# CURRICULUM

## I SEMESTER

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**Total Credits** 30

## II SEMESTER

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**Total** 32

# CA – Continuous Assessment, SE – Semester Examination, TM – Total Marks

* TA – Theory Category A, TB – Theory Category B, TC – Theory Category C,
  LB – Laboratory, EGD – Engineering Graphics / Drawing
  POD – Practice Oriented Design, TCP – Theory Combined with Practice, PR - Practice
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Total Credits: 26

TX® - Theory Course (Category TA/ TB/ TC/TCP)
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TX - Theory Course (Category TA/ TB/ TC/TCP)

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TX - Theory Course (Category TA/ TB/ TC/TCP)
### VII SEMESTER

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**Total Credits** 25

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**Total Credits** 22

TX® - Theory Course (Category TA/ TB/ TC/TCP)
# LIST OF PROGRAMME ELECTIVES

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<td>Communication Theory</td>
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<td>24</td>
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<td>ECG05</td>
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<td>27</td>
<td>CSG02</td>
<td>JAVA Programming</td>
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<td>28</td>
<td>CSG03</td>
<td>Fundamentals of Operating Systems</td>
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<td>29</td>
<td>CSG04</td>
<td>Object Oriented Programming using C++</td>
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<td>30</td>
<td>CSG05</td>
<td>Microprocessors and its Applications</td>
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<td>31</td>
<td>EEG01</td>
<td>Electrical Machines and Utilizations</td>
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<td>32</td>
<td>EEG02</td>
<td>Soft Computing Techniques</td>
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<td>EEG03</td>
<td>Power Generation Systems</td>
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<tr>
<td>34</td>
<td>EIG01</td>
<td>System Design Using Advanced Microcontrollers</td>
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<td>35</td>
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<td>Measurement and Instrumentation</td>
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<td>Fundamentals of Momentum, Heat and Mass Transfer</td>
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<td>44</td>
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<td>Principles of Programming Languages</td>
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<tr>
<td>45</td>
<td>ITG03</td>
<td>Introduction to Operating Systems</td>
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<td>46</td>
<td>ITG04</td>
<td>Introduction to Database and Oracle</td>
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<td>47</td>
<td>ITG05</td>
<td>Business Process</td>
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<td>49</td>
<td>MAG02</td>
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<td>PHG01</td>
<td>Introduction to Nanoscience and Nanotechnology</td>
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<td>52</td>
<td>PHG02</td>
<td>Nanotechnology and Nanoelectronics</td>
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<td>Instrumental Methods of Chemical Analysis</td>
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<td>(c) Mandatory Courses</td>
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SYLLABUS (Core Subjects)
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<td>Mathematics I</td>
<td>L 3 T 1 P</td>
<td>C 4</td>
<td>CA 40 SE 60 TM 100</td>
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</table>

| Prerequisite | -                  |

| Objectives   | • To introduce the ideas of differential and integral calculus  
• To familiarize students with functions of several variables  
• To introduce methods for solving differential equations  |

| Outcome      | • Understands Calculus  
• Functions of several variables  
• Able to solve differential equations  |

**UNIT – I**
Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

**UNIT – II**
Partial derivatives, Total derivative, Differentiation of implicit functions, Change of variables, Jacobians and their properties, Partial differentiation of implicit functions, Maxima and minima of functions of two variables, Lagrange’s method of undetermined multipliers.

**UNIT – III**
Multiple Integrals, change of order of integration in double integrals, Applications: Plane areas (double integration), Change of variables (Cartesian to polar), volumes by solids of revolution, double and triple integrations (Cartesian and polar) – Center of mass and Gravity (constant and variable densities).

**UNIT – IV**
Exact equations, First order linear equations, Bernoulli’s equation, orthogonal trajectories, growth, decay and geometrical applications. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.

**UNIT – V**
Linear differential equations of higher order - with constant coefficients, the operator D, Euler’s linear equation of higher order with variable coefficients, simultaneous linear differential equations, solution by variation of parameters method.

**Total contact Hours: 45**  
**Total Tutorials: 15**  
**Total Practical Classes: 15**  
**Total Hours: 60**

**Text Books:**

**Reference Books:**
Department: Physics  
Programme: B.Tech.

<table>
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<tr>
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Prerequisite:

Objectives:
- To provide a bridge between basic Physics and Engineering courses.
- To introduce the concepts and applications of Ultrasonics, Optics, Lasers, Optical Fibers, and wave mechanics and fundamentals of crystal structure.

Outcome:
- At the end of the course, Students would have adequate exposure to the concepts of the various topics of this Engineering Physics course and their real life applications.

**UNIT – I**  
Acoustics and Ultrasonics  
**Hours: 12**


**UNIT – II**  
Optics  
**Hours: 12**


**UNIT – III**  
Crystal Structure and Lattice Defects  
**Hours: 12**

Crystal structure: Space Lattice, Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices- Atomic Radius, Coordination Number and Packing Factor of SC, BCC, FCC, HCP structures – Miller Indices- Powder X Ray Diffraction Method; Lattice Defects: Qualitative ideas of point, line, surface and volume defects and their influence on properties of solids

**UNIT – IV**  
Wave Mechanics  
**Hours: 12**

Matter Waves – de Broglie hypothesis – Uncertainty Principle – Schrodinger Wave Equations – Time Dependent – Time Independent – Application to Particle in a One Dimensional potential Box –Concept of Quantum Mechanical Tunneling (without derivation) – Applications of tunneling (qualitative) to Alpha Decay, Tunnel Diode, Scanning Tunneling Microscope.

**UNIT – V**  
Lasers and Fiber Optics  
**Hours: 12**


Total contact Hours: 60  
Total Tutorials: -  
Total Practical Classes: -  
Total Hours: 60

**Text Books:**

**Reference Books:**
### Subject: Engineering Chemistry

**Semester:** One  
**Department:** Chemistry  
**Programme:** B.Tech  
**Category:** TA  
**Credit:** 4  
**Maximum Marks:** 100  
**Hours / Week:** 4  
**Prerequisite:** -

### Objectives
- To know the importance of chemistry in engineering education  
- To understand the chemistry of industrial processes  
- To apply the knowledge of chemistry to solve engineering problems  

### Outcome
- Students will be able to understand and appreciate usefulness of chemistry concepts in the design, fabrication and maintenance of materials for engineering applications.  
- Students will gain knowledge about the chemistry background of some of the important industrial processing techniques.  
- With the knowledge gained in conceptual chemistry, engineering students will be able to approach confidently the design and development of futuristic materials to meet the requirement of industry and society.

### UNIT – I  
**Water Treatment**  
**Hours:** 12  

### UNIT – II  
**Industrial Polymers**  
**Hours:** 12  

### UNIT – III  
**Electrochemical Cells**  
**Hours:** 12  

### UNIT – IV  
**Corrosion and Control**  
**Hours:** 12  

### UNIT – V  
**Engineering Materials**  
**Hours:** 12  

- **Total contact Hours:** 60  
- **Total Tutorials:** -  
- **Total Practical Classes:** -  
- **Total Hours:** 60

### Text Books:

### Reference Books:
**Subject Code** | **Subject** | **Hours / Week** | **Credit** | **Maximum Marks**
--- | --- | --- | --- | ---
BE101 | Basic Civil and Mechanical Engineering | 4 - - 4 | 40 60 100

### Prerequisite
- To be able to differentiate the types of buildings according to national building code.
- To understand building components and their functions as well as different types of roads, bridges and dams
- To convey the basics of Mechanical Engineering
- To establish the necessity of basics of Mechanical Engineering to other engineering disciplines
- To explain the concepts of thermal plants used in power systems being a common issue
- To narrate the methods of harnessing renewable energies and their working principles
- To explain the role of basic manufacturing processes
- To develop an intuitive understanding of underlying working principles of mechanical machines and systems.

### Objectives
- Parallels are drawn between the subject and the student’s everyday experience so that this course may be related to what the students already know.
- Students are made to understand the principles of Mechanical Engineering based on theories.
- Students are encouraged to make engineering judgments, to conduct independent exploration of topic of renewable energy systems and to communicate the findings in a professional manner.
- Students are made to develop natural curiosity to explore the various facets of mechanical equipment and machines.
- While emphasizing basic principles, students are provided with explanations used in real time engineering systems.

### Outcome

#### UNIT – I
**Buildings and Building Materials**

- Buildings-Definition-NBC Classification - plinth area, floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses. Impact of manufacture and use of building materials on the environment.

#### UNIT – II
**Buildings and their Components**


#### UNIT – III
**Basic Infrastructure**


#### UNIT – IV
**IC Engines and Steam Generators**

- IC engines – Classification – Working principles - Diesel and petrol engines: two stroke and four stroke engines – Merits and demerits.
- Steam generators (Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories – Merits and demerits - Applications.

#### UNIT – V
**Conventional and Non-conventional Power Generation**

- Power Generation Systems – Conventional and Non-Conventional:
### UNIT – VI

**Introduction to Manufacturing Technology**

| Machines: Lathe – Drilling machine – Grinding machine (Description only) |
|-----------------------------|-----------------------------|

<table>
<thead>
<tr>
<th>Total contact Hours: 60</th>
<th>Total Tutorials: -</th>
<th>Total Practical Classes: -</th>
<th>Total Hours: 60</th>
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</table>

#### Text Books:


#### Reference Books:


#### Web sites:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/
Department : Civil Engineering  
Programme : B.Tech.

<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Hours / Week</th>
<th>Credit</th>
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<td>T</td>
<td>P</td>
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<tr>
<td>CE101</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

Prerequisite: -

Objectives:
- To explain the importance of mechanics in the context of engineering.
- To understand the static equilibrium of particles and rigid bodies in two dimensions.
- To introduce the techniques for analyzing the forces in the bodies.
- To study the motion of a body and to write the dynamic equilibrium equation.

Outcome:
- On successful completion of the course, a student would be able to identify and analyze the problems by applying the principles of engineering mechanics, and to proceed to advanced study on mechanical systems.

UNIT – I Fundamentals of Mechanics  
Hours: 09

UNIT – II Application of Force System  
Hours: 09
Types loads and supports – simply supported beams, cantilever beams and plane trusses – reactions (Introduction only).
Friction: Laws of friction, Static dry friction, simple contact friction problems, body on inclined planes, ladders, wedges, simple screw jack.

UNIT – III Properties of Surfaces  
Hours: 09
Properties of sections – centroids, center of gravity, area moment of inertia, product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.
Principle of virtual work – work done – application to simple structural arrangements.

UNIT – IV Kinematics and Kinetics of Particles  
Hours: 09

UNIT – V Kinematics and Kinetics of Rigid Bodies  
Hours: 09

Total contact Hours: 45   Total Tutorials: 15   Total Practical Classes: -   Total Hours: 60

Text Books:

Reference Books:
Department: Humanities and Social Sciences  Programme: B.Tech.

Semester: One  Category: TA

<table>
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<th>Subject Code</th>
<th>Subject</th>
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<td>Communicative English</td>
<td>4 - - 4</td>
<td>4 40 60 100</td>
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</table>

Prerequisite

Objectives

- To improve the LSRW skills of I. B.Tech students
- To instill confidence and enable the students to communicate with ease
- To equip the students with the necessary skills and develop their language prowess

Outcome

On successful completion of the module students should be able to:

- communicate effectively in English
- get rid of their inhibitions
- possess effective language skills
- improve their career prospects

UNIT – I  Basic Concepts of Communicative English  Hours: 12


UNIT – II  Comprehension and Analysis  Hours: 12


UNIT – III  Writing  Hours: 12


UNIT – IV  Oral Communication  Hours: 12


UNIT – V  Vocabulary and Language Through Literature  Hours: 12

Analysis of

1. “English in India”, R.K. Narayan
3. “Politics and the English Language”, George Orwell


Total contact Hours: 60  Total Tutorials: -  Total Practical Classes: -  Total Hours: 60

Text Books:


Reference Books:

Department : Physics
Programme : B.Tech.
Semester : One
Category : LB

<table>
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<th>Credit</th>
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<td>PH103</td>
<td>Physics Laboratory</td>
<td>L</td>
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</tbody>
</table>

Prerequisite

Objectives
To provide a practical understanding of some of the concepts learnt in the theory course on Physics and Materials Science.

Outcome
The Students would have gained practical experience about some of the Theoretical concepts learnt in the Physics and Materials Science courses.

List of Experiments:
(Any 10 experiments including a maximum of 2 Demonstration experiments are to be performed.)

1. Radius of curvature of a Lens - Newton’s rings
2. Thickness of a thin object by Air – wedge
3. Spectrometer – Resolving power of a Prism
4. Spectrometer – Resolving power of a Transmission grating
5. Determination of wavelength of a Laser source using transmission grating, reflection grating (vernier calipers) & particle size determination
6. Determination of numerical aperture & Acceptance angle of an optical fiber.
7. Laurent’s Half shade polarimeter – Determination of specific rotatory power*
8. Spectrometer - Hollow prism / Ordinary & Extraordinary rays by Calcite Prism*
9. Determination of optical absorption coefficient of materials using laser*
10. Coefficient of Thermal conductivity - Radial flow method
11. Coefficient of Thermal conductivity – Lee’s Disc method
12. Jolly’s Bulb Apparatus experiment – determination of α
13. Magnetism: I – H curve
14. Field along the axis of a coil carrying current
15. Vibration magnetometer – calculation of magnetic moment & pole strength
16. Electrical conductivity of semiconductor – two probe / four probe method*
17. Hall effect in a semiconductor*
18. Michelson’s Interferometer*

*Demonstration Experiments.

Reference Book:
<table>
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<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
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<td>Chemistry Laboratory</td>
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Prerequisite: 

Objectives:  
- To educate the principles involved in chemical analysis.  
- To provide practical knowledge of handling chemicals and chemical analysis.  
- To understand the importance of chemical analysis in various fields.

Outcome:  
- Students will be able to understand chemical analysis and its usefulness in engineering, industry and other fields.  
- Students will gain laboratory skills and that will give confidence in analyzing samples in engineering, industry and other fields.  
- Students will gain knowledge about the principles and methods of listed methods of quantitative analyses.

List of experiments: (Any 10 experiments)

1. Determination of total, permanent and temporary hardness of water by EDTA method.  
2. Determination of magnesium in water by complexometry.  
3. Determination of calcium in lime stone by complexometry.  
4. Determination of alkalinity of water.  
5. Determination of percentage of acetic acid in vinegar.  
6. Determination of ferrous ion in Mohr’s salt.  
7. Determination of lead dioxide by permanganometry.  
8. Determination of ferrous and ferric ions in a solution by dichrometry.  
10. Determination of dissolved oxygen in water.  
11. Determination of COD of water sample.  
12. Determination of available chlorine in bleaching powder.  
13. Determination of chloride content in water by argentometry.  
14. Determination of lead in polluted water by conductometry.  
15. Preparation of potash alum from scrap aluminium.

Total contact Hours: -  
Total Tutorials: -  
Total Practical Classes: 45  
Total Hours: 45

Text Books:


Reference Books:


Department: Chemistry  
Programme: B.Tech.  
Semester: One  
Category: LB
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</table>

| Prerequisite | -                        |

### Objectives

- To convey the basics of mechanical tools used in engineering
- To establish hands on experience on the working tools
- To develop basic joints and fittings using the hand tools
- To establish the importance of joints and fitting in engineering applications
- To explain the role of basic workshop in engineering
- To develop an intuitive understanding of underlying physical mechanism used in mechanical machines.

### Outcome

- Parallels are drawn between the subject and the student’s everyday experience so that this course may be related to what the students already know.
- Students are introduced to basic hand tools used in various mechanical cutting operations.
- Students are encouraged to make simple joints and fittings.
- Students are made to develop natural curiosity to explore the various facets of basic cutting operations.
- While emphasizing basic operations, students are provided with modern hand tools to use in real time engineering jobs.
- Students are exposed to make objects like tray, welded joints.

### UNIT – I

**Fitting**

- Study of tools and machineries
- Symmetric fitting
- Acute angle fitting
- Obuse angle fitting

**Hours:** 11

### UNIT – II

**Welding**

- Study of arc and gas welding equipment and tools
- Simple lap welding (Arc)
- Single V butt welding (Arc)
- Corner joint (Arc)

**Hours:** 11

### UNIT – III

**Sheet Metal**

- Study of tools and machineries
- Funnel
- Waste collection tray
- Rectangular Box

**Hours:** 11

### UNIT – IV

**Carpentry**

- Study of tools and machineries
- Half lap joint
- Corner mortise joint
- Dovetail joint

**Hours:** 12

### Total contact Hours: - | Total Tutorials: - | Total Practical Classes: 45 | Total Hours: 45

### Text Books:


### Web sites:

### Department: Mathematics
**Programme:** B.Tech.

**Semester:** Two  
**Category:** TB

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<td>CA 40 SE 60 TM 100</td>
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**Prerequisite:** -

**Objectives**
- To acquaint with theory of Matrices
- Hyperbolic functions and theory of equations
- Vector calculus and statistics

**Outcome**
- Understands Matrix theory
- Solving techniques of equations
- Understands Vectors and statistics

**UNIT – I**
Hours: 09

Eigen values and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values. Cayley-Hamilton Theorem, Diagonalisation of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation and nature of quadratic forms.

**UNIT – II**
Hours: 09

Trigonometry: Hyperbolic and circular functions, logarithms of complex number, resolving real and imaginary parts of a complex quantity.

Theory of equations: Relation between roots and coefficients, reciprocal equations, transformation of equations and diminishing the roots.

**UNIT – III**
Hours: 09

Finite differences: Definitions and relation between operators (Δ, ∇, δ, E, μ, D), Solution of difference Equations, Solving Boundary value problems for ordinary differential equations using finite difference method.

**UNIT – IV**
Hours: 09

Gradient, divergence and curl, their properties and relations. Stoke’s theorem and Gauss divergence theorem (without proof). Simple applications involving cubes, sphere and rectangular parallelepipeds.

**UNIT – V**
Hours: 09

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

**Total contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:** -  
**Total Hours:** 60

**Text Books:**

**Reference Books:**
Subject Code | Subject | Hours / Week | Credit | Maximum Marks |
|-------------|---------|--------------|-------|---------------|

Prerequisite: -

Objectives:
- To impart knowledge to the Engineering students about the significance of Materials Science and its contribution to Engineering and Technology
- To introduce the Physical concepts and properties of Different category of materials and their modern applications in day-to-day life.

Outcome:
- Engineering Students would have gained fundamental knowledge about the various types of materials and their applications to Engineering and Technology.

UNIT – I | Dielectric Materials | Hours: 12
NLO materials and piezoelectric actuators (introductory concepts).

UNIT – II | Magnetic Materials and Superconductors | Hours: 12
Superconductors: Basic concepts – properties of superconductors –Meissner effect – Type I and II superconductors – BCS theory (qualitative) - High Temperature Superconductors– Qualitative ideas of Josephson effect, quantum interference and SQUID – their applications.

UNIT – III | Semiconductors | Hours: 12

UNIT – IV | Nuclear Reactors & Materials | Hours: 12

UNIT – V | Smart Materials and Nanomaterials | Hours: 12

Reference Books:
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<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
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<td>CY102</td>
<td>Environmental Science</td>
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<td></td>
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<td>100</td>
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</tbody>
</table>

**Prerequisite:** -

**Objectives:**
- To widen the knowledge of environmental awareness and pollution
- To educate the importance of preserving the earth’s resources and ecosystem
- To highlight the modern techniques and regulations to monitor and control pollution

**Outcome:**
- Students will be able to understand about the environment and natural resources we are blessed with.
- Students will become aware of environmental issues like pollution, dwindling natural resources and degrading ecosystem.
- Students will be inspired to act as environmentally friendly and work for sustainable development of the humanity.

**UNIT – I**  
**Ecosystem and Biodiversity**  
**Hours: 12**


**UNIT – II**  
**Air Pollution**  
**Hours: 12**


**UNIT – III**  
**Water and Land Pollution**  
**Hours: 12**


**UNIT – IV**  
**Instrumental Pollution Monitoring**  
**Hours: 12**


**UNIT – V**  
**Energy and Environment**  
**Hours: 12**


**Total contact Hours: 60**  
**Total Tutorials: 40**  
**Total Practical Classes: 60**  
**Total Hours: 60**

**Text Books:**
1. Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International (P) Ltd, New Delhi, 2009. (Unit I)
2. S.S. Dara, AText Bookof Environmental Chemistry and Pollution Control, S. Chand and Company Ltd, New Delhi, 2008. (Unit II, III, & V)
3. C.N. Sawyer, P.L. McCarty And G.F. Parkin, Chemistry for Environmental Engineering and Science, Tata
<table>
<thead>
<tr>
<th>Reference Books:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. K. Raghavan Nambiar, Text Book of Environmental Studies, Scitech Publications</td>
</tr>
<tr>
<td>2. A.K. De, Environmental Chemistry, New Age International (P) Ltd, New Delhi,</td>
</tr>
<tr>
<td>2006.</td>
</tr>
<tr>
<td>4. G.S. Sodhi, Fundamental Concepts of Environmental Chemistry, Narosa</td>
</tr>
</tbody>
</table>
Department: Electronics and Communication Engineering / Electrical and Electronics Engineering
Programme: B.Tech.

**Semester: Two**

**Subject Code** | **Subject** | **Hours / Week** | **Credit** | **Maximum Marks**
--- | --- | --- | --- | ---
BE102 | Basic Electrical and Electronics Engineering | 3 1 - | 4 40 60 100 |

**Prerequisite:**
- To apply Kirchhoff’s law to simplify the given circuit.
- To understand the concept of AC circuit and to simplify the given RL, RC, RLC series and parallel circuits.
- To understand the principle of electromagnetic induction and the working principle of electrical machines.
- The students understand the working principle of transistor, FET, MOSFET, CMOS and their applications.
- To design adders, subtractors and to gain knowledge on sequential logic circuits.
- To understand the need for communication and acquire knowledge on different communication systems.
- To have an overview of different emerging technologies in day-to-day applications.

**Objectives:**
- The students explored the basic terminology, laws and concepts of DC and AC circuits in electrical engineering.
- The students know the principle of operation of DC and AC electrical machines and different types of power plants.
- Will understand the importance of FET’s, MOSFET’s, CMOS and their applications.
- Will be able to design Combinational and Sequential circuits.
- Awareness towards different Communication Systems.
- Gain knowledge in the working principle of real time applications used in day today life like ATM, Microwave Oven, Bluetooth, WiFi and Computer Networks.

**Outcome:**
- The students explored the basic terminology, laws and concepts of DC and AC circuits in electrical engineering.
- The students know the principle of operation of DC and AC electrical machines and different types of power plants.
- Will understand the importance of FET’s, MOSFET’s, CMOS and their applications.
- Will be able to design Combinational and Sequential circuits.
- Awareness towards different Communication Systems.
- Gain knowledge in the working principle of real time applications used in day today life like ATM, Microwave Oven, Bluetooth, WiFi and Computer Networks.

**UNIT – I**
DC Circuits


**UNIT – II**
AC Circuits

Concepts of AC circuits — rms value, average value, form and peak factors — Simple RL, RC and RLC series and parallel circuits — Concept of real and reactive power — Power factor — Series and parallel resonance — Introduction to three phase system - Power measurement by two wattmeter method.

**UNIT – III**
Electrical Machines and Power Plants

Law of Electromagnetic induction, Fleming’s Right & Left hand rule - Principle of DC rotating machine, Single phase transformer, single phase induction motor and synchronous motor (Qualitative approach only) - Layout of thermal, hydro and nuclear power generation (block diagram approach only). Components of AC transmission and distribution systems — One line diagram.

**UNIT – IV**
Electronics


**UNIT – V**
Communication


**UNIT – VI**
Overview of Emerging Technologies

Evolution of Mobile Communication Generations (1G, 2G, 2.5G, 3G and Beyond 3G) — Overview of Bluetooth, Wifi,
WiMax, Sensor Networks and Wireless LANs — Introduction to VLSI Technology and Embedded Systems — Internet of Things (IOT).

Microwave Ovens - RFID - Automated Teller Machines (ATM).

<table>
<thead>
<tr>
<th>Total contact Hours</th>
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<th>Total Practical Classes</th>
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</table>

**Text Books:**

**Electrical**

**Electronics and Communication**

**Reference Books:**

**Electrical**

**Electronics and Communication**

**Web sites:**

1. www.electronics-tutorials.ws
2. www.en.wikipedia.org/wiki/Telecommunication
3. www.nptel.ac.in/courses/IIT-MADRAS/Basic_Electronics.../LECTURE1.pdf
### Course Information

**Department:** Mechanical Engineering  
**Programme:** B.Tech.  
**Semester:** Two  
**Category:** TA  
**Subject Code:** ME101  
**Subject:** Engineering Thermodynamics  
**Prerequisite:** -

<table>
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<th>Subject Code</th>
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<th>Hours / Week</th>
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<td>ME101</td>
<td>Engineering Thermodynamics</td>
<td>3 1 -</td>
<td>4</td>
<td>60 100</td>
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</table>

**Objectives:**
- To convey the basics of the thermodynamic principles
- To establish the relationship of these principles to thermal system behaviors
- To develop methodologies for predicting the system behavior
- To establish the importance of laws of thermodynamics applied to energy systems
- To explain the role of refrigeration and heat pump as energy systems
- To develop an intuitive understanding of underlying physical mechanism and a mastery of solving practical problems in real world.

**Outcome:**
- Parallels are drawn between the subject and the student’s everyday experience so that this course may be related to what the students already know.
- Students are made to understand the principles of thermodynamics and adjudge the viability of operation of any thermal system in real time applications
- Students are encouraged to make engineering judgments, to conduct independent exploration of topic of thermodynamics and to communicate the findings in a professional manner.
- Students are made to develop natural curiosity to explore the various facets of thermodynamic laws.
- While emphasizing basic laws, students are provided with modern tools to use in real time engineering problems.

#### UNIT – I  
**Hours:** 09  

#### UNIT – II  
**Hours:** 09  
The concept of energy, work and heat – reversible work- internal energy -Perfect gas – specific heats – Joules law - enthalpy- Conservation of Energy principle for closed and open systems - First law of thermodynamics – Application of first law to a process (flow and non-flow) – Steady flow energy equation and its engineering application - Calculation of work and heat for different processes.

#### UNIT – III  
**Hours:** 09  

#### UNIT – IV  
**Hours:** 09  

#### UNIT – V  
**Hours:** 09  
Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system – Liquefaction – Solidification (only theory).

**Text Books:**
### Reference Books:


### Web sites:

1. [http://nptel.iitm.ac.in/courses/Webcourse-contents/](http://nptel.iitm.ac.in/courses/Webcourse-contents/)
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<td>CS101</td>
<td>Computer Programming</td>
<td>3</td>
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</table>

**Prerequisite:**
- To introduce the basics of computers and information technology.
- To educate problem solving techniques.
- To impart programming skills in C language.
- To practice structured programming to solve real life problems.

**Objectives:**
- To introduce the basics of computers and information technology.
- To educate problem solving techniques.
- To impart programming skills in C language.
- To practice structured programming to solve real life problems.

**Outcome:**
- On successful completion of the course, students will be able to:
  - Understand the basics of computers and its related components
  - Have the ability to write a computer program to solve specified problems

**UNIT – I**


**UNIT – II**


**UNIT – III**

Strings – String I/O functions, String Library functions – Storage classes.

**UNIT – IV**

Structures – Arrays and Structures – Nested structures – Structure as Argument to functions – Union
Pointers – Declaration, Initialization and Accessing Pointer variable – Pointers and arrays – pointers as argument and return value – Pointers and strings - pointers and structures.

**UNIT – V**

Dynamic Memory Allocation: MALLOC, CALLOC, FREE, REALLOC
Introduction to preprocessor – Macro substitution directives – File inclusion directives – Compiler Control directives – Miscellaneous directives.

**Text Books:**

**Reference Books:**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tr>
<td>ME102</td>
<td>Engineering Graphics</td>
<td>2 - 3 - 4</td>
<td>50</td>
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</table>

Prerequisite: 

Objectives:

- To convey the basics of engineering drawing
- To explain the importance of an engineering drawing
- To teach different methods of making the drawing
- To establish the importance of projects and developments made in drawing that are used in real systems

Outcome:

- From what students have already learnt and know, relation has been brought about how to bring their vision into realities.
- Students are made to follow and understand the basic of mechanical drawing
- Students are encouraged to make engineering drawing of physical object representing engineering systems.
- Students are made to develop natural curiosity to explore the various facets of engineering drawings.

UNIT – 0
Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning.

UNIT – I
Projection of Points and Projection of lines

UNIT – II
Projection of Points and Projection of lines

UNIT – III
Projection of solids in complicated positions

UNIT – IV
Sections of solids - Development of Surfaces

UNIT – V
Axonometric Projections: Isometric Projections (simple solids); Perspective Projections (planes and simple solids; Orthographic Projections

Total contact Hours: 30  Total Tutorials: -  Total Practical Classes: 45  Total Hours: 75

Text Books:

3. BIS, Engineering Drawing practices for Schools & College, SP 46 : 2003

Reference Books:

4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int.,

Web sites:

Department: Computer Science and Engineering / Information Technology

Programme: B.Tech.

Semester: Two

Category: TA

<table>
<thead>
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<th>Subject Code</th>
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<tr>
<td>CS102</td>
<td>Computer Programming Laboratory</td>
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</tbody>
</table>

Prerequisite: -

Objectives:
- To study and understand the use of OS commands
- To get familiarity on MS-Office packages like MS-Word, MS-Excel and MS-PowerPoint
- To gain a hands on experience of compilation and execution of ‘C’ programs
- To inculcate logical and practical thinking towards problem solving using C programming.

Outcome:
On successful completion of the course, students will be able to:
- Have the ability to write a computer program to solve specified problems
- Problem solving ability will be gained by the students

Cycle - I

**Fundamentals of Computing**

1. Study of OS commands
2. Use of mail merge in word processor
3. Use of spreadsheet to create Charts (XY, Bar, Pie) with necessary formulae.
4. Use of Power point to prepare a slide show.

Hours: 09

Cycle - II

**Programming Using C**

1. Study of Compilation and execution of simple C programs
2. Basic C Programs
   a. Arithmetic Operations
   b. Area and Circumference of a circle
   c. Swapping with and without Temporary Variables
3. Programs using Branching statements
   a. To check the number as Odd or Even
   b. Greatest of Three Numbers
   c. Counting Vowels
   d. Grading based on Student’s Mark
4. Programs using Control Structures
   a. Computing Factorial of a number
   b. Fibonacci Series generation
   c. Prime Number Checking
   d. Computing Sum of Digit
5. Programs using String Operations
   a. Palindrome Checking
   b. Searching and Sorting Names
6. Programs using Arrays
   a. Sum of ‘n’ numbers
   b. Sorting an Array
   c. Matrix Addition, Subtraction, Multiplication and Transpose
7. Programs using Functions
   a. Computing nCr
   b. Factorial using Recursion
   c. Call by Value and Call by Reference
8. Programs using Structure
   a. Student Information System
   b. Employee Pay Slip Generation
   c. Electricity Bill Generation

Hours: 36
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<th>9. Programs using Pointers</th>
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<tbody>
<tr>
<td>a. Pointer and Array</td>
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<tr>
<td>b. Pointer to function</td>
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<tr>
<td>c. Pointer to Structure</td>
</tr>
<tr>
<td>10. Programs using File Operation</td>
</tr>
<tr>
<td>a. Counting No. of Lines, Characters and Black Spaces</td>
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<tr>
<td>b. Content copy from one file to another</td>
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<tr>
<td>c. Reading and Writing Data in File</td>
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**Text Books:**

**Reference Books:**
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<tr>
<td>BE103</td>
<td>Basic Electrical and Electronics Engineering Laboratory</td>
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<td>3</td>
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**Prerequisite:**
- To understand the basic electrical tools and their applications.
- To get trained in using different types of wiring.
- To find faults in electrical lamp and ceiling fan.
- To understand and apply Kirchhoff’s laws to analyze electrical circuits.
- To study the operation of CRO and principle of fiber optic communication.
- To design adder and subtractors.
- To understand the frequency response of RC coupled amplifier.

**Objectives:**
- The students get exposure on the basic electrical tools, applications and precautions.
- The students are trained for using different types of wiring for various purposes in domestic and industries.
- The students are taught to find faults in electrical lamp and ceiling fan.
- Will be able to learn and use equipments like Signal Generator, Power Supply and CRO.
- To apply Kirchhoff’s law for simplification of circuits.
- To design combinational circuits.
- To obtain the frequency response of Amplifiers.

**Outcome:**
- To understand the basic electrical tools and their applications.
- To get trained in using different types of wiring.
- To find faults in electrical lamp and ceiling fan.
- To understand and apply Kirchhoff’s laws to analyze electrical circuits.
- To study the operation of CRO and principle of fiber optic communication.
- To design adder and subtractors.
- To understand the frequency response of RC coupled amplifier.

**List of Experiments**
- Electrical Lab
  1. Electrical Safety, Precautions, study of tools and accessories.
  2. Practices of different joints.
  3. Wiring and testing of series and parallel lamp circuits.
  4. Staircase wiring.
  5. Doctor’s room wiring.
  7. Go down wiring.
  8. Wiring and testing a ceiling fan and fluorescent lamp circuit.
  9. Study of different types of fuses and A.C. and D.C. meters.

- Electronics and Communication Lab
  2. Study of Fiber Optic Communication.
  4. Zener Diode as Voltage Regulator.
  5. Design of Adder and Subtractor Circuits.
<table>
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<th>Subject Code</th>
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<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<td>Mathematics - III</td>
<td>L 3 T 1 P 1 C 4 CA 40 SE 60 TM 100</td>
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</table>

**Prerequisite**
- To introduce the ideas of Laplace and Fourier Transforms
- To familiarize students with of Complex Analysis
- To introduce Fourier series.

**Objectives**
- Understands Transform Calculus
- Understand Complex Analysis
- Able to apply Fourier series

**Outcome**
- Understands Transform Calculus
- Understand Complex Analysis
- Able to apply Fourier series

**UNIT – I**  
**Laplace Transform**  

**UNIT – II**  
**Complex Variable - Analytic Functions**  
Analytic functions – Necessary conditions Cauchy-Riemann equations (Cartesian and polar form) and sufficient conditions (excluding proof) – Harmonic and orthogonal properties of analytic function – Construction of analytic functions. Conformal mapping – Simple and standard transformations like $w = z+c$, $cz$, $z^2$, $e^z$, $\frac{1}{z}$ Bilinear transformation. (excluding Schwarz-Christoffel transformation)

**UNIT – III**  
**Complex Integration**  
Complex integration, Cauchy’s Integral theorem, Cauchy’s integral formula and problems, Taylor’s and Laurent’s theorem (without proof) Classification of singularities. Residues and evaluation of residues – Cauchy’s Residue theorem – Contour integration: Application of residue theorem to real integrals – unit circle and semicircular contour (excluding poles on boundaries).

**UNIT – IV**  
**Fourier Series**  

**UNIT – V**  
**Fourier Transform**  
Fourier integral theorem (statement only), Fourier transform and its inverse, properties. Fourier sine and cosine transforms, their properties, convolution and Parseval’s identity.

**Total contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:** -  
**Total Hours:** 60

**Text Books:**

**Reference Books:**
<table>
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<td>EC101</td>
<td>Circuits and Networks</td>
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**Prerequisite**
- To understand the role of various theorems in solving electric circuits.
- To study the frequency response of resonant circuits.
- To learn the analytical tools for handling transient response of RLC circuits.
- To gain knowledge about various network parameters.
- To design filters and Equalizers.

**Objective**
- To understand the role of various theorems in solving electric circuits.
- To study the frequency response of resonant circuits.
- To learn the analytical tools for handling transient response of RLC circuits.
- To gain knowledge about various network parameters.
- To design filters and Equalizers.

On successful completion of the course, students will be able to:
- Analyze and use various network theorems employed in the field of engineering.
- Design and analyze AC circuits using mesh and nodal analysis.
- Design and analyse transient circuits and magnetically coupled circuits.
- Design and implement filters and equalizers.

**UNIT – I Circuit Analysis and Resonance**
Hours: 9
Analysis of DC and AC circuits using Superposition, Thvenin’s, Norton’s, Reciprocity and Maximum power transfer theorems. Resonance: Series resonance - Parallel resonance - Variation of impedance with frequency - Variation in current through and voltage across L and C with frequency – Bandwidth – Q factor -Selectivity.

**UNIT – II Transient Analysis**
Hours: 9
Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by DC sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation.

**UNIT – III Magnetically Coupled Circuits**
Hours: 9
Self-inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multi winding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.

**UNIT – IV Network Parameters**
Hours: 9

**UNIT – V Filters and Equalizers**
Hours: 9

**Text Books:**

**Reference Books:**

**Web sites:**
1. www.circuit_magic.com
2. www.learnabout_electronics.org
# Course: Data Structures and Object Oriented Programming

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tr>
<td>CS140</td>
<td>Data Structures and Object Oriented Programming</td>
<td>3 1</td>
<td>4</td>
<td>40 60 100</td>
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</table>

**Prerequisite:**
- 

**Objective:**
- To acquaint students with data structures used in programming for the storage and manipulation of data.
- To explore the concept of data, Stacks, Queues and Tree.
- To understand the concepts of object oriented programming and expertise the programming skills through C++ language.

**Outcome:**
- On successful completion of the course, students will be able to:
  - Apply logical thinking to create and analyze programs.
  - Design and conduct experiments, as well as to analyze and interpret data of Stacks, Queues and Trees.
  - Identify, formulate, and solve engineering problems using programming skills through C++ language.

---

**UNIT – I**

**Introduction to data structures**


**UNIT – II**

**Stacks and Linked list**


**UNIT – III**

**Topology**


**UNIT – IV**

**Object Oriented Programming**


**UNIT – V**

**Functions in C++**

Operators overloading and type conversions, Inheritance: Extending classes, Pointers, Virtual functions and polymorphism, Exception Handling.

**Total contact Hours: 45**

**Total Tutorials: 15**

**Total Practical Classes:**

**Total Hours: 60**

**Text Books:**


**Reference Books:**


**Web sites:**

1. http://www.cse.unt.edu
2. http://nptel.iitm.ac.in
Department : Electronics and Communication Engineering
Programme: B. Tech. (EC)
Semester : Three
Category : TA

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<td>EC102</td>
<td>Electronic Devices and Circuits</td>
<td>3</td>
<td>1</td>
<td>-</td>
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Prerequisite:
- To understand the PN Junction diodes conceptually and to analyze simple diode circuits.
- To assimilate knowledge with regard to theory and VI Characteristics of Transistors.
- To comprehend the significance of biasing circuits and stability factor.
- To know about special and various high power devices and its characteristics.
- To understand the behaviour of amplifier circuits at both low and high frequencies.

Objective:
- To understand the PN Junction diodes conceptually and to analyze simple diode circuits.
- To assimilate knowledge with regard to theory and VI Characteristics of Transistors.
- To comprehend the significance of biasing circuits and stability factor.
- To know about special and various high power devices and its characteristics.
- To understand the behaviour of amplifier circuits at both low and high frequencies.

Outcome:
On successful completion of the course, students will be able to:
- Assimilate and link the fundamentals associated with semi-conductor Physics.
- Identify the operational principles and concepts of JFET and MOSFET.
- Identify the need for biasing with stability criterion.
- Design amplifier circuits as a function of frequency
- Create Awareness on the features of high power devices and identify its applications.

UNIT – I
Semiconductor Diodes and Application

- Applications of Diode: Clippers, Clampers and Rectifiers with and without Filters (L, C and LC filters).

UNIT – II
Transistors

- Field Effect Transistors: Principle of Operation and Characteristics of JFETs. Construction, Principle of Operation and Characteristics of Enhancement MOSFETs and Depletion MOSFETs. Introduction to CMOS and VMOS.

UNIT – III
Biasing and Stability

- DC and AC load line and Q-point – Need for biasing. Different types of BJT biasing – Fixed bias, Collector to base bias, Self bias. Stability factor, Bias compensation: Diode, Thermistor and Sensistor compensation. FET biasing: Gate bias, Voltage divider bias and Self bias – MOSFET biasing.

UNIT – IV
Transistor Analysis

- Transistor High Frequency Analysis: Hybrid pi CE transistor model – Hybrid pi conductance and capacitances – CE short circuit current gain using Hybrid pi model - Current gain with resistive load.

UNIT – V
Special Semiconductor Devices

- Construction, principle of operation, characteristics and applications of Schottky barrier diode, Varactor diode, Tunnel diode, PIN diode, LED, UJT, SCR, DIAC and TRIAC. Photoconductivity – photodiode, APD, phototransistor, LDR, optocoupler, solar cell, LASER diode and MESFET.

Total contact Hours: 45
Total Tutorials: 15
Total Practical Classes: 15
Total Hours: 60

Text Books:

Reference Books:
Web sites:

1. www.nptel.iitm.ac.in
Subject Code: EC103
Subject: Engineering Electromagnetics

Prerequisite:
- The course will enable the students to:
  - Understand the concepts of vectors, curl and divergence.
  - Acquire adequate knowledge about the electric potential and the electric field intensity.
  - Acquire knowledge about the magnetic potential and the magnetic field intensity.
  - Get adequate knowledge about Maxwell’s equation.
  - Gain adequate knowledge about waves propagating through different media.

Objective:
- After completion of the course, the students will be able to:
  - Calculate the electric field, scalar potential, stored energy, and capacitance associated with simple distributions of charge.
  - Interpret electromagnetic waves and determine its associated parameters.
  - Apply boundary conditions to determine current and charge densities produced on conducting boundaries by applied fields.
  - Determine the attenuation constant, phase constant and skin depth for waves in a lossy medium, where the conductivity may range from low to high.

Outcome:

UNIT – I  Electric Field

UNIT – II  Magnetic Field

UNIT – III  Electromagnetic Induction

UNIT – IV  EM Waves and Wave Equations
Maxwell’s equations in point and integral form – Poynting theorem – Poynting vector and the flow of power – Power flow in a co-axial cable – Instantaneous, average and Complex Poynting vector. Electromagnetic wave equation, wave equation for free space and conducting medium.

UNIT – V  Electromagnetic Waves
Uniform plane wave - Characteristics impedance or intrinsic impedance – Wave propagation in a lossless medium, conducting medium, good dielectric, good conductor – phase velocity and group velocity – Depth of penetration – Polarization, linear polarization, circular polarization and elliptical polarization - Reflection and refraction of plane waves – Surface impedance.

Text Books:

Reference Books:

**Websites:**
1. [http://electromagneticsmadeeasy.blogspot.in/](http://electromagneticsmadeeasy.blogspot.in/)
2. [www.faculty.ece.illinois.edu](http://www.faculty.ece.illinois.edu)
<table>
<thead>
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<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<td>EC104</td>
<td>Circuits and Networks Laboratory</td>
<td>L: 3, T: 2, P: 60, C: 40, CA: 100, SE: 100, TM: 40</td>
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**Prerequisite**

- To practically test various theorems in solving circuits.
- To experimentally determine the frequency response of resonant circuits.
- To evaluate various network parameters.
- To design filters and Equalizers.

**Objectives**

- To practically test various theorems in solving circuits.
- To experimentally determine the frequency response of resonant circuits.
- To evaluate various network parameters.
- To design filters and Equalizers.

**Outcome**

On successful completion of the course, students will be able to:

- Analyze various network theorems employed in the field of engineering.
- Design and analyze AC circuits at ease.
- Design filters and equalizers for any given specification.

1. Simulation and experimental verification of (i) Superposition theorem (ii) Thevenin’s theorem and (iii) Norton’s theorem and (iv) Maximum power transfer theorem applied in (i) DC and (ii) AC circuits.
2. Measurement of (i) frequency response (ii) bandwidth and (iii) Q-factor of (i) series and (ii) parallel resonant circuits using simulation and experiment.
3. Study of transient response of (i) RC (ii) RL and (iii) RLC circuits for DC excitation using simulation and experiment.
4. Study of transient response of (i) RC (ii) RL and (iii) RLC circuits for sinusoidal excitation using simulation and experiment.
5. Design of k-type Low pass and high pass filters.
   a. Frequency and phase response of the Low pass filter using Lumped elements.
6. Design of k-type Band pass and Band stop filters.
   b. Frequency and phase response of the Band stop and notch filter using Lumped Elements.
7. Design of m-derived filters.
   a. Frequency and phase response of the m derived low pass filter.
   b. Frequency and phase response of the m derived high pass filter.
8. Design of switched Twin-T network with its frequency and phase response.
   a. Measurement of attenuation of a transmission line for various lengths (like 25, 50, 75, 100 meters) - frequency response of the line at a fixed length.
   b. Study of frequency response of an equalizer that can boost or attenuate frequencies 50Hz, 1 KHz and 10 kHz.
10. Simulation of filters and equalizers.
    a. Design of LPF/HPF/BPF/BEF/ T / π constant k/m derived / composite for the given cut-off frequency and obtain the relevant responses.
    b. Design of an attenuator/phase equalizer and obtain the relevant responses.
11. Impedance (Z) and ABCD Parameters of a transmission line

**Total contact Hours:** 45
**Total Tutorials:** 45
**Total Practical Classes:** 45
**Total Hours:** 45
<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Credit</th>
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<tr>
<td>CS141</td>
<td>Data Structure and Object Oriented Programming Laboratory</td>
<td>-</td>
<td>3</td>
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**Prerequisite**

- To develop skills to design and analyze simple linear and non-linear data structures.
- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem.
- To make the student to identify and practice the object-oriented programming concepts and techniques.
- To practice the use of C++ classes and class libraries, modify existing C++ classes.
- To develop C++ classes for simple applications.

**Objectives**

- On successful completion of the course, students will be able to:
  - Design and analyze the time and space efficiency of the data structure.
  - Choose the data structure that efficiently models the information in a problem.
  - Apply various data structure such as stacks, queues, trees and graphs to solve various computing problems using C.
  - Acquire practical knowledge on the application of data structures.
  - Design applications which are easier to debug, maintain and extend.
  - Apply object-oriented programming features to program design and implementation.

**Outcome**

A. Data Structures using C Language

1. Searching Techniques
2. Sorting Techniques
3. Implementation of Linked List and doubly linked and its applications
4. Stack and its applications
5. Queues and its applications
6. Binary tree traversal
7. Graph traversal
8. Spanning Tree
9. Shortest path algorithms

B. Object Oriented Programming

10. Programs to implement classes and objects with constructors and destructors
11. Program to implement static variable, default argument and friend function
12. Programs to implement different types of inheritances like multiple, Multilevel and hybrid
13. Programs to implement virtual functions to demonstrate the use of run time polymorphism
14. Programs to implement Exception handling

**Total contact Hours:** Total Tutorials: Total Practical Classes: 45 | Total Hours: 45
### Subject Code: EC105
#### Subject: Electronic Devices and Circuits Laboratory

<table>
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<th>L</th>
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<td>3</td>
<td>2</td>
<td>60</td>
<td>40</td>
<td>100</td>
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</tbody>
</table>

**Prerequisite:**
- To analyze simple diode circuits.
- To comprehend the practical significance of biasing circuits and stability factor.
- To know the VI characteristics of special high power devices.
- To understand the behavior of amplifier circuits at both low and high frequencies.

**Objectives:**
- All possible diode circuits can be analyzed at ease.
- Analysis of amplifier circuits will provide a complete overview on the effects of frequency on circuit performance.
- Practical exposure to high power devices will enable the graduates to understand and identify its applications.

**Outcome:**
- V-I characteristics of semiconductor diodes: a) PN Junction diode b) Point contact diode c) Zener diode
- Characteristics of BJT in CB configuration
  a) Determination of input and output characteristics
  b) Determination of voltage gain, current gain, input and output resistances from the characteristics
- Characteristics of BJT in CE configuration
  a) Determination of input and output characteristics
  b) Determination of voltage gain, current gain, input and output resistances from the characteristics
- Characteristics of JFET
  a) Determination of output and transfer characteristics
  b) Determination of pinch off voltage, $r_{ds}$, $g_m$, and $\mu$ from the characteristics
- Characteristics of MOSFET
  a) Determination of output and transfer characteristics
  b) Determination of pinch off voltage, $r_{ds}$, $g_m$, and $\mu$ from the characteristics
- Characteristics of UJT, SCR and TRIAC.
- Characteristics of photonic devices
  a) Determination of V-I characteristics of LED
  b) Determination of V-I and intensity characteristics of phototransistor
- Design and testing of biasing circuits: a) Fixed bias b) Collector to base bias c) Self bias.
- Rectifier with and without filters (L, C and LC type)
  a) Determination of ripple factor for different types of rectifiers with and without filters.
- Clipper and Clampers circuits using diodes: Positive, negative, biased and combinational clippers
  i) Switching circuit
    a) AND/ OR logic gates using diodes
    b) NOT gate using transistor

**Total contact Hours:** 45
**Total Tutorials:**
**Total Practical Classes:** 45
**Total Hours:** 45
<table>
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<tr>
<th>Subject Code</th>
<th>Subject</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>MA108</td>
<td>Linear Algebra and Numerical Methods</td>
<td>3 1 -</td>
<td>4 40</td>
<td>60 100</td>
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</table>

**Prerequisite:**
- To introduce Linear algebra and Linear Transformations
- To understand interpolation, differentiation and integration
- To solve problems in ordinary and partial differential equations

**Objective:**
After completion of the course, the students will be able to:
- Implement Linear Algebra concepts.
- Solve interpolation problems, numerical differentiation and integration
- Solve ordinary and partial differential equations

**UNIT – I**
Linear Algebra
- Vector spaces, subspaces, span of a set, linear independence and dependence, Dimension and Bases, inner product spaces - Gram-Schmidt orthogonalization.

**UNIT – II**
Linear Transformations
- Definition and examples, Range and Kernel of a linear map, rank and nullity, Inverse of a linear transformation, consequences of Rank-Nullity theorem, the space L(U, V), composition of linear maps, Matrix associated with a linear map and linear map associated with a matrix

**UNIT – III**
Interpolation, Differentiation and Integration

**UNIT – IV**
Solution of Ordinary Differential Equation

**UNIT – V**
Solution of Partial Differential Equations

**Text Books:**

**Reference Books:**

**Websites:**
1. www.math.niu.edu
2. nm.mathforcollege.com
**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech. (EC)  
**Semester:** Four  
**Category:** TA

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<td>EC106</td>
<td>Electronic Circuit Design</td>
<td>L 3  T  1  P  -</td>
<td>C 4  CA 40  SE 60  TM 100</td>
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</table>

**Prerequisite:**  
- To familiarize the theory of multistage amplifiers like cascade, cascode, Darlington pair and feedback amplifiers.  
- To understand the concepts of Large Signal Amplifiers and Oscillators.  
- To gain knowledge on Linear IC-Operational Amplifier IC 741 and its applications in the field of Engineering.  
- To understand the design concepts of Wave Shaping Circuits and Data Converters using Op AMP IC 741.  
- To understand the different Linear IC's like IC555 and PLL565 and their applications.

**Objective:**  
On successful completion of the course, students will be able to:  
- Design and conduct experiment, as well as to analyze multistage amplifiers like cascade, cascode, Darlington pair, feedback amplifiers, large signal amplifiers and oscillators.  
- Design, construct and analyze Wave Shaping Circuits, Multivibrators, Time Base Generator and data converters using IC Op Amp741.  
- Implement application oriented circuits using linear IC's.

**Outcome:**  
**UNIT – I**  
**Hours: 9**  
**Feedback Amplifiers:** Concept of feedback- topological classification-voltage series, voltage shunt, current series, current shunt - effect of feedback on gain, stability, distortion, band width, input and output impedances – practical feedback amplifier circuits and their analysis.

**UNIT – II**  
**Hours: 9**  
**Large Signal Amplifiers:** Classification of power amplifiers - Class A power amplifier-direct and transformer coupled amplifiers; - Class B - Push-pull arrangements and complementary symmetry amplifiers; conversion efficiency calculations, cross over distortion – class AB amplifier - amplifier distortion – power transistor heat sinking – Class C and D amplifiers.  
**Oscillators:** Barkhausen criterion for sustained oscillations - RC oscillators – RC phase shift oscillator and Wien bridge oscillator- LC oscillators - Hartley and Colpitts oscillators – crystal oscillators and frequency stability.

**UNIT – III**  
**Hours: 9**  
**Operational Amplifier, Characteristics and Configurations:** Differential amplifier and its types- Operational amplifier IC741 – Block diagram and characteristics – DC and AC performance – Open loop configurations – Feedback configurations – Inverting, Non inverting and Differential amplifier.  
**Applications:** Summer, Subtractor, Integrator, Differentiator – Zero crossing detector - Comparators– Multivibrators-Schmitt trigger – Window detector-Current to Voltage and Voltage to Current Converters-Active Filters- Voltage Regulators

**UNIT – IV**  
**Hours: 9**  
**Data converters:** DAC characteristics – Binary weighted DAC, R-2R DAC, Monolithic DAC-08– ADC characteristics– Flash ADC, Successive Approximation ADC, Dual slope integrating type ADC.

**UNIT – V**  
**Hours: 9**  
**Other Linear Integrated Circuits:** 555 timer - Block diagram and features – Astable Multivibrator – Applications - Square wave oscillator, Ramp generator, Triangular waveform generator and Voltage to frequency converter – Monostable Multivibrator – applications - Frequency divider, PWM and PPM generators.  
**PLL565:** Principle, Building blocks – Applications – Frequency multiplication, Frequency translation, AM and FM detection, Frequency Shift Keying demodulator.  
**Review on Special ICs:** Data converters and modulator ICs – Introduction to ADC3K ICs, Integrated Precision ADC and DAC ICs – AMC78 series and modulator ICs – AD633, ATSC987.
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<th>Total contact Hours: 45</th>
<th>Total Tutorials: 15</th>
<th>Total Practical Classes:</th>
<th>Total Hours: 60</th>
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</thead>
</table>

**Text Books:**


**Reference Books:**


**Web sites:**

2. http://www.uta.edu/ee/hw/pspice
4. www.ibiblio.org
5. www.gobookee.org
**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech. (EC)

<table>
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<th>Hours / Week</th>
<th>Credit</th>
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<td>EC107</td>
<td>Communication Systems</td>
<td>3 1 - 4 40 60 100</td>
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**Prerequisite**
- To introduce the concepts of different types of analog modulation
- To study the effect of noise on analog communication systems.
- To study the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- To understand the issues related to baseband and bandpass signal transmission and reception techniques.
- To expose the students to the basic concepts of synchronization and spread spectrum communication

**Objective**

On successful completion of the course, students will be able to:
- Formulate and interpret the fundamentals and characteristics of amplitude and angle modulation systems.
- Evaluate the influence of noise on the performance of analog communication receivers.
- Assess and evaluate different transmitters and receivers of various baseband and bandpass transmission systems and their error probabilities.
- Design baseband and bandpass transmission systems with specified performance criteria.
- Apply the concepts of spread spectrum communication and develop its applications.

**Outcome**

### UNIT – I
**Amplitude Modulation Systems**  
Hours: 9


### UNIT – II
**Angle Modulation Systems**  
Hours: 9


### UNIT – III
**Base Band Transmission**  
Hours: 9

Sampling theorem, basics of PAM, PWM and PPM, Base band transmission, Wave form representation of binary digits, PCM, DPCM, DM and ADM systems, Principle of TDM. Detection of signals in Gaussian noise, Matched filter, Application of matched filter, Error probability performance of PCM system, correlation receiver, Multilevel base band PAM system, Inter symbol interference, Eye pattern.

### UNIT – IV
**Band Pass Transmission**  
Hours: 9

Principle, transmitter and receiver of coherent BPSK, BFSK, QPSK, QAM and MSK systems, Principle and operation of DPSK and non-coherent FSK. Power Spectral density and error probability of Coherent BPSK, BFSK, QPSK and MSK. M-ary signaling, Vectorial view of MPSK and MFSK.

### UNIT – V
**Synchronization and Spread Spectrum Systems**  
Hours: 9

Need for synchronization, Receiver synchronization, Coherent systems, Symbol and frame synchronization, Network synchronization, Open and closed loop transmitter synchronization, Introduction to spread spectrum communication, Principle, and operation of Direct Sequence and Frequency Hopping Spread Spectrum Systems.

**Total contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:**  
**Total Hours:** 60

**Text Books:**

**Reference Books:**

**Web sites:**

3. www.hit.ac.il/staff/commEng/Uri_Mahlab/Dc.html
**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech. (EC)  
**Semester:** Four  
**Category:** TA  
**Subject Code:** EC108  
**Subject:** Digital System Design  
**Hours / Week** | **Credit** | **Maximum Marks**  
---|---|---  
L | T | P | C | CA | SE | TM  
---|---|---|---|---|---|---  
3 | 1 | - | - | 4 | - | 100  

**Prerequisite:**  
- To understand the fundamentals of Boolean logic and Simplification of Boolean Function.  
- To understand the concepts and process of Combinational and Sequential Logic Design.  
- To understand the basics and types of Programmable Logic Devices.  
- To understand the organization, operation and types of Memory.  
- To understand the constructs and elements of Verilog HDL.  

**Objective:**  
- Develop any combinational and sequential logic functions  
- Implement combinational and sequential logic using programmable logic devices.  
- Design, simulate and synthesis combinational and sequential logic using Verilog.  
- Implement state machines using FPGA's.  

**Outcome:**  
On successful completion of the course, students will be able to:  
- Develop any combinational and sequential logic functions  
- Implement combinational and sequential logic using programmable logic devices.  
- Design, simulate and synthesis combinational and sequential logic using Verilog.  
- Implement state machines using FPGA’s.  

| UNIT – I | Boolean Algebra | Hours: 9 |  
|---|---|---|---  

| UNIT – II | Combinational Logic Design | Hours: 9 |  
|---|---|---|---  

| UNIT – III | Sequential Circuits | Hours: 9 |  
|---|---|---|---  

| UNIT – IV | Memory and PLD | Hours: 9 |  
|---|---|---|---  
Programmable Logic Devices: PROM – EPROM – EEROM: Programmable Logic Array (PLA) – Programmable Array Logic (PAL) - Realization of combinational circuits using PROM, PLA and PAL – Block diagrams of CPLD and Field programmable Gate Array (FPGA).  

| UNIT – V | Introduction to Verilog | Hours: 9 |  
|---|---|---|---  
Basics of Verilog, operators, Data Types, Continuous assignments, Sequential and parallel statement groups. Timing control (level and edge sensitive) and delays, tasks and functions, control statements, Blocking and non-blocking assignments, {if-else and case statements, For- while-repeat and forever loops, Rise, fall, min, max delays, Behavioural and synthesizable coding styles for modelling combinational logic, Behavioural and synthesizable coding styles for modelling sequential logic.  

**Text Books:**  

**Reference Books:**  

Total contact Hours: 45  
Total Tutorials: 15  
Total Practical Classes:  
Total Hours: 60

<table>
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<tr>
<td>1. <a href="http://www.technologystudent.com">www.technologystudent.com</a></td>
</tr>
<tr>
<td>2. <a href="http://www.facstaff.bucknell.edu">www.facstaff.bucknell.edu</a></td>
</tr>
<tr>
<td>3. <a href="http://www.chegg.com">www.chegg.com</a></td>
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### Subject: Electronic Circuits Design Laboratory

**Subject Code:** EC109

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</table>

**Prerequisite:**
- To practically familiarize the theory of single and multistage amplifiers like cascade, cascode, Darlington pair and feedback amplifiers.
- To design and test the functioning of Large Signal Amplifiers and Oscillators
- To test the applications of Operational Amplifier IC
- To test Wave Shaping Circuits and Data Converters using Op AMP IC 741
- To design circuits with analog ICs.

**Objectives:**
- To design, construct and analyze any type of multistage amplifiers with and without feedback, oscillators and so forth.
- Design, construct and test the functioning of Large Signal Amplifiers and Oscillators
- To test the applications of Operational Amplifier IC
- To test Wave Shaping Circuits and Data Converters using Op AMP IC 741
- To design circuits with analog ICs.

**Outcome:**
- Design, construct and test the functioning of Large Signal Amplifiers and Oscillators
- To design circuits with analog ICs.

1. To design, construct and measure the frequency response, input impedance and output impedance of (i) voltage shunt (ii) voltage series negative feedback amplifiers with and without feedback.
2. Design and measurement of frequency response, signal handling capacity, input and output impedances of cascade amplifier and cascode amplifier.
3. To construct tuned and wideband amplifiers and to obtain the frequency response.
4. a) To obtain the frequency Vs. power and load Vs. power characteristics of Class A power amplifier  
   b) To obtain the frequency Vs. power and load Vs. power characteristics of Class B complementary symmetry amplifier.
5. To design, construct and study the low frequency and high frequency oscillators.
6. To study the applications of Opamp IC741 as  
   a. Inverting amplifier and Non-inverting amplifier  
   b. Summer and Subtractor  
   c. Voltage follower  
   d. Integrator and Differentiator.
7. To study zero crossing detector, window detector and Schmitt trigger using opamp 741.
8. To design and test the performance of a 2nd order LPF, HPF, BPF and BSF using Op AMP IC 741.
9. To design and study using OP AMP IC 741, the working of  
   a. Astable Multivibrator  
   b. Monostable Multivibrator.
10. a) To design, construct and study the performance of OP AMP as Miller integrator and Bootstrap ramp generator.  
    b) To simulate the Bootstrap ramp generator circuit.
11. To Construct and study the performance of  
    a. DAC circuits – R-2R and ladder type.  
    b. Successive approximation type ADC.
12. To design and study the working of  
    a. Astable Multivibrator  
    b. Monostable Multivibrator using IC 555.

**Note:** Experimental results are to be validated with simulated results.

**Total contact Hours:** 45  
**Total Tutorials:**  
**Total Practical Classes:** 45  
**Total Hours:** 45
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)  

<table>
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<th>Hours / Week</th>
<th>Credit</th>
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<tr>
<td>EC110</td>
<td>Communication Systems Laboratory</td>
<td>-</td>
<td>3</td>
<td>60</td>
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</table>

**Prerequisite:** -

**Objectives:**
- To construct and test analog and digital modems.
- To practically test the working of TDM.
- To test and understand the need for pre-emphasis and de-emphasis.

**Outcome:**

On successful completion of the course, students will be able to:
- Demonstrate the working of analog and digital modems.
- Appreciate the uses of TDM and apply them.
- Analyze the effects of noise on analog and digital modulation schemes.

1. **AM modulator and demodulator**  
   a) To construct AM modulator and demodulator circuits and to trace message, carrier, modulated and demodulated signals.
   b) To determine the modulation index of AM by classical and trapezoidal methods.

2. **FM modulator and demodulator:** To construct frequency modulator and demodulator circuits and to plot the message, carrier, modulated and demodulated signals.

3. **Pre-emphasis and de-emphasis:** To construct pre-emphasis and de-emphasis circuits and to determine the frequency response.

4. **Sample & hold and PAM**  
   a) To construct sample and hold circuit and to trace the message and sample and hold signals.
   b) To construct PAM circuit and to trace the input and PAM signals.

5. **PWM and PPM:** To construct PWM and PPM circuits and to trace the output waveforms.

6. **Delta Modulator:** To construct Delta modulator and demodulator circuits. Obtain the coded output for the given sine wave.

7. **ASK modulator and demodulator:** To construct Amplitude Shift Keying (ASK) modulator and demodulator circuits and to obtain the ASK modulated and demodulated waveforms.

8. **FSK modulator and demodulator:** To construct Frequency Shift Keying (FSK) modulator and demodulator circuits and to trace the FSK modulated and demodulated waveforms.

9. **BPSK modulator and demodulator:** To construct Binary Phase Shift Keying (BPSK) modulator and demodulator circuits and to obtain the BPSK modulated and demodulated waveforms.

10. **Time Division multiplexing:** To construct a time division multiplexing circuit to combine two different data streams onto a single channel by assigning time slots to each and to obtain the TDM output.

11. **Simulation of basic analog and digital modulation systems:**  
    a) To simulate AM modulator and demodulator and to trace the time domain and frequency domain signals.
    b) To simulate Direct and Indirect FM generation and detection and to trace the time domain and frequency domain waveforms.
    c) To simulate BASK, BFSK and BPSK circuits. Obtain the time domain and frequency domain response of the above modulation schemes and to compare their bit error performances.

**Total contact Hours:** 45  
**Total Tutorials:** 45  
**Total Practical Classes:** 45  
**Total Hours:** 45
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)  
**Semester:** Four  
**Category:** LB

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<tr>
<td>EC111</td>
<td>Digital System Design Laboratory</td>
<td>-</td>
<td>3</td>
<td>2</td>
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</table>

| Prerequisite | -                                            |

**Objectives**
- To practically apply Boolean algebra fundamentals in Simplification of Boolean Function.
- To design and construct Combinational Logic and Sequential Logic circuit.
- To practically understand the organization, operation and types of Memory.
- To practically understand the constructs and elements of Verilog HDL through coding.

**Outcome**
On successful completion of the course, students will be able to:
- Design the required combinational logic functions using gates, multiplexers, decoders.
- Implement any novel sequential logic circuit using flip flops.
- Write behavioural and synthesizable coding in Verilog for combinational and sequential logic.
- Design application oriented digital circuits

1. Design and implementation of the following Code convertors
   i. BCD to excess-3 code and vice versa
   ii. Binary to gray code and vice-versa
2. Design and implementation of Adder/Subtractor
   i. 4 bit Carry look ahead adder
   ii. 4 bit binary Adder/Subtractor using IC7483
   iii. BCD adder using IC7483
3. Magnitude comparator
   i. Study of 4-bit magnitude comparator IC
   ii. Realization of 8-bit magnitude comparator using 4-bit magnitude comparator ICs
4. Multiplexers and Encoders
   i. Study of an 8x1 multiplexer IC
   ii. Realization of 16x1 multiplexer using 8x1 multiplexer ICs
   iii. Realization of a combinational circuit using multiplexer
   iii. Construction and study of a simple Priority Encoder
5. Decoders and Demultiplexers
   i. Study of a 3 to 8 line decoder IC
   ii. Study of a 3 to 8 line decoder as demultiplexer
   iii. Study of the cascading arrangement of an 8x1 multiplexer IC and a corresponding demultiplexer IC
   iv. Realization of 4 to 16 line decoder using 3 to 8 line decoder ICs
   v. Realization of a combinational circuit using a decoder IC
6. Shift register
   i. Study of a universal shift register IC
   ii. Construction of ring counter and Johnson counter using a shift register IC and study of their timing diagrams
   iii. Designing a PN Sequence Generator using a shift register IC
7. Ripple Counters and their timing diagrams
   i. 3-bit binary counter
   ii. 3-bit binary up/down counter
   iii. A modulo-N-counter (where n is the no. of FFs used to construct the counter)
   iv. BCD counter using mod-10 counter ICs
8. Design and implementation of Synchronous Counters and study of their timing diagrams
   i. Binary counter
   ii. Non-sequential binary counter
   iii. 3-bit binary up/down counter
9. Study of a Memory IC
   i. READ and WRITE operations involving memory chips
ii. Expansion of memory size

10. Writing Verilog code for the following circuits:
   i. Ex-OR Gate
   ii. Full Adder
   iii. Multiplexer
   iv. Binary Up-Counter
   v. Binary Up-down Counter
   vi. Shift Register

<p>| Total contact Hours: | Total Tutorials: | Total Practical Classes: 45 | Total Hours: 45 |</p>
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>MA109</td>
<td>Probability and Random Processes</td>
<td>3 1 - 4</td>
<td>40 60 100</td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite**
- 

**Objective**
- To introduce Moment Generating function, Probability generating function, Characteristic function
- To familiarize students with Discrete and continuous distributions and stochastic Process
- To introduce Queuing Theory Concepts.

**Outcome**
- Construct sample spaces of random experiments and identify the distributions
- Use Markov chains to obtain bounds on probability of events.
- Able to apply Stochastic processes and solve Queuing theory problems

**UNIT – I** Discrete Random Variables
- Random Variables and their event spaces - Probability mass function, Distribution functions, Special discrete distributions: Bernoulli, Binomial, Geometric, Negative Binomial, Poisson, Hyper geometric, Discrete Uniform, Constant and Indicator - Probability Generating function-Characteristic function.

**UNIT – II** Continuous Random Variables
- The Exponential distribution, Reliability, Failure density and Hazard function - Some important distributions: Hypo exponential, Erlang, Gamma, Hyper exponential, Weibull, Gaussian, Uniform and Pareto distributions.

**UNIT – III** Stochastic Processes
- Definition, Classification of Stochastic Processes Strictly Stationary Process, Wide Sense Stationary, Bernoulli Process, Poisson process Renewal process (Fundamental Renewal equation only) Availability analysis.

**UNIT – IV** Discrete Parameter Markov Chains
- Introduction, Computation of n-step transition probabilities Chapman - Kolmogorov equation, State classification and limiting Probabilities, M/G/1 queueing system, Pollaczek-Khinchine transform equation.

**UNIT – V** Continuous Parameter Markov Chain
- The Birth and Death process : M/M/1, M/M/c, M/M/1/N, M/M/c/N (c<N), M/M/c/c, M/M/∞ models only - derivation of mean number of customer in the system, in the queue and waiting time - Simple applications, Special case of Birth and Death model (Pure Birth and Pure Death Processes)

**Text Books:**

**Reference Books:**

**Websites:**
- www.nptel.ac.in/courses/Webcourse-contents/IIT/probabilityrp.
<table>
<thead>
<tr>
<th>Department: Computer Science and Engineering</th>
<th>Programme: B. Tech. (EC)</th>
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<tr>
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<td>Category: TA</td>
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<td>Subject Code</td>
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<tr>
<td>CS142</td>
<td>Microprocessors and Microcontrollers</td>
</tr>
<tr>
<td>Prerequisite</td>
<td></td>
</tr>
<tr>
<td>Objective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- To learn architecture of processors.</td>
</tr>
<tr>
<td></td>
<td>- To understand assembly language programming.</td>
</tr>
<tr>
<td></td>
<td>- To learn system design using Microprocessors and Controllers.</td>
</tr>
<tr>
<td></td>
<td>- To study various interface standards.</td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
</tr>
<tr>
<td></td>
<td>On successful completion of the course, students will be able to:</td>
</tr>
<tr>
<td></td>
<td>- Comprehend the architectures and programming of 8085 and 8086 microprocessor.</td>
</tr>
<tr>
<td></td>
<td>- Interface microprocessor and microcontroller with different kind of peripherals.</td>
</tr>
<tr>
<td></td>
<td>- Get acquainted with state of the art microcontroller families.</td>
</tr>
<tr>
<td></td>
<td>- Design a smart embedded system for real-world application.</td>
</tr>
</tbody>
</table>

**UNIT – I**
Introduction to Microprocessors

**UNIT – II**
Data Transfer Techniques and 8086

**UNIT – III**
Introduction to Microcontrollers

**UNIT – IV**
ARM Architecture

**UNIT – V**
Input and Output Interfacing

**Case Studies:** Data loggers – Software implementation of RTC – USB – Ethernet communications.

**Total contact Hours:** 45  **Total Tutorials:** 15  **Total Practical Classes:**  **Total Hours:** 60

**Text Books:**

**Reference Books:**

**Web sites:**
1. www.PICmicrocontroller.com
2. www.embeddedelectronics.org
**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech. (EC)

**Semester:** Five  
**Category:** TA

<table>
<thead>
<tr>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>EC112</td>
<td>Digital signal Processing and DSP Processors</td>
<td>3 1 - 4</td>
<td>40 60 100</td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite**  
- 

**Objective**
- To introduce the advantages of digital signal processing.
- To introduce the theory and applications of IIR and FIR filters.
- To impart knowledge on the various types of errors that affect signals during digital signal processing.
- To introduce the concepts of power spectral density estimation for random signals.
- To understand the concepts and applications of multi-rate sampling.
- To introduce the architecture of DSP processors.

**Outcome**
- On successful completion of the course, students will be able to:
  - Utilize the advantages of digital signal processing over analog signal processing.
  - Apply the merits of digital filters in designing IIR and FIR filters.
  - Determine the amount of errors due to finite word length effects.
  - Ability to analyze random signals.
  - Apply multi-rate sampling techniques for system design.
  - Describe the modules in the architecture of a typical DSP processor.

**UNIT – I**  
**IIR Filter Design**  
Hours: 9


**UNIT – II**  
**FIR Filter Design**  
Hours: 9


**UNIT – III**  
**Finite Word Length Effects**  
Hours: 9

Fixed point and binary floating point number representations – Truncation and rounding errors - Quantization noise – quantization noise power – input quantization error – coefficient quantization error – product quantization error - Overflow limit cycle - Scaling to prevent overflow – Limit cycle oscillations.

**UNIT – IV**  
**Spectrum Estimation and Multirate Signal Processing**  
Hours: 9


**UNIT – V**  
**Digital Signal Processors**  
Hours: 9

Introduction to programmable DSP processors – MAC unit- Modified Bus structures and memory access schemes- multiported memory - VLIW architecture – pipelining.- Special addressing modes in P-DSPs- On chip peripherals, PDSPs with RISC and CISC- Architecture and addressing modes of TMS320C5X.

Total contact Hours: 45  
Total Tutorials: 15  
Total Practical Classes:  
Total Hours: 60

**Text Books:**

**Reference Books:**
<table>
<thead>
<tr>
<th>Web sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <a href="https://engineering.purdue.edu/~bouman/ece438/lecture/module">https://engineering.purdue.edu/~bouman/ece438/lecture/module</a></td>
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<tr>
<td>Subject Code</td>
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<td></td>
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<tr>
<td>CS143</td>
</tr>
</tbody>
</table>

**Prerequisite**
- 

**Objectives**
- To practically understand assembly language programming.
- To perform system design using Microprocessors and Microcontrollers.
- To study various interface standards.

**Outcome**
On successful completion of the course, students will be able to:
- Program arithmetic and logical operations using 8085 /8086 microprocessor.
- Interface microprocessor and microcontroller with different kind of peripherals.
- Design and test a given microprocessor/ microcontroller system.

**List of experiments:**
1. Arithmetic operations
2. Code conversions
3. Block operations
4. Implementation of sorting algorithms
5. Implementation of Real-Time Clock using timer and interrupt
6. Interfacing with LCD display
7. Interfacing with Keyboard matrix
8. Interfacing with Single/Multi channel Analog to Digital Convertor
9. Interfacing with Digital to Analog Convertor
10. Implementation of Watch dog timer
11. Traffic Lights Control
12. Stepper Motor interface
13. Speed control of DC motors
14. Serial Data transfer
15. Parallel port interface with printer

The list of experiments is indicative only. All these experiments may be done with 8085, 8086, PIC and LPC 2148 in synchronization with sequence of theory lectures.

**Total contact Hours:** Total Tutorials: Total Practical Classes: 45 Total Hours: 45
<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Credit</th>
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<tbody>
<tr>
<td>EC113</td>
<td>Digital Signal Processing and DSP Processors Laboratory</td>
<td>-</td>
<td>3</td>
<td>60</td>
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</tbody>
</table>

**Prerequisite**
- 

**Objectives**
- To design and implement FIR and IIR filter with a relevant software tool.
- To study DSP processors based experiments.

**Outcome**
- On successful completion of the course, students will be able to:
  - Design and synthesize all digital filters types using appropriate softwares.
  - Design hardware experiments by using real time processing algorithms.

The lab involves experiments using software based experiments along with hardware experiments illustrating the programming of real time processing algorithms on a floating point DSP processor.

**I. Simulation with required software**
1. Computation of Linear and Circular convolution
2. Spectrum analysis of different signals using DFT/ FFT.
3. Design and Implementation of FIR filter for the given specifications using frequency sampling and windowing technique
4. Design and Implementation of IIR filter for the given specifications using impulse invariant and bilinear transformation technique
5. Design and implementation of Multirate LPF filters for the given specifications
6. Study and comparison of different non-parametric spectral estimation techniques.
7. Equalization of digital audio signals.

**II. DSP Processor based Experiments**
1. Study of aliasing effects and quantization effects (distortions arising from using wrong sampling and less number of bits)
2. Study of MAC operation using various addressing modes
3. Implementation of Linear and Circular convolution
4. FFT Implementation
5. Waveform generation
6. IIR filter design for the given specifications
7. FIR filter design for the given specifications

**Total contact Hours:** 45  **Total Tutorials:** 45  **Total Practical Classes:** 45  **Total Hours:** 45
Department: Electronics and Communication Engineering

Programme: B.Tech. (EC)

Semester: Five

Category: LB

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<td>EC114</td>
<td>Innovative Design Laboratory</td>
<td>-</td>
<td>3</td>
<td>60</td>
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</table>

Prerequisite: -

Objectives

- The goals are to supplement the theory courses and laboratory courses covering the applications and to assist the students in obtaining a better understanding by doing application oriented experiments pertaining to the benefit of the society using hardware.

Outcome

On successful completion of the course, students will be able to:

- Realize the practical difficulties in bringing out the cost effective prototypes for society needs.

The areas of application include (but not limited to):

1. Electronic circuits
2. Communication systems
3. Linear and digital IC
4. Transmission lines and networks

Each batch will comprise minimum of 3 students and the lab will be conducted for 10 sessions. The application oriented experiments will be chosen by the batches and they can complete the project within the specified session.

Total contact Hours: 45
Total Tutorials: 45
Total Practical Classes: 45
Total Hours: 45
## Course Details

**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech. (EC)  
**Semester:** Six  
**Category:** TA  

<table>
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<tr>
<th>Subject Code</th>
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<th>Credit</th>
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<tr>
<td>EC115</td>
<td>Communication Networks</td>
<td>L 4 T - P -</td>
<td>C 4</td>
<td>CA 40 SE 60 TM 100</td>
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</table>

**Prerequisite:** -  

**Objective:**  
- To understand the basics of communication networks.  
- To comprehend the functionality of OSI layers.  
- To have a clear idea about the various protocols used in networks.  
- To introduce the multiservice network concepts.  
- To become aware of the multicasting, security and networking issues.  

**Outcome:**  
On successful completion of the course, students will be able to:  
- Illustrate the functionality of the various OSI layers in networks.  
- Elaborate and link the challenges associated with heterogeneous networks.  
- Apply the multiservice switching concepts.  
- Identify the networking challenges in the midst of security and QoS Provisioning.

### UNIT – I  
**Introduction**  
Hours: 12  

### UNIT – II  
**Layer 2 And Layer 3 VPN**  
Hours: 12  

### UNIT – III  
**Multiservice Networks**  
Hours: 12  

### UNIT – IV  
**Multicast and NGN Network Management**  
Hours: 12  

**Text Books:**  
### Reference Books:


### Web sites:

1. www.comnet.net
2. www.nptel.iitg.ernet.in/Elec_Comm_Engg
Department: Electronics and Communication Engineering  
Programme: B. Tech. (EC)

<table>
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<th>Semester</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>Six</td>
<td>TA</td>
<td>EC116</td>
<td>Microwave and Optical Engineering</td>
<td>4 L - 4 P - 4 C</td>
<td>40 CA</td>
<td>60 SE 100 TM</td>
</tr>
</tbody>
</table>

Prerequisite: 

- To learn the principles, operation, performance and applications of various microwave tubes and semiconductor devices.
- To understand the concept of S-parameters and characterize Microwave Passive devices through S-matrix.
- To introduce the techniques of Microwave measurement.
- To understand light propagation, signal degradation in optical fibers and to study the operation of different optical sources and detector.
- To design an optical fiber link and study the principles of WDM and optical networks.

Objective:

- To understand the concept of S-parameters and characterize Microwave Passive devices through S-matrix.
- To introduce the techniques of Microwave measurement.
- To design an optical fiber link and study the principles of WDM and optical networks.

Outcome:

On successful completion of the course, students will be able to:

- Design RF circuits with various microwave tube and semiconductor devices.
- Characterize Microwave passive devices.
- Measure the light propagation and signal degradation in optical fibers.
- Demonstrate the working principles of optical fiber link, WDM and optical networks.

UNIT – I  
Microwave Active Devices  
Hours: 14

Gunn diode and its modes of operation, IMPATT and TRAPATT diodes, Microwave bipolar transistor, MESFET and Parametric amplifiers. Two cavity klystron amplifier – Power and efficiency considerations. Reflex Klystron oscillators – Modes and efficiency considerations. Operation and application of cylindrical Magnetrons and Helix TWT.

UNIT – II  
S Parameters  
Hours: 12

Scattering parameters, properties of S matrix, Operation and applications of Wave guide Tee, Hybrid Tee, Hybrid rings (rat-race), attenuators, matched load, waveguide corners, bends and twists. Operation, applications and S-matrix derivation for Directional couplers, Circulators and Isolators. Microwave Measurements: VSWR, power, frequency, impedance, scattering parameters and dielectric constant measurements. Antenna radiation pattern and gain measurements.

UNIT – III  
Optical Fibers  
Hours: 12


UNIT – IV  
Optical Sources, Detectors and Amplifiers  
Hours: 12


UNIT – V  
Optical Networks  
Hours: 10


Total contact Hours: 60  
Total Tutorials:  
Total Practical Classes:  
Total Hours: 60

Text Books:

### Reference Books:


### Web sites:

1. www.advaoptical.com
2. www.opticsexpress.org
3. www.ciena.com
4. www.lightreading.com
5. www.photonicsonline.com
6. www.tellabs.com
7. www.mtt.org
**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech. (EC)

**Semester:** Six  
**Category:** TA

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<td>EC117</td>
<td>VLSI Design</td>
<td>L 3</td>
<td>T 1</td>
<td>P -</td>
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</table>

**Prerequisite:** -

**Objective:**
- To understand the electrical properties of MOS circuits.
- To study the design of combinational and sequential functions using CMOS.
- To analyze the various arithmetic building block architecture in terms of performance speed and hardware resource required.
- To study different types of VLSI testing.
- To understand the steps involved in physical VLSI design.

**Outcome:**
On successful completion of the course, students will be able to:
- Describe the electrical properties of MOS circuits and analyze the behaviour of analog CMOS sub-circuits.
- Design the combinational and sequential logic circuits using standard CMOS, Pass transistor, Transmission gate and Dynamic CMOS logic.
- Determine the pull-up, pull-down resistance and the delay associated in NMOS and CMOS based circuits for the given pull-up to pull-down ratio.
- Control the performance speed and the number of logical gates required in the sub-system design of various arithmetic building blocks.

**UNIT – I**  
Introduction to Mos Technologies and Analog CMOS Sub-Circuits  
**Hours:** 9

- MOS, CMOS, BICMOS Technology, Basic Electrical Properties of MOS Circuits: I_{ds} – V_{th} relationships, Threshold Voltage V_{th}, G_m, G_d, and u_{th}, Body Effect, Latch-up in CMOS circuits, Short-Channel Effects, Channel Length modulation and Device Scaling, MOS Active Resistor, Current Sinks and Sources, Current Mirrors- Current mirror with Beta Helper, Degeneration, Cascode current Mirror, Widlar and Wilson Current Mirror, Current and Voltage References, Band gap Reference. Design of Opamp using CMOS. Compensation in Opamps.

**UNIT – II**  
Digital Integrated Circuits and VLSI  
**Hours:** 9


**UNIT – III**  
Design of Combinational and Sequential Logic Circuits Using CMOS  
**Hours:** 9


**UNIT – IV**  
CMOS Sub-system Design  
**Hours:** 9


**UNIT – V**  
CMOS Testing and Physical Design Automation  
**Hours:** 9


**Total contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:**  
**Total Hours:** 60
### Text Books:


### Reference Books:


### Web sites:

1. www.cmosvlsi.com
2. www.vlsi-world.com
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)

<table>
<thead>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>EC118</td>
<td>Communication Networks</td>
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<td></td>
<td>Laboratory</td>
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<td>2</td>
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</table>

| Prerequisite | -                            |

**Objectives**
- To understand the operation of different layers of ISO/OSI model through simulation.
- To use networking tool to check the performance of different communication networks.

**Outcome**
On successful completion of the course, students will be able to:
- Analyse different networking protocols.
- Gain familiarity with the network simulator tools and analyze the communication networks.

1. Communication between PC’s including parallel Communication using 8 bit parallel cable and serial communication using RS 232C.
2. Design and verify error correction and detection codes.
3. Design and verify congestion control using token bucket and leaky bucket algorithm.
4. Using TCP/IP sockets, write a client server program to make client sending the file name and server to send back the contents of the requested file if present.
6. Implementation of Data encryption and decryption.
7. Simulate a L2 VPN through fiber Optical Link.
8. Installation of TC/IP protocol configuration and study the classification of addresses employing TCP/IP protocols. Study of TCP/UDP Performance.
9. Simulation of ICMP pings for a network management.
10. Implementing MAC protocols and Routing Protocols.
12. To implement wired network topology and wireless network topology.
13. To Implement UDP protocol and study performance.
14. Demonstrate the operation of the Ethernet.
15. Demonstrate the implementation of switched local area networks.
16. Perform multicast communications using appropriate simulator tool.
17. Examine the effect of ATM adaptation layers and service classes on the performance of the network using appropriate simulator tool.
18. Using appropriate simulator tool, configure and analyze the performance of the Routing Information Protocol (RIP) mode.

**Total contact Hours:** 45  
**Total Tutorials:** 45  
**Total Practical Classes:** 45  
**Total Hours:** 45
**Department:** Electronics and Communication Engineering  

**Programme:** B.Tech. (EC)  

**Semester:** Six  

**Category:** LB  

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<tbody>
<tr>
<td>EC119</td>
<td>Microwave and Optical Communication Laboratory</td>
<td>-</td>
<td>3</td>
<td>2</td>
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</table>

**Prerequisite**  
- To construct and test microwave and optical link.  
- To characterize experimentally Microwave Passive devices through S-matrix  
- To analyze the radiation pattern of various kinds of antennas.  
- To practically understand light propagations and signal degradation issues in optical fibers.

**Objectives**  
- On successful completion of the course, students will be:  
  - Design application specific microwave and optical links.  
  - Demonstrate the performance of Microwave passive devices and various antennas.  
  - Able to measure the light propagation and signal degradation in optical fibers for varying optical sources.

1. Mode characteristics of Reflex Klystron  
   Mode characteristics measurement of Reflex Klystron Oscillator and estimation of ETS and ETR.

2. Gunn diode characteristics and standing wave pattern  
   a) V-I and V-P characteristics of Gunn diode.  
   b) Measurement of standing wave pattern, wavelength and operating frequency of Gunn diode using slotted waveguide.

3. Determination of VSWR and impedance of unknown load  
   a) To measure VSWR of a matched load.  
   b) To measure impedances of load such as capacitive iris, horn antenna, etc,

4. Radiation pattern of antenna  
   Estimation of FNBW, HPBW and side lobe level of the given antenna

5. Determination of gain of an antenna  
   a) To determine gain of identical horn antenna.  
   b) To determine gain of unknown parabolic reflector

6. Characteristics of microwave components  
   Characteristics of given passive microwave components such as directional coupler, magic tee, circulator and isolator.

7. Determination of dielectric constant of given material  
   Measurement of relative and absolute dielectric constant of given dielectric materials such as wood, Teflon, Nylon, rubber, ebonite, etc., using basic microwave setup.

8. Study of optical fiber characteristics  
   a) Frequency response of fiber  
   b) Attenuation  
   c) Coupling loss and bending loss  
   d) Numerical aperture and acceptance angle

9. Characteristics of digital link using optical fiber  
   a) To establish a digital fiber optic link and obtain its frequency response.  
   b) To obtain BER of the digital fiber optic link.  
   c) To set up a TDM link using fiber optics and transmit the multiplexed audio and data and receive the same.

10. Characteristics of optical link using LASER source  
    a) To obtain frequency response of free space optical link using laser source.  
    b) To obtain frequency response of fiber optic link using laser source.

**Total contact Hours:** Total Tutorials: Total Practical Classes: 45 Total Hours:45
### Subject Code: EC120
### Subject: VLSI Design Laboratory

<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>EC120</td>
<td>VLSI Design Laboratory</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>60</td>
</tr>
</tbody>
</table>

**Prerequisites:**
- To design VLSI front end.
- To study Spartan6 FPGA Board
- To design VLSI Back End.

**Objectives:**
- To design VLSI Front End.
- To study Spartan6 FPGA Board.
- To design VLSI Back End.

**Outcome:**
On successful completion of the course, students will be able to:
- Simulate VLSI front end.
- Develop any digital system using spartan6 FPGA board.
- Design VLSI back end.

**Part I: VLSI Front End Design**
Write a program in three modeling styles - data flow, structural and behavioral and perform the synthesis of following combinational circuits:
1. Half and full adder
2. Decoder – 2 x 4, 3 x 8
3. Priority encoder
4. 4-Bit Ripple adder
5. 4 – Bit ripple counter
6. Code converter
7. Multiplexer and Demultiplexer
8. Flip – Flop- D and T
9. 8-Bit Serial and Parallel adder/ Subtractor
10. 4 – Bit signed Multiplier
11. State Machine Implementation
12. Sequence Detector (Mealy and Moore)

**Part II: Study of Spartan6 FPGA Board**
1. Buzzer
2. Seven Segment Display
3. LCD
4. Traffic Light Controller
5. 4x4 Matrix Keypad

**Part III: VLSI Back End Design**
Using appropriate tools, generate the layout of the following combinational circuits:
1. 4-Bit Carry Look-Ahead Adder
2. 4x4 Bit Multiplier
3. 4-Bit Counter

**Total contact Hours:**
Total Tutorials: 45
Total Practical Classes: 45
Total Hours: 45
**Subject Code**: HS102  
**Subject**: General Proficiency

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<td>General Proficiency</td>
<td>-  -  3  1  100</td>
<td>-  -  100</td>
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</table>

**Prerequisite**: -

**Objectives**
- To enhance the students’ communication and language skills and make them industry-ready.
- To encourage brainstorming discussions and team work.
- To train students to master soft skills through various activities.

**Outcomes**
On successful completion of the module students will be able to:
- Communicate in English effectively and confidently.
- Imbibe the requisite soft skills.
- Improve critical thinking and analytical skills.

**Art of communication**: Verbal and Non-verbal Communication – Barriers to Communication – Importance of Body Language (Proxemics, kinesics, haptic, chronemics and paralanguage) – Effective Listening – Feedback – presentation skills.


**Comprehension and Analysis**: British and American English – GRE based comprehension – analytical writing – analyzing contemporary issues – current English usage.


**Aptitude**: Vocabulary building - Verbal and Numerical aptitude.

**Total contact Hours**: 45  
**Total Tutorials**: 45  
**Total Practical Classes**: 45  
**Total Hours**: 45

**Reference Books**:

**Websites**:
1. www.cambridgeenglish.org
**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech. (EC)  
**Semester:** Seven  
**Category:** TA

<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>EC121</td>
<td>Wireless Communication</td>
<td>L 3 T 1 P -  C 4</td>
<td>CA 40 SE 60 TM 100</td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite:** -

**Objective:**
- To understand the wireless communication concept.
- To make the students to know about the various propagation methods, Channel models.
- To quantify large scale and small scale path loss.
- To find the capacity of wireless communication system.
- To understand the cellular concept and its associated issues.

**Outcome:**
On successful completion of the course, students will be able to:
- Describe the concept of Wireless Communication Systems.
- Characterize the wireless Channel in terms of large scale path loss and fading.
- Characterize the rapid fluctuations of wireless Channel in terms of small scale fading and multipath parameters.
- Determine the capacity of the wireless communication systems.
- Analyse the multi-path mitigation techniques for performance improvement.

**UNIT – I** Wireless Channel Propagation and Model  
**Hours:** 9  

**UNIT – II** Small Scale and Multipath Fading  
**Hours:** 9  
Impulse response of a multipath model, Multipath Parameters- Time dispersion, Coherence bandwidth, Doppler spread and coherence time. Types of small scale fading - Fading effects due to Doppler spread - Rayleigh and Rician distribution - Statistical models for multipath fading channels - Two-Ray and Rayleigh fading models – indoor and outdoor statistical models.

**UNIT – III** Capacity of Wireless Communication Systems  
**Hours:** 9  
Capacity in AWGN, Capacity of flat fading channels - Channel and system model, Channel Distribution Information (CDI) known, Channel side information at receiver, Channel side information at the transmitter and receiver, Capacity with Receiver diversity and capacity comparison - Capacity of frequency selective fading Channels - Time invariant and Time varying channels.

**UNIT – IV** Multipath Mitigation Techniques  
**Hours:** 9  
Equalisation - Linear and Non-Linear equalization, Adaptive equalization, Zero forcing and LMS algorithms - Diversity - Receiver Diversity- system model - combinatorial techniques - Transmitter Diversity - channel known and channel unknown - Micro and Macro diversity - Diversity combining techniques - Rake receiver

**UNIT – V** Cellular Mobile Communication  
**Hours:** 9  
The cellular concept – Frequency reuse – Interference and system capacity – Trunking and Grade of service – Improving coverage and capacity in cellular systems-Advanced Mobile Phone service –Mobility Management: Handoff - Roaming management - Handoff detection-Intersystem handoff and Authentication-Cordless telephony and low tier TCS

**Total contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:**  
**Total Hours:** 60

**Text Books:**

**Reference Books:**

**Web sites:**

2. [http://www.see.ed.ac.uk/~hxh/ADCCourseMaterial/0902_WComms_Intro.pdf](http://www.see.ed.ac.uk/~hxh/ADCCourseMaterial/0902_WComms_Intro.pdf)
### Subject Code: EC122

#### Subject: Coding and Switching Techniques

<table>
<thead>
<tr>
<th>Hours / Week</th>
<th>Credit</th>
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<td>P</td>
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<tr>
<td>4</td>
<td>-</td>
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</table>

#### Prerequisite
- None

#### Objective
- To introduce the Information theory concept.
- To realize the significance of source coding and error correction techniques.
- Understand and explain the concept of switching, signaling and traffic in the telecommunication environment.
- To know the theory of telecommunications traffic engineering and perform traffic calculations.

#### Outcome
On successful completion of the course, students will be able to:
- Appreciate the need for source and channel coding techniques and to evaluate them in terms of performance metrics.
- Analyze the performance of communication systems using analytical methods.
- Characterize the different digital switching systems and their assessment techniques.

### UNIT – I

#### Information Theory Concepts and Channel Capacity

Introduction to Information Theory: Measure of information- Entropy of symbols - Continuous and discrete cases, Conditional entropies- Mutual information and Tran’s information, Redundancy and Efficiency. Channels: Continuous and discrete communication channels, Discrete memory less channels and representation. Channel Types: lossless channel, deterministic, Binary Symmetric channel, Binary Erasure channel and their capacities - Continuous and discrete channels with noise- Shannon Hartley theorem and its implications.

### UNIT – II

#### Source Coding

Source Coding: Purpose of encoding- Uniquely decipherable codes- Code efficiency and redundancy, Shannon’s first and second fundamental theorem, Shannon’s encoding algorithm, Shannon-Fano code and Huffman code.

### UNIT – III

#### Channel Coding

Linear codes, cyclic codes- Hamming, Linear Block codes, groups, rings, Galois field- BCH and RS codes. Convolutional codes – construction and decoding algorithms- Viterbi algorithm, Trellis code modulation, Concatenated codes. Interleaving concept, Burst error correcting codes. Turbo codes- coding, decoding and performance, LDPC codes- construction and decoding.

### UNIT – IV

#### SPC, Space and Time Division Switching

Stored Program Control (SPC) – centralized and distributed SPC, Concept of Digital switching- Four-wire concept, operation of a hybrid, echo cancellers. Space Division Switching: Two, three and multistage space division networks, blocking probability calculations using Lee’s method. Time Division Switching: Basic time division space switching, time division time switching, time multiplexed space switching, time multiplexed time switching. Combination Switching: S-T, T-S, S-T-S, T-S-T and other multistage combination switching.

### UNIT – V

#### Tele Traffic Engineering

Introduction to Tele traffic analysis- Mathematical basis of traffic theory-Markov processes-Loss system analysis, Arrival process characterization, Network traffic load and parameters, Grades of service and Network blocking probabilities, Blocking models and loss estimates, Delay models and queue analysis. Non - blocking networks-Queuing system and Mean delay estimates. Example system- Switching and transmission systems used in cellular telephony, ISDN, Internet etc.

Total contact Hours: 60
Total Tutorials: 
Total Practical Classes: 
Total Hours: 60

#### Text Books:

#### Reference Books:

**Web sites:**

1. http://www.cse.unt.edu
2. http://nptel.iitm.ac.in
**Subject Code**: HS103  
**Subject**: Industrial Economics and Management

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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</thead>
<tbody>
<tr>
<td>HS103</td>
<td>Industrial Economics and Management</td>
<td>4 - - 4</td>
<td>60</td>
<td>100</td>
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</tbody>
</table>

**Prerequisite**: 
- To familiarize the prospective engineers with elementary principles of economics and management.
- To enable the students with standard management concepts and tools that is likely to be useful in their profession.
- To create awareness about the current status of economic parameters/ indicators/policy debates.

**Objective**
- On successful completion of the module students will be able to:
  - Assess the knowledge of mathematics to understand Industrial micro/macroeconomics and its applications.
  - Implement various management techniques based on the needs.
  - Apply formula and workout problem / case studies on General, Production and Financial Management.

**Outcome**
- **UNIT – I**: Micro and Macro Economics and its Applications  
  Hours: 12
  - Nature and scope of economic science; Micro – Macro Economics – Positive Vs Normative Economics; Equilibrium; Economic decisions and Technical decisions; Economic efficiency and Technical efficiency – Market structure – Demand and Supply concepts; Types of Demand; Determinants of Demand and Supply; Elasticity of Demand; Cost components – Concepts of ISO-quant – Price of Product – Nature of pricing in different types of competitions; Full cost pricing and Marginal cost pricing – Break-even analysis; Economics of large scale production and small scale production.

- **UNIT – II**: Management Techniques  
  Hours: 12
  - Types and Principles of management; Types of Organization Merits and Demerits – Elements of Management – Planning, organizing, Staffing, Co-coordinating Controlling etc – Types of (Ownership) of a Firm.

- **UNIT – III**: Financial Management  
  Hours: 12
  - Sources of finance (Internal and External) – Types of Investments – Evaluation of Investments – Preparation of Balance Sheet and Profit and Loss Statements – Types of Accounting and significance of each types.

- **UNIT – IV**: Production Management  
  Hours: 12
  - Types of Production Merits and Demerits – Process Planning; Routing; Scheduling; Material Control – Concepts of Productivity – Inspection and Dispatches.

- **UNIT – V**: Marketing Management  
  Hours: 12

**Text Books**:

**Reference Books**:

**Websites**:
1. www.economicswebinstitute.org
2. www.hig.se.
### Subject Code: EC123

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
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<tr>
<td>EC123</td>
<td>Wireless Communication Laboratory</td>
<td>- 3</td>
<td>2</td>
<td>60 40 100</td>
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#### Prerequisite
- 

#### Objectives
- To understand the usage of spectrum and network analyzer.
- To analyze satellite and wireless link design.
- To practically understand the operation of GSM, WLAN and sensor networks.

#### Outcome
On successful completion of the module, students will be able to:
- Use modern instrumentation tools to analyze high frequency time and frequency domain signals.
- Design satellite and wireless links.
- Practically assess the operation of GSM, WLAN and sensor networks.

1. Establishment of Microwave Communication Link.
3. Study of GMSK Modulator.
4. Design and testing of LP/HP/BP/BS filters for FM range using Vector Network Analyzer and validating the results through simulation.
5. Design and testing of antenna using Vector Network Analyzer
   a) Antenna response (for FM range)
   b) Impedance measurement of the designed antenna.
6. Study of computer communication
   a) A secure PC to PC communication (wire/wireless).
   b) Voice and data transmission
7. System link design of microwave, optical and satellite communication systems
8. Simulation to determine Error performance of Digital modulation schemes in AWGN and fading channel for multiuser environment.
10. Study of Prototype WSN.
11. Design of Wireless Networks using QualNet:
    a) GSM Network.
    b) WLAN Network.
    c) Heterogeneous network of GSM and WLAN.
13. Simulation of Hand off mechanisms in cellular mobile communications.
15. Design and implementation of PAN Networks.

#### Total contact Hours: 45

#### Total Tutorials: 45

#### Total Practical Classes: 45

#### Total Hours: 45
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>EC 124</td>
<td>Project work (Phase I)</td>
<td>-</td>
<td>3</td>
<td>100</td>
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</table>

| Prerequisite | -                                           |
| Objective    | • To broadly identify the problem.          |
|              | • To perform extensive literature survey.   |
|              | • To schedule the different modules of project. |
|              | • To complete the base work.               |
|              | • To work in a group.                      |

| Outcome      | • Students will be clear with the state of the art, objective and different phases of the project work. |

Each batch of 2 or more students will be assigned an experimental or a simulation project to be carried out under the supervision of a guide. The project work duration is one year and it has to be carried out in the 7th and 8th semesters and has to be completed by the end of the 8th semester.

| Total contact Hours: - | Total Tutorials: - | Total Practicals: 45 | Total Hours: 45 |
**Department:** Electronics and Communication Engineering  
**Programme:** B. Tech.(EC)

<table>
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<td><strong>Subject Code</strong></td>
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<tr>
<td>EC125</td>
<td>Professional Ethics and Practice</td>
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</tbody>
</table>

| **Prerequisite** | - |

| **Objective** | - |
| - | To understand the concepts of ethics and moral.  
- | To understand ethical problems and analyze them.  
- | To learn about the moral dilemmas and framework for solving them.  
- | To learn about the theories of moral development.  
- | To study various ethical theories and undertake case studies. |

| **Outcome** | - |
| - | Knowledgeable in ethical and moral principles.  
- | Ability to understand the ethical problems and analyze them.  
- | Knowledge and skills to confront moral issues and dilemmas.  
- | Knowledgeable in major ethical theories.  
- | Ability to apply the ethical theories to resolve moral issues. |

Moral Dilemmas – definition – examples of moral dilemmas – methodology for resolving moral dilemmas.  

**Total contact Hours:** 45  
**Total Tutorials:**  
**Total Practicals:** 45  
**Total Hours:** 45

**Text Books:**

**Reference Books:**

**Web sites:**
1. www.onlineethics.org  
2. www.nspe.org  
3. www.gobalethics.org  
4. www.ethics.org
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<tr>
<th>Subject Code</th>
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<td>P</td>
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<tr>
<td>EC126</td>
<td>Comprehensive Test and Viva-Voce</td>
<td>-</td>
<td>-</td>
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</table>

**Prerequisite:** -

**Objective:**
- To review and test the knowledge gained in the broad areas of electronic circuits, communication systems, electromagnetic waves and signal processing.

**Outcome:**
- Students will be able to understand the strength and weakness in the core area.

The comprehensive viva-voce is intended to test the domain knowledge of the undergraduate students, pertaining to the subjects covered in the previous semesters falling under broad areas of electronic circuits, communication systems, electromagnetic waves and signal processing. This viva-voce also prepares the students for their competitive examinations like GATE, IES and also enables them to self-assess their domain knowledge.

**Total contact Hours:**

**Total Tutorials:**

**Total Practicals:** 45

**Total Hours:** 45
<table>
<thead>
<tr>
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<td>L</td>
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<td>P</td>
</tr>
<tr>
<td>EC127</td>
<td>Project work (Phase II)</td>
<td>-</td>
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<td>3</td>
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</tbody>
</table>

**Prerequisite:** Project Work (Phase I)

**Objective:**
- To carry out the work and come out with the solution.
- To report the outcomes of the work in the form of thesis and publishable papers.

**Outcome:**
- Students will be able to understand the difficulties in carrying out the project work as a team.
- Will be trained to stick on to the time schedule.

Students will be continuously monitored and assessed regarding the progress of their work and will be advised suitably through a panel of review committee.

**Total contact Hours:** -  
**Total Tutorials:** -  
**Total Practicals:** 45  
**Total Hours:** 45
SYLLABUS (Elective Subjects)
Department: Electronics and Communication Engineering
Programme: B.Tech. (EC)

Semester: Category: TA

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<th>Course Code</th>
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<th>Hours / Week</th>
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<tr>
<td>ECP01</td>
<td>Signals and Systems</td>
<td>3 1 - 4</td>
<td>40</td>
<td>60 100</td>
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</tbody>
</table>

Prerequisite: -

Objectives:
- To understand the fundamentals of signals and systems
- To learn about the classifications of signals and that of systems
- To analyze the continuous time signals and to get familiarized with CTFT, Fourier series and Laplace transform
- To have thorough understanding of continuous time systems
- To impart knowledge on discrete time signals
- To learn in depth about discrete time systems and FFT algorithms

Outcome:
- Acquaintance with the fundamentals of signals and systems
- Comprehend and analyze in-depth continuous time signals
- Will acquire thorough knowledge on discrete time signals and discrete time systems
- Apply DIT and DIF FFT algorithms to solve engineering problems

UNIT – I
Continuous time signals - Discrete time signals – Representation of signals – Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential signals, Operations on the signals – Classification of continuous time and discrete time signals – Continuous time and discrete time systems – Classification of systems – Properties of systems.

Hours: 09

UNIT – II

Hours: 09

UNIT – III
LTI continuous time systems- Differential equations – Transfer function and Impulse response – Block diagram representation and reduction – Convolution Integral – State variable techniques – State equations

Hours: 09

UNIT – IV

Hours: 09

UNIT – V
LTI Discrete time systems – Difference equations – System function and impulse response – Block diagram representation – Convolution Sum – State equations for discrete time systems - FFT algorithms: DIT and DIF

Hours: 09

Total contact Hours: 45 Total Tutorials: 15 Total Practical Classes: Total Hours: 60

Text Books:

Reference Books:

Websites:
1. https://www.edx.org/course/signals-systems
2. nptel.ac.in/courses/117104074
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)

**Semester:** -  
**Category:** TA

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<th>Subject</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tr>
<td>ECP02</td>
<td>Transmission Lines and Waveguides</td>
<td>3 1 -</td>
<td>4 40</td>
<td>60 100</td>
</tr>
</tbody>
</table>

**Prerequisite:** -

**Objectives**
- To learn the principles, operation, performance of various Transmission lines and waveguides.
- To understand the concept of impedance matching
- To understand transmission line problems using smith chart.
- To understand the planar transmission line operations
- To understand propagation of TE and TM waves in rectangular and circular waveguides

**Outcome**
- Aware of principle, operation, performance of various Transmission lines and waveguides.
- Able to Characterize TE, TM and TEM waves.
- Able to solve transmission line problems using smith chart.
- Able to demonstrate the working principles of rectangular and circular waveguides

**UNIT – I**

Basic principles of transmission lines-equivalent circuits representation-basic transmission line equations-Primary and Secondary constants-input impedance of a transmission line-finite and infinite lines-Distortion lines-open and short circuited lines-Reflection coefficient-insertion loss

**UNIT – II**

Coaxial cable at RF- standing waves-principles of Impedance matching-Quarter wave transformer-single and double stub matching-stripline-microstrip line-smith chart and its applications - problem solving using smith chart

**UNIT – III**

Review of Maxwell’s equations-transmission of TE and TM waves between two parallel planes of perfect conductors-Transverse Electromagnetic Waves-phase velocity and group velocity-Attenuation of TE and TM waves in parallel planes-Wave impedances

**UNIT – IV**

Transverse Electric wave in rectangular waveguide-Transverse magnetic wave in rectangular waveguide-difference between TE & TM waves-cutoff wavelength-wave impedance-Dominant mode in rectangular waveguide-Attenuation of TE & TM waves in rectangular waveguide-field pattern of common modes in rectangular waveguides

**UNIT – V**

Bessel functions-Characteristics of circular waveguides- TE & TM waves in circular waveguides –Dominant mode in circular waveguide- wave impedance-Attenuation of TE and TM waves in circular waveguides-field patterns of common modes in circular waveguide-resonant cavities

**Total contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:**  
**Total Hours:** 60

**Text Book:**

**Reference Books:**

**Websites:**
1. nptel.ac.in/courses/117101056
2. www.rejinpaul.com/2013/06/ec2305-transmission-lines-and.html
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<td>ECP03</td>
<td>Control Systems Engineering</td>
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</tbody>
</table>

**Prerequisite**

- To acquire a fundamental understanding of linear and digital control systems and their design.
- To understand the concepts of control system components and mathematical modeling of electrical system, mechanical system, etc.
- To study the concept of time response and frequency response of the system.
- An understanding of the relationship between ordinary differential equations, impulse response functions, frequency response function, and transfer function description of a system.
- An understanding of the concept of marginal stability, asymptotic stability, and bounded-input bounded-output stability for continuous and discrete systems.
- To pioneer the basics of different plots such as Bode plot, Nyquist plot, Root locus method and Polar plot.
- To familiarize the theory of Z-transform, inverse Z-transform and their properties in the digital control system.
- To study the concept of state space analysis this is a modern approach and powerful tool for the design and analysis of modern control system.

**Objectives**

- Determine the transfer function for electrical and mechanical system.
- Characterize the time response and frequency response of the system.
- Characterize the different test input signals
- Determine the transfer function for a first and second order system with test input signals
- Formulate the stability analysis using Nyquist plot and root locus.
- Determine the Z-transform and inverse Z-transform for a given system.
- Explain the state space analysis for modern control system.

**Outcome**

- Introduction to control system
  - Basic elements of control system
  - Open and closed loop control systems
  - Differential equation representation of physical systems
  - Transfer function
  - Mathematical modeling of electrical and mechanical systems (Translational and Rotational)
  - Analogous system
  - Block diagram reduction techniques
  - Signal flow graph.

**UNIT – I**  
**Hours: 09**

- Time response analysis
  - Analysis of transient and steady state behavior of control systems
  - Standard test signals
  - Time response of First order system
  - Step response analysis
  - Generalized error co-efficient
  - Response with P, PI, PD and PID controllers
  - Analysis using MATLAB.

**UNIT – III**  
**Hours: 09**

- Frequency response
  - Frequency domain specifications
  - Correlation between time domain and frequency domain specifications
  - Bode plot
  - Stability analysis using Bode plot
  - Polar plot
  - Analysis using MATLAB.

**UNIT – IV**  
**Hours: 09**

- Concepts of stability
  - Location of poles on s-plane for stability
  - Routh-Hurwitz stability criterion
  - Nyquist stability criterion
  - Root locus Techniques
  - Analysis using MATLAB.

**UNIT – V**  
**Hours: 09**

- Basic digital control system
  - Z transform and its properties
  - Inverse Z transform
  - Response of linear discrete time systems
  - Pulse transfer function
  - Stability analysis
  - Jury’s stability criterion.
**State Space Analysis:** State space model of a control system - State space representation using physical, phase and canonical variables - diagonal canonical form - Jordan canonical form.

<table>
<thead>
<tr>
<th>Total contact Hours: 45</th>
<th>Total Tutorials: 15</th>
<th>Total Practical Classes:</th>
<th>Total Hours: 60</th>
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</thead>
</table>

**Text Books:**

**Reference Books:**

**Websites:**
1. nptel.ac.in/courses.php
2. www.controleng.com
### Subject Code: ECP04

**Subject:** Antennas and Wave Propagation  
**Hours / Week:** L 3, T 1, P 0, C 4, CA 0, SE 40, TM 60, **Maximum Marks:** 100

**Prerequisite:**
- To apply electromagnetic field theory to antennas.
- To analyze and study the radiation pattern of antenna arrays.
- To explore the difference between different types of antennas.
- To study about the antennas used for portable wireless devices.
- To study the different wave propagation mechanism.

**Objective:**
- Apply the appropriate portion of electromagnetic theory and its application compatible to antennas design.
- Understand the need for antenna arrays and mathematically design and analyze broadside and end fire arrays for maxima radiation and equivalent resistance. Design and understand the importance of dipole antennas for impedance matching in free space.
- Distinguish the receiving antennas from transmitting antennas, analyze their characteristics.
- Comprehend the knowledge, design about practical antennas used for wireless mobile devices for the required power gain, frequency, half power beam width and dimension.
- Characterize the factors involved in the propagation of radio waves using practical antennas and design a communication link for optimum working frequency, critical frequency, elevation angle of beam and path range.

### UNIT – I

Hours: 9  

### UNIT – II

Hours: 9  

### UNIT – III

Hours: 9  
Aperture antennas - Radiation from planar, Rectangular and circular aperture, Horn antennas, parabolic reflector, Design of aperture antennas for prospective power gain, half power beam width and impedance. Micro strip antennas. Receiving antennas - Reciprocity relations. Receiving cross section and its relation to gain. Reception of polarized waves.

### UNIT – IV

Hours: 9  

### UNIT – V

Hours: 9  
Wave Propagation: Propagation in free space. Propagation around spherical earth, surface wave propagation, structure of the ionosphere, propagation of plane waves in ionized medium, Attenuation, Determination of critical frequency, MUF. Fading, Tropospheric propagation, Super refraction. Design of communication link for optimum working frequency, critical frequency, elevation angle of beam and path range.

**Total contact Hours:** 45  
**Total Tutorials:** 15  
**Total Practical Classes:**  

**Text Books:**


**Reference Books:**

**Web sites:**

### Objectives
- To understand the need and the various sources of power dissipation in digital integrated circuits.
- To study the various power estimation techniques.
- To gain knowledge on the low power techniques at the circuit, architectural and system level.
- To study and analyze the power optimization algorithms and power estimation techniques at the architectural level.
- To understand the dissipation of power in clock distribution.

### Outcome
- Describe the impact of power dissipation by device scaling and technology scaling.
- Illustrate the power dissipation by means of gate reorganization, clock gating and signal encoding.
- Design the low power memory element and the parallel architecture by voltage scaling.
- Describe the clock distribution network
- Determine the power consumption by applying the various methodologies at the algorithm and at the architectural level.

### UNIT – I
- Hours: 09

### UNIT – II
- Hours: 09
- SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems. Monte Carlo simulation. Probabilistic power analysis: Random logic signals, Probability& frequency, probabilistic power analysis techniques, signal entropy.

### UNIT – III
- Hours: 09
- Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.
- Power and performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

### UNIT – IV
- Hours: 09

### UNIT – V
- Hours: 09

| Total contact Hours: | 45 |
| Total Tutorials:     | 15 |
| Total Practical Classes: | |
| Total Hours:         | 60 |

### Text Books:

### Reference Books:

Websites:

1. nptel.ac.in/courses/106105034/
<table>
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<td>T</td>
<td>P</td>
</tr>
<tr>
<td>ECP06</td>
<td>Microwave Circuit Design</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

**Prerequisite**
- To study in detail about different types of Resonators.
- To study different Types of Mixers and Microwave and RF Measurements.
- Design, construct and analyze the performance of Single-Stage Transistor Amplifier, Broadband Transistor Amplifier and Power Amplifiers.
- Describes the Filter Design, Filter Transformation and Filter Implementation.
- Design and analyze the performance of different Types of Mixers.

**Objectives**
- To understand the concepts of Smith Charts, S-Parameters and Microwave Transistors.
- To analyze the performance of Amplifier Design and Filter Design.
- To study the different Types of Mixers and Microwave and RF Measurements.

**Outcome**
- Analyse S-Parameter and its properties with the aid of Smith Chart
- Design, construct and analyze the performance of Single-Stage Transistor Amplifier, Broadband Transistor Amplifier and Power Amplifiers.
- Describes the Filter Design, Filter Transformation and Filter Implementation.
- Design and analyze the performance of different Types of Mixers.

**UNIT – I**
Hours: 09

**UNIT – II**
Hours: 09

**UNIT – III**
Hours: 09

**UNIT – IV**
Hours: 09

**UNIT – V**
Hours: 09

**Text Books:**

**Reference Books:**

**Websites:**
2. www.wa8wzg.com/radio/microwave/tutorials/
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)  
**Semester:** -  
**Category:** TCP

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<tr>
<td>ECP07</td>
<td>Embedded Systems</td>
<td>3 - 2 - 4</td>
<td>50</td>
<td>50 100</td>
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</tbody>
</table>

**Prerequisite:** -

**Objectives**
- To introduce embedded systems, its design and types of hardware.
- To introduce I/O devices and buses used for embedded networking.
- To introduce programming concepts and embedded programming in C.
- To introduce the concepts of real time operating systems.
- To introduce reliability models and fault tolerant synchronization.
- To introduce the power reduction techniques.

**Outcome**
- Elucidate the embedded system design process and challenges.
- Enumerate the different types of I/O devices and explain the protocols used for the buses.
- Apply the programming concepts and write programs in C for embedded systems.
- Describe the concepts of real time operating systems.
- Evaluate the embedded system by performing reliability analysis.
- Apply the power reductions techniques in embedded design.

**UNIT – I**  
**Hours: 09**

**UNIT – II**  
**Hours: 09**

**UNIT – III**  
**Hours: 09**

**UNIT – IV**  
**Hours: 09**

**UNIT – V**  
**Hours: 09**

**PRACTICALS**  
**Hours: 30**
Practical sessions in Embedded system

**Total contact Hours: 45**  
**Total Tutorials:**  
**Total Practical Classes: 30**  
**Total Hours: 75**

**Text Books:**
<table>
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</table>

<table>
<thead>
<tr>
<th>Websites:</th>
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</thead>
<tbody>
<tr>
<td>1. <a href="http://www.eeherald.com/section/design-guide/esmod1.html">www.eeherald.com/section/design-guide/esmod1.html</a></td>
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</table>
Department: Electronics and Communication Engineering

Programme: B.Tech. (EC)

Semester: - Category: TCP

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<th>Maximum Marks</th>
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<td>ECP08</td>
<td>Arm Processor Architecture and its Applications</td>
<td>3 - 2 4</td>
<td>50 50 100</td>
<td></td>
</tr>
</tbody>
</table>

Prerequisite: Micro processor

Objectives:
- To introduce the core architecture of ARM Processor.
- To get familiarized with the exception process and instruction compression.
- To practically understand ARM assembly level programming.
- To introduce the floating point architecture.
- To understand the use of expressions, functions and procedures in run time environment.
- To study the various instructions supported by ARM processor.

Outcome:
On successful completion of the course, students will be able to:
- Program the arithmetic and logical operations using ARM Processor.
- Describe the functional modules in ARM Processor.
- Design a simple digital system using ARM Processor.

UNIT – I
Hours: 09
Introduction to ARM7TDMI core – instruction pipeline, memory access, memory interface, embedded ICE-RT logic, architecture revisions – nomenclature, ARM registers,

UNIT – II
Hours: 09
Exceptions, exception process, Status registers, and Instruction compression – Block diagram of ARM7TDMI CPU - Processor Functional diagram, ARM Bus.

UNIT – III
Hours: 09
RISC machine- ARM programmer’s model-Development tools-ARM assembly language programming- ARM organization-ARM instruction execution-ARM implementation-ARM coprocessor interface. Memory hierarchy-Memory size and speed-Cache memory management

UNIT – IV
Hours: 09
Floating point architecture-Expressions-Conditional statements- loops-Functions and procedures-Use of memory-Run time environment. ARM assembly language programming, ARM organization and implementation

UNIT – V
Hours: 09
ARM instruction set (exceptions, conditional execution, branching instructions, multiply instructions, coprocessor instructions

PRACTICALS
Hours: 30
Practical sessions using ARM processor

Total contact Hours: 45  Total Tutorials: -  Total Practical Classes: 30  Total Hours: 75

Text Books:

Reference Books:

Web sites:
Subject Code: ECP09
Subject Name: Robotics
Prerequisite:

Objectives:
- To understand the elementary characteristics of robot.
- To learn about the different robot drive systems and end effectors.
- To analyze the various transformations of a robot and requisites of the sensors that finds applications in robots.
- To study the performance of different kinematics of a robot and the programming languages related to it.
- To understand the micro/nano robotic system

Outcome:
- Describe the fundamental concepts of robot
- Characterize the different robot drive systems and elucidate the role of end effectors.
- Characterize the transformations that are specific to robot and the primary requirements of various sensors that support the robots.
- Determine the various types of kinematics and the degrees of freedom.
- Illustrate motion commands, sensor commands and end effector commands with simple programs.

UNIT – I

UNIT – II

UNIT – III

UNIT – IV
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs.

UNIT – V
Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach- Actuators of Micro/Nanorobotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biometric robot-Swarm robot-Nanorobot in targeted drug delivery system.

Total contact Hours: 45   Total Tutorials: 15   Total Practical Classes:   Total Hours: 60

Text Books:

Reference Books:

Websites:

1. www.nrec.ri.cmu.edu/education
<table>
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<tbody>
<tr>
<td>ECP10</td>
<td>Advanced Digital System Design using CPLDs and FPGA</td>
<td>3 L 1 T - 4 P</td>
<td>4 CA 40 SE 60 TM 100</td>
<td></td>
</tr>
</tbody>
</table>

**Prerequisite**

- To get familiarized about basic CPLD and FPGA structures.
- To understand the basics of advanced digital system design and the design tools
- To know the various Xilinx CPLDs and FPGAs.
- To learn the WebPACK ISE Design
- To programme FPGA and CPLD

**Objectives**

- Design advanced digital systems using Xilinx CPLDs and FPGAs.
- Configure various CPLD’s and FPGA’s

**Outcome**

- Design advanced digital systems using Xilinx CPLDs and FPGAs.
- Configure various CPLD’s and FPGA’s

**UNIT – I**

Complex Programmable Logic Devices (CPLDs-Field Programmable Gate Arrays (FPGAs)-Design Integration-The Basic Design - Design Verification-Functional Simulation-Device Implementation- Fitting-Place and Route - Downloading or Programming -System Debug

**UNIT – II**

Xilinx Devices-Platform FPGAs-Virtex FPGAs -Virtex-II Pro FPGAs- Spartan FPGAs-Xilinx CPLDs-XC9500 ISP CPLD Overview -XC9500 5V Family-XC9500XL 3.3V Family-XC9500XV 2.5V CPLD Family-Cool Runner Low-Power CPLDs

**UNIT – III**


**UNIT – IV**


**UNIT – V**

Synthesis -Constraints Editor--Reports -Timing Simulation-Configuration- FPGA Programming

**Total contact Hours**: 45  **Total Tutorials**: 15  **Total Practical Classes**:  60  **Total Hours**: 60

**Text Books**:


**Reference Books**:

1. Ian Grout, Digital Systems Design with FPGAs and CPLDs, Elsevier Ltd, 2008.

**Websites**:

1. esd.cs.ucr.edu/labs/tutorial.
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
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<th>Credit</th>
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<td>ECP11</td>
<td>Medical Electronics and Informatics</td>
<td>3 1 - 4</td>
<td>40</td>
<td>60 100</td>
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</table>

**Prerequisite**

- 

**Objectives**

- To gain knowledge about the various electrical and non-electrical physiological parameters and study the methods of recording together with transmission methods of these parameters.
- To know about the various bio-chemical and non-electrical parameters and its measurement tools.
- To comprehend the significance of various medical imaging techniques.
- To bridge the gap between technology and medicine.
- To introduce the recent health care engineering services.

- Graduates will assimilate and link the fundamentals associated with medical electronics.
- A clear understanding on theoretical health parameters and its measurements would be possible.
- Acquire knowledge about various assist devices used in the hospitals and gain knowledge about equipment used for physical medicine.
- To appreciate the employability of engineering solutions for physical medicine.

**UNIT – I**

The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.

**UNIT – II**

pH, PO2, PCO2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood Cell Counters.

**UNIT – III**

Computer assisted medical imaging- nuclear medicine, ultrasound imaging, ultrasonography-computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance

**UNIT – IV**

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues ,Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Health Informatics – Medical Informatics, Bioinformatics

**UNIT – V**

Virtual reality applications in medicine, Computer assisted surgery, Surgical simulation Telemedicine - Tele surgery computer aids for the handicapped, computer assisted instrumentation in Medical Informatics - Computer assisted patient education and health- Medical education and health care information

**Total contact Hours: 45 | Total Tutorials: 15 | Total Practical Classes: | Total Hours: 60**

**Text Books:**


**Reference Books:**

1. R.Anandanatarajan, Biomedical Instrumentation Engineering, PHI Learning, New Delhi, 2011.

**Websites:**

1. www.ed-informatics.org/
2. www.hslibrary.ucdenver.edu/online-tutorials
<table>
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<tr>
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<th>Subject Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<td>ECP12</td>
<td>Digital Image Processing</td>
<td>3 1 - 4</td>
<td>40 60 100</td>
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</table>

**Prerequisite**
- 

**Objectives**
- To introduce the fundamental concepts in digital image processing
- To understand the need for transforms and to learn about different 2D transforms
- To impart knowledge in image enhancement and restoration techniques
- To get familiarized with image compression techniques
- To learn about different segmentation methods

**Outcome**
- Will get familiarized with the fundamentals of image processing
- Will be able to analyze different 2D transforms in-depth
- Acquire thorough knowledge on image enhancement and image restoration techniques
- Assess the need for segmentation & various segmentation techniques and image compression technique

**UNIT – I**
Hours: 9
Introduction to Digital Image Processing - Components of an Image Processing system - Image sensing and acquisition - Image sampling and quantization - Image storage & file formats - DIP operations - Overview of applications: Watermarking, biometrics and Image fusion

**UNIT – II**
Hours: 9

**UNIT – III**
Hours: 9

**UNIT – IV**
Hours: 9

**UNIT – V**
Hours: 9
Need for segmentation – Point, line and edge detection techniques – Thresholding- Region based segmentation – Watershed segmentation algorithm

**Total contact Hours: 45 **  **Total Tutorials: -15 **  **Total Practical Classes: - **  **Total Hours: 60 **

**Text Books:**

**Reference Books:**

**Websites:**
2. www.tutorialspoint.com/dip/
3. nptel.ac.in/courses/106105032/
Department: Electronics and Communication Engineering  
Programme: B.Tech.(EC)  

Semester: -  
Category: TA  

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<th>Credit</th>
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<tr>
<td>ECP13</td>
<td>Wavelet Transforms and its Applications</td>
<td>3 1 -</td>
<td>4 40</td>
<td>60 100</td>
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</table>

Prerequisite: -

Objectives:
- To understand the fundamentals of linear algebra applied to the subject
- To learn about the different types of wavelets
- To gain thorough knowledge about MRA
- To have thorough understanding of continuous time WT and discrete time WT
- To impart knowledge on various applications of wavelet transforms

Outcome:
- Apply the fundamentals of wavelet transform in various applications
- Gain thorough knowledge on continuous time WT and discrete time WT
- Develop algorithms for image compression using different WT techniques.

UNIT – I

Vector spaces- Basis- Dimension- Orthogonality and Orthonormality-Definition of wavelet- Properties- Representation of wavelet function- Examples of wavelet function: Haar, Daubechies, Shannon, Morlet, Mexican, Hat, Sinc, Gaussian, Bi-orthogonal wavelets.

UNIT – II

Definition of MRA- Construction of a general orthonormal MRA- Wavelet basis for MRA- Digital filtering interpretation- PRQMF filters banks.

UNIT – III

Definition of CWT- CWT as a correlator- Constant Q factor filtering interpretation and time frequency resolution- Inverse CWT.

UNIT – IV

Filter banks and Sub-band coding principles- Inverse DWT computation- Multiband wavelet transform lifting scheme- Wavelet transform using poly phase matrix factorization.

UNIT – V

DTWT for image compression- Wavelet denoising- Speckle removal- Edge detection and Object isolation- Image fusion.

Total contact Hours: 45  
Total Tutorials: 15  
Total Practical Classes: -  
Total Hours: 60

Text Books:

Reference Books:

Websites:
1. www.wavelet.org/tutorial/wbasic.htm
Department: Electronics and Communication Engineering
Programme: B.Tech. (EC)
 Semester: -
 Category: TA

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<th>Subject Code</th>
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<th>Credit</th>
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<td>ECP14</td>
<td>Radar Signal Processing</td>
<td>3 1 - 4</td>
<td>40 60 100</td>
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</table>

Prerequisite: -

Objectives:
- To learn the principles, operation, performance and applications of Radar.
- To understand several detection techniques in Radar.
- To understand the concept of waveform selection in Radar.
- To understand various pulse compression techniques in Radar.
- To understand various pulse coding techniques in Radar.

Outcome:
- Aware of principle, operation, performance and applications of Radar
- Able to detect the waveform selections under different environment.
- Able to measure Constant False Alarm Rate
- Aware of various pulse compression techniques and pulse coding techniques in Radar.

UNIT – I

Hours: 09

UNIT – II

Hours: 09

UNIT – III

Hours: 09

UNIT – IV

Hours: 09

UNIT – V

Hours: 09
Phase Coding Techniques- Principles, Binary Phase Coding, Barker Codes- Maximal Length Sequences (MLS/LRS/PN)-Block Diagram of a Phase Coded CW Radar- Poly Phase Codes - Frank Codes, Costas Codes-Non-Linear FM Pulse Compression- Doppler Tolerant Phase Coded Waveforms – Short Pulse- Linear Period Modulation (LPM/HFM)-Side lobe Reduction for Phase Coded Signals.

Total contact Hours: 45  Total Tutorials: 15  Total Practical Classes:  Total Hours: 60

Text Book:

Reference Books:

Websites:
1. www.radartutorial.eu/10.processing/sp05.en.html
2. https://pe.gatech.edu/courses/fundamentals-radar-signal-processing-4-day
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<tr>
<td>ECP15</td>
<td>Speech Processing</td>
<td>3 1 - 4</td>
<td>CA 40</td>
<td>60 100</td>
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</table>

**Prerequisite**: Signals and Systems

**Objectives**
- To establish artificial model for speech production
- To estimate speech parameters.
- To develop predictive model for speech compression.
- To analyze and apply model for speaker verification

**Outcome**
- Describe the speech production mechanism and nature of speech signal.
- Characterize the frequency and time domain methods for speech analysis.
- Formulate the speech predictive models by estimating the speech parameters.
- Identify speaker after speech processing of the estimated parameters.

**UNIT – I**

- Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis.

**UNIT – II**

- Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.

**UNIT – III**

- Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems

**UNIT – IV**

- Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.

**UNIT – V**

- Central analysis of speech, format and pitch estimation, Applications of speech processing -Speech recognition, Speech synthesis and speaker verification.

**Total contact Hours: 45**  **Total Tutorials: 15**  **Total Practical Classes: 15**  **Total Hours: 60**

**Text Books:**

**Reference Books:**

**Websites:**
1. speech.tifr.res.in/tutorials
2. https://books.google.co.in/books?isbn=1599041340
3. nptel.ac.in/syllabus/117104023/
## Subject Details

**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)

### Semester: TA

<table>
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<tr>
<td>ECP16</td>
<td>Embedded Real Time Operating Systems</td>
<td>3 L 1 T - P 4</td>
<td>40 CA 60 SE 100 TM</td>
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</table>

### Prerequisite

- None specified

### Objectives

- To understand the need of an operating system and the system operation.
- To study the various inter-process communication methods.
- To gain knowledge on the basic services of OS, RTOS and the various task scheduling models.
- To study RTOS programming in Unix and Linux based environment.
- To study the various case studies in an embedded based design.

### Outcome

- Describe the real time systems and the system design implementation.
- Characterize the different methods of inter-process communication.
- Analyze the various task scheduling models.
- Describe the RTOS programming in Unix and Linux Based system.
- Explain the case study of an automatic vending machine in an embedded based system.

### UNIT – I

**Hours: 09**


### UNIT – II

**Hours: 09**


### UNIT – III

**Hours: 09**


### UNIT – IV

**Hours: 09**

- Real-Time Operating Systems (RTOSes) - mC/OS-II (MUCOS) - Introduction to Unix-based Real-time Operating Systems - RTOS VxWorks - POSIX Compliant Operating Systems - Real-Time Linux Operating systems - Windows CE - OSEK

### UNIT – V

**Hours: 09**


### Total contact Hours: 45

### Total Tutorials: 15

### Total Practical Classes: 09

### Total Hours: 60

**Text Books:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Windows XP
**Reference Books:**


**Websites:**

1. www.freertos.org/tutorial/
2. nptel.ac.in/courses/106105036/
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<td>ECP17</td>
<td>Electromagnetic Interference and</td>
<td>3 1 -</td>
<td>4</td>
<td>40 60 100</td>
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<td></td>
<td>Compatibility</td>
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</table>

**Prerequisite:** Electromagnetic Theory

**Objectives**
- To learn the principles, operation, performance and applications of various sources of EMI/EMC.
- To understand the concept of various EMI coupling methods.
- To understand various EMI control techniques.
- To understand standards and regulations for residential and industrial environment.
- To understand the EMC design and study the interconnection techniques.

**Outcome**
- Aware of principle, operation, performance and applications of various sources of EMI/EMC.
- Characterize various control techniques.
- Measure the power emission from various EMI/EMC sources.
- Able to design PCB

**UNIT – I**

EMI-EMC definitions and Units of parameters- Sources and victim of EMI- Conducted and Radiated EMI Emission and Susceptibility- Transient EMI, ESD- Radiation Hazards.

**UNIT – II**

Conducted, radiated and transient coupling; Common ground impedance coupling - Common mode and ground loop coupling - Differential mode coupling - Near field cable to cable coupling- cross talk- Field to cable coupling - Power mains and Power supply coupling.

**UNIT – III**

Shielding-Shielding Material-Shielding integrity at discontinuities-Filtering-Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter-Power line filter design- Filter installation and Evaluation- Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding-Bonding- Isolation transformer- Transient suppressors- Cable routing- Signal control- EMI gaskets

**UNIT – IV**


**UNIT – V**

Cable routing and connection-component selection and mounting-PCB design-Trace routing-impedance control-decoupling-Zoning and Grounding.

**Text Books:**

**Reference Books:**

**Websites:**
3. www.cvel.clemson.edu/emc
<table>
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<tr>
<th>Subject Code</th>
<th>Subject Name</th>
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<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ECP18</td>
<td>Cellular Mobile Communication</td>
<td>4</td>
<td>4</td>
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</tbody>
</table>

**Prerequisite**
- To understand the fundamentals of cellular communications.
- To acquire knowledge of different 2G standards.
- To become familiar with data transmission in Mobile communication.

**Objectives**
- On successful completion of the course students will be able to:
  - Implement the fundamentals of cellular communications in designing a wireless cellular system.
  - Engineer real-time applications using GSM, WCDMA, and 4G technology.
  - Apply the concepts of various Wireless protocols and implement a cellular system using upcoming technologies.

**Outcome**

**UNIT – I**
- Hours: 12
  - GSM-Network architecture-Air interface-Location update-Mobile originated and Terminated voice call.IS 136 system description-Voice channel-Control channel-MAHO.IS 95 system-Forward and reverse CDMA channel-Call processing-Handoffs - Cellular digital packet data.

**UNIT – II**
- Hours: 12
  - Enhancements over 2G-GPRS-services-Air interface-Control channels-Network architecture-Inter SGSN Routing area update.EDGE-Network architecture-HSCSD-WAP.

**UNIT – III**
- Hours: 12

**UNIT – IV**
- Hours: 12

**UNIT – V**
- Hours: 12

**Total contact Hours: 60**
**Total Tutorials: -**
**Total Practical Classes: -**
**Total Hours: 60**

**Text Books:**

**Reference Books:**

**Web sites:**
1. www.etsi.org
2. www.globecommsystems.com/wireless
### Satellite Communication Systems

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECP19</td>
<td>Satellite Communication Systems</td>
<td>4</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

#### Prerequisite
- To understand the concepts of satellite communication.
- To impart knowledge about the orbital mechanics and various subsystems in satellite
- To analyze the link budget and its impact on losses.
- To learn the concepts of various satellite access schemes
- To study about optical satellite cross-links.
- To realize the different services of satellite.

#### Objectives
- Describe the concept of satellite systems and orbital parameters.
- Define the orbits, launching procedure and launching vehicle.
- Describe the satellite subsystems.
- Design the satellite uplink, downlink and cross-link models for GEO and non-GEO systems.
- Familiarize various services of satellite.

#### Outcome
- Describe the concept of satellite systems and orbital parameters.
- Define the orbits, launching procedure and launching vehicle.
- Describe the satellite subsystems.
- Design the satellite uplink, downlink and cross-link models for GEO and non-GEO systems.
- Familiarize various services of satellite.

#### UNIT – I
**Hours: 12**

Types of satellites- Satellite orbit- satellite constellation- orbital mechanics- equation of orbit-orbital elements- look angles determination - limits of visibility - sub satellite point - spacecraft technology- structural, primary power, attitude and orbit control, thermal, propulsion, telemetry, tracking and command, communication and antenna subsystems – earth eclipse of satellite - sun transit outage- launching procedures and launch vehicles –In orbit test- emerging trends in mission control

#### UNIT – II
**Hours: 12**

Types of earth station- earth station design requirements-terrestrial interface, subsystems of earth station - receive and transmit chain, antenna systems –satellite ground communication equipment - system reliability and design life time

Basic transmission theory-satellite link attributes- combined uplink and down link model design, Link budget and $E_b/N_0$ calculation. Performance impairments – system noise, inter modulation and interference - Propagation characteristics and frequency consideration.

#### UNIT – III
**Hours: 12**

Satellite Access – Types - concepts - FDMA – pre assigned and demand assigned - inter modulation and back off- SPADE system - TDMA - frame and burst structure- frame efficiency- channel capacity - satellite switch TDMA- SDMA- CDMA - DS & FH CDMA system- comparison of multiple access schemes

#### UNIT – IV
**Hours: 12**

Inter satellite links- frequency band- optical communication for satellite networks - optical sources and detectors- block diagram of optical satellite cross link- optical beam acquisition, tracking and pointing- satellite system for global mobile telecommunication system – architecture - frequency band allocation

#### UNIT – V
**Hours: 12**

Packet satellite networks and services, fixed satellite services, broadcast satellite services, mobile satellite services- VSAT- Radar SAT, global positioning satellite system - maritime satellite services, local broadband networks-ATM over satellite, role of satellite in future network.

**Total contact Hours: 60**  **Total Tutorials: -**  **Total Practical Classes: -**  **Total Hours: 60**

#### Text Books:

#### Reference Books:
<table>
<thead>
<tr>
<th><strong>Web sites:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <a href="http://www.britannica.com/EBchecked/topic/524891/satellite-communication">www.britannica.com/EBchecked/topic/524891/satellite-communication</a></td>
</tr>
</tbody>
</table>
Department: Electronics and Communication Engineering

Programme: B.Tech. (EC)

Semester: -
Category: TA

Subject Code: ECP20
Subject Name: Simulation of Communication Systems

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</table>

Prerequisite

- To introduce the concepts of modeling and simulation
- To learn the generation of random numbers and sequences
- To understand the role of simulation in communication systems
- To study the different approaches of estimating BER
- To model a cellular radio system

Objectives

- Generate random variables and random process and apply them in simulating communication systems
- Model and simulate different blocks of a communication system
- Evaluating the performance of a digital communication system by different approaches.
- Model and develop a cellular radio system.

Outcome

- Generate random variables and random process and apply them in simulating communication systems
- Model and simulate different blocks of a communication system
- Evaluating the performance of a digital communication system by different approaches.
- Model and develop a cellular radio system.

UNIT – I


UNIT – II

Monte Carlo simulation, Generation of uniform random numbers, generating random numbers from an arbitrary pdf, generation of Gaussian random variables, generation of Independent and Correlated random sequences, Generation of impulsive noise and interference, sampling rate for simulation, Testing of random number generators, Goodness of fit test.

UNIT – III


UNIT – IV

Radio frequency and optical sources, Analog and Digital signals, RF and optical modulation, Free space channels, Fading and multipath channels- statistical characterization of multipath channels and time-varying channels with Doppler effects, models for multipath fading channels. Finite state channel models – channels with and without memory. Methodology for simulating communication systems operating over fading channels.

UNIT – V


Total contact Hours: 45  Total Tutorials: -15  Total Practical Classes: -  Total Hours: 60

Text Books:

Reference Books:
<table>
<thead>
<tr>
<th>Web sites:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <a href="http://www.mathworks.com">www.mathworks.com</a></td>
</tr>
<tr>
<td>2. <a href="http://www.opnet.com">www.opnet.com</a></td>
</tr>
<tr>
<td>3. <a href="http://www.tetcos.com">www.tetcos.com</a></td>
</tr>
<tr>
<td>Subject Code</td>
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<td>--------------</td>
</tr>
<tr>
<td>ECP21</td>
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</tbody>
</table>

**Prerequisite**
- To understand the basic concept of network principles
- To study different packet and circuit switching network
- To study different advanced networking protocol for multimedia system
- To understand the principle of OFDM and MIMO in high data rate communication network
- To understand the concept of optical networking and switching

**Objectives**
- Describe various service application, quality of service of networks and the principle in designing of high performance networks
- Characterize the function of networks under the principle of packet switching and circuit switching
- Characterize the wireless network based on link design, access scheme and feature of future wireless networks
- Characterize and analyze different networking protocol for multimedia networks
- Describe the concept of OFDM and MIMO in WiMAX network (High data rate communication network)
- Analyze the protocol, working and switching concepts of optical networks

**UNIT – I**
**Hours: 12**
Networking principles, network services & layered architecture- Traffic characterization and quality of service - Network services- High performance networks- Network elements- network mechanisms- layered architecture.

**UNIT – II**
**Hours: 12**
Packet switching network: IP Model, Ethernet, Token Ring, FDDI, Frame Relay, DQDM, SMDS. Circuit switched Network: Performance, SONET, DWDM, FTH, DSL, Intelligent Network, CATV.

**UNIT – III**
**Hours: 12**
Wireless channel, link level design, network design, wireless network today. IP forwarding architectures overlay model – Multi Protocol Label Switching (MPLS) – integrated services in the Internet – Resource Reservation Protocol (RSVP), Multimedia information and Switching: Loss less data compression-Digital representation of analog signal-Techniques for increasing compression-Real time transport protocols- session control protocols

**UNIT – IV**
**Hours: 12**
Overview of WiMAX- Features- Physical layer- MAC layer, Advanced feature for Performance Enhancement, Performance characterization, OFDM and OFDMA, Multiple antenna techniques, QoS in WiMax, Wi-Fi system.

**UNIT – V**
**Hours: 12**
Optical link, WDM optical network- WDM network architecture-issues, Optical Cross -Connects, Optical LANs, Optical Burst switching-architecture-protocol, Optical Packet switching-architecture- contention resolution protocol, Enhanced HFC-FTTC-PON architecture

Total contact Hours: 60  Total Tutorials: -  Total Practical Classes: -  Total Hours: 60

**Text Books:**

**Reference Books:**
<table>
<thead>
<tr>
<th>Websites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. nptel.ac.in/subjected=106105081</td>
</tr>
<tr>
<td>2. <a href="http://www.tutorialspoint.com/wimax">www.tutorialspoint.com/wimax</a></td>
</tr>
</tbody>
</table>
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech. (EC)

<table>
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<th>Credit</th>
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<tr>
<td>ECP22</td>
<td>Mobile Adhoc and Wireless Sensor Networks</td>
<td>4 - - 4</td>
<td>40</td>
<td>60 100</td>
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</table>

| Prerequisite | - |

### Objectives
- To expose the students to the fundamentals of wireless communication technologies.
- To introduce the ideas and need for Mobile Ad hoc networks.
- To teach the fundamentals of MAC and Routing protocols.
- To introduce energy management in network protocols.
- To expose the students to the fundamentals of wireless sensor technology.
- To study the Architecture and Middleware of WSN.

### Outcome
- Describe the concepts of Ad hoc and Sensor network.
- Identify the constituents of Wireless Sensor Network for various civilian and military applications.
- Understand the challenges in coverage and routing for energy efficiency.
- Indicate possible node architectures for specific applications
- To analyze the middleware available for WSN.

<table>
<thead>
<tr>
<th>UNIT – I</th>
<th>Hours: 12</th>
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</thead>
<tbody>
<tr>
<td>Generations in Wireless Systems, Cellular and Adhoc Networks - Mobile Ad Hoc Networks (MANETS), Characteristics of MANETs - Classification of Mobile Data Networks- Heterogeneity in Mobile devices – Types of Mobile Host movements – Challenges in Ad hoc Mobile Networks – Ad hoc wireless Internet</td>
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</table>

<table>
<thead>
<tr>
<th>UNIT – II</th>
<th>Hours: 12</th>
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<table>
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<tr>
<th>UNIT – III</th>
<th>Hours: 12</th>
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</thead>
<tbody>
<tr>
<td>Issues in designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing protocols – Table-Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV)– Ad hoc On-Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) – Location Aided Routing (LAR)</td>
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<tr>
<th>UNIT – IV</th>
<th>Hours: 12</th>
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<tbody>
<tr>
<td>Need for Wireless Sensor Networks- Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture –Physical layer and transceiver design considerations in WSNs - Energy scavenging - Data Gathering and Dissemination</td>
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<thead>
<tr>
<th>UNIT – V</th>
<th>Hours: 12</th>
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<tbody>
<tr>
<td>Basic wireless sensor technologies–Hardware and Software - Advanced Radio concepts –The IEEE Standard 802.15.4 –Operating Environment - Energy usage profile- Commercially available sensor nodes</td>
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</table>

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<th>Total contact Hours: 60</th>
<th>Total Tutorials: -</th>
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**Text Books:**

**Reference Books:**
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<th>Web sites:</th>
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<td>Subject Code</td>
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<tr>
<td>ECP23</td>
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</table>

**Prerequisite**

- To introduce the physical aspects of RF circuit design
- To familiarize with Micro fabrication and Actuation Mechanisms in MEMS
- To know RF MEMS circuit elements such as switches, resonators
- To understand the working of RF MEMS Phase Shifters, Filters, Oscillators
- To explore on various Case Study of RF MEMS Devices

**Objectives**

- Describe the fabrication methods and properties of fabrication materials used.
- Characterize the ubiquitous connectivity of wireless networks in terms of skin effect, self-resonance frequency, quality factor packaging, dc biasing, and impedance mismatch in RF MEMS.
- Describe MEMS and Microsystems and miniaturization, micro actuation and micro fabrication.
- Determine the switch parameters and design considerations of MEMS switch design based on dynamics of switch.
- Characterize the Modelling of MEMS systems in terms of electronic Interfaces, Feedback, Noise and Circuit and system issues

**Outcome**

UNIT – I  
**Hours: 12**
MEMS-Definition-Fabrication process- surface, bulk and LIGA process. Sensors, actuators and working principles, transducer classifications, electrostatic, resistive, capacitive etc. Introduction to RF MEMS technologies-Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self-resonance frequency, quality factor packaging, practical aspects of RF circuit design, dc biasing, and impedance mismatch effects in RF MEMS.

UNIT – II  
**Hours: 12**
RF/Microwave substrate properties, Micro machined – enhanced elements – capacitors, inductors, varactors, MEM switches – shunt MEM switch, low voltage hinged MEM switch approaches, push-pull series switch, folded – beam – springs suspension series switch, Resonators and Enabled circuit-transmission line planar resonators, cavity resonators, micromechanical resonators, film bulk acoustic wave resonators, Enabled circuits – reconfigurable circuits – the resonant MEMS switch, Capacitors, inductors, tunable CPW resonator, MEMS micro switch arrays. RF circuit design, physical aspects of RF circuit design

UNIT – III  
**Hours: 12**
Need for RF MEMS components in wireless communications. Review of micromachining techniques and MEMS fabrication approaches. Actuation methods in MEMS, RF MEMS design and modeling – mechanical modeling, electromagnetic modeling. Spheres of wireless activities, the home and office, the ground fixed/mobile platform, the space platform, Wireless standards, systems and architectures, wireless standards, conceptual wireless systems, wireless transceiver architectures, power and bandwidth-efficient wireless systems & challenges, MEMS based wireless appliances enable ubiquitous connectivity

UNIT – IV  
**Hours: 12**
Electronic Interfaces, Feedback systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Piezo electric pressure sensor, MEMS scanners and retinal scanning display, Digital Micro mirror devices, Capacitive RF MEMS switch, performance issues.

UNIT – V  
**Hours: 12**
Film Bulk Acoustic wave Resonator (FBAR) filters for PCS applications, RF MEMS Phase shifter for RADAR System applications. RF MEMS filters- A Ka band millimeter –wave micro machined tunable filters, A High-Q-8-MHz MEMS Resonator filter, RF MEMS Oscillators- A 14 GHz MEM Oscillator, A Ka band Micro machined cavity oscillator, A 2.4GHz MEMS based VCO. Microsystems Technology- Integrated Smart Sensors and MEMS, MEMS for RF Applications, Bonding and Packaging of MEMS, Future Trends.

**Total contact Hours: 60**  
**Total Tutorials: -**  
**Total Practical Classes: -**  
**Total Hours: 60**

**Text Books:**

Reference Books:


Web site:

1. www.eecs.berkeley.edu/~dtse/taiwan_course.pdf
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
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<tbody>
<tr>
<td>ECP24</td>
<td>Optical Networks</td>
<td>4</td>
<td>4</td>
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</tbody>
</table>

**Prerequisite**
- 

**Objectives**
- To introduce the different components used in optical networks
- To expose the different architectures of optical networks
- To understand the various issues related to wavelength routed networks
- To study the concepts of optical circuit, packet and burst switching
- To introduce the concepts of control and management for optical networks

**Outcome**
- Cognize the operation and applications of various components used in optical networks
- Analyze the effect of system impairments on the performance of optical networks
- Gain insight into how optical networks can be implemented given their physical limitations.
- Develop skills in analyzing the various issues related to wavelength routed optical networks and provide appropriate solutions
- Apply the principle of optical packet and burst switching in developing networks.

**UNIT – I**
**Hours: 12**

**UNIT – II**
**Hours: 12**

**UNIT – III**
**Hours: 12**
RWA algorithms - Wavelength re-routing in single fiber networks without wavelength conversion. Needs for wavelength conversion-wavelength convertible node architectures. Virtual topology design using HLDA and MLDA. Optical multicasting node architectures and source based multicast tree generation

**UNIT – IV**
**Hours: 12**

**UNIT – V**
**Hours: 12**

**Total contact Hours: 60**
**Total Tutorials: -**
**Total Practical Classes: -**
**Total Hours: 60**

**Text Books:**

**Reference Book:**

**Web sites:**
1. www.advaoptical.com
2. www.opticsexpress.org
3. www.ciena.com
4. www.lightreading.com
5. www.photonicsonline.com
6. www.tellabs.com
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ECP25</td>
<td>Cryptography and Communication Network Security</td>
<td>3 1 - 4</td>
<td>40</td>
<td>60 100</td>
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</tbody>
</table>

**Prerequisite**
- To gain an overview of cryptographic concepts, primitives, protocols and applications
- To learn security architecture of GSM, UMTS and LTE family of cellular standards
- To study different general purpose and application specific security protocols and
- To analyze how cellular networks have been hacked in the past
- To analyze security issues in IP based and Heterogeneous networks

**Objectives**
- Describe the principles of security and basic cryptographic techniques
- Characterize the communication networks in terms of issues involved in authentication
- Determine the threats and notable attacks in GSM, UMTS and LTE cellular standards
- Predict the vulnerabilities across any computing system and hence be able to design a Security solution for any computing system.
- Identify the standard algorithms used to provide confidentiality, integrity and authenticity

**Outcome**
- Describe the principles of security and basic cryptographic techniques
- Characterize the communication networks in terms of issues involved in authentication
- Determine the threats and notable attacks in GSM, UMTS and LTE cellular standards
- Predict the vulnerabilities across any computing system and hence be able to design a Security solution for any computing system.
- Identify the standard algorithms used to provide confidentiality, integrity and authenticity

**UNIT – I**

<table>
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<th>Hours: 9</th>
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**UNIT – II**

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**UNIT – III**

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<th>Hours: 9</th>
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<tbody>
<tr>
<td>IP Security- overview, IP security architecture, authentication header, security payload, Security associations, key management, web security requirement, secure sockets layer, Transport layer security, secure electronic transaction, dual signature, intruders, viruses, worms, firewall design, trusted systems, antivirus techniques, digital immune systems</td>
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</table>

**UNIT – IV**

<table>
<thead>
<tr>
<th>Hours: 9</th>
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<tbody>
<tr>
<td>Heterogeneous networks- Definition and basics. Ingredients in heterogeneous architecture-Mobile user stations, Base station and Access point, Core IP Network. Authentication and cryptography in heterogeneous networks-Hacking methods and security architecture</td>
</tr>
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</table>

**UNIT – V**

<table>
<thead>
<tr>
<th>Hours: 9</th>
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</thead>
</table>

**Text Books:**

**Reference Books:**

**Web site:**

1. www.cs.ucr.edu
<table>
<thead>
<tr>
<th>Subject Code</th>
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<th>Hours / Week</th>
<th>Credit</th>
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<tbody>
<tr>
<td>ECP26</td>
<td>LTE Technology and Network Design</td>
<td>4</td>
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</table>

### Prerequisite

- To learn the improvements from UMTS to LTE Advanced.
- To understand the architecture of LTE air interface.
- To analyze the mobility management in LTE and interoperation.
- To study the upcoming releases of LTE.

### Objectives

- Aware of the generations from UMTS to LTE Release 12.
- Able to design and develop Interoperating network.
- Design LTE system and estimate cell capacity and coverage.

### Outcome

- Aware of the generations from UMTS to LTE Release 12.
- Able to design and develop Interoperating network.
- Design LTE system and estimate cell capacity and coverage.

#### UNIT – I

**Hours: 12**


#### UNIT – II

**Hours: 12**


#### UNIT – III

**Hours: 12**


#### UNIT – IV

**Hours: 12**

Multimedia Broadcast/Multicast Service -Dual Layer Beam forming- Carrier Aggregation -Enhanced Downlink MIMO - Enhanced Uplink MIMO – Relays- Heterogeneous Networks- Coordinated Multipoint Transmission and Reception-Elevation Beam forming and Full Dimension MIMO

#### UNIT – V

**Hours: 12**


### Text Books:


### Reference Books:


### Web sites:

1. www.edenrockcomm.com
2. www.sofimation.com
Course Code: ECP27  Course Name: RF IC

<table>
<thead>
<tr>
<th>Hours / Week</th>
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</table>

Prerequisite: -

Objectives:
- To understand the characteristics of passive components.
- To quantify various issues of RF Engineering.
- To find the applications of smith chart.
- To analyze the performance of RF Engineering.
- To learn in detail about radio wave propagation.

Outcome:
- Describe briefly about refraction, ground reflections, and roughness of earth for free space propagation.
- Characterize class B and class C RF amplifier.
- Differentiate RF directional coupler and hybrid coupler.
- Determine the capacity, and bit error rate for a given digital modulation scheme using Rayleigh fading environment.

UNIT – I

Hours: 12

RF characteristics of chip resistor, capacitor and inductors, semiconductor realization of resistors, capacitors, inductors, transformers. Coaxial, strip line, and micro strip line design guidelines and behavior at RF.

UNIT – II

Hours: 12

Long and Short channel approximations, bandwidth estimation techniques, open and short circuit time constant procedures, high frequency amplifiers. Radio-Frequency Systems for Digital Television: Constant-impedance filter, output filters, elliptic function filters, cavities, channel combiners.

UNIT – III

Hours: 12

Free-space propagation, distance to the radio horizon, refraction, multipath, ground reflections, surface roughness, effect of earth’s curvature, Fresnel zones, linear distortions, diffraction, fading, desired signal, field tests, Charlotte, North Carolina, Chicago, Illinois, Rayleigh, North Carolina.

UNIT – IV

Hours: 12

RF power amplifiers – Class A, AB, B, C, D, E and F amplifiers, modulation of power amplifiers, linearity considerations.

UNIT – V

Hours: 12

Importance of RF design, Electromagnetic Spectrum, RF behavior of passive components, Chip components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications. RF directional couplers and hybrid couplers; Detector and demodulator circuits.

Text Books:

Reference Books:

Website:
1. www.rf-mw.org
2. www.radio-electronics.com
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Hours / Week</th>
<th>Credit</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td>ECG01</td>
<td>Consumer Electronics</td>
<td>4</td>
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<td>40</td>
</tr>
</tbody>
</table>

**Prerequisite:**

- To understand the working of Home electronic devices
- To understand the principle of telephone communication

**Outcomes:**

- Will be able to identify faults in Home electronic devices
- Will understand the telephone communication

**UNIT – I**

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones

**UNIT – II**

Components of a TV system – interlacing – composite video signal. Color TV – Luminance and Chrominance signal; Monochrome and Color Picture Tubes - Color TV systems – NTSC, PAL, SECAM - Components of a Remote Control

**UNIT – III**


**UNIT – IV**

Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems

**UNIT – V**

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

**Total contact Hours:** 60  
**Total Tutorials:** -  
**Total Practical Classes:** -  
**Total Hours:** 60

**Text Book:**


**Reference Book:**


**Websites:**

1. www.bluetooth.com/Pages/Consumer-Electronics.aspx
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>ECG02</td>
<td>Communication Theory</td>
<td>4</td>
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**Prerequisite:**
- 

**Objectives:**
- To understand amplitude and angle modulation
- To understand baseband and band pass transmission
- To understand the working of cellular phases

**Outcomes:**
- Will be clear with the principle of Amplitude, angle, baseband, bandpass modulation
- Will be clear with cellular transmission

**UNIT – I**

Need for modulation - Amplitude modulation - Spectra and Power equations for AM - Generation and Demodulation of AM, DSBSC, SSB and VSB signals. Principle of FDM.

**UNIT – II**

Frequency and phase Modulation - Narrow band and Wideband FM- Transmission Bandwidth - Generation and Demodulation of FM Signal. Operation of FM receivers

**UNIT – III**

Sampling theorem, basics of PAM, PWM and PPM. Base band transmission - Wave form representation of binary digits - PCM, DPCM, DM and ADM systems- Principle of TDM. Correlation receiver. Multilevel base band PAM system. Inter symbol interference - Eye pattern

**UNIT – IV**

Principle- transmitter and receiver of coherent BPSK, BFSK, QPSK, QAM and MSK systems -Principle and operation of DPSK and no coherent FSK. Need for synchronization- frequency and phase, symbol and frame synchronization approaches

**UNIT – V**

Wireless communication system: paging system – cordless telephone system-cellular telephone system-frequency reuse-handoff-interference and capacity-GPRS-EDGE-UMTS-HSPA-Bluetooth and PAN

**Total contact Hours:** 60  
**Total Tutorials:** -  
**Total Practical Classes:** -  
**Total Hours:** 60

**Text Books:**

**Reference Book:**

**Websites:**
1. www.communicationtheory.org
**Subject Name**: CMOS VLSI Design  
**Subject Code**: ECG03  
**Hours / Week**: 4  
**Credit**: 4  
**Maximum Marks**: 40, 60, 100

### Prerequisite

- None

### Objectives

- To understand the electrical properties of MOS circuits.
- To study the design of combinational and sequential functions using CMOS.
- To gain knowledge on VHDL programming.

### Outcomes

- Describe the electrical properties of MOS circuits.
- Design the combinational and sequential logic circuits using standard CMOS, Pass transistor, Transmission gate and Dynamic CMOS logic.
- Determine the pull-up, pull-down resistance and the delay associated in an NMOS and CMOS based circuits from the given pull-up to pull-down ratio.

### UNIT – I

**Hours: 12**

MOS, CMOS, BiCMOS Technology, Basic Electrical Properties of MOS Circuits: Ids – Vds relationships, Threshold Voltage Vth, Gm, Gds and ωo, Body Effect, Latch-up in CMOS circuits, Short-Channel Effects, Channel Length modulation and Device Scaling

### UNIT – II

**Hours: 12**


### UNIT – III

**Hours: 12**

Pass Transistor - Transmission Gate - Realization of Combinational Logic Using Pass Transistor and Transmission Gate – NAND, NOR, XOR, Multiplexers - Parity Generator – Code Converters — Design of n-bit adders - Dynamic, Pseudo NMOS and Domino Based CMOS Logic Circuits – Charge Sharing. Inverter, NAND and NOR using BiCMOS.

### UNIT – IV

**Hours: 12**


### UNIT – V

**Hours: 12**


**Total contact Hours: 60**  
**Total Tutorials:**  
**Total Practical Classes:**  
**Total Hours: 60**

### Text Books:


### Reference Books:


### Web sites:

1. www.cmosvlsi.com
2. www.vlsi-world.com
**Department:** Electronics and Communication Engineering  
**Programme:** B.Tech.

<table>
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<tr>
<th>Subject Code</th>
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<td>ECG04</td>
<td>Communication for Engineers</td>
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**Prerequisite:** -

**Objectives:**
- To understand the operations of radio/TV
- To understand the operation of modern voice communication networks
- To understand the operation of modern data communication networks

**Outcomes:**
- Will be clear with the operation of radio/TV
- Will be able to use modern voice/data communication devices with an understanding

**UNIT – I**  
Hours: 12

History of Radio, Transistor radio, Commercial public radio station: FM radio, Internet radio, free radio station, streaming radio, Access to radio using a PC, start a radio station, radio installation, audio broadcasting.

**UNIT – II**  
Hours: 12

Television standards, cable TV, IP TV, Digital TV, broadcasting TV through satellites, High Definition TV, 3D enabled TV. Digital cable boxes: Google TV, apple TV, Roku. Air Play, Play station gaming, Motion gaming and other creative advancement in digital entertainment.

**UNIT – III**  
Hours: 12

Evolution of Telegraphic and Telephony systems, MORSE codes, facsimile, Basics of a telephony network, working of a dialup connection, mobile phones: introduction to GSM, GPRS and 3G mobile connectivity, wifi-hotspots.

Review on iPhones, smart phones, cloud phone systems, Instant messaging. IP enabled applications: VoIP, mobile broadband internet applications, Viber, Skype, whatSapp, Wechat, Zoe, Sedge etc.

**UNIT – IV**  
Hours: 12

Role of internet service provider (ISP) and working of ISDN and Broadband internet connection and internet traffic.

Review on rise of social networking sites – Facebook, Twitter, orkut, Linkedln, netlog, Myspace, Hike, research gate and others. Youtube and its features, future potential for growth: Google Vs Facebook – analysis from a business perspective.

**UNIT – V**  
Hours: 12

Concept of Internet of Things and its case study, ICT development worldwide, Broadband Commission for digital development, Building a knowledge economy, Customer owned networks, mobile health care applications, Next generation business applications and BYOD concept.

Total contact Hours: 60  
Total Tutorials: -  
Total Practical Classes: -  
Total Hours: 60

**Text Books:**

**Reference Books:**
1. Edquist C, the internet and mobile telecommunications system of innovation, development in equipment, access and content, Edward Elgar publishers, 2003.

**Websites:**
1. www.itu.int/net/itunews/issues/2010/06/35.aspx
2. www.autocww.colorado.edu/flc/E64content files/
4. www.eurescom.de
5. www.acma.gov.au
### Subject: Avionics

**ECT05**

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#### Prerequisite
- 

#### Objectives
- To understand the basis of aircraft
- To understand the radio navigation and instrumentation in aircraft
- To understand the various displays in cockpit

#### Outcomes
- Will be clear with the Engineering aspects of aircraft

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<th>UNIT – I</th>
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<th>UNIT – II</th>
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| Types of Radio Navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA. ILS, MLS

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<th>UNIT – III</th>
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| Inertial sensors – Gyroscopes, Accelerometers, Inertial navigation systems – Block diagram, Platform and strap down INS. Satellite Navigation - GPS

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<th>UNIT – IV</th>
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| Air data quantities – Altitude, Airspeed, Mach no., Vertical speed, Total Air temperature, Stall warning, Altitude warning. Autopilot – basic principles – longitudinal and lateral autopilot

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<th>UNIT – V</th>
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| Display technologies – LED, LCD, CRT, and Flat Panel Display. Primary Flight parameter displays - Head Up Display, Helmet Mounted Display, Night vision goggles, Head Down Display, MFD, MFK, Virtual cockpit.

**Total contact Hours: 60**

**Total Tutorials: -**

**Total Practical Classes: -**

**Total Hours: 60**

#### Text Books:

#### Reference Books:

#### Web sites:
2. www.autocww.colorado.edu/flc/E64content files/
4. www.eurescom.de
5. www.acma.gov.au