UNIVERSITY OF MUMBAI

SCHEME OF INSTRUCTION AND EVALUATION (R2007)

Programme: B.E. Electronics and Telecommunication Engineering,

Scheme for Semester VII

Sr. No	Subjects	No. of Periods per week (60 minutes each)			Duration of Theory papers (Hours)	Marks			
		Lecture	Practi-cal	Tuto-rial		Theory	Term-work	Oral	Total
1.	**Mobile Communication Systems**	4	2	-	3	100	25	25	**150**
2.	**Fundamentals of Microwave Engineering**	4	2	-	3	100	25	25	**150**
3	**Computer Communication Network**	4	2	-	3	100	25	25	**150**
4	**Discrete Time Signal Processing**	4	2		3	100	25	25	**150**
5.	**Project stage –I**	-	-	4	-	-	25	25	**50**
6.	**Elective-VII Sem**	4	2	-	3	100	25	25	**150**
Total….		**20**	**10**	**4**	**-**	**500**	**150**	**150**	**800**

SCHEME FOR OFFERING ELECTIVE TO STUDENTS (Any ONE): BE, VII Semester

SEM VII:	SEM VII:	SEM VII:	SEM VII:
1.DATA COMPRESSION AND ENCRYPTION	2.INTRODUCTION TO VLSI DESIGN	3.SPEECH PROCESSING	4.ELECTRONIC PRODUCT DESIGN

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester - VII**	
SUBJECT: Mobile Communication Systems			
Periods per week (Each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination	-	25
	Term Work	-	25
	Total		**150**

Module	Contents	Hours
Objective	**To study the concept of cellular system, GSM & CDMA mobile communication.**	-
1	**Introduction** **1]** Introduction to wire1ess communication systems **2] The cellular concept:** Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trunking and grade of service, improving the capacity of cellular systems.	**12hrs**
2	**Mobile radio propagation:** Large scale path loss Reflection, ground reflection model (2 ray model), diffraction, practical link budget design using path loss models. Small scale fading and multi-path Small-scale multipath propagation, parameter of multi-path channels, types of small scale fading, Rayleigh and Ricean distribution, diversity, RAKE Receiver.	**8hrs**
3	**Multiple access Technique in Wireless Communications** Frequency Division Multiple access, Time Division Multiple access, Spread Spectrum Multiple access, Space Division Multiple access.	**4hrs**
4	**GSM** GSM Network architecture, signaling protocol architecture, identifiers, channels, Frame structure, speech coding, authentication and security, call procedure, handoff procedure, services and features. **Mobile data networks** Data oriented CDPD network, GPRS and higher data rates, SMS in GSM.	**10hrs**
5	**CDMA digital cellular standard (1S-95):** Frequency and channel specifications of IS-95, forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management.	**8 hrs**
6	**IMT-2000** Forward and reverse channels in W-CDMA and CDMA2000, Hand off and Power control in 3G system.	**6hrs**

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Questions will be analytical.
4. Question number 1 will be compulsory and cover all modules.
5. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
6. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum Six experiments & tutorials and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Practical list

List of Experiments or similar:

1. Simulation program to observe the change in parameters due to change in channel
2. Simulation program using freely downloadable software eg. J2ME, Python
3. Assignments based on Syllabus

Recommended Books:

Text:

1. Wireless Communications - Theodore S. Rappaport, Prentice Hall of India, PTR publication
2. Principles of Wireless Networks-Kaveh Pahlavan, Prashant Krishnamurthy, PHI

Reference

1. Wireless communication- Singhal_TMH

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester - VII**	
SUBJECT: Fundamentals of Microwave Engineering			
Periods per week (Each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination	-	25
	Term Work	-	25
	Total		**150**

Module	Contents	Hours
Objective	This course will help students understand the essentials of microwave design and engineering, besides, active and passive microwave devices and microwave tubes.	-
1	**BASIC CONCEPTS** Introduction. Maxwell's Equations. Constitutive Relations. Static Fields. Wave Equation. Energy and Power. Boundary Conditions. Plane Waves. Dielectric Interface. Reflection from a Conducting Plane. Potential Theory. Solutions for Vector Potential. Lorentz Reciprocity Theorem.	**4hrs**
2	**TRANSMISSION LINES THEORY AND WAVEGUIDES** The Quarter-Wave Transformer. Generator and Load Mismatches. Impedance Matching with Reactive Elements. Single-Stub, Double-Stub, and Triple-Stub Matching. Lossy Transmission Lines. TEM, TE, TM Waves. Parallel-Plate, Rectangular, Circular Waveguides. Coaxial Line. Surface Waves on a Grounded Dielectric Slab. Coupled Strip Lines. Microstrip Transmission Line. Wave Velocity and Dispersion.	**10hrs**
3	**ACTIVE AND PASSIVE MICROWAVE DEVICES** Diodes. Microwave Transistors. Heterojunction Bipolar Transistor. Microwave FET. Noise in Microwave Circuits. Dynamic Range and Intermodulation Distortion. RF Diode. RF	**8hrs**

	Transistor. Terminations. Attenuators. Phase Shifters. Directional Couplers. Hybrid Junctions. Power Dividers. Microwave Propagation in Ferrites. Faraday Rotation. Microwave Devices Employing Faraday Rotation. Circulators.	
4	**MICROWAVE SEMICINDUCTOR DEVICES** Point Contact Diodes. Schottky Barrier Diodes. Spin Diodes. PIN Diodes. Varactor Diodes. Tunnel Diodes. Gunn Devices. IMPATT Diode. Parametric Devices. Detectors and Mixers.	**6hrs**
5	**MICROWAVE FILTERS** Introduction. Periodic Structures. Filter Design—Image-Parameter Method, Insertion-Loss Method. Filter Transformations. Filter Implementation. Low Pass-Filer Design. Coupled Line Filters. Filters using Coupled Resonators.	**6hrs**
6	**MICROWAVE TUBES** Introduction. Electron Beams with DC conditions: Ion-Neutralized Beam, Beam with Axially Confined Flow. Brillouin Flow. Space-Charge Waves on Beams with Confined Flow. Space-Charge Waves on Unfocused Beams. AC Power Relations. Velocity Modulation. Two-Cavity Klystron. Excitation of Cylindrical Cavity. Reflex Klystron. Magnetron. O-Type and M-Type Traveling Wave Tubes. Gyrotrons. Other Microwave Tubes. **MICROWAVE MEASUREMENTS** VSWR. Frequency. Power. Noise. Q-Factor. Impedance. Attenuation. Dielectric Constant. Antenna Gain.	**8hrs** **2hrs**

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Questions will be analytical and design oriented.
4. Question number 1 will be compulsory and cover all modules.
5. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
6. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum six experiments and a written test.
The distribution of marks for term work shall be as follows,
Laboratory work (Experiments and Journal) : 15 marks.
Test (at least one) : 10 marks.
The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Practical list

SUGGESTED LIST OF EXPERIMENTS:

1. Measurement of attenuation by substitution method
2. Measurement of impendence using slotted wave guide
3. Measurement of scattering parameters
4. Measurement of frequency using slotted wave guide.
5. Measurement of impedance using reflectometer
6. Measurement of Wavelength using reflectometer
7. Measurement of power
8. Measurement of VSWR

Recommended Books:

Text : 1. Pozar, Microwave Engineering, 3rd edi, Wiley

Reference

1. Collin, Foundation of Microwave Engineering, 2nd edi, Wiley
2. Microwave engineering passive circuits - Peter A. Rizzi PHI Publication
3. Microwave Devices and circuits - Samuel Liao PHI Publication
4. Microwave, Gupta K.C., New Age International
5. Microwave Engineering and Applications - O.P. Gandhi Pargamon Press publication
6. Microwave Active Devices, Sisodia M.L., New Age International
7. Basic Microwave Techniques and laboratory manual- M.L. Sisodia, G. S. Raghuvans Wiley eastern Limited publication
8. Electromagnetic Field theory fundamentals - Guru & Hisiroglu Thomson Learning publication

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester - VII**	
SUBJECT: Computer Communication Networks			
Periods per week (Each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks

Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination	-	25
	Term Work	-	25
	Total		**150**

Module	Contents	Hours
Objective	**Students will learn the concept of computer networking. Various protocols involved in modeling the network, the concept of LAN designing and various routing techniques will be studied. TCP/IP, basic queuing theory and delay analysis will be studied.**	-
1	**Communication networks and services:** Network functions and network topology, basics of message switching, packet switching, circuit switching and cell switching. .Application and layered architectures the OSI reference model, unified view of layers, protocols and services, overview of TCP/IP architecture, TCP/IP protocol.	**7hrs**
2	**Peer to peer protocols:** Peer to peer protocols and service models, service models, end to end requirements and adaptation functions, end to end versus hop by hop. ARQ protocols, stop and wait ARQ, goback-N ARO, selective repeat ARO, transmission efficiency of ARQ protocols, sliding windows flow control, timing recovery for synchronous services, reliable stream service, data link controls, HDLC data link control, point to point protocol, statistical multiplexing.	**7hrs**
3	**Local area networks:** Multiple access communications, local area networks (LAN) structure, the medium access control sub layer, the logical link control layer, random access, ALOHA, slotted ALOHA, CSMA CSMACD, scheduling approaches to medium access control, reservation systems, polling, token passing rings, comparison of random access and scheduling medium access controls, IEEE 802.3 standards for 10M bps and 1000 Mbps LANs, repeaters and hubs, LAN bridges, transparent bridges, source routing	**9hrs**

	bridges, mixes media bridges, LAN switches, spanning tree algorithm.	
4	**Packet switching networks:** Network services and internal network operation, packet network topology, connectionless packet switching, virtual circuit packet switching, routing in packet networks, routing algorithm classification, routing tables; hierarchical routing, link state versus distance vector routing, shortest path algorithms, the Bellman-ford algorithm, Dijkstra's algorithm, other routing approaches.	**9hrs**
5	**TCP/IP:** The Internet Protocol (IP), IP packet, IP addressing, subnet mask, classless inter domain routing (CIDR), address resolution, reverse address resolution, IP fragmentation and reassembly, ICMP, User Date gram Protocol (UDP), Transmission Control Protocol (TCP), TCP Reliable stream service, TCP operation, TCP protocol, Dynamic Host Configuration Protocol (DHCP), mobile IP IPv6, internet routing protocols, routing information protocols, open shortest path first protocol, border gateway protocol, multicast routing, reverse path broadcasting, internet group management protocol, reverse path multicasting, distance vector multicast routing protocol.	**10hrs**
6	**Delay and loss Performance in network** Delay analysis Arrival rates and traffic load definition Lintel's formula **Basic queuing models :** Arrival processes, service time queuing system clarification M/M/I queue and basic multiplexer model M/M/I state probabilities and notion of stability, effect of scale on performance, average placket delay Via network. The M/G/I model, service time variability and delay M/M/I system. Erlang formulas and M/M/c/e system priority queuing system.	**8hrs**

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and cover all modules.

4. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
5. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum five experiments & 3 tutorials and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Practical list

Suggested LIST OF EXPERIMENTS

1. Study of the network components
2. Osi layer implementation
3. Study of routing technique
4. Implementation of dikshtras alogorothim for shortest path routing
5. Study of lan wan designing
6. To implement header checksum of tcp/ip
7. Study of etheral software

Recommended Books:

1. Communication networks by Leon Garcia and Indra Widjaja 2nd edition
2. TCP/IP protocol suite, 2nd edition, Behrouz A **Forouzan**
3. Advanced Computer Networks, D.Ambawade, Dreamtech

University of Mumbai		
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester - VII**
SUBJECT: Discrete Time Signal Processing		
Periods per week (Each of 60 min.)	Lecture	4
	Practical	2
	Tutorial	-

		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination		25
	Term Work		25
	Total		**150**

Module	Contents	Hours
Objective	**To develop a thorough understanding of the central elements of discrete Time signal processing theory and the ability to apply this theory to real-world signal processing applications.**	-
1	**Transform analysis of LTI system** Frequency response of LTI systems, Phase Distortion and delay, all pass systems, minimum, maximum and mixed phase systems, Linear phase filters, causal generalized linear phase systems (pole zero plots), symmetric and antisymmetric filters, Low pass, high pass and Band pass filters, digital resonators, comb filter, notch filter, all pass filters, digital sinusoidal oscillators. DFT and its Properties, Linear filtering based on DFT, Frequency analysis of signals using DFT, Filtering of Long data sequences.	**4 hrs** **6 hrs**
2	**Computation of DFT** Radix-2, Radix-4 Fast Fourier Transform, DIT FFT, DIF FFT, IFFT, Split radix FFT Linear filtering and correlation using FFT, Goertzel Algorithm, Chirp-Z Transform	**11 hrs**
3	**Finite Impulse Response (FIR) Filter Design.** FIR Filter Design- Window method, Frequency sampling method, Optimum equiripple Linear phase FIR, FIR Differentiator, Finite word length effect in FIR digital filters. Frequency Transformation. Realization Structures for FIR filters- Direct form structure, Cascade, Frequency Sampling Structure, Lattice Ladder structure. Structures for Linear phase FIR filters.	**6 hrs**
4	**Infinite Impulse Response Filter Design** Design of IIR Filters- Impulse invariant method, Matched Z- Transform Method, Bilinear Transformation method. Butterworth filter, Finite	**8 hrs**

	wordlength effects in IIR Filters. Frequency Transformation- Low pass to High pass, Band Pass and band reject filters. Realization Structures for IIR Filters – Direct form structures, Cascade and parallel realization structures for higher order structures, Lattice Ladder structure. Application examples in Telecommunication- Touch tone generation and reception for digital Telephones, Digital telephony: Dual tone multifrequency detection using Goertzel algorithm, Clock recovery for data communication	
5	**Multi rate Signal Processing** Sampling rate reduction: decimation by integer factors, Sampling rate increase: interpolation by integer factors, sampling rate conversion by non integer factors, Multistage approach to sampling rate conversion, Polyphase implementation of interpolators. Sample rate conversion using poly phase filter structure. Applications of Multirate signal Processing- Interfacing of Digital Systems with different Sampling rates, Filter Banks, Subband coding of speech signals.	**10 hrs**
6	**Telecommunications applications of DTSP** Digital Cellular mobile telephony, Set top box for digital television reception, Adaptive television echo cancellation. Applications to Radar	**3hrs**

Theory Examination:

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3. Questions will be analytical and design oriented.
4. Question number 1 will be compulsory and cover all modules.
5. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
6. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum six experiments & 2 tutorials and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Suggested List of Simulations (MATLAB or C/C++ or Labview)

1) Magnitude and Phase response of a system
2) Spectral Analysis using DFT
3) Fast Fourier Transform
4) IIR Filter Design
5) Realization of IIR Filters
6) FIR Filter Design using Window technique
7) FIR filter design using Frequency sampling structure
8) Decimator & Interpolator
9) Decimation by polyphase decomposition
10) Applications of signal processing operation to practical one dimensional signal e.g. speech signal, ECG signal, music signal etc.

Recommended Books:

Text

1) Discrete Time signal Processing by Alan V. Oppenheim, Ronald Schafer, *Pearson Education*
2) Digital Signal Processing, Principles, algorithms and applications - J. Proakis, D. G. Manolakis, D. Sharma, *Pearson Education*
3) Shaum Outlines, Monson Hayes, Adapted by Subrata Bhattacharya, *Tata McGraw Hill*
4) *Digital Signal Processing , A Practical Approach, Emmanuel C. Ifeachor, Barrie W. Jervis, Pearson Education*

Reference

1) Discrete Time Signal Processing by Salivahnan, A. Vallavaraj, C. Gnanapriya, Second Edition, *Mc Graw Hill*
2) *Digital Signal Processing, 2nd edi, Shailaja Apte, Wiley India*
3) Fundamentals of Digital Signal Processing using MATLAB- Robert Schilling, Sandra Harris, *Cengage Learning*
4) Digital Signal Processing, S. K. Mitra, *Tata McGraw Hill Publication 2001*
5) Digital Signal Processing by Chen, Oxford University Press
6) A Practical Approach to Digital Signal Processing, Padmanabhan K., New Age International
7) Digital signal processing :system analysis and design .Diniz ,da sillva, Netto Cambridge university press
8) Digital Signal Processing, Ashok Ambardar, *Cengage Learning Publication*

B. E. Electronics and Telecommunication Engineering
semester VII

Subject – Project - I

Project Hour: 4 Hrs/week	Term work: **25 marks** Oral Exam. : **25 marks** Total marks=**50 marks**

Note: One faculty will not guide more than 3 projects in a semester. For every group allotted to faculty the load is considered as 1 Hour per group (Internal/ External Project) per week, be specified in time table of the faculty. Each group will not have more than 4 students.

Rationale: Project allows the student to work independently to put the knowledge of Electronics and Telecommunication engineering theory into practice.

Detailed description

Purpose:

- Engineering Project is a technical mandatory course.

- Project is the conclusive effort of independent work in the span of two semesters. The project course challenges the student to explore wide range of topics and opportunities for innovation.
- Responsibility is placed on the student to apply learning from various engineering courses and to seek out and make the best use of the available resources in terms of faculty, staff, library, laboratory, etc.
- This course is an opportunity for students to further develop the managerial skills while working in a team, creative skills by developing novel engineering solutions and communication skills presenting their end application, all necessary to be a successful engineer.
- Introducing the concept of professional literature and Gaining experience in writing a technical document.
- Enhancing employability through the evidence of independent work.

The students of Electronics and Telecommunication Engineering are expected to build a project by designing an engineering solution to the any of the following:

- Improvise existing technology
- Real life concerns to improve basic transport/healthcare/pollution/population/security/utility services - water, gas, electricity, drainage, communication etc /infrastructure, housing etc
- Develop mathematical models to facilitate analysis and verifying the same
- Build dedicated or support applications for space/ military/medical commercial/telephone/industrial/ scientific.

To complete the project, students should describe a mathematical model, simulate, design, development, implementation or small research project in an area of specialization.

Note: Topics are given for student reference and students can explore beyond the topics specified under the guidance of project guide

Guidelines:

- Students should work under the guidance of any faculty member from the department.

- A faculty member must officially supervise all projects. Industry/ research Institute's supervisor (Qualified) may, under the direction of a faculty member, also supervise students. A faculty member is always responsible for the grading of every project.

- Group members should not be more than four
- Project is expected to be completed by end of VIII semester
- At the end of VII semester, students should submit synopsis summarizing the work done in VII semester. The objective of this activity is to achieve the following

    - Introduction/need/scope of the project
    - Clarity on the status of project and plan of action for VIII semester
    - Accumulation of the literature survey done (No un-authentic URL): The literature survey should be through standard Text book, References, Other publications of journals like-IEEE, Wiley Interscience, Springer, Elsevier or similar, of repute.
    - Procurement of Software/ Hardware needed for Installation/ Testing of projects in VIII semester
    - Corrective steps to be taken if any

- **Students are expected to adopt systematic approach towards project completion**

- Each project should follow the scientific method and should apply the problem-solving approaches studied in earlier courses. In general, this includes: Gathering Information: A review of the state of the art should be made using the published literature as well as textbooks and student reports from previous projects if available.
- Proper Planning: Students must define the project goals and must organize a logical sequence of steps to achieve these goals. This will vary depending on the project, ability to procure materials, availability of equipment, etc.
- Regular Meetings: Students must meet regularly (weekly-4Hrs in VII

Semester and 8 Hrs in VIII Semester) with the project guide. ○ Professional Record Keeping: Proper records are essential and are typically kept in a log book with all details of activity noted. Be sure to use standard nomenclature and work in the SI system of units. (Log-book will contain in table format: Date/ Activity/ outcome/ comment on outcome/ Resources utilized/ Next meeting date, Target/ Guide's Remark)
Term work
Term work should consist of the above mentioned activities which shall be evaluated and shall carry a weightage of 25 marks.
Oral Examination
The oral examination shall be conducted on the basis of presentation given by the students and shall carry a weightage of 25 marks.

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VII Elective**	
SUBJECT: Data Compression and Encryption			
Periods per week (Each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination	-	25
	Term Work	-	25
	Total		**150**

Module	Contents	Hours
Objective	**The objective of this course is to introduce to the students the fundamentals of data compression, data encryption and data security**	-
1	**TEXT COMPRESSION** Shannon Fano Coding, Huffmann coding, Arithmetic coding and dictionary techniques- LZW, family algorithms. Entropy measures of performance and Quality measures.	**6hrs**

2	**AUDIO COMPRESSION** Digital Audio, Lossy sound compression, M-law and A-law companding, DPCM and ADPCM audio compression, MPEG audio standard, frequency domain coding, format of compressed data.	**8hrs**
3	**IMAGE AND VIDEO COMPRESSION** Loss less techniques of image compression, gray codes, Two dimensional image transforms, JPEG, JPEG 2000, Predictive Techniques PCM and DPCM. Video compression and MPEG industry standard.	**10hrs**
4	**CONVENTIONAL ENCRYPTION** Introduction, Types of attacks, Steganography, Data Encryption Standard, Block Cipher Principle, S-box design, triple DES with two three keys, introduction to international data encryption algorithm and key distribution.	**8hrs**
5	**PUBLIC KEY ENCRYPTION AND NUMBER THEORY** Euler's theorems, Chinese remainder theorem, Principles of public key cryptography, RSA algorithm, Diffie-Hellman Key Exchange. Elliptic curve cryptology, message authentification and Hash functions, Hash and Mac algorithms, Digital signatures.	**8hrs**
6	**SYSTEM SECURITY & CASE STUDIES** Intruders, Viruses, Worms, firewall design, antivirus techniques, digital Immune systems, Certificate based & Biometric authentication, Secure Electronic Payment System.	**8hrs**

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
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3. Question number 1 will be compulsory and cover all modules.
4. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
5. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum five experiments & 3 tutorials and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Recommended Books:

Text Books

1. Data Compression – David Salomon , Springer Publication, 4th Edition.

2. Introduction to Data Compression – Khalid Sayood, Morgan Kaufmann Series, 3rd Edition

3. Cryptography and Network Security – William Stallings, Pearson Education Asia Publication, 5th Edition.

4. Cryptography and Network Security – Behrouz Forouzan, McGraw-Hill, 1st Edition.

Reference Books:

1.The Data Compression Book – Mark Nelson, BPB publication, 2nd Edition

2. Applied Cryptography – Bruce Schnerer, John Willey & Sons Inc. Publication, 2nd Edition

3. Cryptography & Network Security – Atul Kahate, Tata McGraw Hill, 2nd Edition

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VII Elective**	
SUBJECT: Introduction to VLSI Design			
Periods per week (Each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination	-	25
	Term Work	-	25
	Total		**150**

Module	Contents	Hours
Objective	**The objective of the course is to introduce the students with basics concepts of VLSI devices, their fabrication and design of VLSI building blocks using VLSI CAD tools.**	-
Pre-requisite	**Students opting for this course are expected to have understanding Analog and Digital Integrated Circuits**	
1	Overview of VLSI design flow, representation of CMOS logic gates, Physics of semiconductors. MOSFET transistors. Threshold voltage, I-V characteristics, MOSFET parasitic, Modeling of MOS transistors in SPICE.	**6hrs**
2	DC and transient response of CMOS Inverter, Design of CMOS inverter for given performance specifications. (Noise Margins, delay, power dissipation and area). Design of CMOS logic gate using Transmission Gates. (TG) Introduction to various processes involved in the fabrication of CMOS Integrated Circuits like oxidation, diffusing, ion implantation, photolithography, etching, metallization and etc. (Only qualitative treatment is expected). Fabrication of MOSFET and CMOS Inverter using above processes. Layout and Stick diagrams. Layout design rules, Layout of Inverter and TG.	**12hrs**

3	Design of Arithmetic CMOS circuits like bit adder circuits, ripple carry adders, carry look ahead adders, high speed adders and multipliers. Introduction to Charge Storage Nodes, Dynamic Logic , Domino Logic , NORA Logic Design of Memory elements like SRAM, DRAM, ROM and Programmable logic arrays.	**12hrs**
4	Large scale physical design, Interconnected Delay Modeling, Crosstalk, Interconnected Scaling, Floor planning & Routing, I/P & O/P Circuit, Power dissipation and consumption, Low power Design considerations.	**6hrs**
5	Clocked flip-flop, CMOS clock styles, Pipelined systems, Clock generation and distribution, System design considerations.	**6hrs**
6	System design using Hardware description language (HDL) like VHDL or verilog.	**6hrs**

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Questions will be analytical and design oriented.
4. Question number 1 will be compulsory and cover all modules.
5. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
6. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum six experiments and a written test.
The distribution of marks for term work shall be as follows,
Laboratory work (Experiments and Journal) : 15 marks.
Test (at least one) : 10 marks.
The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Practical list

Tentative Practical list is given below, however concern teacher is free to design and conduct any other experiments based on the syllabus.

1 .Timing and functional analysis of a 1-bit full adder.
2 . Design and simulation of transistor level CMOS circuits.
3. Design and simulation of a TG based 1-bit full adder.
4. Physical layout of inverter and TG.
5. Physical layout of a TG based 1-bit full adder.
6. Physical layout of a D flip-flop.
7. Design of adder/multiplier using VHDL/Verilog
8. Design of Sequential Circuit using VHDL/Verilog

Recommended Books:

Text

1. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons, 2002.

Reference

1. CMOS digital Integrated Circuits Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, McGraw hill international Editions, Electrical engineering series
2. Digital integrated Circuits A design perspective, Jan M abaey, PHI Pvt Ltd (Prentice Hall of India Pvt Ltd)
3. Principles of CMOS VLSI Design, Neil H.E Weste, Kamran Eshragain
4. CMOS ckt design, layout and simulation, R. Jacbob Baker, Wiley Publication
5.Fundamentals of Modern VLSI Devices by Yuan Taur, Cambridge University Press
6. VLSI Design and Technology, Bose D.N., New Age International

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VII Elective**	
SUBJECT: SPEECH PROCESSING			
Periods per week (Each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination	-	25
	Term Work	-	25
	Total		**150**

Module	Contents	Hours
Objective	**To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis**	-
1	**NATURE OF SPEECH SIGNALS Speech** production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals.	**9hrs**
2	**TIME DOMAIN METHODS FOR SPEECH PROCESSING** Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.	**9hrs**
3	**FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING** Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems.	**9hrs**
4	**LINEAR PREDICTIVE CODING OF SPEECH** Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.	**9hrs**
5	**HOMOMORPHIC SPEECH ANALYSIS** Central analysis of speech, format and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.	**9hrs**

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Questions will be analytical.
4. Question number 1 will be compulsory and cover all modules.

5. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
6. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum five experiments & 3 tutorials and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal) : 15 marks.

Test (at least one) : 10 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Recommended Books:

TEXTBOOK :

Rabiner L. R. and Schafer R.E., “Digital processing of speech signals”, Prentice Hall, 1978.

References

1. Owens, F.J., “Signal Processing of Speech”, Macmillan, 1993.

2. Deller J.R. Proakis J.G. and Hanson J.H, “Discrete-Time Processing of Speech Signals”, Macmillan.

3.Applied speech and Audio Processing with MATLAB examples, Ian McLoughlin Cambridge University Press 2009.

4. Digital Speech: Coding for Low Bit Rate Communication Systems, 2nd Edition A. M. Kondoz , Wiley

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VII Elective**	
SUBJECT: ELECTRONIC PRODUCT DESIGN			
Periods per week (Each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination	-	-
	Oral Examination	-	25
	Term Work	-	25
	Total		**150**

Module	Contents	Hours
Objective	**To cover product design & development stages and total coverage of product assessment by introducing the basics of reliability and quality of electronic product and then discusses the various modes and causes of failure.**	-
1	**Product Design and development** Introduction, An overview of product development & product assessment, Pilot production batch, Concept of availability, Screening test , Environmental effects on reliability, Redundancy, Failsafe system, Ergonomic & aesthetic design considerations, Packaging & storage Estimating power supply requirement (Power supply sizing), Power supply protection devices Noise consideration of a typical system, Noise in electronic circuit, Measurement of noise Grounding, Shielding and Guarding Enclosure sizing & supply requirements & materials for enclosure and tests carried out on enclosure Thermal management and its types	**12hrs**

2	**PCB designing** Layout, PCB sizes, Layout – General rules & parameters. Recommendations for decoupling & bypassing. Design rules for digital circuit PCB & analog circuit PCBs Noise generation, Supply & ground conductors Multilayer boards Component assembly & testing of assembled PCB, Bare board testing. Component assembly techniques Automation & computers in PCB design, Computer aided design , Design automation Soldering techniques, Solderability testing Study of packages for discrete devices & ICs, IC reliability issues. Parasitic elements Calculations of parasitic elements in high speed PCB. High speed PCB design and points to be considered for designing the high speed PCBs Mounting in presence of vibration. SMD assemblies Board layout check list. Tests for multilayer PCB Cable	**12hrs**
3	**Hardware design and testing methods** Logic analyzer, its architecture & operation and Use of logic analyzer Spectrum analyzer Network analyzer, Oscilloscope , DSO trigger modes Examples using MSO Signal integrity issues Use & limitations of different types of analysis Monte Carlo analysis	**6hrs**

4	**Software design and testing methods** Introduction Phases of software design & Goals of software design Methods of program flow representation Structured program construct Testing & debugging of program Software design Finite state machine Decision to use assembly & / or high level language for software development Assembler Compilers, Compilers design Simulators, CPU Simulators Emulators	**6hrs**
5	**Product testing** Environmental testing for product. Environmental test chambers & rooms. Tests carried out on the enclosures Electromagnetic compatibility (EMC) with respect to compliance. Electromagnetic compatibility (EMC) testing . Conducted emission test (time domain methods). Radiated emission test Basics on standard used. Instrument specifications	**6hrs**
6	**Documentation** PCB documentation- Specifying laminate grade, drilling details, PCB finish- Tin, solder, gold, silver plating, hot air leveling, and bare board testing. Understanding advantages and limitations of each Product documentation- bill of materials, Production test specification- a case study for real circuit, Interconnection diagram- A case study., Front and rear panel diagrams for selected product	**6hrs**

	Manuals- Instruction or operating manual, Service and Maintenance manual, Fault finding tree Software documentation practices- For C programmes, Assembly programmes with particular focus on development of programme by several engineers simultaneously.	

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Questions will be analytical and design oriented.
4. Question number 1 will be compulsory and cover all modules.
5. Remaining questions will be mixed in nature. (e.g. - Suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
6. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Oral Examination:

Oral examination will be conducted to test the overall understanding of the subject based on the syllabus .

Term work:

Term work shall consist of minimum four experiments & 3 tutorials and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Experiments and Journal) : 15 marks.
Test (at least one) : 10 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Recommended Books:

Text

1. Electronic Product Design, R.G.Kaduskar, V.B.Baru, Wiley India

Reference

1. Printed Circuit Board design and technology – Walter C Bosshart Tata McGraw –Hill-CEDT
2. Handbook of Printed Circuit manufacturing – Raymond H. Clark (Van Nostrand Reinhold Company, New York)
3. Electronic testing and fault diagnosis –G.C. Loveday (Ah wheeler Publication, India)
4. Electronics Engineers reference book 5th Edition – Edited by F.F. Mazda Butterworths Publication Co., UK)
5. Principles of Reliable Soldering Techniques, Sengupta R., New Age International

UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTION AND EVALUATION (R2007)
Programme: B.E. Electronics and Telecommunication Engineering,

Scheme for Semester VII

Sr. No	Subjects	No. of Periods per week (60 minutes each)			Duration of Theory papers (Hours)	Marks			
		Lecture	Practi-cal	Tuto-rial		Theory	Term-work	Oral	Total
1.	**Mobile Communication Systems**	4	2	-	3	100	25	25	**150**
2.	**Fundamentals of Microwave Engineering**	4	2	-	3	100	25	25	**150**
3	**Computer Communication Network**	4	2	-	3	100	25	25	**150**
4	**Discrete Time Signal Processing**	4	2		3	100	25	25	**150**
5.	**Project stage –I**	-	-	4	-	-	25	25	**50**
6.	**Elective-VII Sem**	4	2	-	3	100	25	25	**150**
Total….		**20**	**10**	**4**	**-**	**500**	**150**	**150**	**800**

SCHEME FOR OFFERING ELECTIVE TO STUDENTS (Any ONE): BE, VII Semester

SEM VII:	SEM VII:	SEM VII:	SEM VII:
1.DATA COMPRESSION AND ENCRYPTION	**2.INTRODUCTION TO VLSI DESIGN**	**3.SPEECH PROCESSING**	**4.ELECTRONIC PRODUCT DESIGN**