SYLLABUS & CURRICULUM

of

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

UNIVERSITY OF CALICUT
(2014 admission)

SCHEME for Electronics and Communication Engineering (ECE) Branch for 3rd to 8th Semesters

3rd Semester

Code	Subject	Hours/week			Marks		Sem-end duration -hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EN14 301	Engineering Mathematics III	3	1	-	50	100	3	4
EN14 302	Computer Programming in C	3	-	1	50	100	3	4
EC14 303	Network Analysis & Synthesis	3	1	-	50	100	3	4
EC14 304	Solid State Devices	3	1	-	50	100	3	4
EC14 305	Electronic Circuits I	3	1	-	50	100	3	4
EC14 306	Electrical Engg.	3	1	-	50	100	3	4
EC14 307 (P)	*Basic Electronics Lab*	-	-	3	50	100	3	2
EC14 308 (P)	*Electrical Engg.Lab*	-	-	3	50	100	3	2
	Total	**18**	**5**	**7**				**28**

Note: For EN14 302 Computer Programming in C, the end semester examination will be held by the University as a theory paper.

4th Semester

Code	Subject	Hours/week			Marks		Sem-end duration -hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EN14 401B	Engineering Mathematics IV	3	1	-	50	100	3	4
EN14 402	Environmental Science	3	1	-	50	100	3	4
EC14 403	Signals and Systems	3	1	-	50	100	3	4
EC14 404	Electronic Circuits II	3	1	-	50	100	3	4
EC14 405	Digital Electronics	3	1	-	50	100	3	4
EC14 406	Analog Communication	3	1	-	50	100	3	4
EC14 407 (P)	*Digital Electronics Lab*	-	-	3	50	100	3	2
EC14 408 (P)	*Electronic Circuits Lab*	-	-	3	50	100	3	2
	Total	**18**	**6**	**6**				**28**

5th Semester

Code	Subject	Hours/week			Marks		Sem-end duration -hours	Credits
		L	T	P/D	Internal	Sem-end		
EC14 501	Computer Organization & Architecture	3	1	-	50	100	3	4
EC14 502	Linear Integrated Circuits	3	1	-	50	100	3	4
EC14 503	Digital Communication	3	1	-	50	100	3	4
EC14 504	Electromagnetic Field Theory	3	1	-	50	100	3	4
EC14 505	Microprocessors and Microcontrollers	3	1	-	50	100	3	4
EC14 506	Quantitative Techniques& Managerial Decisions	3	1	-	50	100	3	4
EC14 507 (P)	*Analog Communication Lab*	-	-	3	50	100	3	2
EC14 508 (P)	*Linear Integrated Circuits Lab*	-	-	3	50	100	3	2
	Total	**18**	**6**	**6**				**28**

6th Semester

Code	Subject	Hours/week			Marks		Sem-end duration -hours	Credits
		L	T	P/D	Internal	Sem-end		
EC14 601	Radiation and Propagation	3	1	-	50	100	3	4
EC14 602	Optical Communication	3	1	-	50	100	3	4
EC14 603	VLSI design	3	1	-	50	100	3	4
EC14 604	Digital Signal Processing	3	1	-	50	100	3	4
EC14 605	Control Systems	3	1	-	50	100	3	4
EC14 606	Satellite Communication	3	1	-	50	100	3	4
EC14 607 (P)	*Microprocessors and Microcontrollers Lab*	-	-	3	50	100	3	2
EC14 608 (P)	***Mini Project***	-	-	3	50	100	3	2
	Total	**18**	**6**	**6**				**28**

7th Semester

Code	Subject	Hours/week			Marks		Sem-end duration -hours	Credits
		L	T	P/D	Internal	Sem-end		
EC14 701	Information Theory and Coding	3	1	-	50	100	3	4
EC14 702	Microwave Engineering	3	1	-	50	100	3	4
EC14 703	Digital System Design	3	1	-	50	100	3	4
EC14 704	Elective I	3	1	-	50	100	3	4
EC14 705	Elective II	3	1	-	50	100	3	4
EC14 706 (P)	*VLSI lab*	-	-	3	50	100	3	2
EC14 707 (P)	*Communication Systems lab*	-	-	3	50	100	3	2
EC14 708 (P)	*Project*	-	-	4	100	-	-	4
	Total	**15**	**5**	**10**				**28**

Elective I

EC14 704(A) Internet Technology (Global)
EC14 704(B) Television and Radar Engineering
EC14 704(C) Embedded Systems
EC14 704(D) Nanotechnology
EC14 704(E) Image and Video Processing

Elective II

EC14 705(A) Soft Computing
EC14 705(B) High Speed Digital Design
EC14 705(C) Antenna Theory and Design
EC14 705(D) Electronic Packaging(Global)
EC14 705(E) Biomedical Instrumentation

8th Semester

Code	Subject	Hours/week			Marks		Sem-end duration -hours	Credits
		L	T	P/D	Internal	Sem-end		
EC14 801	Data and Communication Networks	3	1	-	50	100	3	4
EC14 802	Economics and Management	3	1	-	50	100	3	4
EC14 803	Wireless Mobile Communications	3	1	-	50	100	3	4
EC14 804	Elective III	3	1	-	50	100	3	4
EC14 805	Elective IV	3	1	-	50	100	3	4
EC14 806 (P)	*Seminar*	-	-	3	100	-	-	2
EC14 807 (P)	*Project*	-	-	7	100	-	-	4
EC14 808 (P)	*Viva Voce*	-	-	-	-	100	-	4
	Total	**15**	**5**	**10**				**30**

Elective III

EC14 804 (A) Introduction to MEMS
EC14 804 (B) Photonic Switching and Network
EC14 804 (C) Microwave Active Devices and Circuits
EC14 804 (D) Mobile Computing
EC14 804 (E) Data Structures and Algorithms (Global)

Elective IV

EC14 805 (A) Multimedia Communication Systems
EC14 805 (B) Probability and Random Processes
EC14 805 (C) Cryptography and Network security
EC14 805 (D) Advanced Semiconductor Device Technology
EC14 805 (E) Advanced Digital Signal Processing

EN14 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 wealth of ideas and results with wide area of application.

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

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

Module II: Functions of a Complex Variable (13 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 (No proof) – Laurent series (No proof) – Singularities - Zeros – Poles - Residues – Evaluation of residues – Cauchy's residue theorem – Evaluation of real definite integrals.

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

Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Independence – Linear Dependence – Basis – Dimension– Orthogonal and Orthonormal Sets – Orthogonal Basis – Orthonormal Basis – Gram-Schmidt orthogonalisation process – Inner product spaces – Definition – Examples – Inequalities ; Schwartz, Triangle (No proof).

Module IV: Fourier Transforms (13 hours)

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier transforms – transforms of some elementary functions – Elementary properties of Fourier transforms – Convolution theorem (No proof) – Fourier Sine and Cosine transforms – transforms of some elementary functions –Properties of Fourier Sine and Cosine 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. Anuradha Gupta, *Complex Analysis*, Ane Books India.
4. Shahnaz bathul, *Text book of Engineering Mathematics, Special functions and Complex Variables*, Prentice Hall of India.
5. Gerald Dennis, Mahan, *Applied Mathematics*, Springer International Edition.
6. David Towers, *Guide to Linear Algebra*, MacMillan Mathematical Guides.
7. Inder K Rana, *An Introduction to Linear Algebra*, Ane Books India.
8. Surjeet Singh, *Linear Algebra*, Vikas Publishing House.
9. Howard Anton, Chris Rorres, *Elementary Linear Algebra, Applications Version*, John Wiley and Sons.
10. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, Pearson Education.

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EN14 302: COMPUTER PROGRAMMING IN C

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (12 hours)

Introduction to Computers: CPU, Memory, input-output devices, secondary storage devices, Processor Concepts - Evolution and comparative study of processors. Machine language, assembly language, and high level language. Inside a PC, Latest trends and technologies of storage, memory, processor, printing etc. Concept of Program and data, System software - BIOS, Operating System- Definition-Functions-Windows, and Linux. Compilers and assemblers.

Module II (12 hours)

Basic elements of C: Flow chart and algorithm – Development of algorithms for simple problems. Structure of C program – Operators and expressions – Procedure and order of evaluation – Input and Output functions**.** *while*, *do-while* and *for* statements, *if*, *if-else*, *switch, break, continue, goto,* and *labels*. Programming examples.

Module III (14 hours)

Functions and Program structures: Functions – declaring, defining, and accessing functions – parameter passing methods – Recursion – Storage classes – *extern*, *auto*, *register* and *static*. Library functions. Header files – C pre-processor. Example programs. Arrays: Defining and processing arrays – passing arrays to functions – two dimensional and multidimensional arrays – application of arrays. Example programs.

Module IV (14 hours)

Structures – declaration, definition and initialization of structures, unions, Pointers: Concepts, declaration, initialization of pointer variables, Accessing a Variable through its Pointer Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, examples Concept of a file – File operations, Input/Output Operations on Files, Random Access to Files File pointer.

Text Books

1. P. Norton, *Peter Norton's Introduction to Computers*, Tata McGraw Hill, New Delhi
2. E. Balaguruswamy, *Programming in ANSI C*, Tata McGraw Hill, New Delhi

Reference Books

1. K. N. King. *C Programming: A Modern Approach*, W. W. Norton & Company
2. S .Kochan , *Programming in C*, CBS publishers & distributors
3. P. Norton, *Peter Norton's Computing Fundamentals*, Tata McGraw Hill, New Delhi
4. M. Meyer, R. Baber, B. Pfaffenberger. *Computers in Your Future*, Pearson Education India

5. B.Gottfried, *Programming with C*, Tata McGraw Hill, New Delhi
6. B. W. Kernighan, and D. M. Ritchie, *The C Programming Language*, Prentice Hall of India

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

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 303 NETWORK ANALYSIS & SYNTHESIS

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

Objectives

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

Module I (15 hours)

Basic Circuit elements: R, L, C and mutually coupled circuits-voltage current relationship- Independent and dependent Sources. **Analysis of electrical networks**: Loop and Nodal analysis. **Network theorems**: Thevenin, Norton, Superposition, Source transformations, Maximum Power Transfer theorems. Time domain analysis of R-L and R-C circuits- initial conditions. **S-Domain analysis of circuits**: Review of Laplace transform- Transforms of basic signals- transformation of a circuit into S-domain, Analysis of the transformed circuit- mutually coupled circuits, transient analysis of RC, RL and LC networks with Impulse, step, pulse, ramp and exponential inputs- step response of RLC network

Module II (13 hours)

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

Module III (12 hours)

Filters: Brick wall Specifications, Types of filtering, Butterworth Low-Pass Transfer Characteristic, Basic Passive realization of Butterworth filters, Chebyshev Approximation, Characteristics. **Frequency transformations**: Transformation to high pass, band pass and band elimination filters. **Attenuators**: Types of attenuators, T and Bridged T attenuators - compensated attenuators.

Module IV (12 hours)

Elements of realizability Theory: Causality and stability-Hurwitz Polynomials-Positive Real Functions- Elementary Synthesis Procedures. **Synthesis of One-Port Networks**: Properties of L-C Admittance Functions, Synthesis of L-C Driving point Admittances- Properties of R-C Driving point Impedances, Synthesis of R-C Impedances or R-L Admittances-Properties and Synthesis of R-L Impedances and R-C admittances.

Text Books

1. Van Valkenberg, *Network Analysis*, Prentice-Hall of India
2. Franklin F. Kuo, *Network Analysis and Synthesis*, Wiley India, Second Edition.
3. Edminister, *Electric Circuits – Schaum's Outline Series*, McGraw-Hill.
4. William H Hayt & Jack E Kemmerly, *Engineering Circuit Analysis*, TMH

Reference Books

1. DeCarlo/Lin, Linear Circuit Analysis, Oxford University Press, Second edition
2. D. Roy Choudhary, Networks and Systems, New Age International Publishers, Second Edition

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 304: 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 (12 hours)

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

Module II (14 hours)

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

Module III (13 hours)

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

Module IV (13 hours)

Junction FET - pinch off and saturation - gate control - VI characteristics

MOS capacitor - accumulation, depletion and strong inversion - threshold voltage - MOSFET - p channel and n channel MOSFETs - depletion and enhancement mode MOSFETs – small signal model

UJT – operation –VI characteristics

Power Diodes - SCR- Insulated Gate Bipolar Transistor – Power MOSFETs

Text Books

1 Ben G Streetman and Sanjay Banerjee: *Solid State Electronic Devices*, (Fifth Edition) Pearson Education
2 Neamen, *Semiconductor Physics & Devices*, Pearson Education
3 Sze S M, *Physics of Semiconductor Devices*, John Wiley
4 Pierret R F, *Semiconductor Device Fundamentals*, Pearson Education
5 Tyagi M S, *Introduction to Semiconductor Materials & Devices*, John Wiley
6 Sima Dimitrijev, *Physics of Semiconductor Devices*, Oxford University Press

Reference Books

1. Sah C T, *Solid State Electronics*, World Scientific
2. Muller & Camins, *Device Electronics for Integrated Circuits*, John Wiley
3. Dipankar Nagchoudhuri : *Microelectronic Devices*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 305 ELECTRONIC CIRCUITS I

Teaching scheme **Credits: 4**

3 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 (13 Hours)

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

Module II (13 Hours)

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

Module III (13 Hours)

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

Module IV (13 Hours)

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

Text books

1. Sedra A.S & Smith K.C., *Microelectronic Circuits,* Oxford University Press
2. Millman & Halkias : *Integrated Electronics*, MGH. 1996

References

1. Horenstein M.N: *Microelectronic circuits and Devices* PHI
2. Gray & Meyer:*Analysis and Design of Analog Integated Circuits;* John Wiley
3. Schilling D.L. & Belove C.*: Electronic Circuits,* McGraw Hill,
4. Spencer & Ghausi, *Introduction to Electronic Circuit Design*; Pearson Education
5. Thomas L.Floyd and David Buchla: *Fundamentals of Analog Circuits,Pearson*
6. Robert L Boylestad and Louis Nashelsky: *Electronic Devices and Circuit theory*, Pearson

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 306 ELECTRICAL ENGINEERING

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

Objectives

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

Module I (12 hours)

Review of transformers – 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 - principle and working of induction type energy meter

Module II (14 hours)

Review of DC generators – DC generator on no load – open circuit characteristics – Armature reaction and commutation (basics only) - load characteristics of shunt, series and compound generators – Review of dc motors – performance characteristics of shunt, series and compound motors – starter – need of starter - 3 point starter –losses in DC machines – power flow diagram – efficiency – speed control – armature voltage control, armature resistance control & field control – applications of dc motor

Module III (12 hours)

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

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 – speed control of induction motor – stator voltage control, stator frequency control, rotor resistance control
– applications of induction motors

Text Books

1. P.S. Bimbhra, Electrical Machinery, Khanna Publishers

Reference Books

1. Ashfaq Hussain, *Electrical Machines*, Dhanpat Rai & Co
2. D.P. Kothari & I.J. Nagrath, *Electrical Machines*, Tata McGraw Hill Publishing Company Limited

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC 14 307(P) BASIC ELECTRONICS LAB

Teaching Scheme **Credits**: 2

3 hours practical per week

Objectives

- *Implementation of basic Electronic circuits*

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

List of experiments

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

Internal Continuous Assessment *(Maximum Marks-50)*

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

Semester End Examination *(Maximum Marks-100)*

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

EC14 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-100)*

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

EN14 401B: ENGINEERING MATHEMATICS IV

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

Teaching scheme **Credit** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I: Probability Distributions (13 hours)

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

Module II: *Z* – Transforms (14 hours)

Some elementary concepts – Definition of ***Z***-transform – Convergence of ***Z***-transform – Examples of ***Z***-transform – Properties of ***Z***-transform – Inverse ***Z***-transform – Convolution Theorem.

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

Power series method for solving ordinary differential equations – Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Generating functions (No proof) – Relation between Bessel functions – Orthogonality property of Bessel functions (Proof not required).

Module IV: Partial Differential Equations (13 hours)

Introduction – Solutions of equations of the form $F(p,q) = 0$; $F(x,p,q) = 0$; $F(y,p,q) = 0$; $F(z,p,q) = 0$; $F_1(x,q) = F_2(y,q)$; 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.

Text Books

Module I:

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

Module II:
Babu Ram, *Engineering Mathematics Vol. II, 2nd edition*, Pearson Education. Sections: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7.

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

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

Reference books

1. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, *Probability and Statistics in Engineering*, 4e, John Wiley and Sons, Inc.
2. Sheldon M Ross, *Introduction to Probability and Statistics for Engineers . and Scientists*, 3e, Elsevier, Academic Press.
3 Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, 3e, Pearson Education.
4 H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach*, Ane Books India.
5 B V Ramana, *Higher Engineering Mathematics*, McGrawHill.
6 Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
7 J K Sharma, *Business Mathematics, Theory and Applications*, Ane Books India.
8 John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
9 M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
10 Wylie C.R and L.C. Barret, *Advanced Engineering Mathematics*, McGraw Hill.
11. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
12. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II.*, Prentice Hall of India.
13. Michael D Greenberg, *Advanced Engineering Mathematics*, Pearson Education.
14. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.
15. Babu Ram, *Engineering Mathematics Vol.I & II*, Pearson Education.

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EN14 402 ENVIRONMENTAL SCIENCE

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 hours)

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

Module II (13 hours)

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

Biodiversity and its consideration: introduction - definition: genetic, species and ecosystem diversity -bio-geographical classification of India - value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values - biodiversity at global, national, and local level - India as 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 (13 hours)

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

Module IV (13 hours)

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

Text Books:

1. Daniels & Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009
2. Raman Sivakumar, Introduction to environmental science and engineering, 2nd edn, . Tata McGraw Hill, 2010
3. Anindita Basak, Environmental Studies, Pearson Education, 2009
4. Suresh K.D, Environmental Engineering and Management, Katson Books, 2007
5. Benny Joseph, Environmental studies, 2nd edn, McGraw Hill, 2009

References:

1. Raghavan Nambiar, K Text book of Environmental Studies, Scitech Publishers(India) Pvt. Ltd
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009
3. P N Palanisamy, P Manikandan, A Geetha, Manjula Rani, Environmental Science, Pearson Education, 2012
4. D.L. Manjunath, Environmental Studies, Pearson Education, 2011

Internal Continuous Assessment *(Maximum Marks-50)*

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

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

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

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

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

Maximum Total Marks: 100

EC14 403 SIGNALS AND SYSTEMS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module 1 (13 hours)

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

Module II (13 hours)

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

Module III (13 hours)

Laplace transform analysis of systems-Unilateral and Bilateral Laplace Transforms, properties-relation between transfer function and differential equation- causality and stability- inverse system- determining the frequency response from poles and zeros.

Fourier representation of discrete time signals- discrete time Fourier series and discrete time Fourier transform- Properties.

Module IV (13 hours)

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

Text Books

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

Reference Books

1 R.E. Zeimer, W.H. Tranter and D. R. Fannin, Signals and Systems: Continuous and Discrete, 4th ed., Pearson Education, Delhi.

2. Charles L. Phillips, John Parr, Eve Riskin, Signal,Systems and Transform, 4th ed. Pearson.

3. J.B. Gurung, Signals and Systems, PHI

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 404 ELECTRONIC CIRCUITS II

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

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

Module 1 (13 hours)

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

Module II (14 hours)

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

Module III (13 hours)

Pulse response switching characteristics of a BJT - BJT switches with inductive and capacitive loads - nonsaturating switches - emitter follower with capacitive loading-RC differentiator and integrators Multivibrators - principles & analysis of Astable, monostable and bistable multivibrators-triggering methods-Schmitt trigger analysis of emitter coupled circuit-analysis of sweep circuits-principles of miller and bootstrap circuits.

Module IV (12 hours)

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

Text Books

1. Sedra A.S & Smith K.C., Microelectronic Circuits, Oxford University Press
2. Millman J. & Taub H., Pulse, Digital & Switching Waveforms, Tata McGraw Hill

Reference Books

1. Milman & Halkias, Integrated Electronics, McGraw Hill
2. Gray & Meyer, Analysis and Design of Analog Integated Circuits; John WileySchilling D.L. & Belove C., Electronic Circuits, McGraw Hill
3. Robert L Boylestad and Louis Nashelsky: Electronic Devices and Circuit theory, Pearson
4. Spencer & Ghausi, Introduction to Electronic Circuit Design; Pearson Education
5. Venkata Rao K, Rama Sudha K, Manmadha Rao G., Pulse and Digital Circuits:Pearson Education
6. Electronics for Analog Signal Processing - I, Prof. K. RadhakrishnaRao, IIT Madras (nptel.iitm.ac.in)
7. Electronics for Analog Signal Processing - II, Prof. K. RadhakrishnaRao, IIT Madras (nptel.iitm.ac.in)
8. Analog Circuits, Prof. Shanthi Pavan, IIT Madras (VLSI Group, IIT Madras - Video Lectures)
9. Analog Integrated Circuit Design, Prof. Nagendra Krishnapura, IIT Madras (VLSI Group, IIT Madras - Video Lectures)
10. Analog ICs, Prof. K. RadhakrishnaRao, IIT Madras (nptel.iitm.ac.in)
11. Circuits and Electronics, Prof. Anant Agarwal, MIT(ocw.mit.edu)

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 405 DIGITAL ELECTRONICS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 hours)

Boolean algebra: Theorems and operations- Boolean expressions and truth tables-Duality and Inversion- Multiplying out and factoring expressions- Exclusive-OR and equivalence operations- Positive and Negative Logic.

Combinational logic design using truth table- Minterm and Maxterm expansions- Incompletely specified functions.

Minimization Techniques: Algebraic Method, Karnaugh maps (including 5 and 6 variable) – Quine-McCluskey method- Multi-output circuits- Multi-level circuits- Design of circuits with universal gates.

Module II (13 hours)

Number Representation: Fixed point - Floating point - 1‘s complement - 2‘s complement. Binary Codes: BCD- Gray code- Excess 3 code- Alpha Numeric codes – Error detecting and correcting codes- properties- Code conversion circuits-Number systems (Binary, Octal and Hexadecimal): conversions and arithmetic operations.

Arithmetic circuits: adders and subtractors- ripple carry adders- carry look ahead adders- adder cum subtractor-BCD Adder and Subtractor.

Combinational logic design using MSI circuits: Multiplexers- Demultiplexers- Decoders- Encoders- ALU- Digital Comparators -Parity Generators.

Introduction to digital logic families: Characteristics- Basic working of a TTL NAND gate ,ECL gate and CMOS logic gate.

Module III (13 hours)

Latches and Flip-Flops: SR latch- SR Flip Flop- JK Flip Flop- D Flip flop - T Flip Flop- Flip Flops with preset and clear inputs- Triggering methods and their circuits -Conversion of one type of flip flop to another – Excitation table – Applications of Flip Flops.

Shift Registers: right shift- left shift- bi directional- SISO- SIPO- PISO- PIPO- universal shift registers. Synchronous counter: Design, Lock out condition.

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

Other types of Counters: Ring counter- Johnson counter- BCD counter.

Module IV (13 hours)

Synchronous sequential circuits: Finite State Machines- Mealy & Moore types- Basic design steps- Design of counters using Sequential Circuit Approach – FSM as an Arbiter circuit– ASM charts.

Asynchronous sequential circuits: Analysis and Synthesis- State Reduction and State Assignment- Hazards.

Text Books

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
3. R P Jain, Modern Digital Electronics, Tata McGraw Hill

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, *digital Fundamentals* (Eight edition), Pearson

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 406 ANALOG COMMUNICATION

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 hours)

Signals and Spectra - Line Spectra and Fourier Series - Fourier Transforms and Continuous Spectra - Time and Frequency Relations - Signal Distortion in Transmission - Band pass signals and systems - Amplitude modulation -Signals and Spectra of AM, DSB-SC, SSB & VSB- Modulators and transmitters. Exponential continuous wave modulation - Signals and Spectra of FM & PM - Narrow band case, Tone modulation, Transmission bandwidth and Distortion - Generation and Detection of FM and PM - Interference, De-emphasis and Pre-emphasis, Capture effect.

Module II (13 hours)

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

Module III (13 hours)

Probability and Sample Space - Random Variables and Probability Functions - Statistical Averages - Probability Models - Random Processes - Ensemble Averages and Correlation Functions - Ergodic and Stationary Processes - Gaussian Processes - Random Signals - Power Spectrum - Filtered Random Signals - Noise - Different types - noise equivalent band width - Baseband Signal Transmission With Noise - Baseband Pulse Transmission With Noise.

Module IV (13 hours)

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

Text Books

1. Bruce Carlson., Communication Systems, Tata - McGraw Hill.
2. Lathi B.P., Modern Digital and Analog Communication Systems, Oxford University Press.
3. Ziemer R.E. & Tranter W.H., Principles of Communication, John Wiley.
4. Leon W. Couch, Digital and Analog Communication Systems, Pearson Education.
5. Taub H. & Schilling, Principles of Communication Systems, Tata - McGraw Hill.

Reference Books

1 Simon Haykin, Communication Systems, John Wiley.
2 Dennis Roddy, John Coolen, Electronic Communications, Pearson Education.
3 Sam Shanmugam K., Digital and Analog Communication Systems, John Wiley.
4 Tomasi, Electronic Communications Systems, Pearson Education.
5 Proakis & MasoudSalehi, Fundamentals of Communication systems ,Pearson Education.

Web resources:

1. Principles of Communication, Prof. V. VenkatRao, IIT Madras (nptel.iitm.ac.in)
2. Communication Engineering, Prof. Surendra Prasad, IIT Delhi (nptel.iitm.ac.in).
3. Probabilistic Systems Analysis and Applied Probability, Prof. John Tsitsiklis, MIT(ocw.mit.edu).

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 407(P): DIGITAL ELECTRONICS LAB

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

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

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

End Semester Examination *(Maximum Marks-100)*

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

EC14 408(P) ELECTRONIC CIRCUITS LAB

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

Objective

- *To design and setup circuits*

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

List of experiments

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

Internal Continuous Assessment *(Maximum Marks-50)*

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

Semester End Examination *(Maximum Marks-100)*

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

EC14 501: COMPUTER ORGANISATION AND ARCHITECTURE

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 hours)

Basic structure of computer hardware and software - addressing methods - computer arithmetic - number representations - fast adders - fast multiplication - integer division - floating point numbers and operations.

Module II (13 hours)

The processing unit - instruction execution cycle - sequencing of control signals - hardwired control - microprogrammed control - control signals - micro instructions - microprogram sequencing - branch address modification - prefetching of micro instructions.

Module III (13 hours)

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

Module IV (13 hours)

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

Text Books

1. Hamacher C.V, Computer Organisation, McGraw Hill.
2. Morris Mano, Computer system architecture, Pearson.
3. John P Hayes, Computer Architecture and Organization McGraw Hill.

Reference Books

1. William Stallings, Computer Architecture and Organization, Pearson.
2. Patterson D. A & Hennessy J. L, Computer Organization & Design, Morgan Kaufman.

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 502: LINEAR INTEGRATED CIRCUITS

Teaching scheme **Credits:** 4

3 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 (14 hours)

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

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 (14 hours)

Signal generators-Phase shift and Wien Bridge Oscillators-Astable and Monostable Circuits-Linear sweep circuits.

Active filters-filter transfer function-Butterworth and Chebyshev filters-First order and second order function for low-pass, high-pass, band –pass, band-stop and all –pass filters- Sallen-key LPF and HPF-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 (14 hours)

Timer IC 555 – internal diagram – working - multivibrators with timer IC 555

Data converters-definitions and specifications – DAC - Weighted resistor and R-2R DAC-Bipolar DAC.

ADC - flash, integrating type, Counter Ramp, pipeline, tracking and Successive approximation, dual slope & oversampling ADCs - sigma - delta ADC

Linear voltage regulators- protection mechanisms-LM 723 Functional-diagram-Design of voltage regulator using 723-Three terminal Voltage regulators-functional operation of 78xx series IC and design of fixed and adjustable regulators

Module IV (10 hours)

Phase locked loops- operation of first and second order PLLs-Lock and Capture range-LM565PLL-Application of PLL as AM/FM/FSK/ detectors, frequency translators, phase shifter, tracking filter, signal synchronizer and frequency synthesizer. Voltage controlled oscillator

Text Books

1. Sergio Franco , *Design with Operational Amplifiers& Analog integrated Circuits* ; McGraw Hil
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. Roy Choudari.'Linear Integrated Circuits'
2. Coughlin R.F. & Driscoll F.F., *Operational Amplifiers and Linear Integrated Circuits*, Pearson Education
3. Schumann & Valkenberg, *Design of Analog Filters*, Oxford University Press
4. Gray & Meyer, *Analysis and Design of Analog Integated Circuits*; John Wiley
5. Sedra A.S. & Smith K.C., *Microelectronic Circuit*', Oxford University Press

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 503 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 (13 hours)

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

Module II (13 hours)

Shaping - Nyquist criterion for zero ISI - signalling with duobinary pulses - eye diagram- equalizer, scrambling and descrambling - signal space concepts -geometric structure of the signal space - L^2 space-distance, norm and inner product -orthogonality -base band data transmission- matched filter receiver - intersymbol interference - Gram-Schmidt orthogonalization procedure.

Module III (13hours)

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

Module IV (13 hours)

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

Text Books

1. Sklar, Digital Communication, Pearson Education.
2. Bruce Carlson., Communication Systems, Tata - McGraw Hill
3. Taub H. & Schilling, Principles of Communication Systems, Tata - McGraw Hill.
4. Proakis J.G., Digital Communications, McGraw Hill.
5. Leon W. Couch, Digital and Analog Communication Systems, Pearson Education

Reference Books

1. Simon Haykin, Communication Systems, John Wiley.
2. Dennis Roddy, John Coolen, Electronic Communications, Pearson Education
3. Sam Shanmugam K., Digital and Analog Communication Systems, John Wiley.
4. Glover and Grant, Digital Communications, Pearson Education.
5. Rice, Digital Communications, Pearson Education.
6. Proakis and Salehi., Fundamentals of Communication Systems, Pearson Education.
7. Lathi B.P., Modern Digital and Analog Communication Systems, Oxford University Press.
8. M. K. Simon, S. M. Hinedi, and W. C. Lindsey, Digital Communication Techniques, Prentice Hall
9. Tri T. Ha, Theory and Design of Digital Communication Systems, Cambridge University Press

Web resources:

1. Digital Communication, Prof. Bikash Kumar Dey, IIT Bombay (nptel.iitm.ac.in)\
2. Digital Communication, Prof. SaswatChakrabarti, Prof.R.V. Rajakumar, IIT Kharagpur (nptel.iitm.ac.in)
3. Principles of Digital Communications I, Prof. LizhongZheng, Prof. Robert Gallager, MIT

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 504: 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: Gauss's law. 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-Amperes law for a current element. 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. Linear, elliptical and circular polarization.

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

Module IV (12hours)
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
4. Electromagnetic waves and Radiating Systems:Edward C jordan,Keith G. Balman

Reference Books

1. Electromagnetics: J. D. Kraus, Mc Graw Hill Publications.
2. Field & Wave Electromagnetic: Cheng, Pearson Education.
3. Electromagnetics: Edminister, Schaum series, 2 Edn.
4. Network Analysis: Van Valkenberg

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 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 (13 hours)

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

Module II (13 hours)

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

Module III (13 hours)

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

Module IV (13 hours)

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

Text Books

1. Lyla B Das, The x86 Microprocessors Architecture, Programming and Interfacing (8086 to Pentium)
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D Mckinlay.‘ The 8051 Microcontrollers and Embedded Systems using Assembly and C ‖ 2nd Edition Pearson Publishers.
3. Triebal W A & Singh A., The 8088 and 8086 microprocessors McGraw Hill
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-50)*

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

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 506 QUANTITATIVE TECHNIQUES AND 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 (13 hours)

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

Module2 (13 hours)

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

Module 3 (13 hours)

Statement of the LP problem- slack and surplus variables-basic feasible solutions- reduction of a feasible solution to basic feasible solution-artificial variable-optimality conditions- unbounded solutions-charnes _ M method-two phase method-degeneracy-duality.

Module 4 (13 hours)

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

Reference Books

1. Hadley.G Linear programming, Addison Wesley
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-50)*

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

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 507(P) ANALOG COMMUNICATION LAB

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

Objective

- To design and setup circuits for Analog communication

List of experiments

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

Note: Minimum ten experiments must be conducted

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

Semester End Examination *(Maximum Marks-100)*

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

EC14 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 demodulation of PWM and PPM
8. Multipliers using op-amps - 1,2 & 4 quadrant multipliers
9. Square , triangular and ramp generation using op-amps
10. Astable and monostable multivibrators using op-amps
11. Log and Antilog amplifiers
12. 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: A minimum of **10** experiments must be conducted

Internal Continuous Assessment *(Maximum Marks-50)*

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

Semester End Examination *(Maximum Marks-100)*

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

EC14 601: RADIATION AND PROPAGATION

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

Objective

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

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

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

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

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

Text books:

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 Books

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

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 602 OPTICAL COMMUNICATION

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

Objective

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

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

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

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

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

Text Books

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. Mynbaev and L. Scheiner ,'Fiber Optic Communication Techniques', Person Education New Delhi

Text Books

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

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 603 VLSI DESIGN

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

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

Module I (13 hours)

Short and narrow channel effects in MOS transistor (MOST) − sub threshold conduction − body effect - channel length modulation - drain induced barrier lowering - hot carrier effects - velocity saturation of charge carriers

Scaling of MOST - constant voltage and constant field scaling - digital MOSFET model - Estimation of interconnect parasitics and calculation of interconnect delay.

MOS inverters - resistive load, Saturated NMOS load, Depletion NMOS load, pseudo MOS - CMOS inverters-robustness and performance − capacitance components - charge sharing− power dissipation - CMOS ring oscillator

Module II (13 hours)

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

Module III (13 hours)

Wafer processing −diffusion-Fick's Law −analytic solutions for predeposition and drive-in diffusion − Oxidation −Deal -Grove model −Ion implantation-vertical and lateral projected ranges-channeling-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 (13hours)

Device isolation-contacts and metallization-junction and oxide isolation −LOCOS- SILO-SWAMI process-trench isolation −silicon on insulator isolation - schottky contacts-implanted ohmic contacts-alloyed contacts-refractory metal contact technology-multi level metallization

CMOS- p well process −twin tub process

Layout and design rules (λ and μ based) - layout using cell hierarchy - layout of MOSFET − stick diagram - layout of the inverter , NOR and NAND gates − Layout guide lines

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

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

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 604: DIGITAL SIGNAL PROCESSING

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 hours)

Review of Discrete Time Fourier series and Discrete Time Fourier Transform-Frequency do- main 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 (13 hours)

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

Module III (13 hours)

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 (13 hours)

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

Text Books

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
3. Dag Strannbby & William Walker,DSP & Applications. Elsevier, New Delhi, 2nd Ed. 2004
4. Vinay K Ingle, John G Proakis, DSP- A MATLAB based approach ,Cengage learning India
5. Sen M. Kuo and Woon-Seng Gem, Digital Signal Processors, Pearson

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 605: CONTROL SYSTEMS

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

Objective

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

Module I (13 hours)
General Schematic Diagram of Control Systems-Open loop and Closed loop systems – Merits and demerits-Concepts of feed back –Role of computers in Automatic Control –Modeling of Continuous Time Systems. Basic ideas of Functions of Complex Variables ,Mapping Process, Analytic functions, poles and zeros.
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 (13 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 Transient response - Performance of feed back Control systems - Steady state Response-steady state error –computations of steady state 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 (13 hours)
Modeling of discrete-time systems-sampling-mathematical derivations for sampling-sample and hold--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 (13 hours)
State Space Analysis: Introduction-Definitions and explanations of the terms STATE, STATE VARIABLES, STATE VECTOR AND STATE SPACE-State Space Representations of Linear Time-invariant System with i) single input and output ii) multi variable systems iii) SISO System in which forcing
Function involves-Eigen values-phase variable and Diagonal forms-Invariance of Eigen values under linear transformation-Diagonilisation
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-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 606 SATELLITE COMMUNICATION

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 hours)

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

Module II (13 hours)

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

Module III (13hours)

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

Module IV(13 hours)

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

Text Books

1. Timothy Pratl, Charles Bostian & Jeremy Allnutt,' Satellite communications', 2nd Ed., Wiley India, New Delhi, 2008
2. Dennis Roddy, _Satellite Communications', 4th Ed., Tata Mc-Graw-Hill, New Delhi, 2009
3. Tri T. Ha, _Digital Satellite Communications' , 2nd Ed., Tata Mc-Graw-Hill, New Delhi, 2009

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 607(P) MICROPROCESSOR AND MICROCONTOLLER 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: A minimum of **10** experiments must be conducted

Internal Continuous Assessment *(Maximum Marks-50)*

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

Semester End Examination *(Maximum Marks-100)*

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

EC09 608 (P) MINI PROJECT

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

Objectives

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

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

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

No external Examiner is required for mini project evalulation.

Internal Continuous Assessment by the Guide *(Maximum marks - 50)*
40% - Design and development
30% - Final result and Demonstration
20% - Report
10% - Regularity in the class

Semester End Examination *(Maximum Marks-100)*

60% - Demonstration and Presentation of mini project
30% - Viva voce
10% - Final Report

EC14 701 INFORMATION THEORY AND CODING

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

Objective

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

Module I (12 Hours)
Information theory-information and entropy-properties of entropy - entropy of a binary memoryless source- extension of a memoryless source-source coding theorem-Shannon-Fano coding- Huffman coding-Lempel-Ziv coding - discrete memoryless channel - binary symmetric channel- mutual information - properties - channel capacity- channel coding theorem.

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

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

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

Text Books

1. Simon Haykin, Communication Systems,John Wiley
2. ShuLin, Daniel J Costello.Jr, Error Control Coding, 2nd edition., Pearson

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 McGraw Hill
4. Symon Haykins and Michael Moher, Modern Wireless Communication, Pearson Education
5. Sklar, Digital Communications, Pearson Education
6. Couch, Digital and Analog Communication System, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 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 (13 hours)

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

Module II (12 hours)

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

Module III (13 hours)

High frequency limitations of transistors, microwave transistors, varactors, Manley Rowe relations, 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 (14 hours)

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

Text Books

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

Reference Books

1. Rizzi P.A.,Microwave Engineering,Passive Circuits Hall of India
2. Pozar D.M .,|| Microwave Engineering, John Wiley
3. Annapurna Das and Sisir Das, Microwave Engineering, Tata-McGraw Hill , New Delhi, 2008

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 703: DIGITAL SYSTEM DESIGN

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (12 hours)

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

Module II (14 hours)

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

Module III (13 hours)

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

Module IV (13 hours)

Introduction to Testing and Diagnosis Digital System Testing: Fault models - fault equivalence - fault location- fault dominance - single and multiple stuck faults - Testing for single stuck faults - Algorithms - random test generation - Testing for bridging faults Design for Testability: Design for Testability: Ad-hoc design for testability techniques - Classical scan designs - Boundary scan standards - Built-in-self-test - Test pattern generation - BIST architecture examples

Text Books

1 J. Bhasker, A VHDL Primer, Pearson Education, 2000

2 Charles H Roth, Jr , Lizy Kurien John, Digital Design using VHDL , Cengage Publishers, India Second Edition

3 Kenneth L Short, VHDL for Engineers , Pearson Education ,2009

4 John F Wakerly, Digital Design Principles and Practices, Pearson Education, Fourth Edition

Reference Books

1. Stephen Brown & Zvonko Vranesic, Fundamentals of Digital Logic with VHDL design, Tata McGraw Hill
2. Douglas L Perry, VHDL:Programming by example, Mc Graw Hill, Fourth Edition
3. Reiner W. Hartenstein, Andres Keevallik ,Field-Programmable Logic and Applications. From FPGAs to Computing Paradigm, Springer
4. Kevin Skahill, VHDL for Programmable Logic, Pearson Education
5. Stephen Brown,Zvonnko Vranesic,Fundamentals of digital logic design with VHDL, Mc Graw Hill,2006

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 704(A) 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 (13 hours)

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

Module II (13 hours)

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

Module III (13 hours)

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

Module IV (13 hours)

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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 704(B) TELEVISION AND RADAR ENGINEERING

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

Objective

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

Module I (13 hours)

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

Module II (13 hours)

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

Module III (13 hours)

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. Skolnik Introduction to Radar Systems,Mc Graw Hill,Kogakusha Ltd.

Reference Books

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

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 704(C) EMBEDDED SYSTEMS

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

Objective

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

Pre-requisite: EC14 505 Microprocessors and Microcontrollers

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

Module III (13hours)
Microcontroller: PIC microcontroller- architecture- Internal registers and timer/Clock initialization, Interrupts - programming. Introduction to AVR8515 microcontroller.16 and 32 bit microcontrollers. 8096/80196 family. ARM processor- architecture − applications - Motorola 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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 704(D): NANOTECHNOLGY

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

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

Text Books
1 Lyschevski,Sergey Edward,Nano and Microelectromechanical Systems: Fundamentals of Nano and micro engineering,CRC Press, 2000

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

Maximum Total Marks: 100

EC14 704(E) 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: EC14 604 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, one-dimensional 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.

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Module III (14 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 compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 and beyond, Content based video indexing

Text Books

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-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 705(A) 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 (13 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 (13 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.

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*, TMH
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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 705(B) 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 (13 hours)
Introduction to high-speed digital design - frequency, time and distance - capacitance and inductance effects - high speed properties of logic gates - speed and power - measurement techniques - rise time and bandwidth of oscilloscope probes - self inductance, signal pickup and loading effects of probes - observing crosstalk

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

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

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

Text Books

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-50)*

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

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/ DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

EC14 705(C) ANTENNA THEORY AND DESIGN

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

Objectives

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

Pre-requisites: EC14 601 Radiation & Propagation

Module I (13 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 (13 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.

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

Text Books

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

2. R.E.Collin, Antennas and Microwave propagation, Tata Mc-Graw Hill,2004
3. R.C.Johnson and H.Jasik,Antenna Engineering hand book, Mc-Graw Hill,1984
4. I.J.Bhal and P.Bhartia,Micro-strip antennas,Artech house,1980

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 705(D) ELECTRONIC PACKAGING

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

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

Module I (14 hours)

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 (14 hours)

Thermal Management - Heat-transfer fundamentals - Thermal conductivity and resistance - Conduction, convection and radiation − Cooling requirements

Reliability - Basic concepts - Environmental interactions - Thermal mismatch and fatigue − failures − thermo mechanically induced − electrically induces − chemically induced

Module III (12 hours)

Single chip packaging − functions, types, materials processes, properties, characteristics, trends

Multi chip packaging − types, design, comparison, trends

IC assembly − purpose, requirements, technologies − wire bonding, TAB, flip chip

Wafer level packaging - technologies, reliability, wafer level burn − in and test

Module IV (12 hours)

Passives − discrete, integrated, embedded − encapsulation and sealing − fundamentals, requirements, materials, processes

PWB − fundamentals, standards, limitations − microvia boards − PWB assembly − SMT- Through hole assembly − design challenges

Testing - Need for testing − Electrical testing − design for test

Text Books

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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 705(E) BIO MEDICAL 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 (13 hours)

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

Module II (13 hours)

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-Mc graw 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-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A:	*DESCRIPTIVE solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/ DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

EC14 706(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 N MOS transistors, $I_D - V_{DS}$ Characteristics, Extraction of V_T and body effect factor
8. DC transfer characteristics of an inverter
9. Buffer & Ring Oscillator
10. XOR using different logic styles - comparison
11. Single stage CS amplifiers - their responses for different types of load
12. Single stage source follower - their responses for different types of load
13. Current mirror circuits

Note: (i) A minimum of **10** experiments must be conducted, at least four from each part

(ii) Experiments in part – B should include layout of at least two circuits and their verification

Internal Continuous Assessment *(Maximum Marks-50)*

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

Semester End Examination *(Maximum Marks-100)*

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

EC14 707(P) COMMUNICATION SYSTEMS LAB

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

Section1: Microwave Experiments

1. Klystron characteristic o/p power and frequency versus repeller voltage
2. Measurement of frequency and wavelength and verify relation among wavelengths.
3. Characteristics of directional coupler
4. VSWR measurements (high and low).

Section2:

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

Section 3:

1. Spreader and De-spreader
2. Generation of Manchester and Differential codes
3. Generation of Hamming codes and cyclic codes
4. Generation of Gold Sequence.

Internal Continuous Assessment *(Maximum Marks-50)*

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

Semester End Examination *(Maximum Marks-100)*

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

EC14 708 (P) PROJECT

Teaching scheme **Credit:** 4

4 hours practical per week

Objectives

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

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

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

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

Each student has to submit an interim report of the project at the end of the 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 mark 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

EC14 801 DATA AND COMMUNICATION NETWORKS

Teaching scheme **Credits:** 4

4 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (10hours)

Queueing Theory: Markov chain-discrete time and continuous time Markov chains- Poisson Process M/M/1 Queue Little's formula M/M/m/m queueing models.

Layered Architectures in Data networks: OSI standards architecture and protocols.

Module II (14hours)

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

Module III (14 hours)

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

Module IV (14 hours)

Circuit switching: Elements of Traffic Engg. GoS and Blocking Probability. Incoming traffic and service time characterization. Analysis of blocking models and delay models- Erlang formulae.Digital switching networks, Two stage -Three stage and N- stage switches, combination Switches Blocking probability analysis of multistage switches-Lee's approximation.

Text Books

1. Jean Walrand & Pravin Varaiya,‖High Performance Communication Networks‖ Morgan Kaufman Publishers
2. Behrus A. Forouzan etal, –Data Communication and Networking‖, 4th 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 Company

References

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

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 802 ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT

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

Section 1: Engineering Economics

Teaching scheme
1 hour lecture and 1 hour tutorial per week

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

Module1 (13 Hrs)

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

Supply and Demand: Determinants of demand, Law of demand, Determinants of supply, Law of supply, Market equilibrium. Elasticity of demand – Types of elasticity, Factors affecting the price elasticity of demand.

National Income Concepts: GDP and GNP, Per capita income, Methods of measuring national income. Inflation and Deflation: Concepts and regulatory measures – Monetary policy and Fiscal policy.

Module II (13 Hrs)

Value Analysis - Time value of money - Interest formulae and their applications: Single-payment compound amount factor, Single-payment present worth factor, Equal-payment series compound amount factor, Equal-payment series sinking fund factor, Equal-payment series present worth factor, Equal-payment series capital recovery factor, Effective interest rate.

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

Text Books

1. Panneer Selvam, R, –*Engineering Economics*‖, Prentice Hall of India Ltd, New Delhi, 2001.

2. Dwivedi, D.N., –*Managerial Economics, 7/E"*, Vikas Publishing House, 2009.

Reference Books

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P., –*Engineering Economy 15/E*‖, Prentice Hall, New York, 2011.

2. Chan S. Park, –*Contemporary Engineering Economics*‖, Prentice Hall of India, 2002.

3. Prasanna Chandra, –*Financial Management: Theory & Practice, 8/E"*, Tata-McGraw Hill, 2011.

Internal Continuous Assessment *(Maximum Marks-25)*

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

University Examination Pattern for Section 1

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

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

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

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

Maximum Total Marks: 50

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

Section 2: Principles of Management

Teaching scheme
1 hour lecture and 1 hour tutorial per week

Objective

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

Module I (13 hours)

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

Module II (13 hours)

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

Reference Books

1. F. Mazda, *Engineering management*, Addison Wesley, Longman Ltd., 1998
2. Lucy C Morse and Daniel L Babcock, *Managing engineering and technology*, Pearson, Prentice Hall
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*

Internal Continuous Assessment *(Maximum Marks-25)*

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

University Examination Pattern for Section 2

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer FOUR questions out of FIVE. There shall be minimum of ONE and maximum of TWO questions from each module with total FIVE questions.	*4x 5 marks=20 marks*
PART B:	*Analytical/ DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*2 x 15 marks=30 marks*

Maximum Total Marks: 50

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

EC14 803 WIRELESS MOBILE COMMUNICATION

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

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

Module I (13Hrs)

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

Module II (13Hrs)

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

Module III (13Hrs)

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

Module IV (13Hrs)

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

Text Books:

1. Rappaport T.S, Wireless Communication Principles and practices, Pearson Education Asia, New Delhi, 3rd Ed. 2003.
2. Andrea Goldsmith, Wireless Communications, Cambridge University press
3. Vijay k Garg, Joseph E Wilkes, Principles and Applications of GSM, Pearson Education
4. A.J Viterbi, CDMA- Principles of Spread Spectrum, Addison Wesley.

Reference books:

1. Kamilo Feher, Wireless Digital Communication, PHI.
2. A F Molisch, Wireless communications, Wiley India, 2008.

Internal Continuous Assessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 804(A) INTRODUCTION TO MEMS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (12 hours)

Optimization: Unit Commitment- Problem Definition- System constraints- Priority ordering- Dynamic programming

Optimal Power Flow - Problem statement- Lagrangian Solution method- Algorithm- How violations of control and dependant variables are treated

Hydrothermal scheduling- Problem modeling and statement - Discretizaton- solution algorithm

Module II (14 hours)

Control area concepts -P-f control of single control area- ACE- Two area control- tie line bias control - extension to pool operation or multi control area systems

Deregulated power system – Restructure models – functional units – GENCOS, DISCOS, TRANSCOS, ISO, PX, TSP – Transmission open access- Power wheeling- ABT-Distributed generation and spot prices, Micro grid, smart grid (Basic concepts only)

Module III (13 hours)

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

Module IV (13hours)

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

Text books

1. A. K. Mahalanabis, D. P. Kothari, S I Ahson, *Computer Aided Power System Analysis and Control*, Tata McGrawHill.
2. O. L.Elgerd, *Electrical Energy System Theory: An Introduction* ,TMH
3. J. Wood, B. F. Woollenberg, *Power Generation, Operation & Control*, Wiley-India
4. Dr.Loi Lei Lai, *Power System Restructuring and Deregulation*, John Wiley Inc. 2001
5. P Venkatesh et al , *Electrical Power Systems- Analysis, Security & Deregulation*, PHI

Reference Books

1. G. W. Stagg, A H. El- Abiad,*Computer Methods in Power System Analysis*, TMH
2. John J. Grainger, W. D. Stevenson, *Power System Analysis*, TMH
3. B. R. Gupta, *Power System Analysis and Design*, A. H. Wheeler & Co.
4. S. Sivanagaraju, G. Sreenivasan, *Power System Operation And Control*, Pearson Education
5. Dr. K. Uma Rao, *Power system Operation And Control*, Wiley-india

Internal ContinuousAssessment *(Maximum Marks-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 804(B) 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 (13hours)

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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 804(C) MICROWAVE ACTIVE DEVICES AND 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: EC14 702 Microwave Engineering

Module I (13 hours)

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

Module II (13 hours)

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

Module III (13 hours)

Microwave filters-Periodic structures-analysis, k-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 using coupled resonators

Module IV (13 hours)

Microwave Integrated circuits-hybrid MICs, Monolithic MICs, MIC materials-substrate, conductor, dielectric materials, types of MICs, hybrid versus monolithic MICs

Text Books

1. Davis M Pozar,'Microwave Engineering'.2nd Ed. Wiley India, 2008
2. Mathew 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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 804(D) 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 (13 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 (13 hours)
WLANs (Wireless LANs)- Wi-Fi-IEEE 802.11- architecture-services- IEEE 802.11a & 802.11b standard-HIPERLAN-, Bluetooth -IEEE 802. 15-WiMAX-IEEE 802.16

Module III (13 hours)
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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 804(E) DATA STRUCTUES AND 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 (14hours)

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 (13 hours)

Linked Lists - Linked stacks and queues - Doubly linked lists - Polynomial representation using linked lists, Strings − Data representation − Pattern matching.

Module III (14 hours)

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

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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 805(A) 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 (14hours)

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. Multimedia Transport 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: making 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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 805(B) PROBABILITY AND RANDOM PROCESSES

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

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

Module I (12 hours)
Introduction to Probability Theory

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

Module II (13 hours)
Random Variables, Distributions and density functions

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

Module III (13 hours)
Operations on a single Random Variable

Expected value of a random variable - expected values of functions of random variable – Moments – central moments – conditional expected values – probability generating functions –Moment generating functions

Module IV (14 hours)
Random Processes

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

Text Books

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

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

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

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 805(C) 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.*

Module I (13 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 (13hours)

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

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

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

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

Maximum Total Marks: 100

EC14 805(D) ADVANCED SEMICONDUCTOR DEVICE TECHNOLOGY

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

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

Module I (13 hours)

Sub micron MOSFET − effects - junction depth − oxide thickness − depletion widths − isolation − MOSFET device design − scaling − non scaling effects − channel engineering

SOI MOSFET - Strained silicon − realisation − features − Low temperature CMOS

Module II (13 hours)

MESFET − Basic structure − DC characteristics − basic design − small signal operation − Large signal operation − digital operation

Hetero structures − Silicon based HBT − GaAlAs/GaAs HBT - modulation doped structures

Free & confined electrons -1D & 3D space − partially confined electrons − Quantum dots wires and wells - logic realisation using QD − conductivity in metallic nanowires

Module III (13 hours)

Tunnelling effect − tunnelling diode - Resonant tunnelling devices − Digital circuits using RTD − memories − basic gates

Coulomb blockade - Single Electron Transistor - Circuit design

Ballistic transport − quantum resistance − CNT transistors − spin transport − spintronic devices

Module IV (13 hours)

Production of nanolayers − PVD −CVD- Epitaxy − Ion implantation − formation of SiO2 layer − characterisation − applications

Fabrication of 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

Goser, Glosekotter, Dienstuhl,, *Nanoelectronics& Nanosystems*, Springer

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, Quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/ DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

EC14 805(E) 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: EC14 604 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

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Module III (14 hours)

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

Module IV (11 hours)

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

Text Books

1. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, Delhi, 2004
2. K. P. Soman and K. I. Ramachandran, Insight into Wavelets, Prentice Hall of India, New Delhi, 2004
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-50)*

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

University Examination Pattern

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

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

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

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

Maximum Total Marks: 100

EC14 806(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/biomedical/instrumentation engineering or allied areas.*

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

Internal Continuous Assessment *(Maximum marks – 100)*
20% - Relevance of the topic and literature survey
50% - Presentation and discussion
20% - Report
10% - Regularity in the class and Participation in the seminar

EC14 807 (P) PROJECT

Teaching scheme **Total Credits:** 4

7 hours practical per week Credits for interim evaluation: 2

Credits for final evaluation: 2

Objectives

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

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

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8^{th} 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 8^{th} semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide, and three/four faculty members specialised in electrical power system / machines/ electronics/ computer/ instrumentation/ biomedical Engg. etc.

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

Internal Continuous Assessment *(Maximum Marks - 100)*
40% - Design and development/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

EC14 808 (P) VIVA VOCE

Credits: 4

Objective

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

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

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

Assessment in Viva-voce *(Maximum marks – 100)*

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