive Filters: Steepest descent method, LMS algorithm and simplified analysis with emphasis on excess mean square error, Normalized and block LMS algorithm, Least-squares method, Kalman,particle filter.
Recursive least-squares method and their applications.

**Text Books**:


1. "Digital Signal Processing" by Proakis & Manolakis; PHI.

2. "Adaptive Signal Processing" by Proakis, Manolakis & Ingle.


**Reference books**:


3"Adaptive filter theory" by Simon haykin

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester**

**Theory Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-403-6
## RADAR AND STATISTICAL COMMUNICATION THEORY

### Unit- I - Radar

Introduction : Principle of detection and ranging, Radar frequencies and bands. Applications, Radar block diagram and operation.Radar Range Equation : Range prediction, Minimum detectable signal, Receiver noise SNR, Integration of radar pulses, Radar cross section of targets, Transmitter Power, PRF and system losses & Propagation effects.

**Unit-II**

CW FM Radar : Doppler effect, CW Radar, Frequency-modulated CW Radar, Multiple-frequency CW Radar.MTI and Pulse Doppler Radar : MTI delay lines, Delay line Cancelers, Coherent and Non-Coherent MTI, Pulse Doppler Radar.

**Unit-III**

Introduction to Statistical Detection Theory- Binary decisions, single observation- Maximum likelihood decision criterion, Neymann- Pearson criterion, Minimum probability of error criterion,

**Unit-IV**

Baye's Risk criterion- Receiver Operating characteristics. Binary decisions with multiple observations- Vector observations- Waveform Observation- Detection of signals in additive Gaussian Noise- The correlation Receiver – The Matched Filter Receiver- Performance analysis.

**Unit- V**

Introduction to Estimation Theory- Mathematical estimation problem- Maximum likelihood estimation- Minimum Variance unbiased estimator- Baysian Estimators-Mean square criterion-Linear minimum variance estimator-Least square method- Estimation in the presence of Gaussian noise.

**Unit- VI**

Estimation of waveforms- LMMSE estimation of waveforms-Wiener Filter- Kalman filter- Non linear Estimation-Concept of sufficient statistics and statistical estimation of parameters. Radar : Case Study.

### Text Books:


1. "Fundamentals of Statistical Signal Processing Detection Theory" by S.M. Kay; Prentice Hall, 1998 (ISBN:0-13-504135-X).
2. "Fundamentals of Statistical Signal Processing, Estimation Theory" by S.M. Kay; Prentice Hall, 1993 (ISBN: 0-13-345711-7).
3. "Introduction to Radar Systems" by Merrill I. Skolnik; Tata McGraw-Hill (3rd Edition) 2003


### References:


1. "Radar Principles" by Peyton Z Peeble; JohnWiley, 2004.
2. "Principles of Radar" by J C Toomay; PHI, 2004.
3. "Detection, Estimation and Modulation Theory", Part I, by H.L. Van Trees; Wiley, 1968.
4. "An Introduction to Signal Detection and Estimation", 2nd Ed. by H.V. Poor; Springer,1994.
5. "Detection, Estimation, and Time Series Analysis" by L.L. Scharf. Statistical Signal Processing: Addison-Wesley, 1990.
6. "Introduction Statistical Signal Processing with Applications" by M.D. Srinath, P.K. Rajasekaran and R. Viswanathan; Prentice Hall, 1996.
7. "Statistical Signal Processing" by Steven. M. Kay, Vol. 1 : Estimation Theory, vol. 2 : Detection Theory; Prentice Hall Inc, 1995.

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester**
**Theory Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-403-7 SATELLITE COMMUNICATION

### Unit-I

Satellite orbits - solar day and sidereal day - orbital parameters - satellite trajectory - period, velocity and position of a satellite - geostationary satellites - non-geostationary constellations .

### Unit II

Launching of geostationary satellites - Hohmann transfer - effect of earth's shape - other heavenly bodies - atmospheric drag and radiation pressure on the satellite's orbit .

### Unit III

Communication satellites - spacecraft subsystems - payload - repeater, antenna, attitude and control systems - telemetry, tracking and command - power sub system and thermal control .

### Unit IV

Earth stations - antenna and feed systems - satellite tracking system - amplifiers - fixed and mobile satellite service earth stations .

### Unit-V

Communication link design - frequency bands used - antenna parameters - transmission equations - noise considerations - link design - very small aperture terminals (VSAT) - VSAT design issues .

### Unit- VI

Multiple access techniques - frequency division multiple access - time division multiple access - code division multiple access - access protocols for data traffic.

**Text Books :**

1."Satellite Communication", Dennis Roddy ,McGraw Hill

### Reference books :

1. "Satellite Communication Systems" by Richharia M.; Macmillan Press Ltd.
2. "Satellite Communication" by Gagliardi R.M.; CBS.
3. "Digital Satellite Communication" by Ha T.T.; MGH.

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester**
**Theory Paper III**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-403-8 Optical Communication

**Unit-1**

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation.

**Unit-2**

Fabrication of fibers and measurement techniques like OTDR. Optical sources - LEDs and Lasers,

**Unit-3**

Photo-detectors - pin-detectors, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power panelities.

**Unit-4**

Optical switches - coupled mode analysis of directional couplers, electro-optic switches.

**Unit-5**

Non-linear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soltion based communication.

**Unit-6**

Optical amplifiers - EDFA, Raman amplifier, and WDM systems.

**Text Books:**

1. "Fibre Optic communication", 2nd Edition, 1992 by J.Keiser; McGraw-Hill.
2. "Optical communication systems" by J.Gowar; Prentice Hall India, 1987.

**Reference Books:**

1. "Integrated optics" by T. Tamir, (Topics in Applied Physics Vol.7); Springer-Verlag, 1975.
2. "Optical fibers for transmission" by J.E. Midwinter; John Wiley, 1979.
3. "Optical fibres telecommunications" by S.E. Miller and A.G. Chynoweth, eds.; Academic Press, 1979.
4. "Nonlinear fibre optics" by G.Agrawal; Academic Press, 2nd Ed. 1994.
5. "Fiber optic Communication Systems" by G. Agrawal; John Wiley and sons, New York, 1992
6. "Fiber Optics Handbook for engineers and scientists" by F.C. Allard; McGraw Hill, New York (1990).

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester**
**Theory Paper III**

**EC-404: Open Elective-I**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

# Course Curriculum

**B.TECH. (EC) IV-Year, VII-Semester Practical**

**PR1: EC-405: Digital Image Processing LTP 002, Credit:2**

**Based on course work corresponding EC-401**

**PR2: EC-406: Elective I Lab LTP 002, Credit:2**

**Based on Elective I**

**PR3: EC-407: Major project (Part-I) LTP 008, Credit:4**

**PR4: EC – 408: Practical Training-II Credit:4**

# Course Curriculum

**B.TECH. (EC) IV-Year, VIII-Semester**
**Theory Paper I**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-411: Mobile Communication Systems

**Unit-1**
Introduction to mobile communication, Generation of Wireless Networks- 1G, 2G, 3G and 4G Networks, Introduction to Spectrum Allocation for various Wireless services

**Unit-2**
Cellular mobile telephone architecture overview. Cellular radio system design-- Frequency assignments, frequency reuse channels. Concept of cell splitting. Handover in cellular systems. Handoff algorithms.

**Unit-3**
Practical Cellular mobile systems-- AMPS and GSM system architecture overview. Call management and system operation. CDMA based cellular system. Wireless in Local Loop-- DECT and CDMA WLL, Long term Evolution (LTE)

**Unit-4**
Wireless communication channel properties, Types of wireless channels and their mathematical modeling.

**Unit-5**
Multiple access schemes in mobile communications--TDMA, FDMA, CDMA. Random Multiple Access Schemes. Performance analysis issues. MAC layer scheduling and connection admission in mobile communication. Interference suppression and Power control.

**Unit-6**
Teletraffic modelling and Queuing analysis of cellular mobile networks. Resource allocation and mobility management.

**Text Books**


1. "Mobile Cellular Telecommunications Systems" by WCY Lee; McGraw Hill International Editions 1990.
2. "Mobile Communications Design Fundamentals" by WCY Lee; Prentice Hall, 1993.
3. "CDMA: Principles of Spread Spectrum Communications" by AJ Viterbi, Addison Wesley, New York, 1995.
4. "Wireless and personal Communication Systems" by VK Garg and JE Wilkes; Prentice Hall, 1996.


**Reference Books:**


1. "Mobile Radio Communications" by Raymond Steele; IEEE Press, New York, 1992.
2. " Wireless Communication Principle and References", by Rappaport, Pearson.

# Course Curriculum

**B.TECH. (EC) IV-Year, VIII-Semester**

**Theory Paper II**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-412-1: Nonlinear Circuit and System

**Unit1**

Perturbation theory for the analysis of nonlinear circuits.

Unit-2

Examples of nonlinear systems: Pendulum, Mecahnics, Fluid dymnamics, Circuit theory with nonlinear components.

**Unit-3**

Chaotic systems: Sensitivity to initial conditions, impossibility of prediction,

Unit-4

Phase Space: Preservation of areas for conservative systems, stability using Lyapunov's function, dissipative systems, attractors, Hamiltonian systems.

**Unit 5**

Linearization of nonlinear systems, Poincare sections, spectral analysis,
Bifurcation diagrams & period doubling, Logistic map, circle map, horseshoe map, forced doffing oscillator, Lyapunov exponents.

**Unit 6**

Chua's circuit: Examples of oscillations in piecewise linear circuits, Illustration by theory, The concept of equilibria, stability, local and global behavior.

**Text Books:**


1) "Linear and Nonlinear Circuits" by Chua, Desoer and Kuh; Mc Graw Hill.
2) "Chua's Circuits: A Paradigm for Chaos" Edited by Rabinder N. Madan, World Science, Series B, Vol. 1.

# Course Curriculum

**B.TECH. (EC) IV-Year, VIII-Semester**
**Theory Paper II**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**EC-412-2: Microwave Integrated Circuits**

**UNIT-1: Active RF Component Modelling**
Diode models, Transistor models – Large and small signal BJT and FET models, Measurement of active devices, S-parameter device characterization

**UNIT-2: Amplifier Design**
Unilateral and non-unilateral design, One stage and multistage design, Low-noise amplifiers, High-power amplifiers, Balanced amplifiers, Feedback, Design examples, Small-signal distributed amplifiers.

**UNIT-3: Oscillator Design**
Resonators, Dielectric resonators, YIG resonators, Varactor resonators, Resonator measurements, Two-port oscillator design, Low-noise design. Non-linear oscillator model.

**UNIT-4: Mixer Design**
Diode mixer theory, Single diode mixers, Single-balanced mixers, Double balanced mixers, FET mixer theory, Balanced FET Mixers, Spectral mixer circuits, Image rejection mixer., Single side band modulator performance, Simple sub harmonically pumped mixer circuit configuration.

**UNIT-5: Filter Design**
Filter design by the insertion loss method, Filter scaling and transformations, Low –pass and High-pass filters using transmission line stubs, Stepped-impedance low-pass filters, Babdpass filters using transmission line resonators.

**UNIT-6: MIC Design**
Integrated microwave workstation approach, Non-linear tools, Field drivers design, Designing non-linear circuits using the harmonic balanced method, Programmable microwave tuning system, Introduction to MMIC considering layout effects, Microwave integrated circuit components.

**Text Books:**
1. George.D.Vandelin, Anthony M.Pavis and Ulrich L.Rohde, "Microwave circuits design using linear and non linear techniques", John Wiley and sons 1990.
2. Samuel T.Liao, "Microwave Circuits and analysis and amplifier design", PHI, 1987.
3. Jeffrey Frey and Kul.Bhasin, "Microwave Integrated Circuits", Artech House, 1985.

**Referenec Books:**
1. Davis M Pozar, "Microwave and RF Design of Wireless SYSTEMS", John Wiley and Sons.
2. Ludwig and Bretchko, "RF Circuit Design", Pearson Education (India).

# Course Curriculum

## B.TECH. (EC) IV-Year, VIII-Semester

## Theory Paper II

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-412-3: Optical Networks

**Unit: 1**

Overview of optical fiber communication devices, evolution, transmission systems, Optical Layer: Line systems, Basics of transmitting bits, Fiber and Components, Fiber, transmitters, receivers, amplifiers, simple couplers, channel impairment parameters (signal power attenuation, dispersion, noise, etc

**Unit 2:**

WDM line systems, Components: multiplexers, de-multiplexers, amplifiers, filters,
Circulators, couplers, splitters, switches, Transmission system engineering, and design. Optical Layer: Network – Circuit switched paradigm, Rings and mesh topologies,

**Unit 3:**

Components, OADMs, switches Network Design, Client models, Routing and traffic grooming, Traffic models, Optimization algorithms and methods – routing algorithms, integer and mixed integer linear programming, heuristic optimization algorithms, HFC, FTTH-FTTP, PONS

**Unit 4:**

Network Survivability, Standard protection and restoration, rings, mesh topologies SONET/SDH, Next Generation SONET, Fast reroute

**Unit 5:**

Resilient Packet Rings Generalizations: Quality of protection, network coding, protecting path segments, p-cycles SONET/SDH, GFP, Ethernet, Storage Area Networks, MPLS, OTN, ASON,GMPLS .

**Unit 6:**

Time permitting: Bursty optical transport (e.g., burst switching, scheduled lightpaths),
Optical packet switching, access networks, Traffic management in Optical packet switching, OMPLS, Optical Metro Networks.

## Text Books:


1) "Optical Networks" by Rajiv Ramaswami and Kumar Sivarajan, Second edition; Morgan, Kaufmann Publishers.
2) "Optical fiber communications", 3rd ed. by Keiser, G.; McGraw-Hill, 2000.
3) "Optical Networks" by Stern, T.; Bala, K. Multiwavelegth; Addison Wesley, 1999.


**Reference Books:**


1) "DWDM fundamentals, components and applications" by Laude, J. P.; Artech House, 2002.
2) "Optical WDM Networks" by Mukherjee, Biswanath; Springer, 2006.
3) "Next generation optical networks: the convergence of IP intelligence and optical technology; PrenticeHall, 2002.

# Course Curriculum

## B.TECH. (EC) IV-Year, VIII-Semester

## Theory Paper II

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC-412-4: Selected Topics in VLSI

(Advanced Topics related to VLSI technology will be taken by few experts in the field)

# Course Curriculum

## B.TECH. (EC) IV-Year, VIII-Semester

## Theory Paper II

| L | T | P | Credits |
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## EC-412-5: Detection and Estimation Theory

**Unit-I**

**Review of probability theory and linear algebra:** Multivariate normal distribution, it's characterization and properties.

## Unit-2

**Basic detection theory:** Bayes and Minimax criterion, likelihood ratios, false alarm and detection probabilities, receiver operating characteristic bounds on the error probabilities, M hypothesis detection , Composite Hypothesis testing, The general Gaussian detection problem.

## Unit3

Detection of signals in white and colored Gaussian noise-whitening filter method. Detection of signals with unwanted parameters.

Unit-4

Applications in M-ary hypothesis testing for FSK, ASK and PSK signaling schemes waveform estimation.

## Unit-5

**Estimation Theory**

Random Parameters, Bayes Estimation, Parameter Estimation Multiple Parameter Estimation. Linear and non linear signal parameter estimation

## Unit-6

Optimum wiener filters, Kalman Bucy filters,
Case Study of Radar Tracking.

**Text Books:**

1. " Detection, Estimation, and Modulation theory Part-I" , Harry L. Van Trees

2. "Detection, Estimation, and Modulation theory Part-II", Harry L. Van Trees

3. "Detection, Estimation and Modulation theory Part-III", Harry L. Van Trees

**Reference Books:**

1. "Fundamentals of Statistical Signal Processing, Volume 1: Estimation Theory, Kay : Pearson

2. "Fundamentals of Statistical Signal Processing, Volume 1: Detection Theory, Kay : Pearson

# Course Curriculum

## B.TECH. (EC) IV-Year, VIII-Semester

## Theory Paper II

| L | T | P | Credits |
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## EC-412-6: High Speed Networks

**UNIT-I**

Introduction:. The Need for Speed and Quality of Service. Advanced TCP/IP and ATM Networks. Protocols and Architecture**:** The Need for a Protocol Architecture. The TCP/IP Protocol Architecture. The OSI Model. Internetworking. Transmission Control Protocol (TCP). User Datagram Protocol. The Internet Protocol (IP). IPv6.

**UNIT-II**

HIGH-SPEED NETWORKS.

Frame Relay:Packet-Switching Networks. Frame Relay Networks.

Asynchronous Transfer Mode (ATM):ATM Protocol Architecture. ATM Logical Connections. ATM Cells. ATM Service Categories. ATM Adaptation Layer (AAL).

High-Speed LANs**:**The Emergence of High-Speed LANs. Ethernet. Fibre Channel. Wireless LANs.

**UNIT-III**

PERFORMANCE MODELING AND ESTIMATION.

Probability. Random Variables. Stochastic Processes

Queuing Analysis : Queuing Models. Single-Server Queues. Multiserver Queues. Queues with Priorities. Networks of Queues. Other Queuing Models. Estimating Model Parameters

**UNIT_IV**

CONGESTION AND TRAFFIC MANAGEMENT.

Effects of Congestion. Congestion and Control. Traffic Management. Congestion Control in Packet-Switching Networks. Frame Relay Congestion Control.

The Need for Flow and Error Control. Link Control Mechanisms. ARQ Performance.

TCP Flow Control. TCP Congestion Control. Performance of TCP Over ATM

**UNIT-V**

Internet Routing**:** Elementary Concepts of Graph Theory. Shortest Path Length Determination. Interior Routing Protocols: Internet Routing Principles. Distance-Vector Protocol: RIP. Link-State Protocol: OSPF.Exterior Routing Protocols and Multicast.Path-Vector Protocols: BGP and IDRP. Multicasting.

**UNIT-VI**

Integrated and Differentiated Services:Integrated Services Architecture (ISA). Queuing Discipline. Random Early Detection. Differentiated Services. Protocols for QOS Support.Resource Reservation: RSVP. Multiprotocol Label Switching. Real-Time Transport Protocol (RTP.

### Text books:


1. " Business Data Communications" by William Stallings, Fifth Edition; Prentice Hall
2. "High Speed Networks: TCP/IP and ATM Design Principles" by Stallings, William; Prentice-Hall, 1998.


### Reference Books:


1 . " An Introduction to Broadband Networks": LANs, MANs, ATM, B-ISDN, and "Optical Networks for Integrated Multimedia Telecommunications" by Anthony Acampora; Plenum, 1994.
2. " High – Performance Communication Networks" by Jean Walrand and Pravin Varaiya,; Morgan Kaufmann, 1996.

# Course Curriculum

**B.TECH. (EC) IV-Year, VIII-Semester**
**Theory Paper II**

| L | T | P | Credits |
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**EC-412-7: Selected Topics in Signal Processing**
(Recent topics in the field will be taken up by the few experts in the field)

| L | T | P | Credits |
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# Course Curriculum

**B.TECH. (EC) IV-Year, VIII-Semester**
**Theory Paper II**

| L | T | P | Credits |
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## EC 412-8 : CMOS Analog IC Design

**Unit-1**
Large Signal Models of MOS Transistors: I-V Characteristics, Early Effect, Channel Length Modulation, Back Gate Effect and other Second-Order Effects.
Passive Components: Properties of Resistors and Capacitors and Matching Considerations

**Unit – 2**
Analog Sub-circuits: Basic MOS Amplifiers, Differential Pairs, Current Sources, MOS Switches, and Basic Sample/Hold Circuit

**Unit-3**
Basic Two-Stage Op-Amp Design**:** NMOS and CMOS architectures, DC Design, Frequency Compensation, Slew Rate, Power Supply Rejection, Offset Voltage calculation and Noise considerations
Advanced CMOS OP Amp Configurations: Folded-Cascode Op-amp, Class AB Op-amps, and Fully Differential op-amp

**Unit-4**
Voltage References: Basic Design and Evaluation of Band Gap Reference, and CMOS Band Gap References
MOS Voltage Comparators: Various Configurations and Offset Cancellation Techniques
**Unit -5**

Digital-to-Analog and analog to digital converters Current scaling DAC, Voltage scalling DAC charge scaling DAC, Extending resolution of parallel DAC, similar scaled DACs

High speed ADCS, parallel or flash ADCS, interpolating ADCS, folding ADCS, Multibit pipeline ADCS delta sigma modular, Decimators filters.

**Unit-6**
Switched Capacitor Filters: Basic Switched Capacitor Integrators, Z-transforms, and Switched Capacitor Filter Design
MOSFET-C Filters and techniques of non linearity cancellation in MOS circuit

**Text Books:**

1) "Design of Analog CMOS Integrated Circuits" by Behzad Razavi; Tata Mc Graw-Hill
2) "CMOS analog Circuit Design" by Allen Holberg; Oxford University Press

**Reference Books:**

1) "Analog VLSI Signal and Information Processing" by Mohammed Ismail Terri Fiez; Mc Graw Hill International Editions.
2) "Analog MOS Integrated Circuits for Signal Processing" by Roubik Gregorian and Gabor C. Temes; Wiley series on filters
3) "Analysis and Design of Analog Integrated Circuits", Fourth Edition by Gray Hurst Lewis Meyer, Wiley

# Course Curriculum

**B.TECH. (EC) IV-Year, VIII-Semester**

**Theory Paper II**

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC- 412-9 : Robotics and Object Tracking

**Unit-1**

Image-Based Object Tracking, Introduction, Methodologies, Background Subtraction, Temporal Difference between Frames Correlation-Based Tracking, Colour-Based Tracking, Algorithmic Account.

**Unit-2**

Introduction to Robotics, Robot Vision-Projection, Convolution, Edge Detection and Object recognition.

**UNIT-3**

Mobility, Mobile Robot platforms,Inertial Navigation Systems and GPS, graph search, controls and Encoders.

**Unit-4**

Motion Planning, Potential Function. Roadmaps, cell decompositions, sensing and Sensors. Forward and Incerse Kinematics, transformation matrices and DH Transformations. Geometric and Algebraic methods, Robot Behhaviours – Obsttacle Avoidance and WavePoint Following.

**Unit -5**

Soft Computing in Image Processing, Fuzzy Logic in Image Processing, Algorithmic Account , **I**mage Compression**,** Image Compression–Decompression Steps.

**Unit-6**

Classifying Image Data ,Bit Allocation, Quantization, Entropy Coding, JPEG Compression, Algorithmic Account.

**Text/ Reference Books**


- Subhash Challa, Robin J. Evans, Mark R. Morelande, Darko Mu icki "Fundamentals of Object Tracking" Cambridge UniversityPress, June 2020.
- Fundamentals of Robotics- Analysis and control, Sschilling, PHI
- Modern Inertial sensors and systems, 2nd edition of Boose Puri and Banerjee, PHI

# Course Curriculum
## B.TECH. (EC) IV-Year

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC-413-1: Fault Tolerant Computing

**UNIT 1**
Faults in Digital Circuits: Stuck-At- Faults, Bridging Faults, Stuck-Open Faults, test generation for combinational logic circuits: Path Sensitization, Boolean difference etc.

**UNIT 2**
Computer aided testing scheme for combinational digital circuits: D-Algorithm, PODEM and FAN Algorithm.

**UNIT 3**
Test generation for sequential circuits: state identification experiments, checking experiments and machine identification. Easily Testable Design and Diagnosis Sequential Machine,

**UNIT 4**
Self Checking and Fail Safe Logic: Design of Totally Self Checking Checkers. Fail safe design. Totally Self Checking PLA design.

**UNIT 5**
Random testing, transition count testing, signature analysis, LSSD, built in test BILBO and BIDCO,

**UNIT 6**
Design for autonomous self test, controllability and observability, RMC and Syndrome Testable Design.Fault Detection in RAM and Microprocessor.

**Text Book**:
1. "Fault Tolerant and Testable Hardware Design", P. K. Lala: prentice hall USA, & BS publication INDIA.
2. "Digital Circuit and Logic Design", S. C. Lee, (PHI).

**Reference Books:**
1. "Digital System Testing and Testable Design" by M.Abramovici, M. A. Breuer, A. D. Friedman, IEEE press USA; & JYCO, INDIA.
2. "Checking Experiments in Sequential Machine" by A. Bhattacharyya Wiley Easton (New Age International, INDIA).

# Course Curriculum

**B.TECH. (EC) IV-Year**

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC-413-2: Audio and Video Engineering

**Unit I**

Sampling, Nyquist theorem, quantization, image characteristics, audio and video characteristics (telephone, CD, NTSC, PAL, HDTV qualities).

Compression: lossless and lossy coding, run-length coding, Huffmann and Arithmetic Encoding, JPEG, MPEG. Audio and video at the user interface.

**Unit II**

Teleservices. Conversational services - video conferencing. Messaging services: multimedia mail (MIME, X.400). Retrieval services: video on demand, video servers, web services. Interactive TV.

**Unit III**

Digital Radio and Audio Compression

Audio Data Rate Reduction Techniques: Sub band coding, Predictive coding, Psycho acoustic coding, MPEG Audio

Digital Radio: System Overview, Single frequency networks in practice

Digital Radio - Present and Future: Audio services, Data services

**Unit IV**

VIDEO SYSTEMS: Video cameras and CCD technology, Analog video signal coding, Display of video images, Magnetic recording of video signals, camcorders and VCR, Digital recording tools on microcomputers and hard disks, Audio/video storage on CD and various CD formats, Digital Video Transmission, Digital Video Compression

Overview of the DVB System Block diagram overview to put the following sessions into context Digital Video Compression and MPEG, Motion compensation, Constant and variable bit rate transmission

**Unit V**

**MPEG:** The MPEG-2 standard

**Picture Quality Assessment,** Background to quality assessment and measurement, Approaches to Automated Quality Measurement

**Unit VI**

BASIC CONCEPTS OF TELEVISION: The components in television scanning systems, Luminance signal ,H and V synchronization requirements, Bandwidth calculations and frequency requirements, Kell factor, Interlaced and progressive scans, Picture resolution, Video spectrum distribution, Gamma correction, HVS requirements, Color concepts, RGB analogy and CIE chart, Color cameras, Color displays

Transport Streams: Data Stream Multiplexing, DVB Service Information, Electronic Programme Guide, Transport stream health checking, DVB Scrambling

Digital Television and Convergence in Home Entertainment: The TV screen as a mass- market internet terminal, Standards - or lack of them, Converting dreams into reality, HDTV

**Text Books:**


1. Television and Video Engineering, A.M Dhake.
2. Colour Television Theory and Practice , RR Gulati
3. Basic Television and Video Systems, Bernord Grob
4. Multimedia in Practice, Technology and Applications, Judith Jeffcoate : PHI


**Reference Books**


1. Audio- Video Engineering , Gupta
2. Communication Electronics, Frenzel

# Course Curriculum

**B.TECH. (EC) IV-Year**

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC-413-3: Pattern Recognition

**Unit-1**

Introduction to pattern recognition and applications to OCR, speech recognition, fingerprints, signatures etc. Commercial importance of applications. Introduction to Statistical, Neural and Structural Approaches.

**Unit-2**

Statistical Pattern Recognition: Patterns and classification, discriminant functions, Bayes decision rule, nearest neighbour rule, probability of error.

Unit-3

Linear discriminant functions: Perceptrons and training, LMSE approaches. Unsupervised learning and clustering. Feature extraction.

**Unit-4**

Neural Approach: Introduction to artificial neural networks, feed forward networks, delta rule and backpropagation, Hopfield networks and unsupervised learning, Adaptive resonance architectures, related techniques. Pattern associators and content addressable memories, hardware realizations.

**Unit-5**

Syntactic pattern recognition: Formal languages and grammars Pattern grammars and higher dimensional grammars, Parsing,

Unit-6

Automata realizations, stochastic grammars, Grammatical Inference, computational learning theory, Valiant`s framework.

### Text Books:

1. " Pattern Recognition: Statistical, Structural and Neural Approaches" R. J. Schalkoff; Wiley, 1992.

**Reference Books:**

1. " Pattern Classification and Scene Analysis" by R. O. Duda and P. E. Hart; Wiley, New York, 1973.
2. "Structural Methods in Pattern Recognition" by L. Miclet; North Oxford Academic, London, 1986.

# Course Curriculum

**B.TECH. (EC) IV-Year**

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC-413-4: Information Security

**Unit-1**

Significance of Information Security: Attaches and requirements

Cryptographic Protocols: Basic Protocols, Intermediate Protocols, Advances Protocols, Esoteric Protocols.

**Unit-2**

Cryptographic Techniques: Key Length, Key Management, Algorithm Types and Modes. Cryptographic Algorithms: Data Encryption standard (DES), Block ciphers, Pseudo-Random Sequence Generators and Stream Ciphers, One Way Hash Functions,

**Unit-3**

Public-Key Algorithms, Public Key digital signature Algorithms, Identification schemes, Key-Exchange Algorithms. Current Topics in Security.

**Unit-4**

Intrusion Detection System, Kerberos, IPSEC

**Unit-5**

Viruses, Trojans, RSA SS4, SS5. Firewalls.

**Unit-6**

Application of Security in current applications – image, video, web, banking, network etc.

**Text Books:**


1. "Network Security" by Stalling.
2. "Cryptography" by Stalling.

# Course Curriculum

## B.TECH. (EC) IV-Year

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC413-5 Wireless Sensor Network

**Unit 1**

Adhoc Networks: Introduction. Routing protocols :proactive and reactive methods, backbone and position based, and power efficient routing.

**Unit 2**

Sensor Networks: Introduction and applications. Design issues and architecture.

**Unit 3**

Sensor deployment – Issues and challenges, Self organization, Localization

**Unit-4**

Data Fusion: Tree construction algorithms and analysis, Asymptotic capacity, - Lifetime optimization formulations

**Unit 5**

Routing protocols: data centric, hierarchical, location based, energy efficient routing etc.

**Unit 6**

Querying, data collection and processing

**Text Books:**


1. "Handbook of Algorithms for Wireless Networking and Mobile Computing" by Azzedine Boukerche; Chapman & Hall/CRC, 2006.
2. "Handbook of Sensor Networks: Compact Wireless and Wired sensing systems" by Mohammad Ilyas and Imad Mahgoub; CRC Press, 2005.


**Reference Books**


1. "Wireless Sensor Network Designs" by Anna Hac; John Wiley & Sons Ltd., 2003.
2. "Wireless Sensor Networks: A systems perspective" by Nirupama Bulusu and Sanjay Jha; Artech House, August 2005.
3. "Wireless Sensor Networks : Architecture and Protocols" by Jr., Edgar H. Callaway; Auerbach, 2003.
4. "Wireless Sensor Networks" by C.S. Raghavendra, Krishna M. Sivalingam and Taieb Znati; Springer, 2005

## B.TECH. (EC) IV-Year

**L T P Credits**

3 1 0 4

### EC-413-6 NANOELECTRONICS

**Unit 1**
Introduction to Nanoelectronics, Shrink Down Approaches, CMOS Scaling, the Nanoscale MOSFET, FINFETs, Vertical MOSFETs, Strained Silicon Technology, Limits to Scaling, System Integration Limits (Interconnect Issues, etc.)

**Unit 2**
Resonant Tunneling Diodes, Resonant Tunneling Transistors, MOBILEs (Monostable-Bistable Transition Logic Elements), Single Electron Transistors, New Storage Devices, SRAM, DRAM, MRAM (Magnetoresistive RAM), PCRAM (Phase Change RAM), AFM based Mass Storage (the Millipede Concept), Optoelectronic and Spintronic Devices.

**Unit 3**
Molecular Electronics (involving single molecules as electronic devices), Transport in Molecular Structures, Molecular Systems as Alternatives to Conventional Electronics, Molecular Interconnects. MEMS, FBARs (Film Bulk Acoustic Resonators), Cantilevers.

**Unit 4**
Carbon Nanotube Electronics: Bandstructure & Transport, Devices (CNTFETs, CNT Logic Gates, CNT RTL Circuits, CNT SET, CNT RAM, CNT Field Emission Devices), Carbon Nanotube Interconnects, CNT Heat Sink, Applications. Graphene Based Electronics: Bandstructure & Transport, Devices (GNR FETs), Applications. Nanowire FETs, Nanowire Logic Gates.

**Unit 5**
Nanosensors: Biological and Chemical; Electronic Sensor Arrays, CMOS 3-D Time-of –Flight Image Sensor, Nanobiomimetic Technologies: Electronic Skin, Electronic Eye, Electronic Nose (KAMINA), Electronic Tongue; Touchscreens, Robot Tactile Sensors, Fingerprint Sensors, Liquid Crystal Displays, Organic Electronic Devices: Organic Light Emitting Diodes, Organic Solar Cells, Organic Thin Film Transistors; Field Emission & Plasma Displays, Electronic Paper.

**Unit 6**
Neuroelectronic Systems: Iono-electronic Interface, Neuron-Silicon Circuits, Brain-Silicon chips, Neuroelectronic Processors, Neuroprosthetics, Electrical Dynamics of the Neuron-Chip Interface on a Nanoscopic Level, Hybrid Systems made of Neuronal Nets and Electronic Devices on a Microscopic Level, Ionoelectronic Devices, Nerve-based Ionic Processors.

**Textbooks:**


1. Nanoelectronics and Information Technology Advanced Electronic Materials and Novel Devices) by Rainer Waser (Wiley-VCH)
2. Nanoelectronics (Principles and Devices, Second Edition) by Mircea Dragoman (Artech House).
3. Silicon Nanoelectronics by Shunri Oda and David K. Ferry (Taylor & Francis)
4. Molecular Nanoelectronics by Mark A. Reed and Takhee Lee (American Scientific

Publishers)

**References:**


1. Nanoscale Transistors (Device Physics, Modeling & Simulation) by Mark S. Lundstrom and Jing Guo (Springer)
2. Fundamentals of Nanoelectronics by George W. Hanson (Pearson)
3. Research Papers


# Course Curriculum

## B.TECH. (EC) IV-Year

| L | T | P | Credits |
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## EC 413-7 Speech Processing

**Unit-1**

Sampling theory: Sampling frequency , Sampling resolution

Filter bank analysis: Spectrograms , Non-linear frequency scales

Short-term fourier analysis: Windowing ,The short-term Fourier transform ,Zero padding Fast Fourier transforms,Practical application of the short-term Fourier transform Overlap and add for linear filtering ,Example: Spectral subtraction ,Cepstral analysis, Homomorphic filtering,Mel scaled analysis,The Autocorrelation from the FFT

## Unit-2

Linear prediction analysis: Obtaining candidate values, Peak picking on the smoothed spectrum, Peak picking on the LP spectrum, Factoring for the LP roots ,Fitting bumps, Combining candidates

## Unit-3

Formant analysis: Motivation from lossless tubes ,Parameter estimation ,The autocorrelation method The covariance method ,Pre-emphasis ,The LP spectrum ,Gain computation ,The lattice filter implementation ,The Itakura distance measure,The LP cepstrum ,Log area ratios ,The roots of the predictor polynomial,Line spectral pairs

**Unit-4**

voicing analysis: Pitch synchronous analysis, Zero-crossing points, Peak in the autocorrelation function,Peak in the autocorrelation of the LP residual, The average magnitude difference function ,Peak in the cepstrum, Combining candidates

Unit-5

Speech Encoding: Types of Speech Encoders, Waveform Encoding: Pulse Code Modulation (PCM), Differential PCM (DPCM), Delta Modulation (DM), Adaptive DPCM, Adaptive DM,Speech Properties, Channel Vocoders,

Unit-6

Linear Predictive Coders, Hybrid Techniques, Multi-Pulse Linear Predictive Coder, Regular Pulse Excited Long Term Prediction Coder, Codebook Excited Linear Predictive Coders, Speech Coders for the American and European Systems, Other Waveform Coding Techniques, Sub-band Coding - Transform Coders

**Text Books:**

1) "Digital Processing of Speech Signals" by Rabiner and Sc.

**Reference Books**

1) "Signal Processing of Speech Owens" by F.J. (1993), Macmillan.
2) "Discrete-Time Processing of Speech Signals" by Deller, J.R., Proakis, J.G. and Hanson, J.H. (1993); Macmillan.

# Course Curriculum

## B.TECH. (EC) IV-Year

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC-413-8: Bio-Medical Engineering and Instrumentation

**UNIT 1**

Principles of biomedical instrumentation and techniques, Interfacing problems of biomedical, electronic equipments with living systems. ECG, EEG, EMG instruments for measuring biosignals.

**UNIT 2**

Biomedical transducers. Biomagnetic measurement and imaging. Cardiac output measurement techniques. Diagnostic and therapeutic instruments, Prosthetic devices such as pacemaker, hearing aid and myoelectric arm.

**UNIT 3**

Functional electrical stimulation and algorithms for extremity control. Biotelemetry of biological signals, biosensors. Neonatal monitoring. Special aspects such as safety of medical electronic equipment.

**UNIT4**

Introduction to analog and digital computer simulation in biological sciences. Simulation of normal and pathological states. Pattern identification and tissue and cell typing.

Unit-5

Automated examination and interpretation of X-ray films of lungs and hearts. Assembly of three- dimensional images.

Unit-6

Artificial intelligence, Robotics and expert systems in biomedical electronics and medicines.

**Text Books :**

1."Biomedical Instrumentation:Technology and Applications" by R. S. Khandpur.
2. "Handbook Of Biomedical Instrumentation" by khandpur, R.S.; TATA MCGRAW HILL PUBLIHSERS.
3. Biomedical Instrumentation and measurement by Cromewel, Wibell, Pfeiffer, 2nd edition, PHI.

# Course Curriculum
## B.TECH. (EC) IV-Year

| L | T | P | Credits |
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| 3 | 1 | 0 | 4 |

## EC-413-9: Soft Computing

**Unit-I**

**Neural Networks:** History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm,

**Unit 2**

Counter propagation network, architecture, functioning & characteristics of counter Propagation network, Hopfield/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine. Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory.

### Unit-3

**Fuzzy Logic:** Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

**Operations on Fuzzy Sets:** Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

**Fuzzy Arithmetic:** Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

**Fuzzy Logic:** Classical Logic, Multi valued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

### Unit-4

Uncertainty based Information: Information & Uncertainty, Non-specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, Rough Fuzzy Sets.

**Application of Fuzzy Logic:** Medicine, Economics etc.

### Unit-5

**Genetic Algorithm:** An Overview, GA in problem solving, Implementation of GA

Neuro-Genetic training of Back-propagation,

### Unit-6

Design and development of certain scientific and commercial application using computational neural network models, fuzzy models, fuzzy clustering applications and genetic algorithms in specified applications

### Text Books:


1. "An Introduction to Neural Networks" by Anderson J.A.; PHI, 1999.
2. "Introduction to the Theory of Neural Computation" by Hertz J. Krogh, R.G. Palmer; Addison-Wesley, California, 1991.


**Reference Books**


1. "Fuzzy Sets & Fuzzy Logic" by G.J. Klir & B. Yuan; PHI, 1995.
2. "An Introduction to Genetic Algorithm" by Melanie Mitchell; PHI, 1998.
3. "Neural Networks-A Comprehensive Foundations", PHI, New Jersey, 1999.
4. "Neural Networks: Algorithms, Applications and Programming Techniques" by Freeman J.A. & D.M. Skapura; Addison Wesley, Reading, Mass, (1992)

# Course Curriculum
## B.TECH. (EC) IV-Year

| L | T | P | Credits |
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## EC413-10 Computer Vision

**Unit-1**

**Introduction to computer vision**: Role of Artificial intelligence and image processing in Computer Vision, Industrial Machine Vision applications, System architecture, State of the art.

**Visual Sensors**:Camera sensors, Camera interfaces and video standards, Characteristics of camera sensors commercially available cameras Camera Calibration: Interior , exterior calibration and rectification using Tsai's Calibration method

**Unit-II**

**Geometry:** Math methods -linear algebra, vectors, rotations, Stereo – Epi-polar geometry, correspondence, triangulation

**Unit III**

**Image representation:** Local Wavelet basis (multiscale) , Global Fourier basis(Frequency), Adaptive basis (PCA and ICA) , Adaptive basis(discriminants)

**Unit-IV**

**Object Recognition**: Object Modeling , Bayesian Classification , Feature Selection and Boosting , Scene and Object Discrimination

**Unit-V**

**Motion and Tracking:**

Motion- detection and tracking of point features, optical flow, Tracking- Kalman filter, condensation, tracking humans, multi-frame reconstruction under affine and perspective projection geometry

**Unit-VI**

**Computer Graphics:**

2D shape- splines, snakes, PCA descriptors, 3D shape-parts, skeletons, surface models, aspect graphs, Project descriptions.

**Text Books:**

1) "Computer Vision - A modern approach" by D. Forsyth and J. Ponce; Prentice Hall.
2) "Robot Vision" by B. K. P. Horn; McGraw-Hill.
3) "Introductory Techniques for 3D Computer Vision" by E. Trucco and A. Verri; Prentice Hall.

**Reference Books:**

1) "Computer Vision", D. Ballard and C. Brown; previously published by Prentice-Hall, 1982.
2) "From Surface To Objects: Computer Vision and Three Dimensional Scene Analysis" by R. B. Fisher; previously published by John Wiley and Sons, 1989.

## B.TECH. (EC) IV-Year

| L | T | P | Credits |
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## EC-413-11: NEUROELECTRONICS

**Unit 1**
Introduction to Neuroelectronics; neuron: architecture, resting membrane potential, action potentials, axon hillock, synapse, presynaptic cell, postsynaptic cell, synaptic cleft, communication between neurons, neurotransmitters, synaptic potential, depolarization, hyperpolarization.

**Unit 2**
Recording electrical signals from neurons: voltage –clamp technique, patch-clamp technique. EEG (Electroencephalography)

**Unit 3**
Neuroelectronic Interfacing: Iono-Electronic Interface, Neuron-Silicon Circuits, Brain-Silicon Chips. Electrical Dynamics of the Neuron-Chip Interface on a Nanoscopic Level. Interfacing neurons with carbon nanotubes: Electrical signal transfer and synaptic stimulation in cultured brain circuits. Nanowire Integrated Microelectrode Arrays for Neuroelectronic Applications

**Unit 4**
Techniques for neuroelectronic interfacing: thin-film technology, micro-electrode arrays (MEAs), Field-Effect-Transistor arrays (FETs), CMOS integrated systems, Nanotechnology and Bio-chemistry, EOSFET (Electrolyte Oxide Silicon Field Effect Transistor), EOS Capacitors (Electrolyte Oxide Silicon Capacitors)

**Unit 5**
Elementary neuroelectronic hybrids: Cellular neuroprostheses, neuronal memory on chip. Neuronal networks on chip. Ionoelectronic Devices, Neuroelectronic Processors.

**Unit 6**
Neuroprosthetics: sensory prosthetics, motor prosthetics, cognitive prostheses. Artificial pacemakers, cochlear implants, deep brain stimulation, brain-computer interface, MRI, Image-Guided Surgery

**Textbooks:**

1. Principles of Neural Sciences, 4th Edition, by E. R. Kandel, J. H. Schwartz, T. M. Jessell (McGraw-Hill Companies, 2000)
2. Neuroscience, 3rd Edition by D. Purves, G. J. Augustine, D. Fitzpatrick, L. C. Katz, A.-S. LaMantia, J. O. McNamara, S. M. Williams (Sinauer Associates Inc., 1997)
3. Biophysics of Computation (Information Processing in Single Neurons) by C. Koch (Oxford University Press, 1999)
4. Neuroprosthetics (Theory & Practice) by K W Horch, G S Dhillon (World Scientific Publishing)

**References:**

1. An Introduction to Molecular Neurobiology by Z. W. Hall (Sinauer Associates Inc. 1992)
2. Sensation & Perception by E. Bruce Goldstein (8th Edition) (2007 Wadsworth Cengage Learning)
3. Research Papers

# Course Curriculum

**B.TECH. (EC) IV-Year**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## EC-413-12: Power Electronics

**Unit-1**

**Power Semiconductor Devices (PSD):**

Power Diodes, Enhancement of Reverse blocking capacity, Reverse Recovery Silicon Controlled Rectifier (SCR) Structure, v-I characteristics, turn ON and turn OFF characteristic, ratings, control circuits design and protection circuits. Gate turn off thyristor (GTO) v- characteristic, turn ON, turn OFF characteristic, limitation of power handling capability, GTO snubber consideration exc., Triac and its application, power MOSFETs, operation modes, switching characteristics, power BJT, second breakdown, saturation and quasi saturation state.

Unit-2

Insulated Gate Bipolar Transistors (IGBT) Basis structure, V-I characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.

Introduction to emerging devices and circuits, MOS controlled thyristors, integrated Gate Commutated Thyristor (IGCT), Power Integrated Circuits (PIC's) and smart power control chips.

## Unit-3

**Power Electronic Converters:**

Single phase and three phase uncontrolled and controlled AC to DC converters analysis, DC to AC converters (inverters) single phase half bridge, full bridge and switch mode inverters, three phase inverter with $120^o$ and $180^o$ mode of control, Series inverter and parallel inverters.

Unit-4

Choppers principle, first quadrant, second quadrant and multi quadrant and multi quadrant choppers and their analysis. Switch mode converters AC to AC converters, cyclo-

converters topology and structure of matrix power electronics converters, converter protection and future converter applications.

## Unit-5

**Pulse width Modulation for Power Electronics Converters:**

PWM methods, voltage control PWM, SPWM, selected harmonic elimination, minimum ripple current , current control PWM, Adaptive hysteresis band method, space vector method, performance criterion, open loop and closed loop PWM schemes etc.

## Unit-6

**Motor Drives Applications:**

Criterion for selecting drive components, DC motor drives, rectifier control of DC motors, chopper control of DC drives, Multi-quadrant control of chopper fed motors, closed loop control of DC drives, Introduction to Induction motor drives: Comparison of variable frequency drives. Field orientation control principles for induction motors, Introduction to synchronous motors drives and PMBLDC drives.

**Electric Utility Applications:**

Brief introduction to UPS, HVDC, Static VAR compensators and STATCOM, Active filters

## Text books:


1 . "Power Electronics: Circuits Devices & Applications" by Rashid M H, 2nd Edition; Prentice Hall 1993.

2 . "Power Electronic, Converters, Applications and Design" by Ned Mohan, Tore.

3 . "Power Electronics" by M.Undeland and William P. Robbins; John Wiley & Sons, 1989.

P.S.Bhimra, Khanna Publications.


## References:


1. "Power Semiconductor Controlled Drives" by Gopal K. Dubey; Prentice Hall, Englewood cliffs, New Jersey.

2. "Modern Power Electronics and Variable Frequency Drives" by B.K. Bose; Pearson Education, India.

3. "Fundamental of Power Electronics" by Robert W. Erickson and Dragon Maksimovie, Springer International Edition.

4. "Modern Power Electronics, Evolution, Technology and Applications" Edited by B.K. Bose, A JAICO Book.

5. "Power Electronics and Motor Control" by Shepherd; W. University Press, Cambridge.

6. "Power Electronic Converters" by R. Bausiere & G. Seguier; Springer- Verlag, 1987.

7. "DC-DC Switching Regulator Analysis" by D.M.Mitchell; McGraw Hill, 1987.

# Course Curriculum

## B.TECH. (EC) IV-Year, VIII-Semester Practical Papers

**PR1. EC-414: Elective II Lab**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 3 | 3 |

**Based on course work corresponding EC-412 & EC-413**

**PR2. EC – 415: Mobile Communication and networks Lab**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 3 | 3 |

**Based on course work corresponding EC-411**

**PR3. EC – 416: Seminar and Report**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 2 | 2 |

**PR4. EC – 417: Major Project (Part-II)**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 10 | 10 |