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

Code	Subject	Hrs/week			Marks		Sem. End Duration - Hrs	Credits
		L	T	P/ D	Inte rnal	Sem- End		
EN09 301	Engineering Mathematics-III	3	1	-	30	70	3	4
EN09 302	Humanities and Communication Skills	2	1	-	30	70	3	3
EC09 303	Network Analysis & Synthesis	4	1	-	30	70	3	5
EC09 304	Signals and Systems	3	1	-	30	70	3	4
EC09 305	Digital Electronics	3	1	-	30	70	3	4
EC09 306	Electrical Engineering	3	1	-	30	70	3	4
EC09 307(P)	Digital Electronics Lab	-	-	3	50	50	3	2
EC09 308(P)	Electrical Engineering Lab	-	-	3	50	50	3	2
TOTAL		**18**	**6**	**6**				**28**

FOURTH SEMESTER

Code	Subject	Hrs/week			Marks		Sem. End Duration - Hrs	Credits
		L	T	P	Inte rnal	Sem- End		
EN09 401(B)	Engineering Mathematics IV	3	1	-	30	70	3	4
EN09 402	Environmental Science	2	1	-	30	70	3	3
EC09 403	Electronic Circuits	4	1	-	30	70	3	5
EC09 404	Analog Communication	3	1	-	30	70	3	4
EC09 405	Computer Organization & Architecture	3	1	-	30	70	3	4
EC09 406	Solid State Devices	3	1	-	30	70	3	4
EC09 407(P)	Electronic Circuits Lab	-	-	3	50	50	3	2
EC09 408(P)	Analog Communication Lab	-	-	3	50	50	3	2
TOTAL		**18**	**6**	**6**				**28**

FIFTH SEMESTER

Code	Subject	Hrs/week			Marks		Sem. End Duration - Hrs	Credits
		L	T	P	Internal	Sem-End		
EC09 501	Digital Signal Processing	4	1	-	30	70	3	5
EC09 502	Quantitative Techniques For Managerial Decisions	3	1	-	30	70	3	4
EC09 503	Electromagnetic Field Theory	3	1	-	30	70	3	4
EC09 504	Digital Communication	3	1	-	30	70	3	4
EC09 505	Microprocessors & Microcontrollers	3	1	-	30	70	3	4
EC09 506	Linear Integrated Circuits	2	1	-	30	70	3	3
EC09 507(P)	Microprocessors & Microcontrollers Lab	-	-	3	50	50	3	2
EC09 508(P)	Linear Integrated Circuits Lab	-	-	3	50	50	3	2
TOTAL		**18**	**6**	**6**				**28**

SIXTH SEMESTER

Code	Subject	Hrs/week			Marks		Sem. End Duration -Hrs	Credits
		L	T	P	Internal	Sem-End		
EC09 601	Basics of VLSI Design	4	1	-	30	70	3	5
EN09 602	Engineering Economics and Principles of Management	3	1	-	30	70	3	4
EC09 603	Radiation and Propagation	3	1	-	30	70	3	4
EC09 604	Control Systems	3	1	-	30	70	3	4
EC09 605	Optical communication	2	1	-	30	70	3	3
EC09 Lxx	Elective-I	3	1	-	30	70	3	4
EC09 607(P)	Digital Communication & DSP Lab	-	-	3	50	50	3	2
EC09 608(P)	Mini Project	-	-	3	50	50	3	2
TOTAL		**18**	**6**	**6**				**28**

Elective I

EC09 L01	Power Electronics
EC09 L02	Numerical methods for Engineers
EC09 L03	Entrepreneurship
EC09 L04	Speech & Audio Processing
EC09 L05	Satellite Communication.

SEVENTH SEMESTER

Code	Subject	Hrs/week			Marks		Sem. End Duration -Hrs	Credits
		L	T	P	Internal	Sem-End		
EC09 701	Information Theory and Coding	4	1	-	30	70	3	5
EC09 702	Microwave Engineering	3	1	-	30	70	3	4
EC09 703	Analog & Mixed MOS Circuits	2	1	-	30	70	3	3
EC09 704	Digital System Design	2	1	-	30	70	3	3
EC09 Lxx	Elective-II	3	1	-	30	70	3	4
EC09 Lxx	Elective-III	3	1	-	30	70	3	4
EC09 707(P)	Communication systems Lab	-	-	3	50	50	3	2
EC09 708(P)	VLSI Design Lab	-	-	3	50	50	3	2
EC09 709(P)	Project	-	-	1	100	-	-	1
TOTAL		**17**	**6**	**7**				**28**

EIGHTH SEMESTER

Code	Subject	Hrs/week			Marks		Sem. End Duration -Hrs	Credits
		L	T	P	Internal	Sem-End		
EC09 801	Data & Communication Network	4	1	-	30	70	3	5
EC09 802	Wireless Mobile communication	2	1	-	30	70	3	3
EC09 Lxx	Elective-IV	3	1	-	30	70	3	4
EC09 Lxx	Elective-V	3	1	-	30	70	3	4
EC09 805(P)	Seminar	-	-	3	100	-	-	2
EC09 806(P)	Project	-	-	11	100	-	-	7
EC09 807(P)	Viva Voce	-	-	-	-	100	-	3
TOTAL		**12**	**4**	**14**				**28**

ELECTIVES

EC09 L06	Soft Computing
EC09 L07	High Speed Digital Design
EC09 L08	Introduction to MEMS
EC09 L09	Multimedia Communication Systems
EC09 L10	Management Information systems
EC09 L11	Cryptography & Network security
EC09 L12	Antenna Theory & Design
EC09 L13	Microwave Active Devices & Circuits
EC09 L14	Internet technology
EC09 L15	Television & Radar Engineering
EC09 L16	Embedded systems
EC09 L17	Photonic Switching And Network
EC09 L18	Nano Technology
EC09 L19	Advanced semiconductor device technology
EC09 L20	Mobile computing
EC09 L21	Image & video Processing
EC09 L22	Advanced digital signal Processing
EC09 L23	Data Structures & Algorithms
EC09 L24	Electronic Packaging
EC09 L25	Biomedical Instrumentation

GLOBAL ELECTIVES

CE09 L25	Finite Element Analysis
ME09 L23	Industrial Safety Engineering
EE 09 L24	Mechatronics
EE 09 L25	Robotics & Automation
CS09 L23	Simulation & Modeling
CS09 L25	Pattern Recognition
IC09 L25	Aerospace Engineering and Navigation Instrumentation
IC09 L23	Bio-Informatics
AI09 L25	Probability and Random process
BM09 L24	Virtual Instrumentation

EN09 301: Engineering Mathematics III

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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)

Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: Z^n, sinz, cosz, sinhz, coshz, $(z+{}^1/_Z)$– Mobius Transformation.

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

Definition of Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Independence of path – Cauchy's integral formula – Derivatives of analytic functions (Proof not required) – Taylor series – Laurent series – Singularities and Zeros – Residues – Residue Integration method – Residues and Residue theorem – Evaluation of real integrals.

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

Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Independence – Linear Dependence – Basis – Dimension – Ordered Basis – Coordinate Vectors – Transition Matrix – Orthogonal and Orthonormal Sets – Orthogonal and Orthonormal Basis – Gram-Schmidt orthogonolisation process – Inner product spaces –Examples.

Module IV: Fourier Transforms (14 hours)

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier Transforms – Fourier Sine and Cosine Transforms – Properties of Fourier Transforms.

Text Books

Module I:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.

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

Module II:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.

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

Module III:

Bernaed Kolman, David R Hill, *Introductory Linear Algebra, An Applied First Course,* Pearson Education.

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

Module IV:

Wylie C.R and L.C. Barrett, *Advanced Engineering Mathematics*, McGraw Hill.

Sections: 9.1, 9.3, 9.5

Reference books

1. H S Kasana, *Complex Variables, Theory and Applications,* 2e, Prentice Hall of India.
2. John M Howie, *Complex Analysis,* Springer International Edition.
3. Shahnaz bathul, *Text book of Engineering Mathematics, Special functions and Complex Variables,* Prentice Hall of India.
4. Gerald Dennis Mahan, *Applied mathematics*, Springer International Edition.
5. David Towers, *Guide to Linear Algebra*, MacMillan Mathematical Guides.
6. Howard Anton, Chris Rorres, *Elementary Linear Algebra, Applications Version, 9e*, John Wiley and Sons.
7. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, 3e, Pearson Education.
8. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach,* Ane Books India.
9. B V Ramana, *Higher Engineering Mathematics,* McGrawHill.
10. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
11. J K Sharma, *Business Mathematics, Theory and Applications,* Ane Books India.
12. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
13. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
14. N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e,* Infinity Science Press, Fire Wall Media.
15. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
16. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II.*, Prentice Hall of India.
17. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.

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

EN09 302: HUMANITIES AND COMMUNICATION SKILLS
(COMMON TO ALL BRANCHES)

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

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.
Contributions of ancient civilization: Chinese, Indian, Egyptian and Greek. Cultural, Industrial, Transportation and Communication revolutions. Advances in modern India: Achievements in information, communication and space technologies.

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.
Technical report writing: Synopsis writing, formats for reports. Introductory report, Progress report, Incident report, Feasibility report, Marketing report, Field report and Laboratory test report
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

1. Meenakshi Raman and Sangeeta Sharma, *Technical Communication- Principles and Practice* Oxford University press, 2006
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
4. R C Bhatia, *Business Communication*, Ane Books Pvt. Ltd, 2009
5. Sunita Mishra and C Muralikrishna, *Communicatin Skils for Engineers*, Pearson Education, 2007.
6. Jovan van Emden and Lucinda Becker, *Effective Communication for Arts and Humanities Students*, Palgrave macmillam, 2009
7. W C Dampier, *History of Science*, Cambridge University Press
8. Vesilind, *Engineering, Ethics and the Environment*, Cambridge University Press
9. Larson E, *History of Inventions*, Thompson Press India Ltd.
10. Bernal J.D, *Science in History*, Penguin Books Ltd
11. Encyclopedia Britannica, *History of Science, History of Technology*
12. Brownoski J, *Science and Human Values*, Harper and Row

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 **Credits:** 5
4 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (21 hours)
Analysis of electric networks – loop and nodal analysis. Network theorems – Thevenin, Norton, Superposition, Maximum Power Transfer theorems. Signal representations: Impulse, step, pulse, ramp and exponential functions. S-Domain analysis of circuits - review of Laplace transform - transformation of a circuit into S-domain - node analysis and mesh analysis of the transformed circuit - nodal admittance matrix - mutually coupled circuits – RC circuit as integrator and differentiator - transient analysis of RC and LC networks with Impulse, step, pulse, ramp and exponential inputs – step response of a RLC network

Module II (18 hours)

Network functions- The concept of complex frequency –driving point and transfer functions-Impulse response-Poles and Zeros of network functions, their locations and effects on the time and frequency domain responses. Restriction of poles and zeros in the driving point and transfer function. Time domain behaviour from the pole—zero plot. Frequency response plots-Bode plot
Parameters of two-port network – impedance, admittance, transmission and hybrid - Conversion formulae. Analysis of interconnected two port networks-parallel, series, and cascade connections of 2 port networks - Characteristic impedance and propagation constant
Attenuators -propagation constant, types of attenuators-T and Bridged T - compensated attenuators.

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
2. Van Valkenberg M.E., *Introduction to Modern Network Synthesis,* Wiley Eastern
3. R.A. De Carlo and P. Lin, *Linear Circuit Analysis*, Oxford University Press , New Delhi , 2001
4. Kuo B C, *Network Analysis & Synthesis*, John Wiley & Sons
5. *Desoer C.A. & Kuh E.S., Basic Circuit Theory,* McGraw Hill

Reference Books

1. ChoudaryD R , *Networks and Systems,* New Age International
2. W.K. Chen,Passive and Active Filters-Theory and Implementations,John Wiley& Sons, New York.1986
3. Ryder J.D., *Networks, Lines and Fields,* Prentice Hall
4. Edminister, *Electric Circuits,* Schaum's Outline Series, 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

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

EC09 304: SIGNALS AND SYSTEMS

Teaching scheme **Credits:** 4
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- classsification 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
2. A.V Oppenheim, A. S. Wilsky and S. H. Nawab, *Signals and Systems*, 2nd ed. PHI.
3. H P Hsu, *Signals,Systems* ,Schaum's outlines, 2nd ed.,Tata Mc Graw Hill, New Delhi, 2008
4. John Alen Stuller, An Introduction to signals & Systems, Cengage Learning India Pvt. Ltd.,2008, 3rd Indian reprint 2009, New Delhi

Reference Books

1. C.L Philips,J. M. Parr, E. A. Riskin, *Signals,Systems and Transforms*, 3rd ed. Pearson Education, Delhi.
2. R.E. Zeimer, W.H. Tranter and D. R. Fannin, *Signals and Systems: Continuous and Discrete*, 4th ed., Pearson Education, Delhi.
3. M.J. Roberts, *Signals and Systems: Analysis using Transform methods and MATLAB*, Tata Mc Graw Hill, New Delhi.
4. J B Gurung,'Signals & Systems', PHI, 2009
5. S Palani, *Signals Systems*, Ane Book Pvt. Ltd., NewDelhi 2009

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 305 DIGITAL ELECTRONICS

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

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. Binary Codes: BCD- Gray code- Excess 3 code- Alpha Numeric codes – conversion circuits- Properties. Number systems (Binary, Octal and Hexadecimal): conversions and arithmetic operations. Arithmetic circuits: adders and subtractors- ripple carry adders- carry look ahead adders- adder cum subtractors
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)
Latches and Flip-Flops: SR latch- SR Flip Flop- JK Flip Flop- D Flip flop - T Flip Flop- Flip Flops with preset and clear- Triggering methods and their circuits -Conversion of one type of flip flop to other – Excitation table.
Shift Registers: right shift- left shift- bi directional- SISO- SIPO- PISO- PIPO- universal shift registers.

Asynchronous counter operation- Up counter- Down counter- Up/ Down counter- Mod *n* counters- ring counters- Johnson counter.

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

Text books

1. **Stephen Brown and Zvonko Vranesic, *Fundamentals of Digital Logic with VHDL Design*, TMH**
2. **Charles H. Roth, Jr. *Fundamentals of Logic Design, 5th edition*, Thomson Books/Cole**

Reference

1. **John F Wakerly, *Digital Design- Principles and Practices*(Third edition), Pearson**
2. **Mano M M, *Digital Design,* PHI**
3. **Thomas L Floyd & R.P Jain, di*gital Fundamentals* (Eight edition), Pearson**
4. **Taub and Schilling, *Digital principles and applications*, TMH**
5. Volnei A Pedroni, Digital electronics and design with VHDL, Elsevier
6. Ronald J Tocci, Neal S.Widmer and Gregory L.Moss 'Digital Systems Principles and applications' Tenth Edition Pearson Prentice Hall Edition

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 306 ELECTRICAL ENGINEERING

Teaching scheme **Credits:** 4

Objectives

- *To Study the, operation, performance and characteristics of different dc and ac machines*
- *To familiarise various electrical measuring instruments*

Module I (14 hours)

Review of DC generators – DC generator on no load – open circuit characteristics – basics of armature reaction and commutation – load characteristics of shunt, series and compound generators – Review of dc motors – characteristics of shunt, series and compound motors – starter – 3 point and 4 point starters – losses in DC machines – power flow diagram – efficiency – applications of DC motors.

Module II (12 hours)

Review of transformers – Real transformer – winding resistance and leakage reactance – equivalent circuit – phasor diagram – voltage regulation – losses and efficiency – open circuit and short circuit test – Autotransformer – saving of copper – 3 phase transformer - Δ-Δ, Y-Y, Δ - Y, Y - Δ connections – applications.

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)

Review of alternators – distribution and chording factor – emf equation – armature reaction – phasor diagram – voltage regulation – predetermination of voltage regulation by EMF method – synchronous motor – rotating magnetic field – principle of operation – starting of synchronous motor – applications of synchronous motor

Module IV (14 hours)

Review of 3-phase induction motor – slip – rotor frequency – equivalent circuit – phasor diagram – torque equation – torque-slip characteristics – losses and efficiency – power flow diagram – no-load and blocked rotor tests – starting of 3-phase induction motors – direct-on-line, auto transformer, star-delta and rotor resistance starting – single phase induction motor – double revolving field theory – types and applications of single phase induction motors.

Text Books

1. Vincent Del Toro, *Electrical Engineering Fundamentals*, Prentice-Hall of India
2. Hughes, *Electrical technology*, Tata Mc Graw Hill

Reference Books

1. K. Sawhney, *Electrical and Electronics measuring Instruments,* Dhanpat Rai & Sons.
2. P.S. Bhimbra, *Electrical Machinery*, Khanna Publishers
3. K. Murukesh Kumar, *DC machines and Transformers*, Vikas Publishing house Pvt Ltd

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

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

EC09 307(P) DIGITAL ELECTRONICS LAB

Teaching Scheme **Credits**: 2
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
4. Code converters using basic 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.
14. A sequence generator circuit.
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

EC09 308 (P) Electrical Engineering Lab

Teaching Scheme **Credits**: 2

3 hours practical per week

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
5. Measurement of 3-phase power by using two-wattmeter method.
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

EN09 401B: Engineering Mathematics IV

(Common for IC, EC, EE, AI, BM, CS, and IT)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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)

Random variables – Mean and Variance of probability distributions – Binomial Distribution – Poisson Distribution – Poisson approximation to Binomial distribution – Hyper Geometric Distribution – Geometric Distribution – Probability densities – Normal Distribution – Uniform Distribution – Gamma Distribution.

Module II: Z Transforms (14 hours)

Introduction – The Z transform – Z transform and Region of Convergence (ROC) of finite duration sequences – Properties of ROC – Properties of Z-Transforms: Linearity, Time Shifting, Multiplication by exponential sequence, Time reversal, Multiplication by *n*, Convolution, Time Expansion, Conjugation, Initial Value Theorem, Final Value Theorem – Methods to find inverse transforms – long division method – partial fraction method – residue method – Solutions of difference equations using Z Transforms.

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

Power series method for solving ordinary differential equations – Legendre's equation – Legendre polynomials – Rodrigue's formula – Generating functions – Relation between Legendre polynomials – Orthogonality property of Legendre polynomials (Proof not required) – Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Generating functions – Relation between Bessel functions – Orthogonality property of Bessel functions (Proof not required).

Module IV: Partial Differential Equations (13 hours)

Introduction – Solutions of equations of the form $F(p,q) = 0$; $F(x,p,q) = 0$; $F(y,p,q) = 0$; $F(z,p,q) = 0$; $F_1(x,q) = F_2(y,q)$; Clairaut's form, $z = px + qv + F(p,q)$; Legrange'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:
P Ramesh Babu, R Ananda Natarajan, *Signals and* Systems, 2e, Scitech Publications.
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:
Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.
Sections: 4.1, 4.3, 4.4, 4.5

Module IV:
N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e,* Infinity Science Press, Fire Wall Media.
Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9
Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.
Sections: 11.2, 11.3, 11.4, 9.8 Ex.3, 11.5

Reference books

18. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, *Probability and Statistics in Engineering,* 4e*,* John Wiley and Sons, Inc.
19. Sheldon M Ross, *Introduction to Probability and Statistics for Engineers and Scientists,* 3e, Elsevier, Academic Press.
20. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, 3e, Pearson Education.
21. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach,* Ane Books India.
22. B V Ramana, *Higher Engineering Mathematics,* McGrawHill.
23. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
24. J K Sharma, *Business Mathematics, Theory and Applications,* Ane Books India.
25. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
26. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV*., Sanguine Technical Publishers.
27. Wylie C.R and L.C. Barret, *Advanced Engineering Mathematics*, McGraw Hill.
28. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
29. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II*., Prentice Hall of India.
30. Michael D Greenberg, *Advanced Engineering Mathematics*, Pearson Education.
31. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.

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

EN09 402: ENVIRONMENTAL SCIENCE

(Common for all branches)

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

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

1. Clark,R.S.Marine pollution,Clanderson Press Oxford.
2. Mhaskar A. K. Matter Hazrdous, Techno-science Publications.
3. Miller T. G. Jr., Environmental Science, Wadsworth Publishing Co.
4. Townsend C., Harper J, Michael Begon, Essential of Ecology, Blackwell Science
5. Trivedi R. K., Goel P. K., Introduction to Air Pollution, Techno-Science Publications.

Reference Books.

1. Raghavan Nambiar,K Text book of Environmental Studies, Nalpat Publishers, Kochi
2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, Email: mapin@icenet.net
3. Cunningham, W.P., Cooper, T.H., Gorhani, E & Hepworth, M.T. 2001Environmental encyclopedia Jaico publ. House Mumbai 1196p
4. Down to Earth, Centre for Science and Environment
5. Hawkins, R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
6. Mckinney, M.L. & School, R.M. 1996. Environmental Science system & Solutions, Web enhanced edition, 639p.
7. Odum, E.P. 1971. Fundamentals of Ecology. W.B.Saunders Co. USA, 574p
8. Rao, M.N. & Datta, A.K 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd., 345p
9. Survey of the Environment, The Hindu Magazine
10. Wagner.K.D. 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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.

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 403: ELECTRONIC CIRCUITS

Teaching scheme **Credits:** 5

4 hours lecture and 1 hour tutorial per week

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)

The amplifier gain function –Low frequency and high frequency responses- Use of open circuit and short circuit time constants in finding the cut-off frequencies-Low and high frequency response of common emitter amplifier - Emitter followers.
Feedback amplifiers-the general feedback structure – voltage shunt - voltage series - current series and current shunt feedback configurations - effects of negative feed-back-Analysis of negative feedback amplifiers –Stability-study of stability using Bode Plots.
Power amplifiers - class A, B, AB, C, D & S power amplifiers - harmonic distortion - efficiency - wide band amplifiers - broad banding techniques - low frequency and high frequency compensation - cascode amplifier - broad banding using inductive loads – Darlington pairs

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 monoshot - triggering the monoshot - collector coupled and emitter coupled astable multivibrator – analysis of sweep circuits-principles of miller and bootstrap circuits

Text Books

6. Neamen , *Electronic Circuits – Analysis & Design,* McGraw Hill
7. Millman J. & Taub H., *Pulse, Digital & Switching Waveforms,* Tata McGraw Hill
8. Boylestad R. & Nashelsky L., *Electronic Devices & Circuit Theory,* Pearson Education
9. Sedra A.S & Smith K.C., *Microelectronic Circuits,* Oxford University Press

Reference Books

6. Milman & Halkias, *Integrated Electronics,* McGraw Hill
7. Gray & Meyer, *Analysis and Design of Analog Integated Circuits;* John Wiley
8. Schilling D.L. & Belove C., *Electronic Circuits,* McGraw Hill,
9. Spencer & Ghausi, *Introduction to Electronic Circuit Design*; 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

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

EC09 404: ANALOG COMMUNICATION

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

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

processes-Transmission of a Random process through a linear Time-Invariant Filter-Gaussian Process

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 andQuadrature 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)*

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

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

Text Books

1. Simon Haykin**,** 'Communication Systems' Wiley India, New Delhi,4Ed., 2008

Reference Books

2. Bruce Carlson, 'Communication Systems'. McGraw Hill

3. Ziemmer,'Principles Of Communication, Wiley India, New Delhi,5Ed., 2009
4. Wayne Tomasi, 'Electronic Communication Systems: FundamentalsThrough Advanced' Pearson Education
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 home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

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 continuous systems using any technical

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

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

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

1. John P Hayes: Computer Architecture and Organization (Third Edition) MCGraw Hill
2. Ramesh S Gaonkar -8085 Architecture and programming, Wiley Eastern

Reference Books

1. William Stallings: Computer Architecture and Organization (6^{th} Edition) Pearson
2. M Morris Mano; Computer system Architecture, (3^{h} Edition),PHI /Pe
3. Heuring & Jordan: Computer system Design& Architecture,Addison Wesley
4. Patterson D A & Hennessy J L: Computer Organization & Design,Morgan Kaufman

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 406: SOLID STATE DEVICES

Teaching scheme **Credits:** 4
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-freequency 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

1. Ben G Streetman and Sanjay Banerjee: *Solid State Electronic Devices*, (Fifth Edition) Pearson Education
2. Sze S M, *Physics of Semiconductor Devices*, Wiley India
3. Pierret R F, *Semiconductor Device Fundamentals*, Pearson Education
4. Van valkenburgh, Nooger & Neville Inc, Solid State Devices, Cengage learning India Pvt. Ltd., 1992, 1st Indian reprint 2009, New Delhi
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)*

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 problems involving the theory of devices.

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 407(P) ELECTRONIC CIRCUITS LAB

Teaching scheme **Credits:** 2
3 hours practical per week

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 realisaton part

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 **Credits:** 2
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 demodultiaon

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 **Credits:** 5

4 hours lecture and 1 hour tutorial per week

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-Linear convolution using DFT-Linear filtering of long data sequences- Overlap add and overlap save methods-Computation of DFT-Decimation in Time and Decimation in Frequency algorithms

Module II (18hours)

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)

Design of Digital filters-Types of digital filters -FIR and IIR filters-Specifications of digital filters-Design of FIR filters-Linear phase Characteristics-Window method, Optimal method and Frequency Sampling method-Design of IIR filters from analog filters-Impulse invariant and bilinear transformation methods- Frequency transformation in the analog and digital domains

Module IV (18hours)

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

1. Oppenheim A. V., Schafer R. W., Discrete-Time Signal Processing, Prentice Hall/Pearson.
2. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall of India Pvt. Ltd., 1997.
3. Emmanuel C. Ifeacher, Barry W. Jervis, Digital Signal Processing: A Practical Approach, Pearson Education, 2004.
4. Li Tan,'DSP-Fundamentals & Applications', Elsevier, New Delhi, 2008
5. Roberto Cristi, Modern Digital Signal Processing, Cengage learning India pvt. Ltd.,2004, 4th Indian reprint 2009, New Delhi

Reference Books

1. Mitra S. K., Digital Signal Processing : A Computer Based Approach, Tata McGraw-Hill
2. B Venkataramani & M.Bhaskar, Digital Signal Processors-Architecture,
3. Programming and Applications, Tata Mcgraw Hill
4. Dag Strannbby & William Walker,'DSP & Applications'. Elsevier, New Delhi, 2nd Ed. 2004
5. Vinay K Ingle, John G Proakis, DSP- A MATLAB based approach Cengage learning India pvt. Ltd.,2008, 1st Indian reprint 2009, New Delhi

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 filters using MATLAB

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

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

EC09 502: Quantitative Techniques for Managerial Decisions

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

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-
Network Techniques- basic concepts- network construction- CPM and PERT networks-algorithm for critical path-slacks and their significance-crashing-network flow problems-the shortest route problem-minimal spanning tree problem.

Module2 (14 hours)
Inventory control-functions of inventory-structure of inventory problems-relavant cost-opposing costs-selective control techniques-dynamic inventory models under certainity-calssical 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
2. Ravindran , Solberg, & Philips, Operations Research, John Wiley.
3. Riggs, Economic Decision models for Engineers and Managers , McGraw Hill International Students Edition.
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 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.	5 x 2 marks=10 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 x 5 marks=20 marks
PART C:	Descriptive/Analytical/Problem solving questions Two questions from each module with choice to answer one question.	4 x 10 marks=40 marks

Maximum Total Marks: 70

EC09 503: Electromagnetic Field Theory

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

Objectives

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

Module I (13hours)
Review of vector analysis: Cartesian, Cylindrical and Spherical co-ordinates systems- Co-ordinate transformations. Vector fields: Divergence and curl- Divergence theorem- Stokes theorem.
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

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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

1. Elements of Electromagnetics– Mathew N.O. Sadiku, Oxford Pub, 3rd Edition
2. Engineering Electromagnetics – W.H. Hayl, Tata Mc Graw Hill Edition, 5th Edition
3. Introduction to Electrodynamics– David J. Griffithe, Prentice Hall India, 3rd Edition

Reference Books

1. Electromagnetics: J. D. Kraus, Mc Graw Hill Publications.
2. Engineering electromagnetics: E. C. Jordan.
3. Field & Wave Electromagnetic: Cheng, Pearson Education.
4. Electromagnetics: Edminister, Schaum series, 2 Edn.

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.	5 x 2 marks=10 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 x 5 marks=20 marks
PART C:	Descriptive/Analytical/Problem solving questions Two questions from each module with choice to answer one question.	4 x 10 marks=40 marks

Maximum Total Marks: 70

EC09 504: DIGITAL COMMUNICATION

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

Objectives

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

Module I (13hours)

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-companding-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 prosing gain and anti jamming margin-frequency hopped spread spectrum systems –time hopped spread spectrum systems-time synchronisation

Module IV (12hours)

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

1. Taub&Schilling, Principles of Communication Systems', Tata McGraw Hill, New Delhi, 3rd Ed., 2008
2. Bernard Sklar,'Digital Communication' Pearson education
3. John P Proakis & Masoud Salehi, "Communication system Engg', PHI, New Delhi, 2nd Ed. 2006
4. Wayne Tomasi, 'Advanced Electronic Communication Systems' PHI, 6th Ed. 2008

Reference Books

1. Simon Haykin, 'Digital Communication', Wiley India
2. Bruce Carlson, Communication Systems; McGraw Hill
3. Sam Shanmugam- Digital and Analog Communication systems; Wiley Student Edition McGraw Hill, New Delhi, 2003

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 **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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 (13hours)

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 andI/O interfaces-Memory devices, circuits and sub system design – various types of memories, wait state and system memory circuitry.

Module III (14hours)

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 (13hours)

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

1. Triebal W A & Singh A., The 8088 and 8086 microprocessors McGraw Hill
2. David Calcutt, Fred Cowan & Hassan,'8051 Microcontrollers-an application based introduction'.Newnes-Elsevier,Indian Reprint 2008
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D Mckinlay.' The 8051 Microcontrollers and Embedded Systems using Assembly and C " 2nd Edition PHI Publishers
4. Andrew .N.Sloss,Dominic Sysmes,Chris Wright - Arm System Developers Guide-Designing and Optimizing System software, Morgan Kaufmann Publishers.

Reference Books

1. Intel Data Book vol.1, Embedded Microcontrollers and Processors
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

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 **Credits:** 3
2 hours lecture and 1 hour tutorial per week

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
Linear Op-Amp circuits – basic configurations-ideal Op-Amp circuit analysis –The 741 Op-Amp circuit parameters-DC analysis –small signal analysis –Gain ,frequency response and slew rate of the 741 –summing and different amplifiers-Differentiator and integrator –I-V and V-I converters-Instrumentation amplifier, isolation amplifier - log and antilog amplifiers analog multipliers – Voltage Comparators-Schmitt trigger

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

1. Sergio Franco , *Design with Operational Amplifiers& Analog integrated Circuits* ; McGraw Hill
2. Jacob Baker R., Li H.W. & Boyce D.E., '*CMOS- Circuit Design, Layout & Simulation*', PHI
3. Fiore J.M., *Operational Amplifiers and Linear Integrated Circuits*, Jaico Publishing House
4. Gayakwad, *Operational Amplifiers*, Jaico Publishing House

Reference Books

1. Coughlin R.F. & Driscoll F.F., *Operational Amplifiers and Linear Integrated Circuits,* Pearson Education
2. Schumann & Valkenberg, *Design of Analog Filters*, Oxford University Press
3. Gray & Meyer, *Analysis and Design of Analog Integated Circuits*; John Wiley
4. James Cox, Linear Electronic circuits & Devices, Cengage learning India pvt. Ltd.,2002, 1st Indian reprint 2009, New Delhi

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 & 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 **Credits:** 2
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 **Credits:** 2

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 -Delyiannis configuration
5. Active notch filter realization using op-amps
6. Wein bridges oscillator with amplitude stabilization
7. Generation and demodultiaon 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. Volatage 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 **Credits:** 5

4 hours lecture and 1 hour tutorial per week

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)

Wafer processing –diffusion-Fick's Law –analytic solutions for predeposition and drive-in diffusion – oxidation –Deal -Grove model –ion implantation-vertical and lateral projected ranges-channeling-stopping power –optical lithography-optical exposures-modulation transfer function-proximity and projection printing –photoresists - types-contrast curves-etching-wet,, plasma and ion etching-epitaxial growth –MOCVD and molecular beam epitaxy

Module IV (18hours)

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
3. Rabaey J.M., *Digital Integrated Circuits - A Design Perspective*, Pearson Education
4. Weste & Eshraghian , *Principles of CMOS VLSI Design*, Addison Wesley
5. S K Gandhi, *VLSI Fabrication Principles*., John Wiley
6. Sung-Mo Kang & Yusuf Leblebici, *CMOS Digital Integrated Circuits - Analysis & Design*, McGrawHill
7. Nagchoudari., *Principles of Microelectronic Technology*, Wheeler Publishing

Reference Books

11. Yuan Taur & Ning T.H., *Fundamentals of Modern VLSI Devices*, Cambridge Univ. Press
12. Baker. Li & Boyce, *CMOS - Circuit Design, Layout & Simulation*, PHI
13. Sze S M, *VLSI Technology*, McGrawHill
14. Ken Martin, *Digital Integrated Circuit Design*, Oxford Univ. Press
15. Eshraghian & Pucknell,, *Essentials of VLSI Circuits & Systems*, PHI

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

EC 09 602: ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT

(Common for AI, EE, BM, and IC)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Section 1: Engineering Economics

Objective

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

Module1 (14 Hrs)

Economic reasoning, Circular Flow in an economy, Law of supply and demand, Economic efficiency. Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Private and Social cost, Opportunity cost. Functions of Money and commercial Banking. Inflation and deflation: concepts and regulatory measures. Economic Policy Reforms in India since 1991: Industrial policy, Foreign Trade policy, Monetary and fiscal policy, Impact on industry.

Module II (13 Hrs)

Value Analysis – Function, aims, procedure.–Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor. Methods of project analysis (pay back, ARR, NPV, IRR and Benefit -Cost ratio) Break-even analysis-, Process planning.

Text books

1. Panneer Selvam, R, Engineering economics, Prentice Hall of India, New Delhi, 2002.
2. Wheeler R (Ed) Engineering economic analysis, Oxford University Press, 2004.

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 1

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

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.	*2 x 2 marks=4 marks* *1 x 1 mark = 1 mark*
PART B:	*Analytical/Problem solving questions* 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.	*2 x 5 marks=10 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*2 x 10 marks=20 marks*

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)

Financial management – Time value of money and comparison of alternative methods. Costing – Elements & components of cost, allocation of overheads, preparation of cost sheet, break even analysis. Basics of accounting – Principles of accounting, basic concepts of journal, ledger, trade, profit &loss account and balance sheet. Marketing management – Basic concepts of marketing environment, marketing mix, advertising and sales promotion. Project management – Phases, organisation, planning, estimating, planning using PERT & CPM

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
3. O. P. Khanna, Industrial Engineering and Management, Dhanpat Rai and Sons, Delhi, 2003.
4. P. Kotler, Marketing Management: Analysis, Planning, Implementation and Control, Prentice Hall, New Jersey, 2001
5. Venkata Ratnam C.S & Srivastva B.K, Personnel Management and Human Resources, Tata McGraw Hill.
6. Prasanna Chandra, Financial Management: Theory and Practice, Tata McGraw Hill.
7. Bhattacharya A.K., Principles and Practice of Cost Accounting, Wheeler Publishing
8. Weist and Levy, A Management guide to PERT and CPM, Prantice Hall of India
9. Koontz H, O'Donnel C & Weihrich H, Essentials of Management, McGraw Hill.
10. Ramaswamy V.S & Namakumari S, Marketing Management : Planning, Implementation and Control, MacMillan

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 **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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 impedence, noice temperature, elementary ideas about self & mutual impedence, 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-Tchebysceff 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 hight, 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

1. Electromagnetic waves & Radiating Systems– Jordan & Balman, Prentice Hall India
2. Warren L Stutzman and Gary A Thiele, "Antenna Theory and Design", 2ndEd, John Wiley and Sons Inc. 1998
3. Constantine. A. Balanis: "Antenna Theory- Analysis and Design", Wiley India, 2nd Edition, 2008

Reference Book

1. Kraus, "Antennas", Tata McGraw Hill, NewDelhi, 3" Edition, 2003

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 604: CONTROL SYSTEMS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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)

General Schematic Diagram of Control Systems-Open loop and Closed loop systems – Merits and demerits-Concepts of feed back –Role of computers in Automactic Control –Modeling of Continuous Time Systems. Basic ideas of Functions of Complex Variables ,Mapping Process,Analytic functions,poles and Zeros-Laplace Transforms-Properties

Transfer functions-block diagrams-order and type-signal flow graph –Mason's Gain formula-Block diagram reduction using direct techniques and signal flow graphs –examples-derivation of transfer function of simple systems from physical relations -low pass RLC series network –spring mass damper –DC servomotor for position and speed control –low pass active filter-

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
   - Perfomance of feed back Control systems.
   - Steady state Response-steady state error –computations of S. S
   - Error –error constants.
   - Concepts of Stability –Routh-Hurwitz Criterion.
   - Construction of root locus.
2. Frequency Domain Analysis:

Frequency Domain Plots-Polar and Bode Plots-Theory of Nyquist Criterion Frequency Response characteristics- Frequency domain specifications- computation of gain and phase Margins from Bode Plot Theory of Lag,Lead,and Lag-Lead compensators.

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
2. M Gopal,'Control systems- Principles & Design', Tata McGraw Hill, New Delhi, 3rd Ed. 2008
3. B.C Kuo.," Automatic Control System", Prentice Hall of India
4. Nagarath I. J & Gopan M.,"Control System Engineering",Wiley India Ltd

Reference Books

1. Ziemer R.E.,Tranter W.H& Fanin D.R.,"Signals and Systems"Pearson Education Asia
2. Dorf R.C& Bishop R.H.,Modern Control Systems",Addison Wesley
3. Ogata K.,"Discrete Time Control Systems",Pearson Education Asia, 2007
4. Kuo B.C .,"Digital Control Systems" Oxford University 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

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

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

EC09 605: Optical Communication

Teaching scheme **Credits: 3**

2 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (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 disperson 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- pn–pin –avalanche Photodiode-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

1. G. Keiser ,'Optical Fiber Communication', 3rd Edition, Tata Mc Graw Hill new delhi, 2000
2. John M.Senior . 'Optical Fiber Communication Principles & Practice' ,PHI Publication
3. D.F. Mynbacv and L. Scheiner ,'Fiber Optic Communication Techniques', Person Education New Delhi

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 701: Information Theory and Coding

Teaching scheme **Credits: 5**

4 hours lecture and 1 hour tutorial per week

Objectives

- *To provide basic concepts of Information*
- *To enable the students to propose, design and analyse 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)

Coding –convolutional codes-encoder –generator matrix-transform domain Representation-state diagram-distance properties-maximum likelihood decoding-viterbi decoding-sequential decoding-interleaved convolutional codes-Turbo coding- coding & decoding -Trellis coding- coding & decoding

Text Books

1. Simon Haykins,Communication Systems,John Wiley
2. Shi Lin,Costello D.J ., Errpr Control Coding-Fundamentals amd Applications,Prentice Hall Inc. Eaglewood Cliffs

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
3. Taub& Schilling, Principles of Communication System,TATA MC Graw Hill
4. Tomasi,Electronic Communications,Fundamentals Through Advanced,Pearson education
5. Sklon, Digital Communications Pearson education
6. Couch,Digital and Analog Communication System, 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: 70

EC09 702: Microwave Engineering

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (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, parameteric 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-repeaters-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
3. Annapurna Das and Sisir Das, Microwave Engineering, Tata-McGraw Hill , 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

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 x 2 marks=10 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 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EC09 703: ANALOG & MIXED MOS CIRCUITS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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

MOS switch – active resistor – current sources & sinks – current mirrors – current & voltage references – band gap reference

Module II (14 hours)

Single stage Amplifiers – Differential Amplifiers - active load current mirror – stability & frequency response & compensation – noise in single stage & differential amplifiers – Gilbert cell - cascode amplifiers – current amplifiers – output amplifiers - high gain amplifier architectures

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
3. Baker. Li & Boyce, *CMOS - Circuit Design, Layout & Simulation*, PHI
4. Johns & Martin, *Analog Integrated Circuit Design,* John Wiley & Sons

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: 70

EC09 704: Digital System Design

Teaching scheme **Credits:** 3
2hours lecture and 1 hour tutorial per week

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)
Asynchronous sequential circuits: Asynchronous behavior- Analysis of asynchronous circuits- Synthesis of asynchronous circuits- Race condition- State reduction- State assignment- Transition diagrams- Exploiting unspecified next-state entries- State assignment using additional state variables

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

1. Stephen Brown & Zvonko Vranesic, *Fundamentals of Digital Logic with VHDL design,* Tata McGraw Hill.
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.
6. Bhasker J, *A VHDL Primer*, Addison Wesly

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 707(P) COMMUNICATION SYSTEMS LAB

Teaching scheme **Credits:** 2
3 hours practical per week

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

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

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 708 (P) VLSI Design Lab

Teaching scheme **Credits:** 2

3 hours practical per week

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_D-V_{DS} Characteristics – extraction of V_T and body effect factor
8. DC transfer characteristics of an inverter
9. Buffer & Ring Oscillator
10. XOR using different logic styles - comparison
11. Single stage CS amplifiers - their responses for different types of load
12. Single stage source follower - their responses for different types of load
13. Current mirror circuits

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 **Credit:** 1

1 hour practical per week

Objectives

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

Project work is for duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and

develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. The project work may be undertaken in Electronics/Communication/ Computer 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 7^{th} semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7^{th} semester.

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

Internal Continuous Assessment

20% - Technical relevance of the project :
40% - Literature survey and data collection
20% - Progress of the project and presentation :
10% - Report
10% - Regularity in the class

EC09 801: Data and Communication Networks

Teaching scheme **Credits:** 5
4 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (18hours)
Queueing Theory: Markov chain-discrete time and continuous time Markov chains- Poisson Process M/M/1 Queue Little's formula M/M/m/m queueing models-infinite server case State dependnt Queues Birth- Death Process M/G/1 Queue

Module II (18hours)

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)
Circuit switching: Elements of Traffic Engg. GoS and Blocking Probability. Incoming traffic and service time characterization. Analysis of blocking models and delay models- Erlang formulai.
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

1. Jean Walrand & Pravin Varaiya,"High Performance Communication Networks" Morgan Kaufman Publishers
2. Behrus A. Forouzan etal, "Data Communication and Networking", 2nd Edition, Tata McGraw-Hill, 2000.
3. Bertsekas D.& Gallager R.,"Data Networks" Prentice Hall of India
4. William Stallings, "Data and Computer Communication", Fifth Edition, Prentice Hall of India, 1997.
5. Andrew S.Tanenbaum, "Computer networks", Third Edition, prentice Hall of India, 1996.
6. .Viswanathan T.,Telecommunication Switching Systems and Networks,Prentice Hall of India Pvt Ltd.
7. Schwartz M.,Telecommunication Networks-Protocols,Modeling and _Analysis,Addison Wesley Publishing CompanyC

Reference Books

1 Flood J E., Telecocommunication Switching Trffic and Networks,Pearson Education Pvt Ltd.
2.Freeman R L ., Telecocommunication 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 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 802: Wireless Mobile Communication

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

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

1. Rapapport T. S, 'Wireless Communication Principles and Practices', Pearson Education Asia, New Delhi, 3rd Ed.2003.
2. A F Molisch, 'Wireless communications',Wiley India, 2008
3. Mosa Ali Abu-Rgheff,'Introduction to CDMA wireless communications', Academin Press-Elsevier, 2007
4. Vijay K Garg, Joseph E Wilkes,' Principles and Applications of GSM', Pearson Edu.

Reference Books

1. Kamilo Feher ,'Wireless Digital Communication' , Prentice Hall
2. Lee W.C.Y. Mobile Cellular Telecommunication" MGH
3. Jochen Schiller,'Mobile communication 'Pearson Education,Asia.
4. Mark Campa, Jorge Olenewa, Wireless Communication, Cengage learning India pvt. Ltd.,2007, 3rd Indian reprint 2009, New Delhi

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 806(P): PROJECT

Teaching scheme
11 hours practical per week

Total Credits: 7
Credits for interim evaluation:2
Credits for final evaluation: 5

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.

Internal Continuous Assessment
40% - Design and development/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

EC09 807(P): Viva-Voce

Credits: 3

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.

Assessment in Viva-voce
40% - Subjects 30% - Project and Mini Project 20% - Seminar 10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

AI09 L25: Probability and Random Processes

Teaching scheme **Credits:** 4

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

Experiments – sample spaces and Events – axioms of Probability – Assigning Probabilities – joint and conditional probabilities –Baye's thorem – independence - Dicrete random variables – Bernoulli – Binomial – poisson - Geometric

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

The Cumulative distribution function - Probability density function – gaussian Random variable – Uniform random variable – exponential –Laplace – gamma – erlang –Chi – squared –Rayleigh – Rician -Cauchy

Module III (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

Definition and classification of Processes – Mathematical tools for studying random processes – stationary and ergodic random processes – Properties of the Auto correlation function – gaussian random processes- Definition and examples of Markov Processes - calculating transition and state probabilities in Markov chains

Text Books

1 Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009

2 Jean Jacod, Philip Protter, Probability Essentials, Springer 2008

Reference Books

3. Peyton Z. Peebles, Probability, Random Variables and Random signal Principles, Tata McGraw – Hill Publishing Limited, New Delhi, 4TH Edition

4. X. Rong Li, Probability, Random Signals, and Statistics

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 805(P): SEMINAR

Teaching scheme **Credits:** 2

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

20% - Relevance of the topic and literature survey
50% - Presentation and discussion
20% - Report
10% - Regularity in the class and Participation in the seminar

CS09 L23: SIMULATION AND MODELING

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

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)
Simulation of queueing systems - parameters of queue - formulation of queueing problems - generation of arrival pattern - generation of service patterns -Simulation of single server queues - simulation of multi-server queues -simulation of tandom queues.

Module IV (15 hours)
Simulation of stochastic network - simulation of PERT network - definition of network diagrams - forward pass computation - simulation of forward pass -backward pass computations - simulation of backward pass - determination of float and slack times determination of critical path - simulation of complete network - merits of simulation of stochastic networks.

Reference Books

1. C. Deo N., *System Simulation And Digital Computer*, Prentice Hall of India.
2. Gordan G., *System Simulation*, Prentice Hall of India.
3. Law A.M. & Ketton W.D., *Simulation Modelling and Analysis*, 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

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

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 L07: High Speed Digital Design

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

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

1. Howard Johnson & Martin Graham, "High Speed Digital Design: A Handbook of Black Magic", Prentice Hall PTR
2. Dally W.S. & Poulton J.W., "Digital Systems Engineering", Cambridge University Press
3. Masakazu Shoji, "High Speed Digital Circuits", Addison Wesley Publishing Company

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

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 x 2 marks=10 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 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EC09 L010: Management Information System

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

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 sytems 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

1. Robert Schulters & Mary Sumner-Management Information Systems: The Manager's View,Tata Mc Graw Hill

Reference Books

1. London K.C & Landon P.J- Management Information Systems:
2. Sadagopan S. - Management Information Systems: Prentice Hall of India.
3. Basandra S.K.- Management Information Systems, Wheeler Publishing.
4. Alter S.- Information Systems: A Management Prospective,Addision Wesley.
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

EC09 L013: Microwave Active Devices & Circuits

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

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. Simgle 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-β 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 uysing 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

Text Books

1. Davis M Pozar,'Microwave Engineering'.2nd Ed. Wiley India, 2008
2. Mathrw M Radmanesh,'radio Frequency and Microwave Electronics Illustrated, Rearson education, New Delhi, 2001
3. Reinhold Ludwig and Pavel Bretchko, "RF Circuit Design: Theory and Applications", Pearson Education (Asia) Pte. Ltd., 2004.

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

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 L016: Embedded Systems

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

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 (15hours)
Introduction to Embedded Systems:Characteristics of Embedded systems, Categories of Embedded System- Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Role of processor selection in Embedded System (Microprocessor V/s Micro-controller), Software embedded into a system-General ideas of Processor and Memory organization - Processor and memory selection– Interfacing to Memory and I/O devices- Devices and Buses- Device Drivers and Interrupt Servicing mechanisms- Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices.

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 (14hours)

Microcontroller:PIC microcontroller- architecture- Internal registers and timer/Clock initialization,Interrupus - programming. Introduction to AVR8515 microcontroller.16 and 32 bit microcontrollers. 8096/80196 family. ARM processor- architecture – applications - Motrola 68HC11/ 68HC12 family of microcontrollers. Internal architecture. Addressing modes and instruction set. Interrupts.

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

1. Rajkamal "Embedded Systems Architecture; Programming and Design"; Tata McGraw Hill Publications.,New Delhi, 3rd Wd. 2008
2. Sreve Heath,'Embedded system design', Elsevier, 2nd Ed. New Delhi, 2003
3. Steve Farber ,ARM System –on-chip , ,Second Edition,2000 Pearson Education
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
7. S.Furbur, ARM system Architecture, Addition wesley, 1996.

Reference Books

1. Raj Kamal, Microcontrollers Architecture, programming, Interfacing and System Design, Pearson Education.
2. Dr K.V.K.K..Prasad ,Embedded /Real-Time systems :Concepts ,Design &Programming., DreamTech Publishers.,2004
3. Jonathan.W.Valvano, Embedded Microcomputer Systems, Real Time Interfacing, Published by Thomson Brooks/Col, 2002.
4. G.H. Miller, Microcomputer Engineering, 3d edition, Pearson Education.
5. Louis L. Odette ,'Intelligent Embedded Systems' , Addison-Wesley, 1991
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: 70

EC09 L19: ADVANCED SEMICONDUCTOR DEVICES TECHNOLOGY

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

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 nanoparticles – grinding – gas condensation – laser ablation – thermal and UV decomposition –self assembly – solgel – characterisation – applications
Fabrication of nanostructures–lithography–nano imprint lithography –split gate technology– self assembly

Reference Books

1. Taur & Ning, *Fundamentals of modern VLSI Design,* Cambridge University Press
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 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.

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

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 (14hours)
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
3. G. Strang and T. Nguyen, Wavelets and Filter Banks, Wellesley-Cambridge Press, MA, 1996
4. Li Tan,'DSP-Fundamentals & Applications', Elsevier, New Delhi, 2008

Reference Books

1. M. Vetterli and J. Kovacevic, Wavelets and Subband Coding, Prentice-Hall, Englewood Cliffs, N. J., 1995
2. S. K. Mitra, Digital Signal Processing: A Computer Based Approach, 2nd ed., Tata Mc-Graw Hill, New Delhi, 2001
3. C. S. Burrus, R. A. Gopinath, and H. Guo, Introduction to Wavelets and Wavelet Transforms: A Primer, Prentice Hall, Englewood Cliffs, N. J., 1997

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 L025: Biomedical Instrumentation

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

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)

Blood pressure-direct measurements-harmonic analysis of blood pressure waveform-system for measuring venous pressure-heart sounds- phonocardiography-cardiac catheterization-indirect blood pressure measurement –electromagnetic blood flow meters-ultrasonic blood flow meters-impedance plethysmography –photo plethysmography-'indicator- dilution'method for blood flow determination – spirometry-measurement of various respiratory parameters- respiratory plethysmography-chamber plethysmography

Module III (13 hours)

Measurement of gas flow rate cardiac pacemakers and other electric stimulators-defbrillators and cardio converters –blood plumps –hemodialysis-ventilators –infant incubators-drug delivery devices-lithotripsy-therapeutic applications of laser

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

1. Geddes& Baker,'Principles of Applied Biomedical Instrumentation', Wiley
2. Encyclopedia of Medical Devices and Instumentation Wiley
3. Bronzino,Hand book of Biomedical Engineering,IEEE press 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)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 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 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

IC09 L25 Aerospace Engineering and Navigation Instrumentation

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

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)
History of aviation and space flight- anatomy of airplane and space vehicle with emphasis on control surfaces- airfoil nomenclature- basics of aerodynamics to illustrate lift and drag- types of drag – finite wings – swept wings –flaps. Airplane performance- thrust –power- rate of climb- absolute and service ceiling- range and endurance. Introduction to turbojet and turbofan engines. Space vehicle trajectories- kepler's laws- rocket engines, propellents and staging.
(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- Satalite 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 gyroscope, 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

1. John D Anderson Jr., *Introduction to Flight* , McGraw-Hill
2. Pallet.E.H.J, *Aircraft instruments- Principles and applications*, Pitman Publ.
3. Nagararja.M.S, *Elements of electronic navigation*, Tata McGraw Hill
4. San Darite, *Radio aids to navigation*.,
5. John.H. Blakelock; *Automatic control of aircraft and missiles*, John wiley and sons. inc 1991.
6. Keyton.M and Walker.R. Fried,*Avionics navigation systems* ,John Wiley. 1996, 2 Ed
7. Siouris.G.M, *Aerospace avionics system,* A modern synthesis, academic press. 1993
8. Lin.C.F. ,*Modern guidance, navigation and control processing,* Prentice hall-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

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

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

G. Johnson, LabVIEW Graphical Programming, McGraw Hill, New York
L. K. Wells and J. Travis, LabVIEW for Everyone, Prentice Hall, New Jersey.
K. James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.

Reference Book

Sokoloff , Basic Concepts of Labview, Prentice Hall, New Jercy

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 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.
4. Creation of a Digital Multi-meter using Virtual Instrumentation.
5. Design Variable Function Generator Using Virtual Instrumentation.
6. Creation of Digital Temperature Controller 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 **Credits:** 4
3 hours lecture and 1 hour tutorial per week

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
2. Gonzalez R.C. & Thomson M.G., Syntactic Pattern Recognition - An Introduction, Addison Wesley.

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,

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 L08: Introduction to MEMS

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

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*

- *the changes in properties when the dimensions of the system are scaled*

Module I (11 hours)

MEMS and microsystems: MEMS and microsystem products – evaluation of microfabrication – microsystems and microelectronics – applications of microsystems – working principles of microsystems – microsensors – microactuators – MEMS and microactuators – microaccelerometers.

Scaling laws in miniaturization: Introduction – scaling in geometry – scaling in rigid body dynamics – the Trimmer force scaling vector – scaling in electrostatic forces, electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.

Module II (13 hours)

Materials for MEMS and microsystems: Substrates and wafers – Silicon as a substrate material, ideal substrates for MEMS – single crystal Silicon and wafers crystal structure – mechanical properties of Si – Silicon compounds – SiO_2, SiC, Si_3N_4 and polycrystalline Silicon – Silicon piezoresistors – Gallium arsenside, quartz – piezoelectric crystals – polymers for MEMS – conductive polymers.
Engineering mechanics for microsystems design: Introduction – static bending of thin plates – circular plates with edge fixed, rectangular plate with all edges fixed and square plates with all edges fixed. Mechanical vibration - resonant vibration – microaccelerometers – design theory and damping coefficients. Thermomechanics – thermal stresses. Fracture mechanics – stress intensity factors, fracture toughness and interfacial fracture mechanics.

Module III (16 hours)

Basics of fluid mechanics in macro and mesco scales: Viscosity of fluids – flow patterns Reynolds number. Basic equation in continuum fluid dynamics – laminar fluid flow in circular conduits – computational fluid dynamics – incompressible fluid flow in microconducts, surface tension, capillary effect and micropumping - Fluid flow in submicrometer and nanoscale – rarefield gas, Kundsen and Mach number and modelling of microgas flow – heat conduction in multilayered thin films – heat conduction in solids in submicrometer scale - Thermal conductivity of thin films - heat conduction equation for thin films.

Microsystem fabrication process: Photolithography – photoresist and applications – light sources. Ion implanation – diffusion process – oxidation – thermal oxidation – silicon diode – thermal oxidation rates – oxide thickness by colour - Chemical vapour deposition - principle – reactants in CVD – enhanced CVD physical vapour deposion – sputtering – deposition by epitaxy – etching – chemcial and plasma etching.

Module IV (14 hours)

Micromanufacturing and microsystem packaging: Bulk Micromachining - Isotropc And Danisotropic Etching, Wet etchants, etch stops, dry etching comparison of wet and dry etching - Surface micromachining, process in general – problems associated surface micromachining - The LIGA process – description – materials for substrates and photoresists – electroplating – The SLIGA process. Microsystem packaging - General considerations - The three levels of microsystem packaging – die

level, device level and system level – essential packaging technologies – die preparation – surface bonding wire bonding and sealing - Three dimensional
packaging, assembly of microsytems – selection of packaging materials.

Text Book

1 Tai-Ran Hsu, *MEMS and Microsystems Design and Manufacture*, Tata McGraw Hill, New Delhi, 2002

Reference Books

2 Mark Madou, *Fundamentals of Microfabrication*, CRC Press, 1997.
3 J. W. Gardner, *Microsensors: Principles and Applications*
4 S. M. Sze, *Semiconductor Sensors*, McGraw Hill, New York, 1994
5 C. Y. Chang and S. M. Sze, *VLSI Technology*, 2000.

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 L011: Cryptography And Network Security

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

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.
Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machine, Steganography, Problems.
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)

Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC's, Problems.
Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, Digital signature standard.

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

Text Books

1. William Stallings, "Cryptography and Network Security", 3rd Ed, Pearson Education (Asia) / Prentice Hall of India, 2003.

Reference Books

1. C. Kaufman, R. Perlman, and M. Speciner, "Network Security: Private Communication in a Public World", 2nd edition, Pearson Education (Asia) Pte. Ltd., 2002.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003.
3. Eric Maiwald, "Fundamentals of Network Security", McGraw- Hill, 2003.

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 L014: Internet Technology

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

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)

Multimedia networking–applications – streaming stored audio and video-internet telephony-RTP-scheduling and policing mechanisms-integrated services- RSVP-differentiated services-network management-the internet network management framework

Module III (13 hours)

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

Module IV (13 hours)
Mobile internet-mobile network layer-mobile IP-dynamic host configuration protocol-ad hoc networks-mobile transport layer-implications of TCP on mobility-indirect TCP-snooping TCP-Mobile TCP-transmission –selective retransmission –transaction –oriented TCP support for mobility-file system-WAP protocols –WML –WML script- wireless telephony applications

Text Books

1. Kurose J.F.& Ross K.W.,Computer Networking: A Top-Down Approach Featuring the Internet,Addison Wesley,Modules I&II
2. Stallings W.,Cryptography and Network Security Principles and practice.,Pearson Education Asia,ModuleIII
3. Schiller J.,Mobile Communications,Addison Wesley,Module IV

Reference Books

1. Deitel H.M.,Deitel P.J.& Nieto T.R.,Internet And World Wide Web: How to Program, Pearson Education
2. Greenlaw R& Hepp E,In-line/On-line;Fundamentals Of the Internet And the World Wide Web, Tata Mc Graw Hill
3. Sharma V & Sharma R,Developing e-Commerce Sites: An Integrated Approach ,Addison Wesley
4. Singhal et. Al S.,The Wireless Application Protocol, Pearson Education Asia
5. Goncalves M.,Firewalls : A Complete Guide, Tata Mc Graw 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 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 (15hours)
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 109 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 solitions.

Text Books

1. Ramaswami R & Safarajan K, "Optical Networks: A Practical Perspective" 2nd Edition, Morgan Kaufmann.
2. OptSim/OptiSystem Mannuals.
3. Abdellatif Marrakchi, "Photonic Switching and Interconnects," Marcel Dekker, November 1993
4. Jean-Pierre Laude, "DWDM fundamentals, Components, and Applications, "Artech House, January 2002.
5. Debra Cameron, "Optical Networking," Wiley, December 2001.

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

Objectives

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

Module I (14 hours)
Personal Communications Services Architecture, Mobility management-handoff management-network signalling- -GSM- GPRS-DECT-UMTS/ WCDMA-IMT 2000- IS 95-cdma2000satellite networks-basics-parameters and configurations-mobile number portability-FAMA-DAMA-broadcast systems-DAB-DVB

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)
Wireless Networking: MAC protocols, Routing, Transport, Ad-hoc networking.
Mobile IP-dynamic host configuration protocol-Routing-DSDV-DSR-Alternative metrics

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

Text Books

1. Jochen Schiller,'Mobile Communications', PHI/Pearson Education, 2nd Ed., 2003
2. William stallings,'Wireless communications & Networks', 2ndEd, Pearson education,New Delhi, 2005
3. *Lin., 'Wireless & Mobile Architectures', Wiley India, New Delhi, 2009*

Reference Books

1. Mosa Ali Abu-Rgheff,'Introduction to CDMA wireless communications', Academin Press-Elsevier, 2007
2. A F Molisch, 'Wireless communications',Wiley India, 2005
3. *Ivan Stojmenovic,'Handbook of Wirelss Networks and Mobile Computing', Wiley India, New Delhi, 2002*
4. Steele,'GSM, CDMAOne & 3G systems Wiley India, New Delhi, 2008
5. kaveh Pahlavan, prasanth Krishnamoorthi.'Principles of wireless networks', PHI/Pearson Education, 2003
6. Uwe Hansmann, lother Merk, Martin S Nicklons and Thomas Srober,"Principles of mobile computing', Springer, Newyork, 2003
7. Hazysztof Wesolowshi,'Mobile Communication Systems', John Wiley & Sons Ltd. 2002

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.

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

Objectives

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

Module I (14 hours)

Study of basic data structures – Arrays- Structures-Sparse matrix – Stacks – Queues- Circular queues- Priority queues - Dqueues. Evaluation of expressions – Polynomial representation using arrays.

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)

Trees - Binary Trees – Tree Traversal – Inorder - Preorder and Postorder, Graphs – Depth first and breadth first search. Sorting methods: Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Heap sort, Radix sort, External sorting methods (basic idea only).

Module IV (11 hours)
Principles of programming – System Life Cycle - Algorithm Specification-Recursive Algorithms- Documentation- Performance Analysis and Measurements- Time and Space complexity-Complexity calculation of simple algorithms.

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
4. Adan Drozdek, Data structures 7 Algorithms using C $^{++}$, Cengage learning India pvt. Ltd.,2006, 5th Indian reprint 2009, New Delhi

Reference Books

1. Fundamentals of Data Structures in C++: Horowitz, Sahni & Mehta, Galgottia Pub.
2. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum
3. Fundamental Algorithms: Knuth.
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

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

Objectives:

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

Module I (14 hours)
Introduction to Mechatronics.- Mechatronics in manufacturing- Mechatronics in products-Scope of Mechatronics.
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)
System devices: System drives-hydraulic systems, DC motors, stepping motors, AC motors- Feedback devices-Encoders, pulse digitizers, resolvers, Inductosyn, tachometers.- Counting devices-Flip Flops, counters ,decoders, digital to analog converters. Interpolation- linear interpolator-circular interpolators, CNC software interpolator-Flow of data in NC machines.

Module III (13 hours)
NC Part programming: Manual Programming-Concepts-tape formats- tab sequential- fixed block word address and variable block formats- Part Programming examples-Point to point programming and simple contour programming- Computer aided programming- Concepts – Post processor programming languages- APT programming-Part programming examples.

Module IV (14 hours)
Industrial Robotics: Basic concepts- Robotics and automation- Specification of Robots- Resolution, Repeatability and accuracy of manipulator- Classification of Robots- Industrial application- Robot drives- Characteristics of end of arm tooling- Sensors-Tactile, proximity and range sensors- contact and non-contact sensors- velocity sensors- touch and slip sensors- Force and torque sensors- Programming- Lead through programming- Textual programming- Programming languages - On line and offline programming- Intelligent Robots.

References

1. Yoram Koren, *Computer Control of Manufacturing Systems*, McGrawHill
2. Michel P. Groover, *Industrial Robots-Technology, Programming and Applications*, McGrawHill
3. Fu K.S , Gonzales et al, *Robotics-Control, sensing, vision and intelligence*, McGrawHill.

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.	*5 x 2 marks=10 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 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

IC09 L23 Bio-informatics

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

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.

Module II (14hours)

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 & Wuncsh, 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
2. T. K. Attwood and D. J. Parry-Smith, *Introduction to Bioinformatics*, Pearson Education, 2003.
3. Claverie & Notredame, *Bioinformatics - A Beginners Guide*, Wiley-Dreamtech India Pvt
4. Neil C. Jones and PavelA. Pevzner, *An introductin to bioinformatics algorithms*, Ane Books
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

1. Dan Gusfield, *Algorithms On Strings, Trees And Sequences*, Cambridge University Press
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

CE09 L25 FINITE ELEMENT METHODS*

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

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

Module I (14 hours)

Introduction to Finite Element Methods: Physical problems, mathematical models and finite element solutions – Mathematical model of Discrete systems – elements and assemblage - matrix formulation – Equations of equilibrium - element assembly and solution for unknowns –Gauss elimination method, LDL^{-T} Method - Basic equations of elasticity – stress–strain and strain-displacement relations - theory of stress and deformation - stress-strain-temperature relations

Review of direct stiffness method: Descretization – element and structure stiffness matrices DOF relationship- assembly of global stiffness matrix and load vector - solution of equations for unknowns - displacement boundary conditions - computation of stress - support reactions.

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

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
3. Reddy, J.N., An Introduction to the Finite Element Method, McGraw Hill, 2006.

Reference books:

1. Desai C.S., Elementary Finite Element Method, Prentice Hall of India
2. Chandrupatla T.R. & Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India
3. Cook, R.D., Finite Element Modelling for Structural Analysis, John Wiley and sons.
4. Gallaghar R.H., Finite Element Analysis: Fundamentals, Prentice Hall Inc.
5. Rajasekaran S., Finite Element Analysis in Engineering Design, Wheeler Pub.
6. Krishnamoorthy C. S., Finite Element Analysis - Theory and Programming, Tata McGraw Hill
7. Zienkiewics O.C. & Taylor R.L., The Finite Element Method, Vol I & II, McGraw Hill
8. Segrelind., The Finite Element Method.

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 **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (12 Hours)

Artificial Intelligent systems – Neural Networks, Fuzzy Logic and Evolutionary Programming concepts. Artificial Neural Networks – Biological neural networks – Model of an artificial neuron- Comparison between biological neuron and artificial neuron– Basic models of artificial neural network –Learning methods – - Activation function and terminologies of ANN- - Mc Culloch Pitts Neuron – Linear Separability – Hebb network – Perceptron Networks , Adaline, Madaline.

MODULE II (14 Hours)

Back propagation Networks : Architecture - Multi layer perceptron –Back propagation learning – Input layer, Hidden Layer , Output Layer computations, Calculation of error, Training of ANN, Back propagation Algorithm, Momentum and Learning rate, Selection of various parameters in BP networks- Radial Basis Function Networks [T. B. 1].

Variations in standard BP algorithms – Decremental iteration procedure, Adaptive BP, GA based BP, Quick prop training, Augmented BP networks, Sequential learning Approach for single hidden layer Neural networks.

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

value assignments-Defuzzification- Defuzzification methods-Fuzzy Rule Base and approximate reasoning- Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Decomposition of rules, Aggregation of fuzzy rules- Fuzzy Inference Systems- Construction and Working Principle of FIS- Methods of FIS- Mamdani FIS and Sugeno FIS- Fuzzy Logic Control Systems- Architecture and Operation of FLC System- FLC System Models- Application of FLC Systems.

Module IV (14 Hours)

Genetic Algorithms- Basic Concepts- Creation of off- springs- Working Principle- Encoding- Fitness function- Reproduction- Roulette- Wheel Selection, Boltzmann Selection- Tournament selection- Rank Selection- Steady- State Selection- Elitism- Generation gap and steady state replacement- Inheritance operators- Cross Over- Inversion and deletion- Mutation Operator- Bit- wise operators- Generational Cycle- Convergence of Genetic Algorithm- Differences and Similarities between GA and other traditional methods- Applications.

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Text Books

1. S. N. Sivanandam, S. N. Deepa, *Principles of Soft Computing,* Wiley India Pvt. Ltd.[Module I& III]
2. R.Rajasekharan and G.A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications,* Prentice Hall of India. [Module II, & IV]

Reference Books

1. Fakhreddine O.Karray, Clarence De Silva, Intelligent Systems Design, Theory, Tools and Application, Pearson Education
2. S. Haykins, Neural Networks – A Comprehensive Foundation , Prentice Hall 2002.
3. L. Fausett, Fundamentals of Neural Networks, Prentice Hall 1994.
4. T.Ross, Fuzzy Logic with Engineering Applications, Tata McGrawHill, New Delhi 1995.
5. D.E. Goldberg, Genetic Algorithms in search, Optimization and Machine Learning, Addison Wesley MA, 1989.
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 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 L09: Multimedia Communication Systems

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (15hours)

Multimedia Communication Model-Elements of Multimedia Systems-User Requirements-Network Requirements-Packet Transfer Concept-Multimedia Requirements and ATM Networks . Multimedia Terminals. Media Interaction. Bimodality of Human Speech, Lip Reading Speech –Driven Talking Heads. Lip Synchronization. LIP Tracking. Audio-to Visual Mapping. Bimodal Person Verification. Joint Audio-Video Coding.

Module II (14 hours)

Digital Media. Signal Processing Elements. Texture-Based Methods. Shape-Based Methods . Perceptual Coding of Digital Audio Signals.Absolute Threshold of Hearing. Critical Band Frequency Analysis. Simultaneous Masking and the Spread of Masking. Temporal Masking PE. Transform Audio Coders. Audio Subband Coders. Speech Coder Attributes CD Audio Coding for Multimedia

Applications. Image Coding. Video Coding ,Watermarking.Organization,Storage and Retrieval Issues. Signal Processing for Networked Multimedia.

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)

Main features of a Distributed Multimedia Systems (DMS) Resource Management of DMS. Multimedia Operating VoD. Telecooperation Infrastructure. Telemedicine. Basic features of a Hypermedia System. Packet Audio/Video in the Network Environment. MultimediaTransport Across ATM Networks. Multimedia Across IP Networks. . Multimedia Across DSLs. Serial Transmission: TDM . Parallel Transmission Frequency Division Multiplexing Internet Access Neteworks. Multimedia Across Wireless. Communication System (WBCS) for Multimedia.. Multicast Routing in Cellular Networks. Broadband Wireless Mobile. Digital Video Broadcasting (DVB).

Text Books

1. K.R., Rao, MultimediaCommunication System, Technology,Standards and Networks,Pearson Education.
2. Rajan parekh,'Principles of multimedia, Tata McGraw Hill Pub., New Delhi, 2006
3. Tay Vaughan.'Multimedia: makng it works', McGraw Hill Pub., New Delhi, 7th ed. 2008

Reference Books

1. Gibson.J.D, Multimedia Communications,Directions and Innovations, Academic Press
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: 70

EC09 L012: Antenna Theory & Design

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

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)

Antenna Synthesis: Formulation of the synthesis problem, synthesis principles, line sources shaped beam synthesis, linear array shaped beam synthesis — Fourier Series, Woodward — Lawson sampling method, comparison of shaped beam synthesis methods, low side lobe narrow main beam synthesis methods Dolph Chebyshev linear array, Taylor line source method.

Text Books

1. Warren L Stutzman and Gary A Thiele, "Antenna Theory and Design", 2ndEd, John Wiley and Sons Inc. 1998
2. Constantine. A. Balanis: "Antenna Theory- Analysis and Design", Wiley India, 2nd Edition, 2008
3. Kraus, "Antennas", Tata McGraw Hill, NewDelhi, 3" Edition, 2003

Reference Books

1. R.E.Collin, Antennas and Microwave propagation, Tata Mc-Graw Hill,2004
2. R.C.Johnson and H.Jasik,Antenna Engineering hand book, Mc-Graw Hill,1984
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: 70

EC09 L015: Television & Radar Engineering

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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 degaussing circuits- frequency interleaving- Bandwidth for color signal transmission- modulation of colour diference 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)

CW Radar – Simple CW radar- Intermediate frequency CW radar- FM- CW radar- FM- CW altimeter- Multiple frequency CW radar- Pulse doppler MTI radars- Delay line canceller- blind speed- tracking radar- A scope and PPI display

Text Books

1. Gulati R.R., Modern Television Engineering ,Wiley Eastern Ltd.
2. Michael Robin& Michael Poulin, Digital Television Fundamentals, Mc Graw Hill
3. Bernard Grob& Charles E. Herndon,Basic Television and Video Systems,
4. Introduction to Radar Systems,Mc Graw Hill,Kogakusha Ltd.

Reference Books

7. Dhake A.M.,Television Engineering,Tata Mc Graw Hill
8. Damacher P. Digital Broadcasting ,IEE Telecommunication Series

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 L018: Nano Technology

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

Objectives

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

Module I (11hours)
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
Lyschevski,Sergey Edward, Nano and Micro-electromechanical Systems: Fundamentals of Nano and micro engineering, CRC Press, 2000

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.	*5 x 2 marks=10 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 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EC09 L021: Image and Video Processing

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

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 (11hours)

Introduction: 2D systems, Mathematical preliminaries – Fourier Transform, Z Transform, Optical & Modulation transfer function, Matrix theory, Random signals, Discrete Random fields, Spectral density function. Image Perception: Light, Luminance, Brightness, Contrast, MTF of the visual system, Visibility function, Monochrome vision models, Fidelity criteria, Color representation, Chromaticity diagram, Color coordinate systems, Color difference measures, Color vision model, Temporal properties of vision.

Module II (15 hours)

Image Sampling and Quantization: Introduction, 2D sampling theory, Limitations in sampling & reconstruction, Quantization, Optimal quantizer, Compander, Visual quantization. Image Transforms: Introduction, 2D orthogonal & unitary transforms, Properties of unitary transforms, DFT, DCT, DST, Hadamard, Haar, Slant, KLT, SVD transform. Image Representation by Stochastic Models: Introduction, onedimensional Causal models, AR models, Non-causal representations, linear prediction in two dimensions.Image Enhancement: Point operations, Histogram modeling, spatial operations, Transform operations, Multi-spectral image enhancement, false color and Pseudo-color, Color Image enhancement.

Module III (16 hours)

Image Filtering & Restoration: Image observation models, Inverse & Wiener filtering, Fourier Domain filters, Smoothing splines and interpolation, Least squares filters, generalized inverse, SVD and Iterative methods, Maximum entropy restoration, Bayesian methods, Coordinate transformation & geometric correction, Blind de-convolution.
Image Analysis & Computer Vision: Spatial feature extraction, Transform features, Edge detection, Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation, Classification Techniques.
Image Reconstruction from Projections: Introduction, Radon Transform, Back projection operator, Projection theorem, Inverse Radon transform, Fourier reconstruction, Fan beam reconstruction, 3D tomography.Image Data Compression: Introduction, Pixel coding, Predictive techniques, Transform coding, Inter-frame coding, coding of two tone images, Image compression standards.

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 ompensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 and beyond, Content based video indexing

Text Books

1 K. Jain, “Fundamentals of Digital Image Processing”, Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.
2. Z. Li and M.S. Drew, “Fundamentals of Multimedia”, Pearson Education (Asia) Pte. Ltd., 2004.
3. R. C. Gonzalez and R. E. Woods, “Digital Image Processing”, 2nd edition, Pearson Education (Asia) Pte. Ltd/Prentice Hall of India, 2004.
4. M. Tekalp, “Digital Video Processing”, Prentice Hall, USA, 1995.

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 L24: ELECTRONIC PACKAGING

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

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)
Introduction – role of packaging – IC packaging – MEMS packaging – consumer electronics packaging – medical electronics packaging – Trends – challenges

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

1. Tummala, Rao R., *Fundamentals of Microsystems Packaging,* McGraw Hill

Reference Books

1. Blackwell (Ed), *The electronic packaging handbook,* CRC Press
2. Tummala, Rao R, *Microelectronics packaging handbook,* McGraw Hill
3. Bosshart, *Printed Circuit BoardsDesign and Technology,*TataMcGraw 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)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 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 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

EE09 L 25 ROBOTICS AND AUTOMATION

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an introduction of industrial robotics and automation*

Module I (14 Hours)

Automation and Robotics - Robotics in Science Fiction - A Brief History of Robotics - The Robot and Its Peripherals-Robot Activation and Feedback Components - Position Sensors - Velocity Sensors - Actuators - Power Transmissions Systems - Robot Joint Control Design- Introduction to Manipulator Kinematics - Homogeneous Transformations and Robot Kinematics -Manipulator Path Control - Robot Dynamics - Configuration of a Robot Controller.

Module II (13 Hours)

Types of End Effectors - Mechanical Grippers - Other Types of Grippers - Tools as End Effectors - The Robot/End Effector Interface - Considerations in Gripper Selection and Design - Sensors in Robotics - Tactile Sensors - Proximity and Range Sensors - Miscellaneous Sensors and Sensor-Based Systems - Uses of Sensors in Robotics - Introduction to Machine Vision - The Sensing and Digitizing Function in Machine Vision - Image Processing and Analysis - Training and Vision System - Robotic Applications.

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 -

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)

Introduction to robot intelligence and task planning- state space search-problem reduction-use of predicate logic-means –end analysis-problem-solving –robot learning-robot task planning-expert systems and knowledge learning.

Text Books

1. Mikell P. Groover- et. Al, *Industrial robotics, Technology, programming and Applications*, McGraw Hill
2. K. S. Fu, R. C. Gonzalez, C. S. G. Lee, *Robotics, Control, Sensing and Intelligence,*

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 **Credits: 4**
3 hours lecture and I hour tutorial per week

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)
Concept of Industrial hygiene, programmes-Recognition –Evaluation- Control, Noise- source –effects and noise control, exposure limits –standards, Hearing conservation programmes, Fire –fire load-control and industrial fire protection systems, Fire Hydrant and extinguishers, Electrical Hazards, protection and interlock-Discharge rod and earthling device, safety in the use of portable tools.

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

1. Thomas J. Anton, *Occupational Safety and Health Management*, McGraw Hill
2. Ian T.Cameron & Raghu Raman, *Process Systems Risk Management*, ELSEVIER Academic press.
3. C.S.Rao, *Environmental Pollution Control Engineering*, New Age International Limited
4. L. S. Srinath, *Reliability Engineering*, East west Press, New Delhi.

Reference books

1. Frank E. McErloy,P.E; C.S.P, *Accident Prevention Manual for Industrial Operations*,NSC Chicago
2. Lees F.P, *Loss Prevention in Process Industries*, Butterworths, New Delhi.
3. BHEL,*Occupational Safety Manual*, Tiruchirappalli.
4. Dr. A.K. Gupta, *Reliability, Maintenance and Safety Engineering*, Laxmi Publications, New Delhi.

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.
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University Examination Pattern

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

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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