SCHEME AND SYLLABI

FOR

THIRD TO EIGHTH SEMESTERS

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM
# Scheme for ECE Branch of Calicut University – 2009

## Third Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
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<th>Sem. End Duration - Hrs</th>
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## Fourth Semester

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<td>Entrepreneurship</td>
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<td>Speech &amp; Audio Processing</td>
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<td>Photonic Switching And Network</td>
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<td>Image &amp; video Processing</td>
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<td>Data Structures &amp; Algorithms</td>
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### GLOBAL ELECTIVES

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<td>Probability and Random process</td>
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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 wealths of ideas and results with wide area of application.

Module I: Functions of a Complex Variable (13 hours)

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-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:** *Short answer questions (one/two sentences)*  
5 x 2 marks=10 marks  
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** *Analytical/Problem solving questions*  
4 x 5 marks=20 marks  
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*  
4 x 10 marks=40 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 76*
EN09 302: HUMANITIES AND COMMUNICATION SKILLS  
(COMMON TO ALL BRANCHES)

Objectives

- To identify the most critical issues that confronted particular periods and locations in history;
- To identify stages in the development of science and technology;
- To understand the purpose and process of communication;
- To produce documents reflecting different types of communication such as technical descriptions, proposals, and reports;
- To develop a positive attitude and self-confidence in the workplace; and
- To develop appropriate social and business ethics.

Module I (8 hours)

Humanities, Science and Technology: Importance of humanities to technology, education and society- Impact of science and technology on the development of modern civilization.

Module II (9 hours)

Concept of communication: The speaker/writer and the listener/reader, medium of communication, barriers to communication, accuracy, brevity, clarity and appropriateness
Reading comprehension: Reading at various speeds, different kinds of text for different purposes, reading between lines.
Listening comprehension: Comprehending material delivered at fast speed and spoken material, intelligent listening in interviews
Speaking: Achieving desired clarity and fluency, manipulating paralinguistic features of speaking, task oriented, interpersonal, informal and semi formal speaking, making a short classroom presentation.
Group discussion: Use of persuasive strategies, being polite and firm, handling questions and taking in criticisms on self, turn-taking strategies and effective intervention, use of body language.

Module III (10 hours)

Written Communication: Note making and taking, summarizing, notes and memos, developing notes into text, organization of ideas, cohesion and coherence, paragraph writing, ordering information in space and time, description and argument, comparison and contrast, narrating events chronologically. Writing a rough draft, editing, proof reading, final draft and styling text.
Project report: Reference work, General objective, specific objective, introduction, body, illustrations using graphs, tables, charts, diagrams and flow charts. Conclusion and references
Preparation of leaflets, brochure and C.V.

Module IV (9 hours)
Human relations and Professional ethics: Art of dealing with people, empathy and sympathy, hearing and listening. Tension and stress, Methods to handle stress
Responsibilities and rights of engineers- collegiality and loyalty – Respect for authority – Confidentiality – conflicts of interest – Professional rights, Rights of information, Social responsibility
Senses of ethics – variety of moral issues – Moral dilemma – Moral autonomy – Attributes of an ethical personality – right action – self interest

Reference Books
2. Jayashree Suresh and B S Raghavan, Professional Ethics, S Chand and Company Ltd, 2005
3. Subrayappa, History of Science in India, National Academy of Science, India
6. Jovan van Emden and Lucinda Becker, Effective Communication for Arts and Humanities Students, Palgrave macmillam, 2009
9. Larson E, History of Inventions, Thompson Press India Ltd.
11. Encyclopedia Britannica, History of Science, History of Technology

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: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one
EC09 303: NETWORK ANALYSIS & SYNTHESIS

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Credits: 5

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 (21 hours)

Module II (18 hours)

Module III (16 hours)
Filters- Introduction and basic terminology –types of filtering-L.P filter basics-Butterworth LP filter transfer characteristics- Basic passive realization of Butterworth transfer functions. Frequency transformations- Transformation to high pass, band pass and band elimination. Chebyshev filters – Characteristics-poles of the Chebyshev function

Module IV (17 hours)
Synthesis: positive real functions - driving point functions - Brune's positive real functions - properties of positive real functions - testing driving point functions - application of maximum module theorems - properties of Hurwitz polynomials - even and odd functions - Strum's theorem - driving point synthesis - RC elementary synthesis operations - LC network synthesis - properties of RC network functions - foster and Cauer forms of RC and RL networks
Text Books
1. Van Valkenberg, *Network Analysis*, Prentice Hall of India

Reference Books
1. Choudary D R, *Networks and Systems*, New Age International

Internal Continuous Assessment (Maximum Marks 30)
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: Short answer questions (one/two sentences) 5 x 2 marks = 10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks = 20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks = 40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 76
Note: More than 75% of the questions shall be analytical/problem oriented types.
EC09 304: SIGNALS AND SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
- To give basic ideas about different signals and systems
- To impart basic knowledge about the representations and transforms of the signals

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 description, convolution- impulse response- representation of LTI systems- differential equation and difference equation representation of LTI systems.

Module II (15 hours)
Fourier representation of continuous time signals- Fourier transform- existence of the Fourier integral- FT theorems- 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)
Fourier representation of discrete time signals- discrete Fourier series and discrete Fourier transform- Laplace transform analysis of systems- relation between transfer function and differential equation- causality and stability- inverse system- determining the frequency response from poles and zeros.

Module IV (13 hours)
Z-transform- definition- 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.

Text Books

1. S. Haykin and B. V. Bean, Signals and Systems, John Wiely & Sons, NY

Reference Books
OBJECTIVE

- **This subject exposes the students to digital fundamentals.**
- **After studying this subject the student will be able to design, analyze and interpret combinational and sequential digital circuits of medium complexity.**

**Module I (15 Hours)**

- Boolean algebra: Theorems and operations- Boolean expressions and truth tables- Multiplying out and factoring expressions- Exclusive-OR and equivalence operations.
- Combinational logic design using truth table- Minterm and Maxterm expansions- Incompletely specified functions.
- Minimization Techniques: Algebraic Method, Karnaugh maps – Quine-McCluskey method-
- Multi output circuits- Multi-level circuits- Design of circuits with universal gates.

**Module II (15 hours)**

- Number Representation: Fixed point - floating point - 1’s complement - 2’s complement.
- **Synthesis of combinational logic functions using MSIs - multiplexers- demultiplexers- decoders- encoders**
- **Introduction to TTL and ECL logic families:** Basic working of a TTL NAND gate- characteristics of a TTL NAND gate- important specifications – Basic working of ECL gate- Transfer characteristics of a ECL NAND gate- important specifications

**Module III (12 Hours)**

- **Shift Registers:** right shift- left shift- bi directional- SISO- SIPO- PISO- PIPO- universal shift registers.

Module IV (12 Hours)

Synchronous sequential circuits: Finite State Machines- Mealy & Moore types- Basic design steps- Design of counters, sequence generators, and sequence detectors - Design of simple synchronous machines – state minimization- ASM charts

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<tr>
<td>4. Taub and Schilling, <em>Digital principles and applications</em>, TMH</td>
</tr>
<tr>
<td>5. Volnei A Pedroni, <em>Digital electronics and design with VHDL</em>, Elsevier</td>
</tr>
</tbody>
</table>

**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: Short answer questions (one/two sentences)*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

*PART B: Analytical/Problem solving questions*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

*PART C: Descriptive/Analytical/Problem solving questions*

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

*Maximum Total Marks: 70*
Teaching scheme

Module I (14 hours)

Module II (12 hours)
Principle of indicating instruments – moving coil, moving iron and dynamometer type instruments – extension of range of ammeter and voltmeter using current transformer and voltage transformer – principle and working of induction type energy meter

Module III (14 hours)

Module IV (14 hours)

Text Books

Reference Books
**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences)  \[ 5 \times 2 \text{ marks} = 10 \text{ marks} \]

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  \[ 4 \times 5 \text{ marks} = 20 \text{ marks} \]

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  \[ 4 \times 10 \text{ marks} = 40 \text{ marks} \]

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

**Internal Continuous Assessment** *(Maximum Marks: 30)*

- **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

**Note:** More than 75% of the questions shall be analytical/problem oriented types.
EC09 307(P) DIGITAL ELECTRONICS LAB

Teaching Scheme
3 hours practical per week

Objective

- 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, Deconder 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/s
10% - Regularity in the class

Semester-End Examination (Maximum Marks-50)

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
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

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

Semester-End Examination (Maximum Marks-50)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
Objective

Objective of this course is 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. Also it is intended to stimulate the students understanding of the Z-transform. A study of some important partial differential equations is also included to make the student get acquainted with the basics of PDE.

Module I: Probability Distributions (13 hours)

Module II: Z Transforms (14 hours)

Module III: Series Solutions of Differential Equations (14 hours)

Module IV: Partial Differential Equations (13 hours)
Introduction – Solutions of equations of the form $F(p,q) = 0$ ; $F(x,p,q) = 0$ ; $F(y,p,q) = 0$ ; $F(z,p,q) = 0$ ; $F_1(x,q) = F_2(y,q)$ ; 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 – D’Alembert’s solution of one dimensional wave equation.
**Text Books**

**Module I:**
Richard A Johnson, CB Gupta, *Miller and Freund’s Probability and statistics for Engineers, 7e*, 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:**
Sections: 10.1, 10.2, 10.3, 10.4, 10.5.1, 10.5.2, 10.5.3, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.12, 10.5.13, 10.6, 10.10

**Module III:**
Sections: 4.1, 4.3, 4.4, 4.5

**Module IV:**
Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9
Sections: 11.2, 11.3, 11.4, 9.8 Ex.3, 11.5

**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

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**University Examination Pattern**

**PART A:** *Short answer questions (one/two sentences)*  
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** *Analytical/Problem solving questions*  
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*  
4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EN09 402: ENVIRONMENTAL SCIENCE
(Common for all branches)

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 3

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

Module I (8 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 defects 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 land slides, soil erosion and desertification.

Module II (8 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 ecosystem- Forest ecosystem- Grassland ecosystem –Desert ecosystem-Aquatic ecosystem(ponds, streams, lakes, rivers, oceans , estuaries)
Biodiversity and its consideration
Introduction- Definition: genetic, species and ecosystem diversity-Biogeographical; classification of India –value of biodiversity: consumptive use, productive use, social ethical , aesthetic and option values Biodiversity at Global, national , and local level-India at mega –diversity nation-Hot spot of biodiversity-Threats to biodiversity: habitat loss, poaching of wild life, man , wild life conflicts –Endangered and endemic species of India-Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Module III (10 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-Role of an individual in prevention of pollution-pollution case studies-Disaster management: floods , earth quake, cyclone and landslides-Environmental impact assessment
Module IV (10 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, water shed 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 recycling of products-Value education.

Text Books


Reference Books.

2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, Email: mapin@icenet.net
4. Down to Earth, Centre for Science and Environment
5. Hawkins, R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay

Internal Continuous Assessment (Maximum Marks-30)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as Report of field work, literature survey, seminar etc.
10% - Regularity in the class

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.
EC09 403: ELECTRONIC CIRCUITS

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Credits: 5

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 (20 hours)
Resistors: concepts of fixed & variable resistors, metal film resistors, wire wound resistors - construction, power rating & tolerance
Capacitors: different types, Construction of mica and ceramic capacitors (disc & tubular), colour code, electrolytic (Teflon) capacitors
Inductors: construction of single layer, multilayer and variable inductors, principle of low power transformers
Diode applications - diode clipping and clamping circuits, voltage multiplier circuits, Rectifiers: Half wave and full wave rectifiers – derivation of rectifier specifications like PIV, DC output voltage, ripple factor, efficiency, rectification factor – analysis of filters with rectifiers – L, C, LC and pi filters
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
BJT circuit models - small signal low frequency and small signal high frequency models of BJT: hybrid model, T model and hybrid π model - effect of temperature on BJT model parameters - equivalent circuits of CC, CB and CE configurations - current gain - voltage gain - input and output impedances
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 response

Module II (18 hours)

Module III (17 hours)
Analysis of UJT Characteristics and relaxation Oscillator JFET – structure and VI characteristics - biasing of JFET -- analyses of common source and common drain amplifier configurations - biasing in ICs Positive feedback and oscillators - analysis and design of RC phase shift, Wien - bridge, Colpitt’s, Hartley and crystal oscillators - stabilization of oscillations Differential Amplifiers-The BJT differential pair-Large and small signal operation- Large and small signal operation-Non ideal characteristics of the differential amplifier- Differential amplifier with active load- concept of CMRR - methods to improve CMRR - Frequency response analysis.

Module IV (17 hours)
Pulse response switching characteristics of a BJT - BJT switches with inductive and capacitive loads - non saturating switches - emitter follower with capacitive loading - Bistable multivibrator – principles & analysis-fixed bias and self biased transistor bistable circuit-triggering methods-Schmitt trigger analysis of emitter coupled circuit. Monostable and astable multivibrators - collector coupled monoshot - emitter coupled monosbot - triggering the monoshot - collector coupled and emitter coupled astable multivibrator – analysis of sweep circuits-principles of miller and bootstrap circuits

Text Books

Reference Books
9. Spencer & Ghausi, *Introduction to Electronic Circuit Design*; Pearson Education
Objectives
- To impart the basic concepts of basic analog modulation schemes
- To develop understanding about performance of analog communication system

Module I (14 hours)
- Concept of probability
- Random Variables
- Statistical Averages
- Central limit theorem
- Joint distribution and density functions
- Conditional distribution functions
- Random process
- Stationary process
- Mean, correlation and Covariance functions
- Power spectral density
- Ergodic

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

Note: One of the assignments shall be simulation of circuits using any SPICE tool.

University Examination Pattern

PART A: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
Module II (14 hours)
Introduction to continuous wave modulation - needs of modulation - Amplitude modulation-modulators and transmitters (low level, medium & high power) - spectrum - Demodulation. DSBSC signals - spectrum, modulators demodulators. SSB signals - spectrum, modulators demodulators. - VSB - signal and spectra - modulation and demodulation. Signal to Noise ratio in amplitude modulated systems.
Angle modulation - FM & PM (narrowband & wideband) - Transmission bandwidth. Generation of FM (direct indirect methods). De-emphasis & pre-emphasis. Signal to Noise ratio in Angle modulated systems

Module III (13 hours)
Receivers for continuous wave modulation - Tuned Radio Frequency Receiver - A detailed study about Super heterodyne Receiver - Special purpose receivers - double conversion receivers - receiver specifications - Frequency Translation, FDM - FM stereo multiplexing - Phase locked loop operation - synchronous detection and frequency synthesis - FM Receiver - threshold effect

Module IV (13 hours)
Noise - sources of noise - thermal shot and flicker noises - white noise - signal to noise ratio - noise factor - noise equivalent band width - effective noise temperature - Narrow band noise - Representation of narrowband noise in terms of In phase and Quadrature Components - Noise in CW modulation Systems - Noise in linear Receivers using Coherent detection - Noise in AM Receivers using Envelope detection - Noise in FM Receivers

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

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<td>60%</td>
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<tr>
<td>10%</td>
<td>Regularity in the class</td>
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</table>

**Note:** One of the assignments shall be simulation of continuous systems using any technical

**Text Books**

1. Simon Haykin, ‘Communication Systems’ Wiley India, New Delhi, 4Ed., 2008

**Reference Books**

5. Dennis Roddy and John Coolen, ‘Electronic Communication Systems’ PHI
**Internal Continuous Assessment (Maximum Marks-30)**

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

**Note:** One of the assignments shall be simulation of continuous systems using any technical

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**University Examination Pattern**

**PART A:**  Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:**  Analytical/Problem solving questions  
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:**  Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EC09 405: Computer Organization and Architecture

Objectives

• To impart the basic idea of memory & system organisation and architecture of computers
• To develop the basic understanding & programming concepts of 8085 microprocessor

Module I (14 hours)
Design methodology- the register level- the processor level components and design-Processor basics-CPU Organization-Instruction set instruction formats-types and programming considerations.Data path design-fixed point arithmetic –various operations-arithmetic & logic units-combinational and sequential ALUs-Control design-Hardwired control-micro programmed control

Module II (13 hours)
Memory Organization-memory technology-Device Characteristics-Random access memories-serial access memories-Memory systems-multi level memories-Address translation memory allocation-caches-features-address mappings-Structure versus performance

Module III (14 hours)
System Organization -communication methods-basic concepts, bus control-I/O and system control-Programmed I/O DMA and interrupts; I/O processors-Parallel processing-Processor level parallelism-multiprocessors-shared bus systems

Module IV (13 hours)
Introduction to Microprocessor architecture, 8085 architecture, Instruction set, Counter and timing delays, stacks and subroutines, code conversion, Interrupts, basic Interfacing concepts-Memory mapped and I/O mapped I/O
### Text Books
2. Ramesh S Gaonkar -8085 Architecture and programming, Wiley Eastern

### Reference Books
2. M Morris Mano; Computer system Architecture, (3rd Edition), PHI /Pe
3. Heuring & Jordan: Computer system Design& Architecture, Addison Wesley

### Internal Continuous Assessment (Maximum Marks-30)
- **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:** *Short answer questions (one/two sentences)*  
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** *Analytical/Problem solving questions*  
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*  
4 x 10 marks = 40 marks

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

*Maximum Total Marks: 76*
EC09 406: SOLID STATE DEVICES

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 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 (15 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 - schottky barrier - rectifying and ohmic contacts - tunnel diode - varactor diode - zener diode - GaAs isotype diodes - Metal semiconductor junctions-Heterojunctions.

Module III (13 hours)

Bipolar junction transistors-Minority carrier distribution and terminal currents-the coupled diode model-charge control analysis -switching -Drift in the base region,Base narrowing ,Avalanche breakdown,Kirk effect-frequency limitations of transistor -capacitance and charging times-Hetero junction bipolar transistors. Junction FET - pinch off and saturation - gate control - VI characteristics

Module IV (13 hours)

MOS capacitor - accumulation, depletion and strong inversion - threshold voltage - MOSFET - p channel and n channel MOSFETs - depletion and enhancement mode MOSFETs - substrate bias effects - floating gate MOSFETs - short channel effects Power Diodes - SCR- Insulated Gate Bipolar Transistor – Power MOSFETs

Text Books

2. Sze S M, Physics of Semiconductor Devices, Wiley India
5. Sima Dimitrijev, Physics of Semiconductor Devices, Oxford University Press

Reference Books

1. Sah C T, Solid State Electronics, World Scientific
2. Neamen, Semiconductor Physics & Devices, Pearson Education
3. Muller & Camins, Device Electronics for Integrated Circuits, John Wiley
4. Dipankar Nagchoudhuri : Microelectronic Devices, Pearson Education
**Internal Continuous Assessment** *(Maximum Marks-30)*

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<tr>
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**Note:** One of the assignments shall be problems involving the theory of devices.

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**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*

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**EC09 407(P) ELECTRONIC CIRCUITS LAB**

**Teaching scheme**

3 hours practical per week

**Credits:** 2

1. Rectifiers with C, LC & CLC filters - half wave, full wave & Bridge
2. Clipping, Clamping circuits & voltage multipliers with diodes
3. Series Voltage regulator with short circuit and fold back protection
4. JFET characteristics in CS and CD modes
5. MOSFET characteristics in CS and CD modes
6. Emitter follower with & without complementary transistors - frequency and phase response for a capacitive load
7. RC coupled amplifier - frequency response - with and without feedback
8. UJT characteristics & the relaxation oscillator
9. Phase shift oscillator using BJT
10. Hartley / Colpitts oscillator using BJT
11. Single BJT crystal oscillator
12. Power amplifier - Class A & Class AB
13. Cascode amplifier - frequency response
14. Multivibrators using BJT
15. Sweep Circuits

**Note:**
(i) A minimum of **10** experiments must be conducted
(ii) Each experiment will have two parts – a simulation part (Using SPICE tool) and a hardware realisation part

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

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

### Semester-End Examination (Maximum Marks-50)

- **70%** - Procedure, conducting experiment, results, tabulation, and inference
- **20%** - Viva voce
- **10%** - Fair record
EC09 408 (P) Analog Communication Labs

Teaching scheme
3 hours practical per week

1. AM generation
2. AM detection with simple and delayed AGC
3. Balanced modulator for DSB –SC signal
4. Mixer using JFET/BJT
5. FM generation (reactance modulator)
6. FM demodulation
7. PAM generation and demodulation
8. Implementation of intermediate frequency amplifier
9. FM demodulation using PLL
10. AM generation and demodulation using opamps/IC multipliers
11. SSB generation and demodulation using integrated circuits

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

Note: A term project, comprising of an application oriented electronic circuit, is to be designed and completed as part of this practical subject.

Semester-End Examination (Maximum Marks-50)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EC09 501: Digital Signal Processing

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Credits: 5

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

Module I (18 hours)
Review of Discrete Fourier series and Discrete Time Fourier Transform-Frequency domain sampling- Discrete Fourier Transform-Properties-Circular convolution-Lineal convolution using DFT-Lineal filtering of long data sequences- Overlap add and overlap save methods- Computation of DFT-Decimation in Time and Decimation in Frequency algorithms

Module II (18 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 (18 hours)

Module IV (18 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
2. B Venkataramani & M.Bhaskar, Digital Signal Processors-Architecture,
3. Programming and Applications, Tata Megraw Hill
**Internal Continuous Assessment (Maximum Marks-30)**

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

**Note:** One of the assignments shall be simulation of filters using MATLAB

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**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences)  
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.  
$5 \times 2 \text{ marks} = 10 \text{ marks}$

**PART B:** Analytical/Problem solving questions  
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.  
$4 \times 5 \text{ marks} = 20 \text{ marks}$

**PART C:** Descriptive/Analytical/Problem solving questions  
Two questions from each module with choice to answer one question.  
$4 \times 10 \text{ marks} = 40 \text{ marks}$

Maximum Total Marks: 70

**Note:** More than 75% of the questions shall be analytical/problem oriented types.
EC09 502: Quantitative Techniques for 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 (14 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-

Module2 (14 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-30)*

- **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

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**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EC09 503: 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 (13 hours)


Static electric & Magnetic field: Electrical scalar potential- different types of potential distribution- Potential gradient- Energy stored-Boundary conditions Capacitance-Steady current and current density in a conductor-Equation of continuity- energy stored in magnetic fields-Magnetic dipole- Electric and Magnetic boundary conditions- vector magnetic potential-Magnetic field intensity.

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.

Module III (16 hours)

Guided waves between parallel planes- transverse electric and transverse magnetic waves and its characteristics- , linear elliptical and circular polarization, 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)

Transmission lines & Waveguides: -Transmission line equations- transmission line parameters- Skin effect- VSWR- Characteristic impedance- Stub matching- Smith chart - Phase velocity and group velocity Theory of waveguide transmission-Rectangular waveguides- TE modes-TM modes- mathematical analysis- circular wave guide- modes of propagation- dominant modes- cut off wave length cavity resonators-applications

Text Books


Reference Books

## Internal Continuous Assessment *(Maximum Marks-30)*

- **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

<table>
<thead>
<tr>
<th>PART A: Short answer questions (one/two sentences)</th>
<th>5 x 2 marks=10 marks</th>
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<tbody>
<tr>
<td>All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.</td>
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<table>
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<tr>
<th>PART C: Descriptive/Analytical/Problem solving questions</th>
<th>4 x 10 marks=40 marks</th>
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<tr>
<td>Two questions from each module with choice to answer one question.</td>
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Maximum Total Marks: 70
EC09 504: DIGITAL COMMUNICATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Module I (13 hours)
Analog pulse modulation-generation and demodulation of PAM/TDM Systems, PPM and PWM- Sampling theorem for band limited and band pass signals-Signal Reconstruction- Practical difficulties in Signal Reconstruction- PCM- Quantization-Signal to noise ratio for quantized pulses-uniform and nonuniform quantization-compressing-μ Law and A Law characteristics-DPCM, Delta modulation, Adaptive Delta modulation-Line codes-NRZ, RZ, Phase encoded, Multilevel binary

Module II (13 hours)
Pulse shaping- Inter symbol interference- Nyquist’s Criterion for distortion less Base Binary Transmission- Signaling with duobinary pulses- eye diagram- Equalizer- Transversal Equalizer- Zero forcing Equalizer- Decision Feedback Equalizer- Preset and Adaptive Equalizer- Scrambling and descrambling- Geometric Representation of Signals- Schwarz inequality- Gram-Schmidt Orthogonalization Procedure

Module III (16 hours)
Optimum receiver- Conversion of continuous AWGN channel into a vector channel- Likelihood Functions- Maximum Likelihood receiver- Matched filter- correlation receiver-decision procedure- Optimum receiver of colored noise-carrier and symbol synchronization- Fundamental concepts of spread spectrum systems-pseudo noise sequence-performance of direct sequence spread spectrum systems-analysis of direct Sequence spread spectrum systems- the proing gain and anti jamming margin-frequency hopped spread spectrum systems –time hopped spread spectrum systems-time synchronisation

Module IV (12 hours)
Digital modulation schemes- coherent binary schemes- ASK, FSK, PSK, MSK and coherent M- ary schemes –calculation of average probability error for different modulation schemes-power spectra of digitally modulated signals-performance comparison for different modulation schemes
Text Books

Reference Books
1. Simon Haykin, ‘Digital Communication’, Wiley India
2. Bruce Carlson, Communication Systems; McGraw Hill

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: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
EC09 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)
Software architecture of the 8086/8088 microprocessors-Address space, Data organization, registers, memory segmentation and addressing, stack, I/O space, Assembly language programming and program development.

Module II (14 hours)
8086/88 microprocessor architecture-min/max mode- Coprocessor and Multiprocessor configuration - hardware organization of address space-control signals andl/I/O interfaces-Memory devices, circuits and sub system design – various types of memories, wait state and system memory circuitry.

Module III (14 hours)
I/O interfacing circuits –Hand shaking, serial and parallel interfacing-Address decoding-Interfacing chips-Programmable peripheral interfacing (8255)-Programmable communication interface(8251)-Programmable timer(8253)-DMA controller(8237/8257)-Programmable interrupt controller(8259)-Keyboard display interface(8279)

Module IV (13 hours)
Intel 8051 microcontroller-CPU operation-Memory space-Software overview-Peripheral overview-Interrupt- timers parallel port inputs and outputs-serial port-low power special modes of operation-Introduction to ARM processors –features of ARM 7 and 9 processors

Text Books

Reference Books
1. Intel Data Book vol.1, Embedded Microcontrollers and Processors
2. Hall D.V., Microprocessors and Interfacing McGraw Hill
3. Mohammed R.,Microprocessor& Microcomputer based system design,Universal Book stall
**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

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**University Examination Pattern**

**PART A:** *Short answer questions (one/two sentences)*

5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

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

4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*

4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EC09 506: LINEAR INTEGRATED CIRCUITS

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 3

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 (9 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 (9 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-Delyiannis-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 (9 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 (9 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

### Reference Books
2. Schumann & Valkenberg, *Design of Analog Filters*, Oxford University Press

### Internal Continuous Assessment (Maximum Marks 30)
- **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 & Participation in the class

**Note:** One of the assignments shall be simulation of OP-AMP circuits using any SPICE tool.

### University Examination Pattern

**PART A:** Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EC09 507(P) MICRO PROCESSOR & 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: 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-50)
70% - Procedure and tabulation form, Conducting experiment, results and inference
20% - Viva voce
10% - Fair record
EC09 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 - Delayannis 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: 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-50)
70% - Procedure and tabulation form, Conducting experiment, results and inference
20% - Viva voce
10% - Fair record
EC09 601: VLSI DESIGN

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Credits: 5

Objectives
- To study the issues in devices used for VLSI design
- To introduce the various building blocks and test methods in a digital integrated circuit 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 (18 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 inverters - resistive load, Saturated NMOS load, Depletion NMOS load, pseudo MOS - CMOS inverters-robustness and performance – capacitance components - charge sharing – buffer design – power dissipation - CMOS ring oscillator

Module II (18 hours)
CMOS logic Styles - clocking strategies - Design & implementation of Adder – Full adder, Dynamic adder, Carry bypass adder, Carry select adder, Square root carry selector adder, Carry look head adder - Multipliers, and array multipliers - Multiplexers - Memory elements- SRAM, DRAM, ROM, Sense amplifiers – Differential, Single ended - Reliability and testing of VLSI circuits – General concept, CMOS testing - Test generation methods

Module III (18 hours)

Module IV (18 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 and bipolar technologies –early bipolar process-advanced bipolar processes 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
**Text Books**
1. Weste & Harris, *CMOS VLSI Design*, Pearson Education
2. Plummer, Deal & Griffin, *Silicon VLSI Technology*, Pearson Education

**Reference Books**

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**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:** Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks  
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks = 20 marks  
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks  
Two questions from each module with choice to answer one question.

**Maximum Total Marks:** 70
Section 1: Engineering Economics

Objective
Impart fundamental economic principles that can assist engineers to make more efficient and economical decisions.

Module I (14 Hrs)

Module II (13 Hrs)

Text books

<table>
<thead>
<tr>
<th>Internal Continuous Assessment (Maximum Marks-15)</th>
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<tbody>
<tr>
<td>60% - Tests (minimum 2)</td>
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<tr>
<td>30% - 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% - Regularity in the class</td>
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</tbody>
</table>
Section 2: Principles of Management

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 (14 hours)
References
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-15)
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 – for Section 2
Note: Section 1 and Section 2 are to be answered in separate answer books

PART A: Short answer questions (one/two sentences) 2 x 2 marks=4 marks
1 x 1 mark = 1 mark
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 2 x 5 marks=10 marks
Candidates have to answer two questions out of three. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 2 x 10 marks=20 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 35
EC09 603: RADIATION & PROPAGATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- 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 (14 hours)
Antenna Arrays: Introduction, various forms of antenna arrays, arrays of point sources, nonisotropic 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-Tchebyscheff arrays, tapering of arrays, binomial arrays, continuous arrays, rectangular arrays, superdirective arrays.

Module III (14 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 Book**


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**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

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**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences)  
5 x 2 marks=10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks=20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks=40 marks

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

*Maximum Total Marks: 70*
EC09 604: CONTROL SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basic theory behind the analysis of continuous and discrete control systems in time and frequency domains
- To introduces concepts about the state space modelling of systems.

Module I (14 hours)

Module II (16 hours)
1. Time Domain analysis:
   - Analysis of Continuous Time systems-Transient and steady State Responses-Standard Test Signals-Response comparisons for various Root locations in the S-plane-Time Domain Solutions of First order systems- Step Response of Second order system –Time domain specifications – Relationships between Damping ratio and the amount of Overshoot for a second Order system
   - Effects of derivative and Integral Control on the Transien
   - Performance of feed back Control systems.
   - Steady state Response-steady state error –computations of S. S
   - Error –error constants.
   - Construction of root locus.
2. Frequency Domain Analysis:

Module III (12 hours)
Modeling of discrete-time systems-sampling-mathematical derivations for sampling-sample and hold-Z transforms- properties-solutions of difference
Equations using Z-transforms-example of sampled data systems –mapping between s plane and z plane –cyclic and multi-rate sampling (definitions only) –analysis of discrete time systems-pulse transfer function-examples-stability –Jury’s criterion –bilinear transformation-stability analysis after bilinear transformation –stability analysis Routh-Hurwitz techniques-

Module IV (12 hours)
State Space Analysis: Introduction-Definitions and explanations of the terms STATE, STATE VARUABLES,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**

2. Dorf R.C& Bishop R.H.,Modern Control Systems”,Addison Wesley

**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
Objectives

- To provide 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 (10 hours)

- Solution to Maxwell’s equation in a circularly symmetric step index optical fiber – single mode and multimode fibres
- 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 (8 hours)

- Optical source – LED and laser diode
- Concepts of line width–phase noise – switching and modulation characteristics
- Typical LED and LD structures – optical detectors
- Principles of operation – concepts of responsivity and quantum efficiency

Module III (9 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

University Examination Pattern

<table>
<thead>
<tr>
<th>PART A</th>
<th>Short answer questions (one/two sentences)</th>
<th>5 x 2 marks = 10 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART B</th>
<th>Analytical/Problem solving questions</th>
<th>4 x 5 marks = 20 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PART C</th>
<th>Descriptive/Analytical/Problem solving questions</th>
<th>4 x 10 marks = 40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two questions from each module with choice to answer one question.</td>
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</tbody>
</table>

Maximum Total Marks: 70

Note: More than 75% of the questions shall be analytical/problem oriented types.

EC09 605: Optical Communication

Teaching scheme

- 2 hours lecture and 1 hour tutorial per week

Credits: 3

Module I (10 hours)

- Solution to Maxwell’s equation in a circularly symmetric step index optical fiber – single mode and multimode fibres
- 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 (8 hours)

- Optical source – LED and laser diode
- Concepts of line width–phase noise
- Switching and modulation characteristics
- Typical LED and LD structures
- Optical detectors
- Principles of operation
- Concepts of responsivity and quantum efficiency

Module III (9 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 (9 hours)
Optical amplifiers—semiconductor amplifier-rate earth doped fiber amplifier (with special reference to erbium doped fibers) — broad band EDFA Raman amplifier-Brillouim amplifier-principles of operation-, WDM & DWDM Optical System, Optical Networks – SONET/SDH

Text 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:  Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B:  Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C:  Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 76
EC09 701: Information Theory and Coding

Objectives

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

Module I (18 hours)
Information theory- information and entropy-properties of entropy of a binary memory less source-extension of a binary memory less source – source coding theorem-Shannon fano coding-Huffman coding –Lempel ziv coding-discrete memoryless source-binary symmetric channel –mutual information-properties-channel capacity –channel coding theorem

Module II (18 hours)
Introduction to algebra-groups-fields-binary field arithmetic-construction of Galois field-basic properties-computations-vector spaces-matrices-BCH codes-description-coding & decoding –Reed Solomon codes-coding & decoding

Module III (18 hours)
Coding –linear block codes-generator matrices-parity check matrices-encoder-syndrome and error correction-minimum distance-error correction and error detection capabilities-cyclic codes-coding and decoding

Module IV (18 hours)

Teaching scheme

4 hours lecture and 1 hour tutorial per week

Credits: 5

Text Books

1. Simon Haykins, Communication Systems, John Wiley

Reference Books

1. Das J, Malik A.K., Chatterjee P. K., Principles of Digital Communications, New Age International
2. Simon Haykin, Digital Communications, John Wiley
4. Tomasi, Electronic Communications, Fundamentals Through Advanced, Pearson education
5. Sklon, Digital Communications, Pearson education
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.

University Examination Pattern

**PART A**: Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B**: Analytical/Problem solving questions  
4 x 5 marks = 20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C**: Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks
Two questions from each module with choice to answer one question.

**Maximum Total Marks: 76**

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**EC09 702: Microwave Engineering**

**Teaching scheme**  
3 hours lecture and 1 hour tutorial per week

**Credits**: 4

**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 (14 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 (15 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, varators, 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 (12 hours)
Planer transmission lines such as stripline, microstrip line, slotline etc. technology of hybrid MICs, monolithis MICs. Comparison of both MICs. VSWR measurement, microwave power measurement, impedance measurement, , frequency measurement, concept of microwave communication-repeater-frequencies

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 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:  Short answer questions (one/two sentences)  \[ 5 \times 2 \text{ marks} = 10 \text{ marks} \]
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B:  Analytical/Problem solving questions  \[ 4 \times 5 \text{ marks} = 20 \text{ marks} \]
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C:  Descriptive/Analytical/Problem solving questions  \[ 4 \times 10 \text{ marks} = 40 \text{ marks} \]
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

EC09 703: ANALOG & MIXED MOS CIRCUITS

Teaching scheme  
3 hours lecture and 1 hour tutorial per week  

Credits: 4

Objectives
• To impart the concepts of analog & mixed circuit design using MOS transistors

Module I (13 hours)
Active & passive components of basic CMOS technology – parasitics – limitations of CMOS technology
Analog MOS models-small signal, large signal & sub threshold models

Module II (14 hours)

Module III (13 hours)
CMOS operational amplifiers – design of single stage & two stage operational amplifiers – compensation – cascode op amps
Switched capacitor circuits - Switched capacitor amplifiers - Switched capacitor integrators
Module IV (14 hours)
Switched capacitor filters – switched capacitor implementation of ladder filters
Digital phase locked loops - phase detector (XOR & phase frequency detectors) – Charge pump PLL – non ideal effects - voltage controlled oscillator (current starved & source coupled CMOS configurations) - loop filter
CMOS comparator design –pre amplification-decision and post amplification stages-transient response-clocked comparators-analog multiplier-sample and hold circuits

Text Books
1. Allen & Holberg, CMOS Analog Circuit Design, Oxford University Press
2. Razavi B., Design of Analog CMOS integrated Circuits., Tata McGraw Hill

Reference Books
1. Mohammed Ismail& Terri Fiez, Analog VLSI-Signal& Information Processing,MGH
2. Roubik Gregorian& Gabor C Temes, Analog MOS Integrated Circuits for Signal Processing , John Wiley & Sons

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: Short answer questions (one/two sentences)  5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions  4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions  4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 76
Objective
After learning this subject students must be able to simulate and implement typical combinational and sequential digital systems in PLDs and express the design in VHDL.

Prerequisite
A good knowledge in digital electronics

Module I (8 hours)

Module II (10 hours)
Introduction to VHDL: Entities and architectures- Behavioral, Data flow and structural descriptions- Identifies, Data objects, Data types and attributes- Delay models- Delta delays- VHDL codes for simple combinational and sequential circuits- State machine Design, simple examples

Module III (10 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 (8 hours)
Hazards - Static and Dynamic hazards- Design of hazard free circuits. Elementary ideas of Clock skew, synchronizer failure and metastability

Text Books
2. Perry D.L, VHDL, McGraw Hill

Reference Books
1. John F Wakerly, Digital design principles & practices, Pearson Education.
2. Roth C.H.Jr., Digital system Design using VHDL, PWS Pub.co
3. Kevin Skahill 'VHDL for Programmable Logic' Pearson Education
4. Volnei A Pedroni, Digital electronics and design with VHDL, Elsevier
5. Sudhakar Yalamanchili, Introductory VHDL from simulation to synthesis, Pearson Education.
EC09 707(P) COMMUNICATION SYSTEMS LAB

Teaching scheme
3 hours practical per week

Credits: 2

Microwave and optical experiments

1. Klystron characteristics o/p power & frequency versus repeller voltage
2. Measurement of frequency and wavelength
3. Slotted line measurements. VSWR (Low & High)
4. Measurement of Impedance
5. Antenna radiation pattern measurements
6. Characteristics of isolator
7. Characteristics of Directional coupler
8. Characteristics of Gunn diode

University Examination Pattern

PART A: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

Internal Continuous Assessment (Maximum Marks-30)

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
Optical fibre experiments.

1. To setting up fiber optic analog link.
2. Study of numerical aperture of optical fiber.
3. Study of characteristics of fiber optic LED’s and photo detector.

Hardware
1. Implementation of cyclic code, Hamming code, Gold code generators
2. PN sequence generation
3. Spreader & despreader,
4. Study of Manchester coding and decoding.
5. Study of voice coding and codec chip.

Note: Minimum of 10 experiments, covering all the three sections, must be conducted

<table>
<thead>
<tr>
<th>Internal Continuous Assessment (Maximum Marks-50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% - Laboratory practical and record</td>
</tr>
<tr>
<td>30% - Test/s</td>
</tr>
<tr>
<td>10% - Regularity in the class</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester-End Examination (Maximum Marks-50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70% - Procedure and tabulation form, Conducting experiment, results and inference</td>
</tr>
<tr>
<td>20% - Viva voce</td>
</tr>
<tr>
<td>10% - Fair record</td>
</tr>
</tbody>
</table>

EC09 708 (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 NMOS transistors - $I_{DS}$ - $V_T$ 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

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

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

University Examination (Maximum Marks-50)
70% - Procedure and tabulation form, Conducting experiment, results and inference
20% - Viva voce
10% - Fair record

EC09 709(P): PROJECT

Teaching scheme
1 hour practical per week

Credit: 1

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 science or any allied area. Project evaluation committee consisting of the guide and three/four faculty members specialised in Electronics/Communication/Computer science Engg. will 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 is 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 marks is to be awarded by the guide and 50% by the evaluation committee.

<table>
<thead>
<tr>
<th>Internal Continuous Assessment</th>
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<tbody>
<tr>
<td>20% - Technical relevance of the project :</td>
</tr>
<tr>
<td>40% - Literature survey and data collection :</td>
</tr>
<tr>
<td>20% - Progress of the project and presentation :</td>
</tr>
<tr>
<td>10% - Report :</td>
</tr>
<tr>
<td>10% - Regularity in the class :</td>
</tr>
</tbody>
</table>
EC09 801: Data and Communication Networks

Teaching scheme

4 hours lecture and 1 hour tutorial per week

Credits: 5

Objectives

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

Module I (18 hours)
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-infinite server case State dependent Queues Birth- Death Process M/G/1 Queue

Module II (18 hours)
Layered Architectures in Data networks: OSI standars architecture and protocols X.25 protocol 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 (18 hours)
Local Area Networks IEE 802 standards CSMA/CD,Random access Aloha-pure and slotted aloha Random access using CSMA/CD. Ethernet, Token Bus, Token ring, FDDI ,ATM Networks, Distributed Queue Dual Bus, Switched Multimega Bit Data Service. Routing in ATM networks self routing networks Bense Networks addressing and signaling IP over ATM - SONET, SDH - X .25 Protocols, Architecture And Layers of Protocol,

Module IV (18 hours)
Digital switching networks, Two stage Tree stage and N- stage switches, Combination Switches Blocking probability analysis of multistage switches-Lee’s approximation. Examples of Digital switches-AT & T No.5 ESS switch, DMS-100 switch
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

Reference Books
1 Flood J E., Telecommunication Switching Traffic and Networks, Pearson Education Pvt Ltd.
2 Freeman R L., Telecommunication System Engineering, Wiley Inter Science Publications
3 Das J., Review of Digital Communication, New Age Internal (p) Ltd., Publishers

Internal Continuous Assessment (Maximum Marks-30)
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: Short answer questions (one/two sentences) 5 x 2 marks = 10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks = 20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks = 40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
EC09 802: Wireless Mobile Communication

Teaching scheme

2 hours lecture and 1 hour tutorial per week

Credits: 3

Objectives

- 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 (10hours)

Cellular concept and frequency reuse, Channel assignment and handoff, cochannel interference-adjacent channel Interference –power control for reducing interference –improving capacity in cellular systems-cell splitting –sectoring, , Trunking and Erlang capacity calculations.

Module II (10hours)

Radio wave propagation issues in wireless systems-basic propagation Models- Multipath fading based models, Parameters of mobile multipath channels, Equalization/Rake receiver concepts, Diversity, combining methods and Space-time processing.

Module III (7hours)

Multiple access techniques; FDMA, TDMA and CDMA. Spread spectrum-cellular CDMA. Principles-Power control- WCDMA-multiuser detection in CDMA.

Module IV (9hours)

Standards of wireless communication systems – GSM, IMT- 2000, UMTS. GSM architectures, objectives, servicing frequency bands-GSM sub systems, Radio link features in GSM

Text Books


Reference Books

2. Lee W.C.Y. Mobile Cellular Telecommunication” MGH
**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

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**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences)  \[5 \times 2 \text{ marks}=10 \text{ marks}\]

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  \[4 \times 5 \text{ marks}=20 \text{ marks}\]

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  \[4 \times 10 \text{ marks}=40 \text{ marks}\]

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

*Maximum Total Marks: 76*
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 Electronics/Communication/computer science.

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

<table>
<thead>
<tr>
<th>Internal Continuous Assessment</th>
<th>Total Credits: 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>40% - Design and development/Simulation and analysis</td>
<td>Credits for interim evaluation: 2</td>
</tr>
<tr>
<td>30% - Presentation &amp; demonstration of results</td>
<td>Credits for final evaluation: 5</td>
</tr>
<tr>
<td>20% - Report</td>
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</tr>
<tr>
<td>10% - Regularity in the class</td>
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</tbody>
</table>
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</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</td>
</tr>
<tr>
<td>or Paper presented at National-level</td>
</tr>
</tbody>
</table>
AI09 L25: Probability and Random Processes

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective

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

Module I (12 hours) Introduction to Probability Theory

Module II (14 hours) Random Variables, Distributions and density functions

Module III (14 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

Text Books

Reference Books
4. X. Rong Li, Probability, Random Signals, and Statistics
EC09 805(P): SEMINAR

OBJECTIVE
To assess the ability of the student to study and present a seminar on a topic of current relevance in electronics/communication/computer science. 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.

Internal Continuous Assessment (Maximum Marks-30)

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Component</th>
</tr>
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<tbody>
<tr>
<td>60%</td>
<td>Tests (minimum 2)</td>
</tr>
<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>
</tr>
</tbody>
</table>

Teaching scheme
3 hours per week

University Examination Pattern

- **PART A:** Short answer questions (one/two sentences) 5 x 2 marks=10 marks
  - All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

- **PART B:** Analytical/Problem solving questions 4 x 5 marks=20 marks
  - Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

- **PART C:** Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
  - Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

EC09 805(P): SEMINAR

Credits: 2

Teaching scheme
3 hours per week

OBJECTIVE
To assess the ability of the student to study and present a seminar on a topic of current relevance in electronics/communication/computer science. 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.

Internal Continuous Assessment

<table>
<thead>
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<tr>
<td>20%</td>
<td>Relevance of the topic and literature survey</td>
</tr>
<tr>
<td>50%</td>
<td>Presentation and discussion</td>
</tr>
<tr>
<td>20%</td>
<td>Report</td>
</tr>
<tr>
<td>10%</td>
<td>Regularity in the class and Participation in the seminar</td>
</tr>
</tbody>
</table>
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To teach the students how to reproduce real-world events or process under controlled laboratory conditions, using mainly mathematical models.

Module I (12 hours)
Introduction - systems and models - computer simulation and its applications - continuous system simulation - modeling continuous systems - simulation of continuous systems - discrete system simulation - methodology – event scheduling and process interaction approaches - random number generation - testing of randomness - generation of stochastic variates - random samples from continuous distributions - uniform distribution - exponential distribution m-Erlang distribution - gamma distribution - normal distribution - beta distribution - random samples from discrete distributions - Bernoulli - discrete uniform - binomial - geometric and poisson

Module II (12 hours)
Evaluation of simulation experiments - verification and validation of simulation experiments - statistical reliability in evaluating simulation experiments - confidence intervals for terminating simulation runs - simulation languages - programming considerations - general features of GPSS - SIM SCRIPT and SIMULA.

Module III (15 hours)

Module IV (15 hours)

Reference Books
1. C. Deo N., System Simulation And Digital Computer, Prentice Hall of India.
**Internal Continuous Assessment (Maximum Marks-30)**

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

**Note:** One of the assignments shall be computer based simulation. One of the tests shall be computer based (practical).

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**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences) \n5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions \n4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions \n4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
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 (14 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 (15 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 (12 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-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

Note: One of the assignments shall be Simulation of any active device characteristics using any high frequency tool
EC09 L010: Management Information System

**University Examination Pattern**

<table>
<thead>
<tr>
<th>PART A:</th>
<th>Short answer questions (one/two sentences)</th>
<th>5 x 2 marks=10 marks</th>
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<tbody>
<tr>
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<td>All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.</td>
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<table>
<thead>
<tr>
<th>PART B:</th>
<th>Analytical/Problem solving questions</th>
<th>4 x 5 marks=20 marks</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.</td>
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<thead>
<tr>
<th>PART C:</th>
<th>Descriptive/Analytical/Problem solving questions</th>
<th>4 x 10 marks=40 marks</th>
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<tbody>
<tr>
<td></td>
<td>Two questions from each module with choice to answer one question.</td>
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</table>

*Maximum Total Marks: 70*

**Teaching scheme**

3 hours lecture and 1 hour tutorial per week

**Credits:** 4

**Objectives**

*To create general awareness and exposure of management principles relevant to industrial sector*

**Module I (13 hours)**

Information systems-Functions of management-Level of management–Frame work for information systems-Systems approach-Systems concept- Systems and their environment –Effects of system approach in information system design-Using systems approach in problem solving –Strategic uses of information

**Module II (13 hours)**

An overview of computer hardware and software components –File and database management systems-Introduction to network components-Topologies and types-remote access- The reason for managers to implement networks-Distributed systems- The internet and office communications.

**Module III (14 hours)**

Application of information systems to functional-Tactical and strategic areas if management,decision support systems and expert systems.
Module IV (14 hours)
Information systems planning-Critical success factor-Business system planning-Ends/means analysis-
Organizing the information system plan-System analysis and design-Alternative application
development approaches-organization of data processing- Security and ethical issues of information
systems.

Text Books

Reference Books
1. London K.C & Landon P.J- Management Information Systems:
5. Effy Oz-Management Information Systems,Vikas Publishing

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: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
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 (14 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 switchwes, phase shifters

Module II (14 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, $k\beta$ 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-substate, conductor, dielectric materials, types of MICs, hybrid versus monolithic MICs

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

Text Books

1. Davis M Pozar,’Microwave Engineering’.2nd Ed. Wiley India, 2008
2. Mathrw M Radmanesh,‘radio Frequency and Microwave Electronics Illustrated, Pearson education, New Delhi, 2001

Reference Books

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

**Note:** One of the assignments shall be Simulation of any active device characteristics using any high frequency tool.

<table>
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<td><strong>PART A:</strong> Short answer questions (one/two sentences)</td>
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<td>All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.</td>
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| **PART B:** Analytical/Problem solving questions | 4 x 5 marks=20 marks |
| Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module. |

| **PART C:** Descriptive/Analytical/Problem solving questions | 4 x 10 marks=40 marks |
| Two questions from each module with choice to answer one question. |

*Maximum Total Marks: 70*
EC09 L016: Embedded Systems

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Pre-requisite: EC09 505 Microprocessors and Microcontrollers

Module I (15 hours)

Module II (14 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 (14 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-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: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 76
Objective

- 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 (10 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 (10 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

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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
5. Goser, Glosekotter, Dienstuhl, Nanoelectronics & Nanosystems, Springer
**Internal Continuous Assessment** *(Maximum Marks-30)*

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

**Note:** One of the assignments shall be a literary survey on any topic in this area.

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**University Examination Pattern**

**PART A:** *Short answer questions (one/two sentences)* 
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** *Analytical/Problem solving questions* 
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions* 
4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EC09 L022: 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 (15 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
**Objectives**

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

**Module I (14 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 (14 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
1. Webster J,’ Medical Instrumentation-Application and Design’, John Wiley
2. Handbook of Biomedical Instrumentation, Tata-Migraw Hill, New Delhi

Reference Books
2. Encyclopedia of Medical Devices and Instumentation Wiley

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
IC09 L25 Aerospace Engineering and Navigation Instrumentation

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
To expose the students to the field of aerospace engineering and to impart basic knowledge of its navigation instrumentation.

Prerequisites
Familiarity with control system theory and basic concepts of instrumentation

Module I (15 Hours)
(Introductory treatment of the above topics is only expected, no detailed derivations)

Module II (11 Hours)
Basic engine instruments- Capacitive fuel content- Gauges. Standard atmosphere- Altimeters- Aneroid and radio altimeters. Aircraft compass- Remote indicating magnetic compass- Rate of climb indicator-
Pitot static system- Air speed indicator- Mach meters- Integrated flight instruments- Flight testing-
Recording of flight tests.

Module III (13 hours)
Command and homing guidance systems- Introduction to classical and modern guidance laws- Satellite
navigation systems- GPS and GNSS, Augmented satellite navigation- Hybrid navigation concepts.
Automatic Pilots- Sun sensors- Horizon scanner- Aircraft flight simulation instrumentation.

Module III (15 hours)
Introduction to navigation and guidance instrumentation- Principle, construction and applications of
inertial sensors- Gyroscope and accelerometers- Ring laser gyroscope- Fiber optic gyroscopes, MEMS
gyroscopes and accelerometers- Directional gyros- Rate gyros- Turn and slip indicator. Radar-
continuous wave and frequency modulated radar- MTI and pulse Doppler radar.

Reference Books

4. San Darite, Radio aids to navigation.,

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: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
BM09 L24: Virtual Instrumentation

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart knowledge on the concepts of virtual instrumentation.
- To provide knowledge on the data acquisition

Module 1 (13 hours)
Review of Virtual Instrumentation, Historical perspective, Need of VI, Advantages of VI, Define VI, block diagram & architecture of VI, data flow techniques, graphical programming in data flow, comparison with conventional programming.

Module II (14 hours)
Programming Techniques, VIS & Sub VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local and global variable, string & file input. Data Acquisition basics, ADC, DAC, DIO, Counters & timers, PC Hardware structure, timing, interrupts, DMA, Software and Hardware Installation

Module III (13 hours)
Common Instrument Interfaces for Current loop, Rs 232C/Rs 485, GPIB, System basics, interface basics: USB, PCMCIA, VXI, SCXI, PXI etc, networking basics for office & industrial application VISA & IVI, image acquisition & processing, Motion Control.

Module IV (14 hours)
Use of Analysis Tools, Fourier transforms, Power spectrum, Correlation methods, windowing & flittering. Application of VI: Application in Process Control Designing of equipments like Oscilloscope, Digital Millimeter using Lab view Software, Study of Data Acquisition & control using Lab view Virtual instrumentation for an Innovative Thermal Conductivity Apparatus to measure the Thermal Conductivity Apparatus- to measure the conductivity of non Newtonian fluids white they are subjected to sharing force.

Text Books

Reference Book
Sokoloff , Basic Concepts of Labview, Prentice Hall, New Jersey
Internal Continuous Assessment *(Maximum Marks-30)*

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

Note: One of the assignments shall be a term-project. The term project shall consist of Design of following Virtual Instruments (any two) using a graphical Programming software.

1. Data Acquisition using Virtual Instrumentation from Temperature transducer.
2. Data Acquisition using Virtual Instrumentation from a Pressure Transducer
3. Creation of a CRO using Virtual Instrumentation.
7. Machine Vision concepts using Virtual Instrumentation

University Examination Pattern

**PART A:**  *Short answer questions (one/two sentences)*  
5 x 2 marks = 10 marks  
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:**  *Analytical/Problem solving questions*  
4 x 5 marks = 20 marks  
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:**  *Descriptive/Analytical/Problem solving questions*  
4 x 10 marks = 40 marks  
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
CS09 L25: PATTERN RECOGNITION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To impart a basic knowledge on pattern recognition and to give a sound idea on the topics of parameter estimation and supervised learning, linear discriminant functions and syntactic approach to PR.
- To provide a strong foundation to students to understand and design pattern recognition systems.

Module I (12 hours)
Introduction - introduction to statistical - syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case - 2-category classification - minimum error rate classification - classifiers - discriminant functions - and decision surfaces - error probabilities and integrals - normal density - discriminant functions for normal density

Module II (12 hours)
Parameter estimation and supervised learning - maximum likelihood estimation - the Bayes classifier - learning the mean of a normal density - general bayesian learning - nonparametric technic - density estimation - parzen windows - k-nearest neighbour estimation - estimation of posterior probabilities - nearest-neighbour rule - k-nearest neighbour rule

Module III (12 hours)
Linear discriminant functions - linear discriminant functions and decision surfaces - generalised linear discriminant functions - 2-category linearly separable case - non-separable behaviour - linear programming procedures - clustering - data description and clustering - similarity measures - criterion functions for clustering

Module IV (16 hours)
Syntactic approach to PR - introduction to pattern grammars and languages - higher dimensional grammars - tree, graph, web, plex, and shape grammars - stochastic grammars - attribute grammars - parsing techniques - grammatical inference

Text Books
1. Duda & Hart P.E, Pattern Classification And Scene Analysis, John Wiley

Reference Books
1. Fu K.S., Syntactic Pattern Recognition And Applications, Prentice Hall, Eaglewood cliffs
2. Rajjan Shinghal, Pattern Recognition: Techniques and Applications, Oxford University Press,
**EC09 L08: Introduction to MEMS**

**Teaching scheme**
3 hours lecture and 1 hour tutorial per week

**Credits:** 4

**Objective**
To introduce the following concepts to the students:
- manufacturing of a micro device from material selection to final product design
- the various materials used in microfabrication and their applications
- how basic engineering design can couple with practice manufacturing techniques for getting a MEMS device

**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:** Short answer questions (one/two sentences) $5 \times 2 \text{ marks} = 10 \text{ marks}$
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions $4 \times 5 \text{ marks} = 20 \text{ marks}$
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions $4 \times 10 \text{ marks} = 40 \text{ marks}$
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 76*
- the changes in properties when the dimensions of the system are scaled

Module I (11 hours)


Module II (13 hours)


Module III (16 hours)


Module IV (14 hours)


Text Book

Reference Books
3  J. W. Gardner, *Microsensors: Principles and Applications*

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:** Short answer questions (one/two sentences)  
5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 76*
EC09 L011: 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 (14 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 (14 hours)

Module IV (13 hours)
Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator.
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

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**University Examination Pattern**

- **PART A:** Short answer questions *(one/two sentences)*
  
  All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.
  
  \[5 \times 2 \text{ marks} = 10 \text{ marks}\]

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

  Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

  \[4 \times 5 \text{ marks} = 20 \text{ marks}\]

- **PART C:** Descriptive/Analytical/Problem solving questions

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

  \[4 \times 10 \text{ marks} = 40 \text{ marks}\]

*Maximum Total Marks: 70*
EC09 L014: Internet Technology

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Module I (14 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 (14 hours)

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
2. Greenlaw R & Hepp E, In-line/On-line; Fundamentals Of the Internet And the World Wide Web, Tata Mc Graw Hill
### University Examination Pattern

**PART A:** *Short answer questions (one/two sentences)*

5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

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

4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*

4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*

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### 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
EC09 L017: Photonic Switching and Network

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

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 (15 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, BPONs, 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-30)*

<table>
<thead>
<tr>
<th>Percentage</th>
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<tr>
<td>60%</td>
<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>

One of the assignments shall be Design and analysis using simulation tool OptSim or OptiSystem and Artifex.

## University Examination Pattern

**PART A:** *Short answer questions (one/two sentences)*  
5 x 2 marks = 10 marks  
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** *Analytical/Problem solving questions*  
4 x 5 marks = 20 marks  
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*  
4 x 10 marks = 40 marks  
Two questions from each module with choice to answer one question.

*Maximum Total Marks: 70*
EC09 L20: 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 (14 hours)

Module II (14 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)
Mobile IP-dynamic host configuration protocol-Routing-DSDV-DSR-Alternative metrics

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’, 2ndEd, Pearson education, New Delhi, 2005


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-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

**Note:** One of the assignments shall be a literary survey on any topic in this area.

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University Examination Pattern

**PART A:** Short answer questions (one/two sentences)  
5 x 2 marks=10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks=20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks=40 marks

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

Maximum Total Marks: 70
EC09 L023: Data Structures & 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 (14 hours)
Linked Lists - Linked stacks and queues - Doubly linked lists - Polynomial representation using linked lists, Strings – Data representation – Pattern matching.

Module III (15 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, Augenstei]n & Tanenbaum
4. Algorithms + Data Structures & Programs: N.Wirth, PHI
5. Data structures in Java: Thomas Standish, Pearson Education Asia
**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

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**University Examination Pattern**

**PART A:** *Short answer questions (one/two sentences)*

5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

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

4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*

4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EE09 L24 MECHATRONICS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To provide knowledge on the fundamentals of mechatronics, Numerical control machine tools, part programming and robotics.

Module I (14 hours)
Fundamentals of numerical control-advantages of NC systems- Classification of NC systems- Point to point and contouring systems- NC and CNC – Incremental and absolute systems-Open loop and closed loop systems-features of NC machine tools- Fundamentals of machining-Design consideration of NC machine tools-Methods of improving machine accuracy and productivity- Special tool holders

Module II (13 hours)

Module III (13 hours)

Module IV (14 hours)

References

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
IC09 L23 Bio-informatics

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
- To get the students acquainted with the interdisciplinary field of bioinformatics
- To expose the students to the biological database resources and tools
- To provide an introduction to the important problems and algorithms in bioinformatics.

Prerequisites
Familiarity with internet resources and an aptitude for learning algorithms along with high school level knowledge in biology.

Module I (14hours)
The biological backdrop:
Cells-Prokaryotes and Eukaryotes-DNA double helix- central dogma – DNA, RNA, aminoacids, Proteins -string representations- different levels of protein structures-DNA cloning- RFLP-SNP-Polymerase chain reaction (PCR)-gel electrophoresis-hybridization-A brief introduction to different mappings techniques of genomes- genome sequencing methods-DNA micro arrays –Human Genome Project-A glossary of biological terms.

University Examination Pattern

PART A: Short answer questions (one/two sentences)  5 x 2 marks = 10 marks
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions  4 x 5 marks = 20 marks
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions  4 x 10 marks = 40 marks
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70
Module II (14 hours)

Bioinformatics—the big picture and the biological database resources:
Scope of bioinformatics—Genomics and Proteomics—A very brief introduction to major problems in bioinformatics like sequence alignment, phylogeny, gene finding, microarray analysis, secondary structure prediction, protein structure prediction, comparative genomics and drug design.
An introduction to the major resources at NCBI, EBI and ExPASy—Nucleic acid sequence databases: GenBank, EMBL, DDBJ—Protein sequence databases: SWISS-PROT, TrEMBL, PIR_PSD—Genome Databases at NCBI, EBI, TIGR, SANGER—How to access these databases and to make use of the tools available. Various file formats for bio-molecular sequences like genbank and fasta.
The concept of profiles—The derived databases—Prosite, Pfam, PRINTS, CATH, SCOP

Module III (13 hours)

Sequence alignment algorithms and Tools:
Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues.
Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM matrices, differences between distance & similarity matrix.
Pairwise sequence alignments: basic concepts of sequence alignment, Needleman & Wunchsh, Smith & Waterman algorithms for pairwise alignments. BLAST and FASTA and their versions.
Multiple sequence alignments (MSA): the need for MSA, basic concepts of various approaches for MSA (e.g. progressive, hierarchical etc.). Algorithm of CLUSTALW.

Module IV (13 hours)

Phylogeny, gene finding and molecular visualization:
Phylogeny: Basic concepts of phylogeny; molecular evolution; Definition and description of phylogenetic trees. Phylogenetic analysis algorithms—Maximum Parsimony, UPGMA and Neighbour-Joining.
Gene Finding: The six reading frames—Computational gene finding in prokaryotes and eukaryotes—Basic signals—start and stop codons, promoters etc—important coding measures—Regular expressions—Introduction to Hidden Markov models—Introduction to genomic signal processing
Molecular visualization: Visualization of protein structures using Rasmol or Rastop

Text Books
1. Dan E. Krane and Michael L. Raymer, Fundamental concepts of Bioinformatics, Pearson Education
5. Gary Benson and Roderic Page, Alogorithms in Bioinformatics, Springer.
6. R. Durbin et.al., Biological Sequence Analysis, Cambridge University Press.
7. Gauthm, Bioinformatics databases and algorithms, Narosa Publishers

References
2. Resources at web sites of NCBI, EBI, SANGER, PDB etc

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:** Short answer questions (one/two sentences)  
5 x 2 marks=10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks=20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks=40 marks

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

*Maximum Total Marks: 70*

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CE09 L25 FINITE ELEMENT METHODS*

**Teaching scheme**

3 hours lecture and 1 hour tutorial per week

**Credits:** 4

**Objective:**

*To make the back ground, basic concepts and basic formulation of finite element method clear to the students*

**Module I (14 hours)**


**Module II (13 hours)**

**Continuous systems:** Practical Examples –mathematical models- differential formulation – limitations – Variational formulation – Total potential energy - principle of stationary potential energy - problems having many d.o.f - potential energy of an elastic body - the Rayleigh-Ritz method - piecewise polynomial field - finite element form of Rayleigh-Ritz method - finite element
formulations derived from a functional - interpolation - shape functions for $C^0$ and $C^1$ elements - Lagrangian interpolation functions for two and three dimensional elements

**Module III (13 hours)**

**Displacement based elements for structural mechanics:** formulas for element stiffness matrix and load vector - overview of element stiffness matrices - consistent element nodal vector - equilibrium and compatibility in the solution - convergence requirements - patch test - stress calculation - other formulation methods

**Straight sided triangles and tetrahedral:** natural coordinates for lines - triangles and tetrahedral - interpolation fields for plane triangles - linear and quadratic triangle - quadratic tetrahedron

**Module IV (14 hours)**

**The isoparametric formulation:** introduction - an isoparametric bar element - plane bilinear element - summary of gauss quadrature - quadratic plane elements - direct construction of shape functions for transition elements - triangular isoparametric elements - consistent element nodal loads - validity of isoparametric elements - appropriate order of quadrature - element and mesh instabilities - remarks on stress computation

**Coordinate transformation:** transformation of vectors - transformation of stress, strain and material properties - transformation of stiffness matrices - transformation of flexibility to stiffness - inclined support - joining dissimilar elements to one another- rigid links - rigid elements

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**Text books:**
1. Bathe K.J., Finite Element Procedures in Engineering Analysis, Prentice Hall of India
2. Cook R.D., Malkus D.S. & Plesha M.F., Concepts & Applications of Finite Element Analysis, John Wiley

**Reference books:**
1. Desai C.S., Elementary Finite Element Method, Prentice Hall of India

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**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:** *Short answer questions (one/two sentences)*

5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

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

4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** *Descriptive/Analytical/Problem solving questions*

4 x 10 marks = 40 marks

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

Maximum Total Marks: 70

EC09 L06 SOFT COMPUTING

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

**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 (14 Hours)**

Fuzzy sets and crisp sets-Fuzzy sets –Fuzzy set operations-Fuzzy relations- Membership functions – Features of the membership functions-Fuzzification- Methods of membership
Module IV (14 Hours)

Text Books

Reference Books
1. Fakhreddine O.Karray, Clarence De Silva, Intelligent Systems Design, Theory, Tools and Application, Pearson Education
6. John Yen, Reza Lengari, Fuzzy Logic- Intelligence, Control and Information, Pearson Education

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:** Short answer questions (one/two sentences) \(5 \times 2 \text{ marks} = 10 \text{ marks}\)

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

**PART B:** Analytical/Problem solving questions \(4 \times 5 \text{ marks} = 20 \text{ marks}\)

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

**PART C:** Descriptive/Analytical/Problem solving questions \(4 \times 10 \text{ marks} = 40 \text{ marks}\)

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

*Maximum Total Marks: 70*

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**EC09 L09: 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 (15 hours)**


**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-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:** Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 76
EC09 L012: Antenna Theory & Design

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

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

Pre-requisites: EC09 603 Radiation & Propagation

Module I (14 hours)
Antenna Fundamentals: Radiation mechanism – over view, Electromagnetic Fundamentals, Solution of Maxwell’s Equations for Radiation Problems, Ideal Dipole, Radiation Patterns, Directivity and Gain, Antenna Impedance, Radiation Efficiency. Antenna Polarization
Arrays: Array factor for linear arrays, uniformly excited, equally spaced Linear arrays, pattern multiplication, directivity of linear arrays, nonuniformly excited -equally spaced linear arrays, Mutual coupling, multidimensional arrays, phased arrays, feeding techniques, perspective on arrays.

Module II (14 hours)
Types of Antennas: Traveling - wave antennas, Helical antennas, Biconical antennas, sleave 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)

Text Books

Reference Books
3. I.J.Bhal and P.Bhartia,Micro-strip antennas,Artech house,1980
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

One of the assignments may be MATLAB / C Implementation to obtain radiation pattern of any antenna

University Examination Pattern

PART A: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 76
EC09 L015: Television & Radar Engineering

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- 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 (14 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 (14 hours)

Colour TV- compatibility- Three colour theory- Grassnans laws- -luminance, hue and saturation - Colour TV Camera tube- Picture tube- Pincushion correction techniques- auto deaussing 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)

Radar system- Simple form of radar equation- Radar block diagram- radar frequencies- Prediction of range performance- minimum detectable signal- receiver noise- pulse reception-frequency and range ambiguities- antenna parameter – Doppler effect= system losses and propagation effects.

Module IV (13 hours)


Text Books

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

Reference Books

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

- **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

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**University Examination Pattern**

**PART A:** Short answer questions (one/two sentences) \[5 \times 2 \text{ marks}=10 \text{ marks}\]

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

**PART B:** Analytical/Problem solving questions \[4 \times 5 \text{ marks}=20 \text{ marks}\]

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

**PART C:** Descriptive/Analytical/Problem solving questions \[4 \times 10 \text{ marks}=40 \text{ marks}\]

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

*Maximum Total Marks: 70*
EC09 L018: Nano Technology

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

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 (16 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 Book


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:** Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks = 20 marks

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks

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

Maximum Total Marks: 70

EC09 L021: 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**

EC09 501 Digital Signal Processing

**Module I (11 hours)**

Module II (15 hours)

Module III (16 hours)

Module IV (12 hours)
Video Processing: Fundamental Concepts in Video – Types of video signals, Analog video, Digital video, Color models in video, Video Compression Techniques – Motion compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 and beyond, Content based video indexing

Text Books
**Objectives**

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

**Module I (13 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 (13 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 (10 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 (10 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
1. Blackwell (Ed), The electronic packaging handbook, CRC Press

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
EE09 L 25 ROBOTICS AND AUTOMATION

Objectives

- To give an introduction of industrial robotics and automation

Module I (14 Hours)

Module II (13 Hours)

Module III (14 Hours)
Methods of Robot Programming – Lead through Programming Methods - A Robot Program as a Path in Space - Motion Interpolation - WAIT, SIGNAL, and DELAY Commands -

University Examination Pattern

**PART A:** Short answer questions (one/two sentences)  
5 x 2 marks = 10 marks
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions  
4 x 5 marks = 20 marks
Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions  
4 x 10 marks = 40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
Branching - capabilities and Limitations of Lead through Methods - The Textual Robot Languages - Generations of Robot Programming Languages - Robot Language Structure - Constants, Variables, and Other Data Objects - Motion Commands - End Effector and Sensor Commands - Computations and operations - Program Control and Subroutines - Communications and Data Processing - Monitor Mode Commands.

Module IV (13 Hours)

Text Books
2. K. S. Fu, R. C. Gonzalez, C. S. G. Lee, Robotics, Control, Sensing and Intelligence, McGraw Hill

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: Short answer questions (one/two sentences) 5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions 4 x 5 marks=20 marks
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70
ME09 L23: Industrial Safety Engineering

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To provide on concept of safety in industry, principle of accident prevention, major hazards, consequences and concept of reliability.

Pre-requisites: Nil

Module I (14 Hours)
Introduction to the concept of safety-Need-safety provisions in the factory Act-Laws related to the industrial safety-Measurement of safety performance, Safety Audit, Work permit system, injury and accidents-Definitions-Unsafe act -unsafe condition- causes, investigations and prevention of accidents, hazards, type of industrial hazards-nature, causes and control measures, hazard identifications and control techniques-HAZOP, FMEA,FMECA etc.

Module II (14 Hours)

Module III (13 Hours)
Logics of consequence analysis-Estimation-Toxic release and toxic effects-Threshold limit values, Emergency planning and preparedness, Air pollution-classification- Dispersion modeling -pollution source and effects- -control method and equipments-Gravitational settling chambers-cyclone separators-Fabric filter systems-scrubbers etc.

Module IV (13 Hours)
Concept of reliability-Definition-Failure rate and Hazard function, System reliability models-series, parallel systems, reliability hazard function for distribution functions-exponential-normal –lognormal-weibull and gamma distribution.

Text books

3. C.S.Rao, *Environmental Pollution Control Engineering*, New Age International Limited
# 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:** Short answer questions (one/two sentences) \( 5 \times 2 \text{ marks} = 10 \text{ marks} \)

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

**PART B:** Analytical/Problem solving questions \( 4 \times 5 \text{ marks} = 20 \text{ marks} \)

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

**PART C:** Descriptive/Analytical/Problem solving questions \( 4 \times 10 \text{ marks} = 40 \text{ marks} \)

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

*Maximum Total Marks: 70*