SYLLABUS & CURRICULUM

of

B. Tech.
ELECTRONICS & COMMUNICATION ENGINEERING
(3rd to 8th semesters)

UNIVERSITY OF CALICUT
(2013 admission)
### SCHEME for Electronics and Communication Engineering (ECE) Branch for 3rd to 8th Semesters

#### 3rd Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours/week</th>
<th>Marks</th>
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<td>EN13 301</td>
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**Note:** For EN 13 302 Computer Programming in C, the end semester examination will be held by the University as a theory paper.

#### 4th Semester

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**Elective I**

- EC13 704(A) Internet Technology (Global)
- EC13 704(B) Television and Radar Engineering
- EC13 704(C) Embedded Systems
- EC13 704(D) Nanotechnology
- EC13 704(E) Image and Video Processing

**Elective II**

- EC13 705(A) Soft Computing
- EC13 705(B) High Speed Digital Design
- EC13 705(C) Antenna Theory and Design
- EC13 705(D) Electronic Packaging (Global)
- EC13 705(E) Biomedical Instrumentation

### 8th Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Hours/week</th>
<th>Marks</th>
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**Elective III**

- EC13 804 (A) Introduction to MEMS
- EC13 804 (B) Photonic Switching and Network
- EC13 804 (C) Microwave Active Devices and Circuits
- EC13 804 (D) Mobile Computing
- EC13 804 (E) Data Structures and Algorithms (Global)

**Elective IV**

- EC13 805 (A) Multimedia Communication Systems
- EC13 805 (B) Probability and Random Processes
- EC13 805 (C) Cryptography and Network Security (Global)
- EC13 805 (D) Advanced Semiconductor Device Technology
- EC13 805 (E) Advanced Digital Signal Processing
EN13 301 ENGINEERING MATHEMATICS III
(Common for all branches)

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
This course provides a quick overview of the concepts and results in complex analysis that may be useful in engineering. Also it gives an introduction to linear algebra and Fourier transform which are wealth of ideas and results with wide area of application.

Module I: Functions of a Complex Variable (13 hours)
Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: $e^z$, $\sin z$, $\cosh z$, $(z^{1/2})$– Mobius Transformation.

Module II: Functions of a Complex Variable (14 hours)

Module III: Linear Algebra (13 hours) – (Proofs not required)

Module IV: Fourier Transforms (14 hours)

Text Books

Module I:
Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.9

Module II:
Sections: 13.1, 13.2, 13.3, 13.4, 14.4, 15.1, 15.2, 15.3, 15.4

Module III:
Sections: 6.1, 6.2, 6.3, 6.4, 6.7, 6.8, Appendix.B.1

Module IV:
Sections: 9.1, 9.3, 9.5
**Reference books**

**Internal Continuous Assessment (Maximum Marks-50)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B:** Analytical/Problem solving DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

**Maximum Total Marks: 100**
EN13 302: COMPUTER PROGRAMMING IN C  
(Common for all branches)

Teaching scheme  
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To impart the basic concepts of computer and information technology
- To develop skill in problem solving concepts through learning C programming in practical approach

Module I (12 hours)  
Introduction to Computers: CPU, Memory, input-output devices, secondary storage devices, 
Processor Concepts - Evolution and comparative study of processors. Machine language, 
assembly language, and high level language. Inside a PC, Latest trends and technologies of 
storage, memory, processor, printing etc. Concept of Program and data. System software - BIOS, 

Module II (12 hours)  

Module III (14 hours)  

Module IV (14 hours)  

Text Books
1. P. Norton, Peter Norton’s Introduction to Computers, Tata McGraw Hill, New Delhi

Reference Books
2. S. Kochan, Programming in C, CBS publishers & distributors
Internal Continuous Assessment (Maximum Marks: 50)

- 50% - Lab Practical Tests
- 20% - Assignments
- 20% - Main Record
- 10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks = 40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks = 60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 303 NETWORK ANALYSIS & SYNTHESIS

Teaching scheme: 
Credits 4
3 Hours lecture and 1 hour tutorial per week

Objectives
- To expose the students to the basic concepts of electric circuits and their analysis in time and frequency domain
- To introduce the concept of filter circuits and design of passive filters
- To introduce the techniques of network synthesis

Module I (15 hours)

Module II (13 hours)
Network functions: The concept of complex frequency- driving point and transfer functions- Impulse response-Poles and Zeros of network functions-their locations and effects on the time and frequency domain responses-Restriction of poles and zeros in the driving point and transfer function, Time domain behaviour from the pole-zero plot, Bode plot. Two-port network parameters: Impedance, admittance, transmission and hybrid-Conversion formulae. Analysis of interconnected two port networks-parallel, series, and cascade connections of two port networks.

Module III (12 hours)

Module IV (12 hours)
Text Books
1. Van Valkenberg, *Network Analysis*, Prentice-Hall of India

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions \[8 \times 5 \text{ marks} = 40 \text{ marks}\]
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions \[4 \times 15 \text{ marks} = 60 \text{ marks}\]
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 304: SOLID STATE DEVICES

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basic concepts of semiconductor Physics
- To create an insight into the working of different conventional electronic devices

Module I (12 hours)
Energy bands and charge carriers in semiconductors - direct and indirect band gap semiconductors - concept of effective mass - intrinsic and extrinsic semiconductors - Fermi level - electron and hole concentrations at equilibrium - temperature dependence of carrier concentrations - conductivity and mobility - quasi Fermi level - diffusion and drift of carriers - Einstein relation - continuity equation

Module II (14 hours)
PN junctions - contact potential - space charge at a junction - current flow at a junction - carrier injection - diode equation - minority and majority carrier currents - capacitance of pn junctions - reverse bias breakdown - zener and avalanche breakdown - abrupt and graded junctions – short diodes - Schottky barrier - rectifying and ohmic contacts - tunnel diode - varactor diode - zener diode - GaAs isotope diodes - Metal semiconductor junctions

Module III (13 hours)
Bipolar junction transistors-Minority carrier distribution and terminal currents-the coupled diode model-switching –Drift in the base region-Base narrowing -Avalanche breakdown-Kirk effect-frequency limitation of transistor –capacitance and charging times- Hybrid-pi model

Module IV (13 hours)
Junction FET - pinch off and saturation - gate control - VI characteristics
MOS capacitor - accumulation, depletion and strong inversion - threshold voltage - MOSFET - p channel and n channel MOSFETs - depletion and enhancement mode MOSFETs – small signal model
UJT – operation –VI characteristics
Power Diodes - SCR- Insulated Gate Bipolar Transistor – Power MOSFETs

Text Books
   Pearson Education
2. Neamen, Semiconductor Physics & Devices, Pearson Education
4. Pierret R F, Semiconductor Device Fundamentals, Pearson Education

Reference Books
1. Sah C T, Solid State Electronics, World Scientific
2. Muller & Camins, Device Electronics for Integrated Circuits, John Wiley
3. Dipankar Nagchoudhuri : Microelectronic Devices, Pearson Education
Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving and descriptive SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 305 ELECTRONIC CIRCUITS I

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basic idea of constructing passive devices
- To develop the skill of analysis and design of various circuits using electronic devices

Module I (13 Hours)
Resistors- Types and tolerances -AF and RF chokes-transformers-Type of capacitors-
specification and constructional details - Half wave, full wave and Bridge
rectifiers(Analysis and Design)- derivation of rectifier specifications like PIV, DC output
voltage, ripple factor, efficiency, transformer utilization factor - analysis and design
of filters with rectifiers - L, C, LC and pi filters

Module II (13 Hours)
Diode circuit models-DC-low frequency and high frequency small signal models-
applications- diode clipping and clamping circuits, voltage multiplier circuits - Regulators
- zener diode regulator- emitter follower output regulator - series pass transistor feedback
voltage regulator- short circuit protection and fold back limiting - load and line regulation
curves

Module III (13 Hours)
BJT circuit models - small signal equivalent models-the hybrid and T model of
transistor-BJT amplifiers- biasing - load line - bias stabilization - stability factor - bias
compensation -analysis and design of CC, CE and CB configurations - RC coupled
multistage amplifiers - high frequency hybrid pi model-the cut off frequencies, unity gain
bandwidth

Module IV (13 Hours)
FET amplifiers: Biasing of JFET and MOSFET - small signal equivalent circuit
models-Analysis and design of common source, common drain and common gate
amplifier configurations - gain function -Low frequency and high frequency
responses- Use of open circuit and short circuit time constants in finding the cut-off
frequencies-Low and high frequency response of common emitter and common source
amplifier -Emitter followers and source followers.
Text books

References
1. Horenstein M.N: Microelectronic circuits and Devices PHI
4. Spencer & Ghausi, Introduction to Electronic Circuit Design; Pearson Education
5. Thomas L.Floyd and David Buchla: Fundamentals of Analog Circuits, Pearson

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8 x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 306 ELECTRICAL ENGINEERING

Teaching scheme  
3 hours lecture and 1 hour tutorial per week  

Credits: 4

Objectives
- To study the operation, performance and characteristics of different types of electrical machines  
- To familiarise various electrical measuring instruments.

Module I (12 hours)

Module II (14 hours)

Module III (12 hours)

Module IV (14 hours)
Text Books
1. P.S. Bimbhra, Electrical Machinery, Khanna Publishers

Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions  8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC 13 307(P) BASIC ELECTRONICS LAB

Teaching Scheme
3 hours practical per week

Credits: 2

Objectives
- Implementation of basic Electronic circuits

Each Experiment Will Have Two Parts - A Simulation Part (SPICE) and Hardware Realization

List of experiments
1. Measurements using Cathode Ray Oscilloscope (CRO)
2. Introduction to SPICE - Simple Analysis, Device Models, Netlists, Schematic Capture and plotting
3. Diode and Zener diode characteristics - DC and dynamic resistance
4. First order LPF/HPF with R & C for a given cut-off frequency.
5. Clipping and clamping circuits with diodes
6. Half wave rectifier with C, LC filters
7. Full wave rectifier with C, LC filters
8. CE configuration determination of h-parameters
9. CB configuration determination of h-parameters
10. MOSFET characteristics Common Source and Common Drain modes
11. JFET characteristics Common Source and Common Drain modes
12. Series Voltage Regulator

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

Semester End Examination (Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EC13 308 (P) ELECTRICAL ENGINEERING LAB

Teaching Scheme
3 hours practical per week

Credits: 2

Objectives
- To Familiarise various electrical measurement equipments and measurement methods.
- To obtain the performance characteristics of dc and ac machines

1. Calibration of single phase energy meter by direct loading
2. Load test on DC shunt generator
   a. Plot external characteristics
   b. Deduce internal characteristics
3. Load test on 3-phase squirrel cage induction motor
4. Load test on DC series motor
   a. Plot the performance characteristics
6. Determination of V-I characteristics of linear resistance and incandescent lamp
7. No-load and blocked rotor tests on slip ring induction motor
   a. Determine equivalent circuit parameters
   b. Predetermine the torque, line current and efficiency from equivalent circuit corresponding to a specified slip.
8. Measurement of L,M & K of i) transformer windings and ii) air core coil.
9. OC & SC tests on 3-phase alternator
   a. Predetermine the voltage regulation at various loads and different power factors by EMF method.
10. Load test on single phase transformer
    a. Determine efficiency and regulation at various loads and unity power factor.
11. OC & SC tests on single phase transformer
    a. Determine equivalent circuit parameters
    b. Predetermine efficiency and regulation at various loads and different power factors.
12. Open circuit characteristics of dc shunt generator
    a. Plot OCC of rated speed
    b. Predetermine OCC for other speeds
    c. Determine critical field resistance for a specified speed
    d. Determine critical speed for a specified shunt field resistance
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<tr>
<td>10% - Fair record</td>
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EN13 401B: ENGINEERING MATHEMATICS IV
(Common for IC, EC, EE, AI, BM, CS, and IT)

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To inculcate the students an adequate understanding of the basic concepts of probability
  theory.
- To make them develop an interest in the area which may find useful to pursue their studies
- To stimulate the students understanding of the z-transform
- To make the student get acquainted with the basics of PDE

Module I: Probability Distributions (13 hours)
Random variables – Mean and Variance of probability distributions – Binomial Distribution –
Poisson Distribution – Poisson approximation to Binomial distribution – Hyper Geometric
Distribution – Geometric Distribution – Probability densities – Normal Distribution – Uniform
Distribution – Gamma Distribution.

Module II: Z – Transforms (14 hours)
Some elementary concepts – Definition of Z-transform – Convergence of Z-transform –
Examples of Z-transform – Properties of Z-transform – Inverse Z-transform – Convolution
Theorem.

Module III: Series Solutions of Differential Equations (14 hours)
Power series method for solving ordinary differential equations – Frobenius method for solving
ordinary differential equations – Bessel’s equation – Bessel functions – Generating functions (No
proof) – Relation between Bessel functions – Orthogonality property of Bessel functions (Proof
not required).

Module IV: Partial Differential Equations (13 hours)
Introduction – Solutions of equations of the form F(p,q) =0 ; F(x,p,q) =0 ; F(y,p,q) =0 ; F(z,p,q)
=0 ; F1(x,q) = F2(y,q) ; Clairaut’s form, z=px +qv +F(p,q) ; Lagrange’s form, Pp +Qq =
R – Classification of Linear PDE’s – Derivation of one dimensional wave equation and one
dimensional heat equation – Solution of these equation by the method of separation of variables.

Text Books
Module I:
Richard A Johnson, CB Gupta, Miller and Freund’s Probability and statistics for Engineers, 7th
edition, Pearson Education - Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7

Module II:

Module III:
Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
Sections: 4.1, 4.4, 4.5

Module IV:
N Bali, M Goyal, C Watkins, Advanced Engineering Mathematics, A Computer Approach, 7e,
Infinity Science Press, Fire Wall Media.
Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9
Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
Sections: 11.2, 11.3, 9.8 Ex.3, 11.5
Reference books

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

**PART A:** *Analytical/problem solving SHORT questions* 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** *Analytical/Problem solving DESCRIPTIVE questions* 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EN14 402 ENVIRONMENTAL SCIENCE  
(Common for all branches)

Teaching scheme  
Credits: 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the problems of pollution, deforestation, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues at local and global levels.*
- *To create awareness among the students to address these issues and conserve the environment in a better way.*

Module I (15 hours)

The multidisciplinary nature of environmental science - definition - scope and importance - need for public awareness-natural resources-renewable and non-renewable resources: natural resources and associated problems - forest resources: use and over-exploitation, deforestation, case studies. timber extraction, mining, dams and their effects on forests and tribal people - water resources: use and over utilization of surface and ground water, floods, drought, conflicts over water, dams - benefits and problems.- mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, case studies.- food resources: world food problems, changes caused by agriculture over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - energy resources: growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources, land resources: land as a resource, land degradation, man-induced landslides, soil erosion and desertification.

Module II (15 hours)

Ecosystems - concept of an ecosystem-structure and function of an ecosystem - producers, consumers, decomposers - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - introduction, types, characteristics features, structure and function of the following ecosystems: forest ecosystem- grassland ecosystem - desert ecosystem - aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

Module III (15 hours)

Environmental pollution: definition, causes, effects and control measures of: air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution - nuclear hazards - Solid waste management: causes, effects and control measures of urban and industrial wastes; e-waste management - role of an individual in prevention of pollution - pollution case studies - disaster management: floods, earth quake, cyclone and landslides - environmental impact assessment

Module IV (15 hours)

Environment and sustainable development - Sustainable use of natural resources - conversion of renewable energy resources into other forms - case studies - problems related to energy and energy auditing - water conservation, rain water harvesting, watershed management - case studies - climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust - waste land reclamation - consumerism and waste products - reduce, reuse and recycle concept of products - value education for environment conservation, global conservation movements and agreements, green economy, carbon foot print, carbon trading.

Text Books:
1. Daniels & Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009

References:
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
**University Examination Pattern**

**PART A:**  Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:**  Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*

**Note:** Field work can be visit to a local area to document environmental assets - river/forest/grass land/mountain or visit to local polluted site - urban/rural/industrial/agricultural etc. or study of common plants, insects, birds etc. or study of simple ecosystems-pond, river, hill slopes etc. or mini project work on renewable energy and other natural resources, management of wastes etc.
EC13 403 SIGNALS AND SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To introduce the student to the idea of signals, system analysis and its characterization.
- To provide a foundation to numerous other courses that deal with signal and system concepts directly or indirectly: viz: communication, control, instrumentation etc.

Module I (13 hours)
Introduction to signals and systems- Classification of signals-basic operations on signals- elementary signals- concept of system- properties of systems-stability, invertibility, time invariance, linearity, causality, memory- Time domain representation for Linear Time Invariant Systems -Impulse response representation for LTI systems- Convolution sum, convolution integral and their evaluation - properties of impulse response representation- differential equation and difference equation representation for LTI systems.

Module II (13 hours)
Fourier representation of continuous time signals- Fourier integral- existence of the Fourier integral- Properties of Fourier representation- energy spectral density and power spectral density- frequency response of LTI systems- correlation theory of deterministic signals- condition for distortionless transmission through an LTI system- transmission of a rectangular pulse through an ideal low pass filter-Hilbert transform- sampling and reconstruction.

Module III (13 hours)
Laplace transform analysis of systems-Unilateral and Bilateral Laplace Transforms, properties- relation between transfer function and differential equation- causality and stability- inverse system- determining the frequency response from poles and zeros.
Fourier representation of discrete time signals- discrete time Fourier series and discrete time Fourier transform- Properties.

Module IV (13 hours)
Z transform-properties of the region of convergence- properties of the Z- transform- analysis of LTI systems- relating transfer function and difference equation- stability and causality- inverse systems- determining the frequency response from poles and zeros- Unilateral Z-transform- Solving difference Equations.

Text Books
1. S. Haykin and B. V. Veen, Signals and Systems, John Wiely & Sons, NY
3. A. Anand Kumar, Signals and Systems, 2nd ed. PHI

Reference Books
3. J.B. Gurung, Signals and Systems, PHI
**Internal Continuous Assessment (Maximum Marks-50)**

- **60%** - Tests (minimum 2)
- **30%** - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10%** - Regularity in the class

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**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC 13 404 ELECTRONIC CIRCUITS II

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
To develop the skill of analysis and design of various circuits using electronic devices.

Module I (13 hours)
Feedback amplifiers-the general feedback structure - effects of negative feedback-Analysis of negative feedback amplifiers -Stability-study of stability using Bode Plots. Positive feedback and oscillators - analysis and design of RC phase shift, Wein bridge, LC and crystal oscillators - stabilization of oscillations-UJT relaxation Oscillators

Module II (14 hours)
Differential Amplifiers -The BJT differential pair- Large and small signal operation-MOS differential amplifier- Large and small signal operation -Nonideal characteristics of the differential amplifier - Differential amplifier with active load- concept of CMRR - methods to improve CMRR - Frequency response analysis.

Module III (13 hours)

Module IV (12 hours)
Power amplifier - class A, B, AB, C, D & S power amplifier - harmonic distortion-efficiency -wide band amplifier - broad banding techniques - low frequency and high frequency compensation -cascode amplifier -broad banding using inductive loads - Darlington pairs.
Text Books

Reference Books
4. Spencer & Ghausi, Introduction to Electronic Circuit Design; Pearson Education
5. Venkata Rao K., Rama Sudha K., Manmadha Rao G., Pulse and Digital Circuits:Pearson Education
6. Electronics for Analog Signal Processing - I, Prof. K. RadhakrishnaRao, IIT Madras (nptel.iitm.ac.in)
7. Electronics for Analog Signal Processing - II, Prof. K. RadhakrishnaRao, IIT Madras (nptel.iitm.ac.in)
8. Analog Circuits, Prof. Shanthi Pavan, IIT Madras (VLSI Group, IIT Madras - Video Lectures)
10. Analog ICs, Prof. K. RadhakrishnaRao, IIT Madras (nptel.iitm.ac.in)
11. Circuits and Electronics, Prof. Anant Agarwal, MIT(ocw.mit.edu)

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 405 DIGITAL ELECTRONICS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
This paper exposes the students to digital fundamentals. Through learning this paper
students are expected to gain knowledge in designing combinational as well as
synchronous sequential circuits

Module I (13 hours)
Boolean algebra: Theorems and operations- Boolean expressions and truth tables-Duality and
Inversion- Multiplying out and factoring expressions- Exclusive-OR and equivalence operations-
Positive and Negative Logic.
Combinational logic design using truth table- Minterm and Maxterm expansions- Incompletely
specified functions.
Minimization Techniques: Algebraic Method, Karnaugh maps (including 5 and 6 variable) –
Quine-McCluskey method- Multi-output circuits- Multi-level circuits- Design of circuits with
universal gates.

Module II (13 hours)
Number Representation: Fixed point - Floating point - 1’s complement - 2’s complement. Binary
Codes: BCD- Gray code- Excess 3 code- Alpha Numeric codes – Error detecting and correcting
codes- properties- Code conversion circuits-Number systems (Binary, Octal and Hexadecimal):
conversions and arithmetic operations.
Arithmetic circuits: adders and subtractors- ripple carry adders- carry look ahead adders- adder cum
subtractor-BCD Adder and Subtractor.
Combinational logic design using MSI circuits: Multiplexers- Demultiplexers- Decoders-
Encoders- ALU- Digital Comparators -Parity Generators.
Introduction to digital logic families: Characteristics- Basic working of a TTL NAND gate, ECL
gate and CMOS logic gate.

Module III (13 hours)
Flops with preset and clear inputs- Triggering methods and their circuits -Conversion of one type
of flip flop to another – Excitation table – Applications of Flip Flops.
Shift Registers: right shift- left shift- bi directional- SISO- SIPO- PISO- PIPO- universal shift
registers. Synchronous counter: Design, Lock out condition.
Asynchronous counter operation- Up counter- Down counter- Up/ down counter-Mod n counters.
Other types of Counters: Ring counter- Johnson counter- BCD counter.

Module IV (13 hours)
Synchronous sequential circuits: Finite State Machines- Mealy & Moore types- Basic design
steps- Design of counters using Sequential Circuit Approach – FSM as an Arbiter circuit- ASM
charts.
Asynchronous sequential circuits: Analysis and Synthesis- State Reduction and State
Assignment- Hazards.
Text Books

Reference

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks=40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving DESCRIPTIVE questions**  
4 x 15 marks=60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 406 ANALOG COMMUNICATION

Teaching scheme  Credits: 4
3 hours lecture and 1 hour tutorial per week

Objectives
- To impart the basic concepts of analog modulation schemes
- To develop understanding about performance of analog communication systems

Module I (13 hours)

Module II (13 hours)
Receivers for continuous wave modulation - Superheterodyne Receivers, Receiver specifications, Multiplexing systems - Frequency division, Quadrature carrier and Time division Phase locked loop operation, Synchronous detection and Frequency synthesis - FM detection, Analog Pulse Modulation - Signals and Spectra of Pulse Amplitude Modulation (PAM) and Pulse Time Modulation (PWM/PPM).

Module III (13 hours)

Module IV (13 hours)
Noise in analog modulation systems - Bandpass noise - System models, Quadrature components, Envelope and Inphase - Linear continuous wave modulation with noise - Synchronous detection - Envelope detection and threshold effect - Exponential continuous wave modulation with noise - Post detection noise - Destination S/N - FM threshold effect - Comparison of continuous wave modulation systems - Analog Pulse Modulation with Noise.
Text Books

Reference Books
2. Dennis Roddy, John Coolen, Electronic Communications, Pearson Education.
4. Tomasi, Electronic Communications Systems, Pearson Education.
5. Proakis & MasoudSalehi, Fundamentals of Communication systems ,Pearson Education.

Web resources:
1. Principles of Communication, Prof. V. VenkatRao, IIT Madras (nptel.iitm.ac.in)
2. Communication Engineering, Prof. Surendra Prasad, IIT Delhi (nptel.iitm.ac.in).

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8 x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 407(P): DIGITAL ELECTRONICS LAB

Teaching scheme
3 hours practical per week

Credits: 2

Objectives

- To provide experience on design, testing, and analysis of digital electronic circuits

1. Realization of logic gates using diodes and transistors.
2. Characteristics of TTL Gates
3. Realization of logic gates using universal gates
5. Seven segment display
6. Realization of Mux, Decoder and Encoder using basic gates
7. Combinational logic design using Decoders and Muxs
8. Half and Full adders and Subtractors.
9. 4 bit adder-subtractor IC & BCD adder circuit
10. Flip-Flop Circuit (RS Latch, JK, T, D and Master Slave) using basic gates.
11. Asynchronous Counters
12. Johnson and Ring Counters.
13. Synchronous counters.
15. A sequence detector Circuit.
16. Registers.

Note: A minimum of 10 experiments must be conducted

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical and record
30% - Test
10% - Regularity in the class

End Semester Examination (Maximum Marks-100)

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EC13 408(P) ELECTRONIC CIRCUITS LAB

Teaching Scheme
3 hours practical per week

Credits: 2

Objective

- To design and setup circuits

Each Experiment Will Have Two Parts - A Simulation Part (SPICE) and Hardware Realization

List of experiments

1. SPICE - Advanced Analysis, Device Models, Netlists, Schematic Capture and Plotting
2. Feedback voltage regulator with short circuit protection
3. Voltage regulation with Zener diode and pass transistor.
4. Single / Two Stage RC coupled amplifier - design for gain - frequency response
5. JFET amplifier - design for gain - frequency response
6. Feedback amplifiers - gain & frequency response
7. Emitter follower with and without complementary transistors frequency response
8. Phase shift oscillator using BJT/FET
9. Crystal / LC Oscillators
10. Power amplifier - Class A / Class AB
11. Cascode amplifier - frequency response
12. Active load MOS amplifier
13. UJT characteristics and relaxation oscillator
14. Wide band single BJT/MOS voltage amplifier with inductance

Internal Continuous Assessment (Maximum Marks-50)
60%-Laboratory practical and record
30%- Test/s
10% - Regularity in the class

Semester End Examination (Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EC13 501: COMPUTER ORGANISATION AND ARCHITECTURE

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basic idea of memory and system organisation and architecture of Computers.

Module I (13 hours)
Basic structure of computer hardware and software - addressing methods - computer arithmetic - number representations - fast adders - fast multiplication - integer division - floating point numbers and operations.

Module II (13 hours)
The processing unit - instruction execution cycle - sequencing of control signals - hardwired control - microprogrammed control - control signals - micro instructions - microprogram sequencing - branch address modification - prefetching of micro instructions.

Module III (13 hours)
Memory organization - Semiconductor RAM memories - internal organization - Bipolar and MOS devices - Dynamic memories - multiple memory modules and interleaving - cache memories-mapping functions - replacement algorithms - virtual memory - address translation - page tables - memory management units - Secondary memory - disk drives - organization and operations.

Module IV (13 hours)
Input-output organizations-accessing I/O devices-direct memory access (DMA) - interrupts-interrupt handling-handling multiple devices-device identification -vectored interrupts - interrupt nesting - Daisy chaining - I/O interfaces - serial and parallel standards - buses - scheduling- bus arbitration-bus standards. Introduction to parallel organizations - multiple processor organization- symmetric multiprocessors -cache coherence - non uniform memory access - vector computation - introduction to CISC and RISC architectures - comparisons

Text Books

Reference Books
**Internal Continuous Assessment (Maximum Marks-50)**

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

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**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks = 40 marks

**PART B:** Analytical DESCRIPTIVE questions

Two questions from each module with choice to answer one question.

4 x 15 marks = 60 marks

*Maximum Total Marks: 100*
EC13 502: LINEAR INTEGRATED CIRCUITS

Teaching scheme
3 hours lecture and 1 Hour tutorial per week

Credits: 4

Objectives

- To develop the skill of analysis and design of various circuits using operational amplifiers
- To develop design skills to design various circuits using different data conversion systems

Module I (14 hours)
Various stages of an operational amplifier - simplified schematic circuit of op-amp 741 - need for compensation - lead, lag and lead-lag compensation schemes - typical op-amp parameters - slew rate - power supply rejection ratio - open loop gain - unity gain bandwidth - offset current & offset voltage

Module II (14 hours)
Signal generators-Phase shift and Wien Bridge Oscillators-Astable and Monostable Circuits-Linear sweep circuits.
Active filters-filter transfer function-Butterworth and Chebyshev filters-First order and second order function for low-pass, high-pass, band-pass, band-stop and all-pass filters- Sallen-key LPF and HPF-Delyianiss-Friend band Pass filters-twin-tee notch filter-Second order LCR Resonator and realizations of various types-Filters based on inductor replacement-switched capacitor filters

Module III (14 hours)
Timer IC 555 – internal diagram – working - multivibrators with timer IC 555
Data converters-definitions and specifications – DAC - Weighted resistor and R-2R DAC-Bipolar DAC.
ADC - flash, integrating type, Counter Ramp, pipeline, tracking and Successive approximation, dual slope & oversampling ADCs - sigma - delta ADC
Linear voltage regulators- protection mechanisms-LM 723 Functional-diagram-Design of voltage regulator using 723-Three terminal Voltage regulators-functional operation of 78xx series IC and design of fixed and adjustable regulators

Module IV (10 hours)
Phase locked loops- operation of first and second order PLLs-Lock and Capture range-LM565PLL-Application of PLL as AM/FM/FSK/ detectors, frequency translators, phase shifter, tracking filter, signal synchronizer and frequency synthesizer. Voltage controlled oscillator
Text Books
1. Sergio Franco , Design with Operational Amplifiers & Analog integrated Circuits ; McGraw Hil
3. Fiore J.M., Operational Amplifiers and Linear Integrated Circuits, Jaico Publishing House
4. Gayakwad, Operational Amplifiers, Jaico Publishing House

Reference Books
1. Roy Choudari.‘Linear Integrated Circuits’
3. Schumann & Valkenberg, Design of Analog Filters, Oxford University Press

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 503 DIGITAL COMMUNICATION

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objectives

- To impart the basic concepts of various digital modulation schemes
- To develop understanding about digital transmitters & Receivers

Module I (13 hours)
Sampling Theory and Practice - Ideal Sampling and Reconstruction - Practical Sampling and Aliasing - Flat-Top Sampling - Sampling theorem for bandpass signals - Waveform coding - quantization - PCM - DPCM - delta modulation - adaptive delta modulation - line coding schemes- ON-OFF, NRZ, Bipolar, Manchester signalling and differential encoding.

Module II (13 hours)

Module III (13 hours)
Review of Gaussian random process - optimum threshold detection - optimum receiver for AWGN channel - matched filter and correlation receivers - decision procedure - maximum a-posteriori probability detector - maximum likelihood detector - probability of error - bit error rate - Optimum receiver for coloured noise- carrier and symbol synchronisation.

Module IV (13 hours)
Digital modulation schemes - coherent binary schemes - ASK, FSK, PSK, MSK coherent M-array schemes - calculation of average probability of error for different modulation schemes - power spectra of digitally modulated signals - performance comparison of different digital modulation schemes.

Text Books
1. Sklar, Digital Communication, Pearson Education.
5. Leon W. Couch, Digital and Analog Communication Systems, Pearson Education

Reference Books
2. Dennis Roddy, John Coolen, Electronic Communications, Pearson Education
4. Glover and Grant, Digital Communications, Pearson Education.
5. Rice, Digital Communications, Pearson Education.
Web resources:
1. Digital Communication, Prof. Bikash Kumar Dey, IIT Bombay (nptel.iitm.ac.in)/
2. Digital Communication, Prof. SaswatChakrabarti, Prof.R.V. Rajakumar, IIT Kharagpur (nptel.iitm.ac.in)

<table>
<thead>
<tr>
<th>Internal Continuous Assessment (Maximum Marks:50)</th>
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</thead>
<tbody>
<tr>
<td>60% - Tests (minimum 2)</td>
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<tr>
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<tr>
<td><strong>PART A:</strong> Analytical/problem solving SHORT questions 8x 5 marks = 40 marks</td>
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<td>Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.</td>
</tr>
<tr>
<td><strong>PART B:</strong> Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks = 60 marks</td>
</tr>
<tr>
<td>Two questions from each module with choice to answer one question.</td>
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<tr>
<td>Maximum Total Marks: 100</td>
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EC13 504: ELECTROMAGNETIC FIELD THEORY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the knowledge of electric, magnetic fields and the equations governing them as well as time varying field
- To develop understanding about guided waves & transmission lines

Module I (13hours)

Module II (13 hours)
Maxwell’s equations and travelling waves: conduction current and displacement current- Maxwell’s equations- Plane waves- Poynting theorem and Poynting vector- Plane electromagnetic waves- Solution for free space condition- Uniform plane wave-wave equation for conducting medium- Wave polarization- Poisson’s and Laplace equations. Linear, elliptical and circular polarization.

Module III (14 hours)
Guided waves between parallel planes- transverse electric and transverse magnetic waves and its characteristics, wave equations for conducting medium, wave propagation in conductors and dielectric, depth of penetration, reflection and refraction of plane waves by conductor and dielectric, Poynting vector and flow of power.

Module IV (12hours)

Text Books
3. Introduction to Electrodynamics- David J. Griffiths, Prentice Hall India, 3rd Edition

Reference Books
2. Field & Wave Electromagnetic: Cheng, Pearson Education.
4. Network Analysis: Van Valkenberg

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 505: MICROPROCESSORS AND MICROCONTROLLERS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To introduce the student with knowledge about architecture, interfacing and programming with 8086 microprocessors and 8051 microcontrollers. It gives a brief introduction to ARM 7 and ARM 9 micro controllers.
- After studying this subject, the student should be able to design microprocessor/controller based system for any relevant applications.

Module I (13 hours)
Brief history of Microprocessors, Von Neumann and Harvard architecture-Distinction between CISC and RISC computers Intel 8086 /8088 microprocessors- Bus Interface Unit(BIU) and Execution Unit(EU) - Address space, Data organization, registers, memory segmentation and addressing, stack, I/O space Programming concepts- Assembly programming using instructions for data transfer ,arithmetic, logical , shift and rotate operations and string manipulations -Procedures-Macros-ASCII operation- use of MASM

Module II (13 hours)
Hardware structure of 8086 microprocessor -minimum and maximum mode-basic read and write machine cycle timing- Coprocessor and Multiprocessor configuration - hardware organization of address space-control signals and I/O interfaces-Memory devices, circuits and sub system design - various types of memories, memory address decoding -Interrupts

Module III (13 hours)
I/O interfacing circuits -Hand shaking, serial and parallel interfacing-Address decoding-Interfacing chips-Programmable peripheral interfacing (8255)-Internal block diagram-modes of operation Programmable communication interface(8251)-Basics of serial communication-Internal block diagram of 8251 Programmable timer(8253)- Internal block diagram of 8253- Different Modes DMA controller(8237/8257)-Internal block diagram- Programmable interrupt controller(8259)- features - Internal block diagram-Interrupt sequence for an 8086 based system-Keyboard display interface(8279)- Keyboard interface-Display interface

Module IV (13 hours)
Intel 8051 microcontroller -Architecture-Program and Data memory organization- Addressing modes-Software overview-Ports-Timer-Interrupt- Serial port-Introduction to ARM processors - features of ARM 7 and 9 processors


**Text Books**
1. Lyla B Das, The x86 Microprocessors Architecture, Programming and Interfacing (8086 to Pentium)
4. Andrew N. Sloss, Dominic Sysmes, Chris Wright - Arm System Developers Guide- Designing and Optimizing System software, Morgan Kaufmann Publishers

**Reference Books**
1. Intel Data Book vol.1, Embedded Microcontrollers and Processors.
3. Mohammed R., Microprocessor & Microcomputer based system design, Universal Book Stall.

**Internal Continuous Assessment (Maximum Marks-50)**
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

**Note:** One of the assignments shall be simulation of VHDL programs

**University Examination Pattern**

**PART A: Analytical/problem solving SHORT questions** 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/Problem solving/ DESCRIPTIVE questions** 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 506 QUANTITATIVE TECHNIQUES AND MANAGERIAL DECISIONS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
To impart basic ideas on various quantitative techniques for managerial decision making

Module 1 (13 hours)
Decision making- strategic and tactical decisions-strategy formulation-models of decision making-single stage decisions under risk-incremental analysis-multistage decision making decision trees-decision making under uncertainty- baye’s decision theory-Network Techniques- basic concepts-network construction- CPM and PERT networks-algorithm for critical path-slacks and their significance-crashing-network flow problems-the shortest route problem-minimal spanning tree problem.

Module 2 (13 hours)
Inventory control-functions of inventory-structure of inventory problems-relevant cost-opposing costs-selective control techniques-dynamic inventory models under certainty- classical EOQ model with and without back logging-production lot size model-quantity discount- safety stock probabilistic model-one time mode-P system and Q system

Module 3 (13 hours)
Statement of the LP problem- slack and surplus variables-basic feasible solutions- reduction of a feasible solution to basic feasible solution-artificial variable-optimality conditions- unbounded solutions-charnes _M method-two phase method-degeneracy-duality.

Module 4 (13 hours)
Transportation problem- coefficient matrix and its properties-basic set of column vectors-linear combination of basic vectors-tableau format-stepping stone algorithm-UV method-inequality constraints-degeneracy in transportation problems - assignment problem-hungarian method

Reference Books
1. Hadley.G Linear programming, Addison Wesley
4. Weist & Levy , A management Guide to PERT and CPM. Prentice hall of India
5. Starr & Miller , Inventory control –Theory and Practice- Prentice Hall of India

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: One of the assignments shall be simulation of continuous systems using any technical computing software
**University Examination Pattern**

**PART A:** *Analytical/problem solving SHORT questions*  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** *Analytical/Problem solving DESCRIPTIVE questions*  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 507(P) ANALOG COMMUNICATION LAB

Teaching Scheme
3 hours practical per week

Objective
- To design and setup circuits for Analog communication

List of experiments
1. AM generation using JFET/ BJT
2. AM generation and demodulation using op-amps / IC multipliers
4. PAM generation and demodulation
5. Implementation of intermediate frequency (IF) tuned amplifier
6. Mixer using JFET/BJT
7. PWM - Generation and demodulation
8. PPM - Generation and demodulation
9. AM detection with simple and delayed AGC
10. SSB generation and demodulation using integrated circuits
11. FM generation (Reactance modulator)
12. FM demodulation
13. PLL characteristics and demodulation using PLL

Note: Minimum ten experiments must be conducted

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<td>10% - Fair record</td>
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EC13 508(P) LINEAR INTEGRATED CIRCUITS LAB

Teaching Scheme
3 hours practical per week

1. Measurement of op-amp parameters-CMRR, slew rate, open loop gain, input and output impedances
2. Inverting and non inverting amplifiers, integrators and differentiators-
   Frequency response, Comparators-Zero crossing detector, Schmitt trigger-precision limiter
3. Instrumentation amplifier-gain, CMRR & input impedance
4. Single op-amp second order LFF and HPF - Sallen-Key configuration, Narrow band active
   BPF -Delyannis configuration
5. Active notch filter realization using op-amps
6. Wein bridges oscillator with amplitude stabilization
7. Generation and demodulation of PWM and PPM
8. Multipliers using op-amps - 1,2 & 4 quadrant multipliers
9. Square, triangular and ramp generation using op-amps
10. Astable and monostable multivibrators using op-amps
11. Log and Antilog amplifiers
12. Voltage regulation using IC 723
13. Astable and monostable multivibrators using IC 555
14. Design of PLL for given lock and capture ranges & frequency multiplication
15. Applications using PLL
16. Realisation of ADCs and DACs

Note: A minimum of 10 experiments must be conducted

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EC 13 601: RADIATION AND PROPAGATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
- To impart the basic concepts of radiating structures and their arrays
- To give understanding about analysis and synthesis of arrays
- To give idea about basic propagation mechanisms

Module I (13 hours)
Retarded potentials: Radiation, retarded potential - Radiation from an A.C current element-monopoles and dipoles-power radiated from a dipole
Antenna Parameters: Introduction, Isotropic radiators, Radiation pattern, Gain - radiation intensity, Directive gain, Directivity, antenna efficiency - Reciprocity theorem & its applications, effective aperture, radiation resistance, terminal impedance, noise temperature, elementary ideas about self & mutual impedance, front-to-back ratio, antenna beam width, antenna bandwidth, antenna beam efficiency, antenna beam area or beam solid angle, polarization, antenna temperature.

Module II (13 hours)
Antenna Arrays: Introduction, various forms of antenna arrays, arrays of point sources, non-isotropic but similar point sources, multiplication of patterns, arrays of n-isotropic sources of equal amplitude and spacing (Broad-side & End-fire array cases), array factor, directivity and beam width, array of n-isotropic sources of equal amplitude and spacing end-fire array with increased directivity, scanning arrays, Dolph-Tchebysceff arrays, tapering of arrays, binomino arrays, continuous arrays, rectangular arrays, superdirective arrays.

Module III (13 hours)
VLF, LF and MF antennas - Introduction, effects of ground on antenna performance, effects of antenna height, efficiency of electrically short antenna, medium frequency antennas, high frequency antennas, fundamental antenna (i.e. half wave dipole or dipole antenna), long wire antenna, V and inverted V antenna, Rhombic antenna, traveling wave antenna, radio direction finders, loop antennas, VHF, UHF, SHF Antennas - Introduction. Folded dipole antenna, Yagi-Uda antenna, and helical antenna, slot antenna, microstrip or patch antennas, and turnstile antenna, frequency independent antennas- log periodic antenna, and microwave antennas- Microstrip antenna, fractal antenna.

Module IV (13 hours)
Factors involved in the propagation of radio waves: the ground wave-Reflection of radio waves by the surface of the earth-space wave propagation-considerations in space wave propagation-atmospheric effects in space wave propagation-ionosphere and its effects on radio waves - mechanism of ionosphere propagation-refraction and reflection of sky waves by ionosphere-ray paths-skip distance-maximum usable frequency-vertical and oblique incidence-fading of signals - selective fading-diversity reception, Duct Propagation.

Text books:
Reference Books

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer FIVE questions out of EIGHT. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 602 OPTICAL COMMUNICATION

Teaching scheme                 Credits: 4
3 hours lecture and 1 hour tutorial per week

Objective

- To provides the basic theory of optical fibres and principle of various components in optical communication system.
- To give basic idea about system aspects and design concepts of fiber optical system

Module I (14 hours)
Solution to Maxwell’s equation in a circularly symmetric step index optical fiber – single mode and multimode fibres-numerical Aperture. Acceptance angle-concept of V number – graded index fibres-polarization maintaining fibres-attenuation mechanisms in fibres-dispersion in single mode and multimode fibres-dispersion shifted and dispersion flattened fibres

Module II (10 hours)
Optical source-LED and laser diode- -concepts of line width-phase noise-switching and modulation characteristics-typical LED and LD structures-laser types-optical detectors- pn–pin –avalanche Photodiode-principles of operation – concepts of responsivity and quantum efficiency

Module III (14 hours)
Intensity modulated direct detection systems-quantum limit to receiver sensitivity-detected signal & shot noise –ISI and equalization-coherent systems-homodyne and heterodyne systems-system structures- degradation due to fiber dispersion-degradation induced by non-linear effects in fiber propagation

Module IV (14 hours)
Optical amplifiers-semiconductor amplifier-rare earth doped fiber amplifier (with special reference to erbium doped fibers) – broad band EDFA Raman amplifier- Brillouin amplifier-principles of operation-,WDM & DWDM Optical System, Optical switches, Isolators, Circulators and attenuators. Optical couplers and splitters-Optical Networks – SONET/SDH
Text Books

Text Books
1. Optical Electronics: Ajoy Ghatak, K Thyagarajan
2. Textbook on Optical Fiber Communication and its Applications: S.C. Gupta

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Simple Problem solving DESCRIPTIVE 4 x 15 marks=60 marks questions
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 603 VLSI DESIGN

Teaching scheme
3 hours lecture and 1 hour tutorial per week

credits: 4

Objective
- To study the issues in devices used for VLSI design
- To introduce the various steps in IC fabrication, starting from the raw material to the finished product as well as physical principles involved in these processes

Module I (13 hours)
Short and narrow channel effects in MOS transistor (MOST) - sub threshold conduction - body effect
- channel length modulation - drain induced barrier lowering - hot carrier effects - velocity saturation of charge carriers
Scaling of MOST - constant voltage and constant field scaling - digital MOSFET model - Estimation of interconnect parasitics and calculation of interconnect delay.
MOS inverter - resistive load, Saturated NMOS load, Depletion NMOS load, pseudo MOS - CMOS
inverter-robustness and performance - capacitance components - charge sharing - power dissipation
- CMOS ring oscillator

Module II (13 hours)
CMOS logic Styles - Design & implementation of Adder - Full adder, Dynamic
adder, Carry bypass adder, Carry select adder, Square root carry selector adder, Carry look ahead
adder - Multipliers, and array multipliers - Multiplexers - Memory elements- SRAM, DRAM,
ROM, Sense amplifiers - Differential, Single ended

Module III (13 hours)
Wafer processing - diffusion-Fick's Law - analytic solutions for predeposition and drive-in diffusion -
Oxidation - Deal -Grove model - ion implantation-vertical and lateral projected ranges-channeling-
stoping power - Optical lithography-optical exposures-modulation transfer function-proximity and
projection printing - Photoresists - types-contrast curves-Etching-wet, plasma and ion etching-
Epitaxial growth - MOCVD and molecular beam epitaxy.

Module IV (13 hours)
Device isolation-contacts and metallization-junction and oxide isolation -LOCOS- SILO-SWAMI
process-trench isolation - silicon on insulator isolation - schottky contacts-implanted ohmic contacts-
alloyed contacts-refractory metal contact technology-multi level metallization
CMOS- P well process - twin tub process
Layout and design rules ( λ and μ based) - layout using cell hierarchy - layout of MOSFET - stick
diagram - layout of the inverter, NOR and NAND gates - Layout guide lines

51
Text Books
1. Weste & Harris, CMOS VLSI Design, Pearson Education
2. Plummer, Deal & Griffin, Silicon VLSI Technology, Pearson Education
4. Weste & Eshraghian, Principles of CMOS VLSI Design, Addison Wesley
5. S K Gandhi, VLSI Fabrication Principles., John Wiley

Reference Books
5. Eshraghian & Pucknell., Essentials of VLSI Circuits & Systems, PHI

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 604: DIGITAL SIGNAL PROCESSING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart basic ideas (i) in the transforms used in digital domain (ii) in the design and hardware realization of digital filters

Module I (13 hours)

Module II (13 hours)
Structures for realization of discrete time systems-Signal flow graph representation- structures for FIR and IIR systems-direct form, cascade form, parallel form-lattice and transposed structures- Representation of numbers & errors due to rounding and truncation- Quantization of filter coefficients-round off effects in digital filters-Limit cycle oscillations, scaling to prevent overflow

Module III (13 hours)

Module IV (13 hours)
Computer Architectures for signal processing-Harvard Architecture, Pipelining, Multiplier-Accumulator, Special Instructions for DSP, extended parallelism-General Purpose DSP Processors- Implementation of DSP Algorithms for various operations-Special purpose DSP hardware-Hardware Digital filters and FFT processors-Case study and overview of TMS320 series processor, ADSP 21XX processor

Text Books

Reference Books
4. Vinay K Ingle, John G Proakis, DSP-A MATLAB based approach, Cengage learning India
**Internal Continuous Assessment (Maximum Marks-50)**

- **60% -** Tests (minimum 2)
- **30% -** Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10% -** Regularity in the class

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**University Examination Pattern**

**PART A:**  *Analytical/problem solving SHORT questions*  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:**  *Analytical/Problem solving DESCRIPTIVE questions*  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 605: CONTROL SYSTEMS

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objective

- To impart the basic theory behind the analysis of continuous and discrete Systems in time and frequency domains
- To introduce concepts about the state space modeling of systems.

Module I (13 hours)


Module II (13 hours)

1. Time Domain analysis:

2. Frequency Domain Analysis:

Module III (13 hours)


Module IV (13 hours)

State Space Analysis: Introduction-Definitions and explanations of the terms STATE, STATE VARIABLES, STATE VECTOR AND STATE SPACE-State Space Representations of Linear Time-invariant System with i) single input and output ii) multi variable systems iii) SISO System in which forcing Function involves-Eigen values-phase variable and Diagonal forms-Invariance of Eigen values under linear transformation-Diagonalisation
Solutions of Linear Time-invariant State Equations-Homogeneous and Non-homogeneous case(example up to second order only)- Matrix Exponential- Laplace Transform approach to the solutions of state equations-State Transition Matrix-properties.
State Space representation of Discrete Time Systems-Relation between Transfer function /Transfer Matrix and State Space models for continuous and discrete cases.
### Text Books
1. Ogata K. — Modern Control Engineering, Prentice Hall of India
3. B.C Kuo, || Automatic Control System||, Prentice Hall of India
4. Nagarath I. J & Gopan M., || Control System Engineering||, Wiley India Ltd

### Reference Books
1. Ziemer R.E., Tranter W.H & Fanin D.R., || Signals and Systems|| Pearson Education Asia
2. Dorf R.C & Bishop R.H., Modern Control Systems||, Addison Wesley

### Internal Continuous Assessment (Maximum Marks-50)
- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

### University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 606 SATELLITE COMMUNICATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basic concepts of satellite communication and systems
- To develop understanding about the link design and the latest trends in satellite communication

Module I (13 hours)
Satellite Orbits: Orbital mechanics-Kepler’s laws, locating the satellite in orbit, orbital elements; look angle determination-subsatellite point, azimuth and elevation angle calculation; orbital perturbations-longitudinal and inclination changes; launches and launch vehicles-ELVs, placing satellites into geostationary orbit; orbital effects in communication system performance-doppler shift, range variations, solar eclipse, sun transit outage

Module II (13 hours)
Communication Satellites- Satellite subsystem; Attitude and orbit control system (AOCS); Telemetry, Tracking, Command and Monitoring (TTC&M); power systems; communications subsystem-description, transponders; satellite antennas-basic antenna types, satellite antennas in practice

Module III (13 hours)
Satellite link design and Satellite access- Basic transmission theory, system noise temperature and G/T ratio; Downlink design-link budget; Uplink design; design for specified C/N, uplink and downlink attenuation in rain, communication link design procedure; system design examples

Module IV(13 hours)
Multiple access schemes-FDMA, TDMA, CDMA, DAMA; VSAT systems-basic techniques, VSAT earth station engineering, system design; DBS systems-C-band and Ku0band home TV, digital DBS; satellite mobile systems; GPS

Text Books

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions 8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/ DESCRIPTIVE questions 4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 607(P) MICROPROCESSOR AND MICROCONTROLLER LAB

Teaching Scheme
3 hours practical per week

1. 8086 kit familiarization and basic experiments
2. Programming exercise using BCD and Hexadecimal numbers
3. Programming exercise: sorting, searching and string
4. Interfacing with A/D and D/A converters
5. Interfacing with stepper motors
6. IBM PC programming: Basic programs using DOS and BIOS interrupts
7. Interfacing with PC: Serial communication and Parallel printer interfacing

Interfacing experiments using 8051
1. Parallel interfacing I/O ports (Matrix keyboards)
2. Serial communication with PC
3. Parallel interfacing - LCD
4. Interfacing with serial EEPROM

Note: A minimum of 10 experiments must be conducted

**Internal Continuous Assessment (Maximum Marks-50)**
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

**Semester End Examination (Maximum Marks-100)**
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EC09 608 (P) MINI PROJECT

Teaching scheme
3 hours practical per week

Credits: 2

Objectives
- To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of a Electronic system.
- For enabling the students to gain experience in organisation and implementation of a small project and thus acquire the necessary confidence to carry out main project in the final year.

In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex electronic system with practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project.

Internal continuous assessment will be carried out by the Guide. End Semester evaluation of individual student will be carried out by a committee consisting of minimum three faculty members. Students have to submit a report on the mini project and demonstrate the mini project before the evaluation committee

No external Examiner is required for mini project evaluation.

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<tr>
<td>40% - Design and development</td>
</tr>
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<td>30% - Final result and Demonstration</td>
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<tr>
<td>60% - Demonstration and Presentation of mini project</td>
</tr>
<tr>
<td>30% - Viva voce</td>
</tr>
<tr>
<td>10% - Final Report</td>
</tr>
</tbody>
</table>
EC13 701 INFORMATION THEORY AND CODING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective

- To provide basic concepts of Information theory
- To enable the students to propose, design and analyse suitable coding/decoding scheme for a particular digital communication application

Module I (12 Hours)

Module II (14 Hours)
Introduction to algebra-groups- fields -binary field arithmetic- construction of Galois field GF(2m)- basic properties of Galois field GF(2m)- properties of minimal polynomial - computations using GF(2m) arithmetic-vector spaces-matrices - Linear Block Codes -generator matrices-parity check matrices- encoder for linear systematic code-syndrome and error correction-minimum distance- error correction and error detection capabilities.

Module III (13 Hours)
Cyclic Codes: polynomial description-algebraic properties – generator and parity check matrices of cyclic codes- encoding of cyclic codes-syndrome computation-error detection - decoding of cyclic codes- Binary Primitive BCH codes-generator polynomial -parity check matrix- decoding of BCH codes, nonbinary BCH Codes- Reed Solomon codes- basic concepts of coding and decoding

Module IV (13 Hours)
Coding - convolutional codes- binary non-systematic feed forward encoder -generator matrix- time domain and transform domain representation- state diagram and Trellis diagram representation of convolutional codes- distance properties of convolutional codes- maximum likelihood decoding-Viterbi decoding- interleaved convolutional codes.

Text Books
1. Simon Haykin, Communication Systems, John Wiley

Reference Books
1. Das J, Malik A.K., Chatterjee P.K., Principles of Digital Communications, NewAge International
2. Simon Haykin, Digital Communications, John Wiley
4. Symon Haykins and Michael Moher, Modern Wireless Communication, Pearson Education
5. Sklar, Digital Communications, Pearson Education
6. Couch, Digital and Analog Communication System, Pearson Education
### Internal Continuous Assessment *(Maximum Marks - 50)*

- **60%** - Tests (minimum 2)
- **30%** - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10%** - Regularity in the class

### University Examination Pattern

**PART A:** *Analytical/problem solving SHORT questions*  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** *Analytical/Problem solving DESCRIPTIVE questions*  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 702 MICROWAVE ENGINEERING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To give the basic ideas about the characteristics and applications of microwave frequency bands
- To understand the working of various microwave passive and active devices and circuits.

Module I (13 hours)
Characteristic, features and applications of microwaves- Scattering matrix representation of microwave networks, properties of scattering matrices, properties and s-matrices for typical network such as section of uniform transmission line, 3-port networks (reciprocal and nonreciprocal), T-junctions, directional coupler, magic tee, ferrite devices, isolator, circulators

Module II (12 hours)
Generation of microwaves by tubes, limitations of conventional tubes, klystron amplifiers - analysis, reflex klystron oscillator-analysis, magnetrons, traveling wave tube (TWT), backward wave oscillator (BWO)-basic principles. Millimetre wave tubes-introduction

Module III (13 hours)
High frequency limitations of transistors, microwave transistors, varactors, Manley Rowe relations, parametric amplifiers and frequency multipliers, tunnel diodes, Gunn effect, Gunn Diode oscillators, Avalanche effect, IMPATT & TRAPATT diodes, PIN diodes and their applications, Schottky barrier and backward diodes.

Module IV (14 hours)
Planar transmission lines such as stripline, microstrip line, slotline etc. VSWR measurement, microwave power measurement, impedance measurement, frequency measurement. Microwave filters, Analysis of infinite periodic structures, Terminated periodic structures, k-β Diagrams and Wave velocities, Filter design by the image parameter method, Constant K filter sections, m-derived filter sections and Composite filters.

Text Books
1. Liao S.Y.,[Microwave devices and Circuits], Prentice Hall Of India, New Delhi, 3rd Ed. 2006

Reference Books
1. Rizzi P.A.,Microwave Engineering,Passive Circuits Hall of India
2. Pozar D.M .,[Microwave Engineering, John Wiley

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
## University Examination Pattern

**PART A:**  *Analytical/problem solving SHORT questions*  \[ 8 \times 5 \text{ marks} = 40 \text{ marks} \]

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:**  *Analytical/ DESCRIPTIVE questions*  \[ 4 \times 15 \text{ marks} = 60 \text{ marks} \]

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 703: DIGITAL SYSTEM DESIGN

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- After learning this subject students must be able to simulate and implement typical digital circuits

Module I (12 hours)
Introduction to VHDL - Behavioral, Data flow and structural description - Identifiers, Data objects, Data types, Delay models - Transport vs Inertial Delay - Simulation Deltas - Sequential Processing - Process Statement - Signal Assignment vs Variable Assignment - Assert and report statements - Subprograms and functions - Packages - Predefined Attributes - Configurations - Subprogram Overloading - VHDL synthesis - Design Examples

Module II (14 hours)
Finite State machines: Design of finite state machines - state tables - state graphs - General models for sequential networks - Derivations of State Graphs and Tables Reduction of state Tables State Assignment - Sequential Network Design- Design examples using the FSM approach - sequence detector, multiplier Impediments to Synchronous design: Clock Skew, Gating the clock, Asynchronous inputs Synchronizer Failure and Metastability Timing hazards: Static Hazards, Dynamic Hazards, Designing hazard free circuit.

Module III (13 hours)
Designing with Programmable devices: Programmable Logic Arrays - Programmable Array Logic - sequential - combinational PLDs (Eg: PAL14L4 & PAL12H6), Sequential PLDs (Eg: PAL16R4) - Simple PLDs (Eg: 22V10) - Complex Programmable Logic Devices (Eg: XC9500) - Field Programmable Gate Arrays (Eg: XC 4000 & FLEX 10K)

Module IV (13 hours)
Text Books  

Reference Books  
4. Kevin Skahill, VHDL for Programmable Logic, Pearson Education  

Internal Continuous Assessment (Maximum Marks-50)  
60% - Tests (minimum 2)  
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.  
10% - Regularity in the class  

University Examination Pattern  
PART A: Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.  

PART B: Analytical/Problem solving DESCRIPTIVE questions  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.  

Maximum Total Marks: 100
EC13 704(A) INTERNET TECHNOLOGY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To make the student aware of the various protocols used in internet.

Module I (13 hours)
Computer networks and the internet-principles of application-layer protocols-HTTP- FTP-e-mail DNS-socket programming with TCP/UDP-web servers-web pages design using HTML and XML

Module II (13 hours)
Multimedia networking-applications - streaming stored audio and video-internet telephony-RTP-scheduling and policing mechanisms-integrated services- RSVP-differentiated services-network management-the internet network management framework

Module III (13 hours)
Network security -E-mail security-privacy-S/MIME-IP security-overview-architecture-authentication-header and payload-combining security associations-key management- web security-SSL and transport layer security - SET-systems security-intruders and viruses-firewalls-design-trusted systems.

Module IV (13 hours)

Text Books
2. Stallings W., Cryptography and Network Security Principles and practice., Pearson Education Asia, Module III
3. Schiller J., Mobile Communications, Addison Wesley, Module IV

Reference Books
### Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

### University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/ DESCRIPTIVE questions  
4x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 704(B) TELEVISION AND RADAR ENGINEERING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
- To give the basic ideas & operating principles of different types of b/w as well as color CTV and radar (both transmitter and receiver) and their uses.
- To create the awareness about the different standards of TV systems used in different countries and their basic principles.

Module I (13 hours)
Principles of TV- image continuity- Horizontal and vertical scanning- number of scanning lines- flicker- interlaced scanning fine structure – Composite video signal- VSB transmission and reception-
Channel bandwidth - positive and negative modulation- Transmitter – receiver – monochrome picture tube- CCD camera

Module II (13 hours)
Colour TV- compatibility- Three colour theory- Grassmans laws- -luminance, hue and saturation - Colour TV Camera tube- Picture tube- Pincushion correction techniques- auto degaussing circuits-
frequency interleaving- Bandwidth for color signal transmission- modulation of colour difference signals- colour burst- weighting factors- -principles of NTSC,PAL and SECAM coder and decoder-
Block Diagram of Digital T.V.-Transmitter- receiver- HDTV, Concept of Plasma Screen

Module III (13 hours)

Module IV (13 hours)

Text Books
3. Bernard Grob& Charles E. Herndon,Basic Television and Video Systems,

Reference Books
2. Damacher P. Digital Broadcasting ,IEE Telecommunication Series

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
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<tr>
<td><strong>PART A:</strong> Analytical/problem solving SHORT questions</td>
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<td><strong>PART B:</strong> DESCRIPTIVE questions</td>
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<td>Two questions from each module with choice to answer one question.</td>
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*Maximum Total Marks: 100*
EC13 704(C) EMBEDDED SYSTEMS

Teaching scheme  
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
- To give ideas about embedded systems and system development
- To impart knowledge about real time operating systems and microcontrollers

Pre-requisite
Microprocessors and Microcontrollers

Module I (13 hours)

Module II (13 hours)
Real time operating systems: Task and Task States, tasks and data, Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS. OS services. I/O subsystems. Network operating system. Real time embedded system OS.OS security- Real-Time Embedded Software Development

Module III (13 hours)

Module IV (13 hours)
Embedded system development: Interfacing of external Memory. Interfacing Analog and digital blocks, interfacing of different peripheral devices such as LED, LCD, Graphical LCD, Switches, Relay, stepper motors, ADC, DAC and various sensors. Introduction to-assembler, compiler, cross compilers and Integrated Development Environment (IDE).
Text Books
4. K.J. Ayala ,The 8051 Microcontroller , Penram International
5. J B Peatman, Design with PIC Microcontrollers, Prentice Hall
6. Dhananjay Gadre ,Programming and Customizing the AVR Microcontroller,MGH

Reference Books
6. Microchip Manual for PIC 18F 452

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 704(D): NANOTECHNOLOGY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To provide basic knowledge about nano/microdevices, mathematical modeling of
electromechanical systems and applications

Module I (11 hours)
Biological analogies of Nano and Micro-electromechanical systems (NMEMS)-Fabrication of
MEMS- assembling and packing –applications of NMEMS

Module II (15 hours)
Mathematical models and design of NMEMS- NMEMS architecture-electro magnetics and its
applications is NMEMS –Molecular and Nano structure dynamics-molecular wires and molecular
circuits- thermo analysis and heat equation.

Module III (14 hours)
Carbon nanotubes and nono devices-structural design of nano and MEM actuators and sensors-
configurations and structural design of motion nano and micro-structures.

Module IV (12 hours)
Algebra of sets-direct current micro machines-mathematical models of induction motors-micro
synchronous machines-single phase reluctance motors-stepper motors-synchronous reference
frames-control of NMEMS

Text Books

Internal Continuous Assessment (Maximum Marks-50)
- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions,
quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks = 40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be
minimum of TWO and maximum of THREE questions from each module with
total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks = 60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 704(E) IMAGE AND VIDEO PROCESSING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give ideas & techniques of image & video processing
- To impart knowledge about image filtering, restoration & reconstruction

Pre-requisite
Digital Signal Processing

Module I (11 hours)

Module II (15 hours)

Module III (14 hours)
Image Analysis & Computer Vision: Spatial feature extraction, Transform features, Edge detection, Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation, Classification Techniques.

Module IV (12 hours)
Text Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions  8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions  4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 705(A) SOFT COMPUTING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To acquaint the students with the important soft computing methodologies- neural networks, fuzzy logic, genetic algorithms and genetic programming

Module I (12 Hours)

MODULE II (14 Hours)


Module III (13 Hours)

Module IV (13 Hours)

Text Books
Reference Books
1. Fakhreddine O.Karray & Clarence De Silva, Intelligent Systems Design, Theory, Tools and Application, Pearson Education
4. T.Ross, Fuzzy Logic with Engineering Applications, TMH
6. John Yen, Reza Lengari, Fuzzy Logic- Intelligence, Control and Information, Pearson Education

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks=40 marks

PART B: Analytical/ DESCRIPTIVE questions
Two questions from each module with choice to answer one question.

4 x 15 marks=60 marks

Maximum Total Marks: 100
EE13 705(B) HIGH SPEED DIGITAL DESIGN

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give the basic ideas involved in high speed digital design
- To understand the transmission line effects and cross talk and the effects of terminations & vias

Module I (13 hours)
Introduction to high-speed digital design - frequency, time and distance - capacitance and inductance effects - high speed properties of logic gates - speed and power - measurement techniques - rise time and bandwidth of oscilloscope probes - self inductance, signal pickup and loading effects of probes - observing crosstalk

Module II (13 hours)
Transmission line effects and crosstalk - transmission lines - point to point wiring - infinite uniform transmission lines - effects of source and load impedance - special transmission line cases - line impedance and propagation delay - ground planes and layer stacking - crosstalk in solid ground planes, slotted ground planes and cross-hatched ground planes - near and far end crosstalk

Module III (13 hours)
Terminations and vias - terminations - end, source and middle terminations - AC biasing for end terminations - resistor selection - crosstalk in terminators - properties of vias - mechanical properties of vias - capacitance of vias - inductance of vias - return current and its relation to vias

Module IV (13 hours)
Stable reference voltage and clock distribution - stable voltage reference - distribution of uniform voltage - choosing a bypass capacitor - clock distribution - clock skew and methods to reduce skew - controlling crosstalk on clock lines - delay adjustments - clock oscillators and clock jitter

Text Books

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
### University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/ DESCRIPTIVE questions**  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 705(C) ANTENNA THEORY AND DESIGN

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the concepts of different types of antennas and antenna arrays-analysis & synthesis
- To develop understanding about design and modeling of antenna using computational methods

Pre-requisites: Radiation & Propagation

Module I (13 hours)

Module II (13 hours)
Types of Antennas: Traveling - wave antennas, Helical antennas, Biconical antennas, slave antennas, and Principles of frequency independent Antennas, spiral antennas, and Log - Periodic Antennas. Aperture Antennas- Techniques for evaluating Gain, reflector antennas - Parabolic reflector antenna principles, Axi -symmetric parabolic reflector antenna, offset parabolic reflectors, dual reflector antennas, Gain calculations for reflector antennas, feed antennas for reflectors, field representations, matching the feed to the reflector, general feed model, feed antennas used in practice.
Microstrip Antennas-Introduction, rectangular patch, circular patch, bandwidth, coupling, circular polarization, arrays and feed network

Module III (13 hours)

Module IV (13 hours)
CEM for Antennas: Introduction to computational electromagnetics, Introduction to method of moments-Pocklington’s integral equation, source modeling, weighted residuals.Introduction to Finite Difference Time Domain Method-Finite difference and Yee’s algorithm, cell size, numerical stability and dispersion. Absorbing boundary conditions. Introduction to geometrical optics
Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8 x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 705(D) ELECTRONIC PACKAGING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
- Introduction to packaging technologies, technology drivers, electrical performance, thermal management, materials, optoelectronics, RF integration, reliability, system issues, assembly, and testing.

Module I (14 hours)
Electrical Design - Interconnect Capacitance, Resistance and Inductance fundamentals - Transmission Lines (basic concepts) - Clock Distribution - Noise Sources - power Distribution – signal distribution – EMI - Digital and RF Issues

Module II (14 hours)
Thermal Management - Heat-transfer fundamentals - Thermal conductivity and resistance - Conduction, convection and radiation – Cooling requirements
Reliability - Basic concepts - Environmental interactions - Thermal mismatch and fatigue – failures – thermo mechanically induced – electrically induces – chemically induced

Module III (12 hours)
Single chip packaging – functions, types, materials processes, properties, characteristics, trends
Multi chip packaging – types, design, comparison, trends
IC assembly – purpose, requirements, technologies – wire bonding, TAB, flip chip
Wafer level packaging - technologies, reliability, wafer level burn – in and test

Module IV (12 hours)
Passives – discrete, integrated, embedded – encapsulation and sealing – fundamentals, requirements, materials, processes
PWB – fundamentals, standards, limitations – microvia boards – PWB assembly – SMT- Through hole assembly – design challenges
Testing - Need for testing – Electrical testing – design for test
Text Books

Reference Books

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<tr>
<td>10% - Regularity in the class</td>
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University Examination Pattern

**PART A:** *Analytical/problem solving SHORT questions*  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** *DESCRIPTIVE questions*  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 705(E) BIO MEDICAL INSTRUMENTATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart knowledge about the principle and working of different types of biomedical electronic equipments/devices

Module I (13 hours)
Electrical activity of excitable cells-SD curve-functional organization of the peripheral nervous system-electrocardiogram (in detail with all lead systems)-electroencephalogram-electromyogram -electroneurogram- electrode –electrolyte interface-polarisation-polarisable and non polarisable electrodes- surface electrodes –needle electrodes-micro electrodes- practical hints for using electrodes- skin-electrodes’ equivalent circuit-characteristics of bio-amplifiers

Module II (13 hours)

Module III (13 hours)

Module IV (13 hours)
Physiological effects of electricity-important susceptibility parameters-macro shock hazards-micro shock hazards-protection against shock-electrical isolation- electrical safety analyzers-measurements of pH,pC2, and PO2

Text Books
2. Handbook of Biomedical Instrumentation, Tata-Mc graw Hill, New Delhi

Reference Books
2. Encyclopedia of Medical Devices and Instumentation Wiley

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
### University Examination Pattern

**PART A:**  **DESCRIPTIVE solving SHORT questions**  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:**  **Analytical/DESCRIPTIVE questions**  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 706(P) VLSI DESIGN LAB

Teaching Scheme
3 hours practical per week

Credits: 2

PART A
1. Comparators using different models
2. Multiplexers & Demultiplexers
3. Shift Registers
4. Ripple adder & Carry look ahead adder
5. Sequence generator & Detector
6. Implementation of a RAM

PART B
7. P and N MOS transistors, \( I_D - V_{DS} \) Characteristics, Extraction of \( V_T \) and body effect factor
8. DC transfer characteristics of an inverter
9. Buffer & Ring Oscillator
10. XOR using different logic styles - comparison
11. Single stage CS amplifiers - their responses for different types of load
12. Single stage source follower - their responses for different types of load
13. Current mirror circuits

Note: (i) A minimum of 10 experiments must be conducted, at least four from each part
(ii) Experiments in part – B should include layout of at least two circuits and their verification

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<td>60% - Laboratory practical and record</td>
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<tr>
<td>30% - Test/s</td>
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<tr>
<td>10% - Regularity in the class</td>
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<th>Semester End Examination (Maximum Marks-100)</th>
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<tr>
<td>70% - Procedure, conducting experiment, results, tabulation, and inference</td>
</tr>
<tr>
<td>20% - Viva voce</td>
</tr>
<tr>
<td>10% - Fair record</td>
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EC13 707(P) COMMUNICATION SYSTEMS LAB

Teaching scheme
3 hours practical per week

Credits: 2

Section 1: Microwave Experiments
1. Klystron characteristic o/p power and frequency versus repeller voltage
3. Characteristics of directional coupler
4. VSWR measurements (high and low).

Section 2:
1. Sampling and reconstruction of low pass signals and verification of Sampling theorem
2. Delta modulation and demodulator
3. Generation and detection of BASK, BFSK, BPSK signals.
4. Matched filter receiver

Section 3:
1. Spreader and De-spread
2. Generation of Manchester and Differential codes
3. Generation of Hamming codes and cyclic codes

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Tests
10% - Regularity in the class

Semester End Examination (Maximum Marks-100)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EC13 708 (P) PROJECT

Teaching scheme  Credit: 4
4 hours practical per week

Objectives

- To judge the capacity of the students in converting the theoretical knowledge into practical systems/investigative analysis.

Project work is for duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. The project work may be undertaken in electronics/ communication / computer / instrumentation / biomedical engineering or any allied area and must have relevance in electronics and communication engineering. Project evaluation committee consisting of the guide and three/four faculty members specialised in the above field shall perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40% of the work has to be completed in the seventh semester.

Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

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<td>20% - Technical relevance of the project</td>
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<tr>
<td>40% - Literature survey and data collection</td>
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<td>20% - Progress of the project and presentation</td>
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<td>10% - Report</td>
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<td>10% - Regularity in the class</td>
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</table>
EC13 801 DATA AND COMMUNICATION NETWORKS

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Objectives
- To give the basic ideas of data communication networks-queuing theory, architecture and protocol
- To understand the concept of switching networks

Module I (10hours)
Queueing Theory: Markov chain-discrete time and continuous time Markov chains- Poisson Process M/M/1 Queue Little’s formula M/M/m queueing models. Layered Architectures in Data networks: OSI standards architecture and protocols.

Module II (14hours)
Data link layer-ARQ retransmission strategies Flow control and congestion control in network layer-error control, stop and wait, Sliding windows, Automatic Repeat (ARQ) Asynchronous Protocols, - X MODEM, Y MODEM, Synchronous protocols – Character Oriented and Bit oriented protocols (HDLC). Routing functions and routing algorithm shortest path routing virtual circuit and datagram networks.TCP/IP protocols

Module III (14 hours)
Local Area Networks IEEE 802 standards CSMA/CD, Random access Aloha-pure and slotted aloha Random access using CSMA/CD. Ethernet, Token Bus, Token ring, FDDI .ATM Networks, . Routing in ATM networks, Distributed Queue Dual Bus, SONET, SDH- X .25 Protocols

Module IV (14 hours)
Text Books
3. Bertsekas D. & Gallager R., [Data Networks] Prentice Hall of India
7. Schwartz M., Telecommunication Networks-Protocols, Modeling and Analysis, Addison Wesley Publishing Company

References
1. Flood J E., Telecommunication Switching Traffic and Networks, Pearson Education Pvt Ltd.
2. Freeman R L., Telecommunication System Engineering, Wiley Inter Science Publications

Internal Continuous Assessment (Maximum Marks=50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8 x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 802 ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 4

Section 1: Engineering Economics

Teaching scheme
1 hour lecture and 1 hour tutorial per week

Objective
The prime objective of the Engineering Economics course is to make students familiar with the economic way of thinking. This course provides the students with the foundations of economic theory, tools and techniques for use in the process of efficient economic decision-making in their engineering and managerial profession.

Module I (13 Hrs)

Introduction to Engineering Economics - Technical efficiency, Economic efficiency - Cost concepts: Elements of costs, Opportunity cost, Sunk cost, Private and Social cost, Marginal cost, Marginal revenue, Profit maximisation, Break-even analysis.


Module II (13 Hrs)


Investment criteria: Pay Back Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.
Text Books


Reference Books


Internal Continuous Assessment (Maximum Marks-25)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

PART A: Analytical/problem solving SHORT questions 4x 5 marks=20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of ONE and maximum of TWO questions from each module with total FIVE questions.

PART B: DESCRIPTIVE questions 2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 50

Note: Section 1 and Section 2 are to be answered in separate answer books
Maximum 50 marks each for Section 1 and Section 2
Section 2: Principles of Management

Teaching scheme
1 hour lecture and 1 hour tutorial per week

Objective
- To provide knowledge on principles of management, decision making techniques, accounting principles and basic management streams

Module I (13 hours)
Principles of management - Evolution of management theory and functions of management
Organizational structure - Principle and types. Decision making - Strategic, tactical & operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree
Human resource management - Basic concepts of job analysis, job evaluation, merit rating, wages, incentives, recruitment, training and industrial relations

Module II (13 hours)

Reference Books
1. F. Mazda, Engineering management, Addison Wesley, Longman Ltd., 1998
2. Lucy C Morse and Daniel L Babcock, Managing engineering and technology, Pearson, Prentice Hall
8. Weist and Levy, A Management guide to PERT and CPM, Prantice Hall of India

Internal Continuous Assessment (Maximum Marks-25)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class
**University Examination Pattern for Section 2**

**PART A:**  *Analytical/problem solving SHORT questions*  \(4 \times 5 \text{ marks}=20 \text{ marks}\)

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of ONE and maximum of TWO questions from each module with total FIVE questions.

**PART B:**  *Analytical/ DESCRIPTIVE questions*  \(2 \times 15 \text{ marks}=30 \text{ marks}\)

Two questions from each module with choice to answer one question.

\[ \text{Maximum Total Marks: 50} \]

**Note:**  *Section 1 and Section 2 are to be answered in separate answer books*

Maximum 50 marks each for Section 1 and Section 2
EC13 803 WIRELESS MOBILE COMMUNICATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
- To provide a strong background in the basics of wireless mobile communication
- To impart knowledge about the existing GSM and CDMA mobile communication technology

Module I (13Hrs)
Cellular concept -frequency reuse- co channel interference-adjacent channel interference- power control for reducing interference-improving capacity in cellular systems-cell splitting-sectoring- hand off strategies-channel assignment strategies- Trunking and Erlang capacity calculations.

Module II (13Hrs)
Mobile radio propagation- free space propagation model- ground reflection model- large scale path loss- small scale fading and multipath propagation-impulse response model of a multi- path channel- parameters of a mobile multipath channel- multi path delay spread-doppler spread-coherence bandwidth- coherence time- time dispersion and frequency selective fading-frequency dispersion and time selective fading.

Module III (13Hrs)
Fundamental concepts of spread spectrum systems-performance of direct sequence spread spectrum systems- analysis of DSSS- processing gain and anti jamming margin-frequency hopped spread spectrum systems. Multi user detection in CDMA. RAKE receiver concepts, Diversity , combining methods - space time processing.

Module IV (13Hrs)
Standards of wireless communication systems- GSM, IMT -2000, UMTS, Wideband CDMA, Wi-Fi, Wi-Max. GSM architectures, objectives, servicing frequency bands-GSM sub systems, Radio link features in GSM. Introduction to multi carrier communication: OFDM, MC CDMA.

Text Books:
2. Andrea Goldsmith, Wireless Communications, Cambridge University press
3. Vijay k Garg, Joseph E Wilkes, Principles and Applications of GSM, Pearson Education

Reference books:
1. Kamilo Feher, Wireless Digital Communication, PHI.
### Internal Continuous Assessment (Maximum Marks-50)

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Component</th>
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<tr>
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<td>Tests (minimum 2)</td>
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<tr>
<td>30%</td>
<td>Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.</td>
</tr>
<tr>
<td>10%</td>
<td>Regularity in the class</td>
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</tbody>
</table>

### University Examination Pattern

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/DESCRIPTIVE questions  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 804(A) INTRODUCTION TO MEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To prepare students for a career as power system engineers with a basic understanding of modern tools and practices
- To impart an understanding of the activities in load dispatch centers
- To install an awareness of current research topics

Module I (12 hours)
Optimization: Unit Commitment- Problem Definition- System constraints- Priority ordering-Dynamic programming
Optimal Power Flow - Problem statement- Lagrangian Solution method- Algorithm- How violations of control and dependant variables are treated
Hydrothermal scheduling- Problem modeling and statement - Discretization- solution algorithm

Module II (14 hours)
Control area concepts -P-f control of single control area- ACE- Two area control- tie line bias control - extension to pool operation or multi control area systems
Deregulated power system - Restructure models - functional units - GENCOS, DISCOS, TRANSCOS, ISO, PX, TSP - Transmission open access- Power wheeling- ABT-Distributed generation and spot prices, Micro grid, smart grid (Basic concepts only)

Module III (13 hours)
Power System Security: Definition- Security functions- State transition diagram- selection of contingency and modeling for analysis- Contingency analysis using (a) sensitivity method- derivation of generalized constants- Analysis of a contingency case of removal of a line or transformer of series impedance ZS (b) using ac load flow method

Module IV (13 hours)
State Estimation: Introduction to SCADA - block diagram concept -definition of state estimation and requirement for an estimator- Problem statement and LSE and weighted LSE - Basic solution-Sequential solution- extension to power system

Text books
2. O. L. Elgerd, Electrical Energy System Theory: An Introduction ,TMH
3. J. Wood, B. F. Woollenberg, Power Generation, Operation & Control, Wiley-India
4. Dr.Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley Inc. 2001

Reference Books
2. John J. Grainger, W. D. Stevenson, Power System Analysis, TMH
4. S. Sivanagaraju, G. Sreenivasan, Power System Operation And Control, Pearson Education
5. Dr. K. Uma Rao, Power system Operation And Control, Wiley-india
### Internal Continuous Assessment *(Maximum Marks-50)*

- **60%** - Tests (minimum 2)
- **30%** - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10%** - Regularity in the class

### University Examination Pattern

**PART A:** *Analytical/problem solving SHORT questions*  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** *Analytical/ DESCRIPTIVE questions*  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 804(B) PHOTONIC SWITCHING AND NETWORK

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give ideas about photonic switching and associated circuits
- To impart knowledge about design and analysis of common optical systems and networks

Module I (13 hours)
Introduction: Overview of the architectures and principles of optical systems and networks; Access networks; LANS, WANS & MANS; SONET, SDH and ATM.
Components for Optical Networks: Fused fibre devices such as couplers, WDMs and WFCs; filters and WDMs such as interference filters, Fabry Perot etalons and Bragg gratings; optical isolators; integrated optic modulators and switches; wavelength converters, Dispersion Compensating techniques.

Module II (14 hours)
Optical Amplifiers (EDFAs and SOAs): Principles of operation; gain characteristics; wavelength characteristics, cross talk and wavelength conversion; noise characteristics and noise figure; characteristics of amplifiers cascades.

Module III (12 hours)
Design and Analysis of Optically Amplified links: systems performance analysis and power budget analysis for BERs of 10^9 for optically Amplified links.

Module IV (13 hours)
Design and Analysis of Common Optical Systems and Networks: Power budgets, issues of component specification and tolerances; PONs, BPOFs, WDM systems, wavelength routing networks and all optically switched systems. Optical Fiber impairment issues like: higher order dispersion, fiber nonlinearities in optical systems and Networks, optical solitons.

Text Books
2. OptSim/OptiSystem Manuals.
3. Abdellatif Marrakchi, —Photonic Switching and Interconnects, Marcel Dekker, November 1993

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

8x 5 marks=40 marks

**PART B: Analytical/ DESCRIPTIVE questions**

Two questions from each module with choice to answer one question.

4 x 15 marks=60 marks

*Maximum Total Marks: 100*
EC13 804(C) MICROWAVE ACTIVE DEVICES AND CIRCUITS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To develop understanding about design & analysis of various microwave active circuits
- To impart knowledge about MICs and MMICs

Pre-requisites: EC09 702 Microwave Engineering

Module I (13 hours)
Active Microwave Circuits-Noise in microwave circuits-source of noise, noise power and equivalent noise temperature, noise figure; detectors and mixers-diode rectifiers and detectors, single ended mixer, balanced mixer, types of mixers; PIN diode and control circuits-single pole switches, phase shifters

Module II (13 hours)
Microwave amplifiers and oscillators-Characteristics of transistors-FETs, bipolar transistors; gain and stability. Single stage amplifier design-design for maximum gain and low noise amplifiers, broadband amplifier design, oscillator design

Module III (13 hours)
Microwave filters-Periodic structures-analysis, k-/- diagram and wave velocities; filter design by image parameter method-image impedance and transfer functions for two port networks, constant k-filter sections, m-derived filter sections, composite filters, filter transformations-impedance and frequency scaling, bandpass and bandstop transformations; coupled line filters, filter using coupled resonators

Module IV (13 hours)
Microwave Integrated circuits-hybrid MICs, Monolithic MICs, MIC materials-substrate, conductor, dielectric materials, types of MICs, hybrid versus monolithic MICs
Text Books

Reference Books
1. O.P.Gandhi, Microwave design engineering and applications, Elsevier Science,1991

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks = 40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks = 60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 804(D) MOBILE COMPUTING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give basic concepts of mobile computing
- To impart knowledge about various wireless systems, LANs and Mobile IP

Module I (13 hours)

Module II (13 hours)
WLANs (Wireless LANs) - Wi-Fi-IEEE 802.11- architecture-services- IEEE 802.11a & 802.11b standard-HIPERLAN-, Bluetooth -IEEE 802. 15-WiMAX-IEEE 802.16

Module III (13 hours)

Module IV (13 hours)
Wireless Application Protocol (WAP): The Mobile Internet standard-architecture-components of WAP standard WAP Gateway and Protocols-WAP2.0- wireless mark up Languages (WML)-basics

Text Books
2. William stallings, 'Wireless communications & Networks', 2nd Ed, Pearson education, New Delhi, 2005
3. Lin, 'Wireless & Mobile Architectures', Wiley India, New Delhi, 2009

Reference Books
2. A F Molisch, Wireless communications', Wiley India, 2005
3. Ivan Stojmenovic, 'Handbook of Wireless Networks and Mobile Computing', Wiley India, New Delhi, 2002
4. Steele, 'GSM, CDMAOne & 3G systems Wiley India, New Delhi, 2008
**Internal Continuous Assessment (Maximum Marks-50)**

- **60%** - Tests (minimum 2)
- **30%** - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10%** - Regularity in the class

**University Examination Pattern**

**PART A:** Analysitical/problem solving SHORT questions  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/ DESCRIPTIVE questions  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 804(E) DATA STRUCTURES AND ALGORITHMS

Teaching scheme  
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To give ideas of basic data structures
- To impart knowledge about algorithm specification

Module I (14 hours)

Module II (13 hours)
Linked Lists - Linked stacks and queues - Doubly linked lists - Polynomial representation using linked lists, Strings – Data representation – Pattern matching.

Module III (14 hours)

Module IV (11 hours)
Text Books
1. Classic Data Structures: Samanta, PHI
2. Data Structures and program design in C: Robert Kruse, Pearson Education Asia
3. An introduction to Data Structures with applications: Trembley & Sorenson, McGraw Hill

Reference Books
2. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum
4. Algorithms + Data Structures & Programs: N.Wirth, PHI
5. Data structures in Java: Thomas Standish, Pearson Education Asia

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/ DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100
EC13 805(A) MULTIMEDIA COMMUNICATION SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart knowledge in audio/video standards and different types of multimedia networks and technology.

Module I (14hours)

Module II (14 hours)

Module III (11hours)
Speech coding standards-Audio coding standards-Still image compression standards-Multimedia conferencing standards. MPEG-1and -2 compression
MPEG -4 and -7

Module IV (14hours)

Text Books

Reference Books
2. Ralf Steinmetz, Multimedia Fundamentals, Pearson Education
**Internal Continuous Assessment** *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

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**University Examination Pattern**

**PART A:** Analytical/DESCRIPTIVE SHORT questions  
*8 x 5 marks = 40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/DESCRIPTIVE questions  
*4 x 15 marks = 60 marks*

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 805(B) PROBABILITY AND RANDOM PROCESSES

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
To impart knowledge on tools and skills in probability theory for solving engineering problems

Module I (12 hours)
Introduction to Probability Theory
Experiments - sample spaces and Events - axioms of Probability - Assigning Probabilities - joint
and conditional probabilities - Baye's theorem - independence - Discrete random variables - Bernoulli
- Binomial - poisson - Geometric

Module II (13 hours)
Random Variables, Distributions and density functions
The Cumulative distribution function - Probability density function - gaussian Random variable -
Uniform random variable - exponential -Laplace - gamma - erlang -Chi - squared -Rayleigh -
Rician -Cauchy

Module III (13 hours)
Operations on a single Random Variable
Expected value of a random variable - expected values of functions of random variable - Moments -
central moments - conditional expected values - probability generating functions -Moment
generating functions

Module IV (14 hours)
Random Processes
Definition and classification of Processes - Mathematical tools for studying random processes -
stationary and ergodic random processes - Properties of the Auto correlation function - gaussian
random processes - Definition and examples of Markov Processes - calculating transition and state
probabilities in Markov chains.
**Text Books**

**Reference Books**
2. X. Rong Li, Probability, Random Signals, and Statistics

**Internal Continuous Assessment (Maximum Marks-50)**
- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

**University Examination Pattern**

**PART A:** Analytical/problem solving SHORT questions  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** Analytical/ DESCRIPTIVE questions  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 805(C) CRYPTOGRAPHY AND NETWORK SECURITY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basic concepts of network security
- To develop understanding about various cryptography schemes and securing networks.

Pre-requisites: EC09 801 Data Communication & Network

Module I (13 hours)
Overview: Services, Mechanisms and attacks, OSI security architecture, Model for network security.
Block Ciphers and DES (Data Encryption Standards): Simplified DES, Block cipher principles, DES.
Strength of DES, Block cipher design principles, Block cipher modes of operation, Problems.

Module II (13 hours)
Public Key Cryptography and RSA: Principles of public key cryptosystems, RSA algorithm, Problems.
Other Public Key Crypto Systems and Key Management: Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Problems.

Module III (13 hours)

Module IV (13 hours)
Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator.
IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security pay load), Security associations, Key management, Problems.)
Firewalls: Firewall design principles; Trusted systems, Problems.

Text Books

Reference Books
**Internal Continuous Assessment** *(Maximum Marks-30)*

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class

**University Examination Pattern**

**PART A:** *Analytical/problem solving SHORT questions*  
8x 5 marks = 40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B:** *Analytical/ DESCRIPTIVE questions*  
4 x 15 marks = 60 marks

Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 805(D) ADVANCED SEMICONDUCTOR DEVICE TECHNOLOGY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- A very basic expose to students on sub-micron device technology & to discuss the alternate options in devices

Module I (13 hours)
Sub micron MOSFET – effects - junction depth – oxide thickness – depletion widths – isolation – MOSFET device design – scaling – non scaling effects – channel engineering
SOI MOSFET - Strained silicon – realisation – features – Low temperature CMOS

Module II (13 hours)
MESFET – Basic structure – DC characteristics – basic design – small signal operation – Large signal operation – digital operation
Hetero structures – Silicon based HBT – GaAlAs/GaAs HBT - modulation doped structures
Free & confined electrons -1D & 3D space – partially confined electrons – Quantum dots wires and wells - logic realisation using QD – conductivity in metallic nanowires

Module III (13 hours)
Tunnelling effect – tunnelling diode - Resonant tunnelling devices – Digital circuits using RTD – memories – basic gates
Coulomb blockade - Single Electron Transistor - Circuit design
Ballistic transport – quantum resistance – CNT transistors – spin transport – spintronic devices

Module IV (13 hours)
Production of nanolayers – PVD –CVD- Epitaxy – Ion implantation – formation of SiO2 layer – characterisation – applications
Fabrication of nanostructures– lithography–nano imprint lithography –split gate technology– self assembly

Reference Books
2. George W Hanson, Fundamentals of nanoelectronics, Pearson Education
3. Sze S. M , High Speed Semiconductor Devices, Wiley interscience
4. Fahrner, Nanotechnology & Nanoelectronics , Springer
   Goser, Glosekotter, Dienstuhl,, Nanoelectronics& Nanosystems, Springer

Internal Continuous Assessment (Maximum Marks-50)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
### University Examination Pattern

**PART A: Analytical/problem solving SHORT questions**  
8x 5 marks = 40 marks  
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

**PART B: Analytical/ DESCRIPTIVE questions**  
4 x 15 marks = 60 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 100*
EC13 805(E) ADVANCED DIGITAL SIGNAL PROCESSING

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To give ideas of multirate systems and filter banks
- To impart knowledge about wavelet transforms & their applications

Pre-requisite

EC09 501 Digital Signal Processing

Module I (14 hours)

Multirate system fundamentals: Basic multirate operations, up-sampling and down sampling: Time domain and frequency domain analysis, Identities of multirate operations, Interpolator and decimator design, Rate conversion, Polyphase representation.

Module II (14 hours)

Multirate Filter banks: Maximally decimated filter banks, Quadrature mirror filter (QMF) banks, Polyphase representation, Errors in the QMF banks: Aliasing and Imaging Method of cancelling aliasing error, Amplitude and phase distortion, Prefect reconstruction (PR) QMF banks, PR condition, M-channel perfect reconstruction filter banks, Paraunitary PR Filter Banks

Module III (14 hours)

Wavelets: Fundamentals of signal decomposition - brief overview of Fourier transform and short time Fourier transform - time frequency resolution - Continuous wavelet transform - different wavelets- DWT - wavelet decomposition - approximation of vectors in nested linear vector spaces - example of MRA - orthogonal wavelet decomposition based on the Haar wavelet - digital filter implementation of the Haar wavelet decomposition

Module IV (11 hours)

Wavelet applications: Image compression - EZW algorithm - Audio compression - signal denoising techniques- different types- edge detection. Lossless compression

Text Books

1. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, Delhi, 2004
2. K. P. Soman and K. I. Ramachandran, Insight into Wavelets, Prentice Hall of India, New Delhi, 2004

Reference Books

**Internal Continuous Assessment (Maximum Marks-50)**

- **60%** - Tests (minimum 2)
- **30%** - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- **10%** - Regularity in the class

<table>
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<th>University Examination Pattern</th>
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<tbody>
<tr>
<td><strong>PART A:</strong> Analytical/problem solving SHORT questions</td>
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<tr>
<td>Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.</td>
</tr>
<tr>
<td><strong>PART B:</strong> Analytical/Problem solving DESCRIPTIVE questions</td>
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<tr>
<td>Two questions from each module with choice to answer one question.</td>
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<tr>
<td><em>Maximum Total Marks: 100</em></td>
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EC13 806(P) SEMINAR

Teaching scheme
3 hours per week

Credits: 2

Objective

- To assess the ability of the student to study and present a seminar on a topic of current relevance in electronics/communication/computer/biomedical/instrumentation engineering or allied areas.

It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members will evaluate the seminar.

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<thead>
<tr>
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<td>20% - Relevance of the topic and literature survey</td>
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<td>50% - Presentation and discussion</td>
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<tr>
<td>20% - Report</td>
<td></td>
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<tr>
<td>10% - Regularity in the class and Participation in the seminar</td>
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</tr>
</tbody>
</table>
EC13 807 (P) PROJECT

Teaching scheme: 7 hours practical per week
Total Credits: 4
- Credits for interim evaluation: 2
- Credits for final evaluation: 2

Objectives
- To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model or a system.

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation.

Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide, and three/four faculty members specialised in electrical power system / machines/ electronics/ computer/ instrumentation/ biomedical Engg. etc.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

<table>
<thead>
<tr>
<th>Internal Continuous Assessment (Maximum Marks - 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40% - Design and development/Simulation and analysis</td>
</tr>
<tr>
<td>30% - Presentation &amp; demonstration of results</td>
</tr>
<tr>
<td>20% - Report</td>
</tr>
<tr>
<td>10% - Regularity in the class</td>
</tr>
</tbody>
</table>
EE13 808 (P) VIVA VOCE

Credits: 4

Objective
- To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. Course, mini project, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level. For final viva-voce, candidates should produce certified reports of mini project, seminar, and project (two interim reports and main report). If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

Allotment of marks for viva-voce shall be as given below.

<table>
<thead>
<tr>
<th>Assessment in Viva-voce (Maximum marks – 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40% - Subjects</td>
</tr>
<tr>
<td>30% - Project and Mini Project</td>
</tr>
<tr>
<td>20% - Seminar</td>
</tr>
<tr>
<td>10% - Industrial training/industrial visit/educational tour or Paper presented at National-level</td>
</tr>
</tbody>
</table>