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**

Scheme forSemester VIII

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.	**Advance Microwave Engineering**	4	2	-	3	100	25	25	**150**
2.	**Optical Fibre Communication**	4	2	-	3	100	25	25	**150**
3	**Wireless Network**	4	2	-	3	100	25	25	**150**
4.	**Project stage-II**	-	-	8	-	-	50	100	**150**
5.	**Elective-VIII Sem**	4	2	-	3	100	25	25	**150**
Total….		**16**	**8**	**8**	**-**	**400**	**150**	**200**	**750**

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

SEM VIII:	SEM VIII:	SEM VIII:	SEM VIII:
1. IMAGE PROCESSING	**2. SATELLITE COMMUNICATION**	**3. TELECOM NETWORK MANAGEMENT**	**4. MICROWAVE INTEGRATED CIRCUITS**

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	**10hrs**

	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.	
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.	**10hrs**

	Surface Waves on a Grounded Dielectric Slab. Coupled Strip Lines. Microstrip Transmission Line. Wave Velocity and Dispersion.	
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 Transistor. Terminations. Attenuators. Phase Shifters. Directional Couplers. Hybrid Junctions. Power Dividers. Microwave Propagation in Ferrites. Faraday Rotation. Microwave Devices Employing Faraday Rotation. Circulators.	**8hrs**
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	**9hrs**

	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 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	**8hrs**

	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.	

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	**6 hrs**

	Transformation. Realization Structures for FIR filters- Direct form structure, Cascade, Frequency Sampling Structure, Lattice Ladder structure. Structures for Linear phase FIR filters.	
4	**Infinite Impulse Response Filter Design** Design of IIR Filters- Impulse invariant method, Matched Z- Transform Method, Bilinear Transformation method. Butterworth filter, Finite 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	**8 hrs**
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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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 & 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.
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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.
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.

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

Scheme for Semester VIII

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.	Advance Microwave Engineering	4	2	-	3	100	25	25	**150**
2.	Optical Fibre Communication	4	2	-	3	100	25	25	**150**
3	Wireless Network	4	2	-	3	100	25	25	**150**
4.	Project stage-II	-	-	8	-	-	50	100	**150**
5.	Elective-VIII Sem	4	2	-	3	100	25	25	**150**
Total….		**16**	**8**	**8**	**-**	**400**	**150**	**200**	**750**

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

SEM VIII:	SEM VIII:	SEM VIII:	SEM VIII:
1. IMAGE PROCESSING	2. SATELLITE COMMUNICATION	3. TELECOM NETWORK MANAGEMENT	4. MICROWAVE INTEGRATED CIRCUITS

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester - VIII**	
SUBJECT: Advanced 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 basic principles and advanced applications of Microwave Engineering, as well as different amplifier design, oscillators design, and mixers.**	-
1	**TWO-PORT NETWORKS** Two-Port Parameters. S-Parameters. S-Parameters from Spice Analysis. Stability. Power Gains, Voltage Gains and Current Gains. Three Ports. Derivation of Transducer Power Gain. Differential S-Parameters. Twisted-Wire Pair Lines. Low-Noise and High-Power Amplifier Design.	**6hrs**
2	**NOISE IN LINEAR TWO-PORT** Signal-to-Noise Ratio. Noise Figure Measurements. Noise Parameters and Noise Correlation Matrix. Noise Two-Port Description. Noise Figure of Cascaded Networks. Influence of External Parasitic Elements. Noise Circuits. Noise Correlation in Linear Two-Ports using Correlation Matrices. Noise Figure Test Equipment. Determination of Noise Parameters. Calculation of Noise Properties of Bipolar and FETs. Bipolar Transistor Noise Model in T Configuration. The GaAs FET Noise Model.	**8hrs**
3	**SMALL- AND LARGE-SIGNAL AMPLIFIER DESIGN** Introduction. Single-Stage Amplifier Design—High Gain, Maximum Available Gain and Unilateral Gain, Low-Noise, High-Power,	**8hrs**

	Broadband, Feedback, Cascode, Multistage, Distributed and Matrix, Multimeter-Wave Amplifiers. Frequency Multipliers. Design Examples of 1.9-GHz PCS and 2.1-GHz W-CDMA Amplifiers. Stability Analysis and Limitations.	
4	**POWER AMPLIFIER DESIGN** Introduction. Device Modeling and Characteristics. Optimum Loading. Single-Stage Power Amplifier Design. Multistage Design. Power Distributed Amplifiers. Class of Operation. Power Amplifier Stability. Amplifier Linearization Methods.	**8hrs**
5	**OSCILLATOR DESIGN** Introduction. Compressed Smith Chart. Series of Parallel Resonance. Resonators. Two-Port Oscillator Design. Negative Resistance from Transistor Model. Oscillator Q and Output Power. Noise in Oscillators: Linear Approach. Analytic Approach to Optimum Oscillator Design using S Parameters. Nonlinear Active Models for Oscillators. Oscillator Design using Nonlinear CAD Tools. Microwave Oscillator Performance. Design of an Oscillator using Large Single Y Parameters. Example for Large Single Design Based on Bessel Functions. Design Examples for Best Phase Noise and Good Output Power. CAD Solution for Calculating Phase Noise in Oscillators. Validation Circuits. Analytical Approach for Designing Efficient Microwave FET and Bipolar Oscillators.	**10hrs**
6	**MICROWAVE MIXER DESIGN** Introduction. Diode Mixer Theory. Single-Diode, Single-Balanced, and Double-Balanced Mixers. FET Mixer Theory. Balanced FET Mixers. Special Mixer Circuits. Using Modern CAD Tools. Mixer Noise. Diode mixer theory, single diode mixer, balanced mixer, FET mixer theory, balanced FET mixer	**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 four experiments & four 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:

1. Microwave Circuit Design - George D. Vendelin, Anthony M. Pavio & Ulrich L. Rehde John Wiley & Sons publication
2. Radio Frequency and Microwave Electronics - Matthew M. Radmanesh Pearson Education Asia publication

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester - VIII**	
SUBJECT: Optical Fibre Communication			
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 understand the concept of transmission through Optical Fibre.**	-

1	**Overview Of Optical Fiber Communications:** Communication system applications in the electromagnetic spectrum, elements of or fiber transmission link, advantages of optical fiber communication. **Light Propagation in Optical Fiber:** Filter types, rays and modes, ray theory transmission, electromagnetic mode theory propagation, single mode and multimode fibers, linearly polarized models.	**8hrs**
2	**Fiber Optics Technology:** Fiber materials, fiber fabrication, fiber optic cables, couplers, splices, connectors.	**8hrs**
3	**Signal Degradation in Optical Fibers:** Alternation, dispersion, bit rate and bandwidths, mode coupling.	**8hrs**
4	**Optical Sources and Detectors:** Related semiconductor physics, light emitting diodes, laser diodes, their characteristics modulation circuits, optical detection principles, quantum efficiency, responsively, n time photo detector noise, PIN and Avalanche photodiodes.	**8hrs**
5	**Optical Receiver Operation:** Noise, Receiver capacitance, receiver structures, pre-amplifiers.	**8hrs**
6	**Optical Fiber Systems:** Link power budget, rise time budget, analog systems, digital systems, coherent systems- homodyne and heterodyne detection, multiplexing. **Optical Fiber Measurements:** Measurement of attenuation, dispersion, refractive index profile, numerical aperture diameter, OTDR.	**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. 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

1. Analog fiber optic system
2. Digital fiber optic system
3. Measurement of numerical aperture
4. Measurement of attenuation
5. Measurement of pulse spreading
6. Multiplexing in fiber optic system
7. Light source characteristics
8. Measurements using OTDR

Recommended Books:

Text Books:

1. Optical Fiber Communication - John Senior Prentice Hall of India Publication.
2. Optical Fiber Communication - Gred Keiser Mc- Graw Hill Publication

Reference Books:

1. Fiber Optic Communication - Djafar K. Mynbarv, Lowell L. Scheiner
2. Optical Fiber Communication - Selvarajan, Subartkar, T. Srinivas Tata Mc-Graw Hill Publication
3. Fundamentals of Fibre Optics in Telecommunication and sensor System, Pal B.P., New Age International
4. Fiber Optic Communication, Agrawal, 3rd edi, Wiley
5. Fibre optics and Optoelectronics by Khare,Oxford University Press
6. Rajappa Papannareddy, Lightwave Communication Systems: A Practical Perspective, Penram International Publishing

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester - VIII**	
SUBJECT: WIRELESS NETWORK			
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 understand the concept of wireless WAN, WAP and different IEEE standards.**	-
1	**Wide Area Wireless Networks (WANs) – GSM Evolution** Introduction, GSM evolution for data, Third-Generation (3G) Wireless Systems UMTS Network Reference Architecture, Channel Structure in UMTS Terrestrial Radio Access Network, UMTS Terrestrial Radio Access Network Overview ,UMTS Core Network Architecture, Adaptive Multi-Rate Codec for UMTS, UMTS Bearer Service,HSDPA.	**8hrs**
2	**Wide Area Wireless Networks (WANs) – CDMA One Evolution** Introduction, cdma2000 Layering Structure, Forward Link Physical Channels of cdma2000 ,Forward Link Features, Reverse Link Physical Channels of cdma2000 Evolution of cdmaOne (IS-95) to cdma2000,Technical Differences between cdma2000 and WCDMA.	**8hrs**
3	**Planning and Design of Wide Area Wireless Networks** Introduction , Planning and Design of a Wireless Network, Radio Design for a Cellular Network, Receiver Sensitivity and Link Budget .	**8hrs**

4	**Wireless Application Protocol (WAP)** Introduction, WAP and the World Wide Web (WWW) , Introduction to Wireless Application Protocol , The WAP Programming Model ,WAP Architecture , WAP Advantages and Disadvantages , Applications of WAP, imode, imode versus WAP.	**8hrs**
5	**Wireless Personal Area Network – Bluetooth** Introduction, The Wireless Personal Area Network , Bluetooth (IEEE 802.15.1), Definitions of the Terms Used in Bluetooth, Bluetooth Protocol Stack, Bluetooth Link Types, Bluetooth Security, Network Connection Establishment in Bluetooth, Network Topology in Bluetooth, Bluetooth Usage Models, Bluetooth Applications, WAP and Bluetooth **Wireless Personal Area Networks (WPAN): Low Rate (LR) and High Rate (HR)** Wireless Sensor Network, Usage of Wireless Sensor Networks, Wireless Sensor Network Model, Sensor Network Protocol Stack, ZigBee Technology, IEEE 802.15.4 LR-WPAN Device Architecture, IEEE 802.15.3a — Ultra WideBand, Radio Frequency Identification.	**10hrs**
6	**Wireless Local Area Networks (WLANs)** WLAN Equipment , WLAN Topologies, WLAN Technologies, IEEE 802.11 WLAN Joining an Existing Basic Service Set, IEEE 802.11n , IEEE 802.16 ,World Interoperability for MicroAccess, Inc. (WiMAX).	**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 & 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. Wireless communication and Networking-Vijay Garg, ELSEVIER Inc.
2. Wireless Communication_Singal_TMH

Reference Books
1. Next Generation Wireless Systems and Networks: Hsiao – Hwa Chen, Mohsen Guizani – Wiley
2. Wireless and Mobile Networks-Concepts and protocols: Dr Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri-- Wiley
3. Essentials of UMTS: Christopher Cox—Cambridge

B. E. Electronics and Telecommunication Engineering **Fourth Year Semester VIII**	
Subject – Project -II	
Project Hour: 8 Hrs/week	Term work: **50 marks** Oral / Practical/ Presentation / Demonstration examination: **100 marks** Total marks= **150 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 2 Hour per group (Internal/ External Project) per week, be specified in the time table of faculty.	
Rationale: Project allows the student to work independently to put the knowledge of **Electronics and Telecommunication engineering** theory into practice.	
Detailed description	
In continuation to the efforts taken towards building the project in VII semester, during VIII semester, students are expected to complete their project idea and meet the set goals and compile the project report. **FINAL PROJECT REPORT** Your guide will give you specific instructions as to the expected content of your final report. The report should cover the progress that has been made, including	

results obtained, graphical data, design drawings, and a statement of conclusions and recommendations (if applicable). Details of theory, experimental data, computer programs, purchased materials, sources and suppliers etc., must be included. Your report must be sufficiently complete that a student continuing your project would benefit from your report and would not be required to duplicate any of your work.

PROJECT MARKING SCHEME

A project used to assign marks in three general categories, as explained below. Achievement in each of these areas is critical to a successful project.

Project Goals & Achievements (20%): Guide will evaluate both the difficulty of the goals and whether the goals were achieved. Although projects will differ, it is always extremely important to set goals at the start of a project and work toward these goals. The project goals should be set in collaboration with the guide and an effort should be made to establish a realistic scope for the project. In some cases, it may become apparent as the project progresses that the original goals need to be adjusted and a modified set of goals must be set.

Final Report Quality & Content (40%): This is an evaluation of the quality of the final report based on the report format, the clarity of communication and the analytical content.

Student Organization, Creativity & Effort (40%): This portion of the evaluation reflects the student's performance, with emphasis on effort, organization, creativity and initiative.

Project Report Outline

The hard-bound report will contain following details:

- Title
- Certificate
- Acknowledgement (if any)
- Table of Contents
- List of Figures
- Abstract
- Introduction
- Literature Survey
- Mathematical Modeling/ Analysis and Design
- Implementation
- Result and Discussion
- Conclusion and Future Scope
- Reference
- Appendix (optional)

Term work
Term work shall consist of the above mentioned activities which shall be evaluated and shall carry a weight-age of 50 marks.
Oral Examination
The oral examination shall be conducted on the basis of presentation/ practical /

demonstration given by the students and shall carry a weightage of 100 marks.
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University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VIII Elective**	
SUBJECT: Digital Image 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	**The objectives of this course are to:** **- Cover the basic theory and algorithms that are widely used in digital image processing** **- Expose students to current technologies and issues that are specific to image processing systems** **- Develop hands-on experience in using computers to process images.**	-
1	**Digital Image fundamentals** Digital Image Representation, Elements of digital Image processing systems, Elements of Visual Perception, Sampling and Quantization, Basic relationships between pixels.	**4 hrs**
2	**Image Transforms** 2D DFT and its properties, Walsh Transform, Hadamard Transform, Haar Transform, Discrete Cosine Transform, Slant Transform, Hotelling Transform.	**10 hrs**
3	**Image Enhancement** Spatial Domain Methods, Point Processing,	**10 hrs**

	Neighbourhood Processing, spatial domain filtering, Zooming, Enhancement based on Histogram modeling, Enhancement in Frequency domain, Frequency domain filters, Generation of spatial mask from frequency domain.	
4	**Image Compression** Fundamentals, Image compression model, Redundancy, Error Criteria, Information Theory for Image compression, Lossy and lossless compression techniques, Image compression standards.	**10 hrs**
5	**Image Segmentation** Image segmentation based on discontinuities(Point, Line & Edge detection), Edge Linking, Thresholding (Global, Local, Optimum), Region based Segmentation	**4 hrs**
6	**Image Restoration** Model of Image degradation and Restoration Process, Noise models, Spatial Filtering, Frequency Domain Filtering, Modeling the degradation function, Inverse Filtering, Wiener Filtering	**10 hrs**

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 eight experiments from the suggested List such that all the modules are covered & 2 tutorials and a written test.
The distribution of marks for term work shall be as follows,

Laboratory work (Experiments) : 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

1. Spatial and Tonal Resolution
2. Image Rotation, Scaling, Translation
3. Forward and Inverse Transform. Comparing Inverse Transform with Image data.
4. Histogram Equalization
5. Spatial Domain filtering (High Pass, Lowpass, High Boost)
6. Frequency Domain Filtering (Butterworth filter)
7. Homomorphic Filtering
8. Compression codes
9. Image Thresholding
10. Impulse Noise removal
11. Gaussian Noise removal

Recommended Books:

Text

1. Digital Image Processing- By R. Gonzales, R. Woods- Pearson Education
2. Fundamentals of Image Processing- By Anil K. Jain, Prentice Hall of India Publication

Reference

1. Image Processing Analysis and Machine vision- Milan Sonka, Viciav Hivac, Roger Boyle- Thomson Learning Publication
2. Digital Image Processing, Pratt, 3rd edi, Wiley India

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VIII Elective**	
SUBJECT: Satellite Communications			
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 understand the concept of satellite launching and its operations.**	-
1	**Introduction:** General background, frequency allocations for satellite services, basic satellite system, system design considerations, applications. **Satellite Orbits:** Introduction, laws governing satellite motion, antenna look angles, antenna mount, limits of visibility, Earth eclipse of satellite, inclined orbits, sun-synchronous orbit, launching of geostationary satellites.	**8hrs**
2	**Wave Propagation and Polarization:** Introduction, atmospheric losses, ionospheric effects, rain attenuation, other impairments, antenna polarization, polarization of satellite signals, cross polarization discrimination, ionospheric depolarization, rain depolarization, ice depolarization.	**6hrs**
3	**Communication Satellites:** Introduction, design considerations, lifetime and reliability, spacecraft sub systems, spacecraft mass and power estimations, space segment cost estimates. **Satellite Antenna:** Antenna basics, aperture antennas, parabolic reflectors, offset feed, double relflector antenna shaped reflector systems.	**10hrs**
4	**Link Design:** Introduction, transmission losses, link power budget equation, system noise, carrier to noise ratio for uplink and downlink, combined uplink and downlink carrier to noise ratio, intermodulation noise.	**8hrs**

5	**Earth Stations:** Introduction, design considerations, general configuration and characteristics.	**6hrs**
6	**Multiple Access Techniques:** Introduction, FDMA, TDMA, FDMA/DMA, operation in a multiple beam environment, CDMA, multiple access examples	**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. 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 & 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. Satellite Communication, A.K.Maini; Varsha Agrawal, Wiley India
2. Satellite Communications - Dennis Roddy - 3rd edition, Mc-Graw Hill publicatio

Reference

1. Satellite Communications systems - M. Richharia - 2nd edition Mc Millan publication.
2. Satellite Communication, Pratt T, John Wiley

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VIII Elective**	
SUBJECT: Telecommunication Network Management			
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 understand the concept of Telecom network management, architecture and protocol.**	-
1	**Foundations:** Network management standards, network management model, organization model, information model abstract syntax notation 1 (ASN.1), encoding structure, macros, functional model. **Network management application functional requirements:** Configuration management, fault management, performance management, Error correlation technology, security management, accounting management, common management, report management, polity based management, service level management, management service, community definitions, capturing the requirements, simple and formal approaches, semi formal and formal notations.	**8hrs**
2	**Telecommunication management network (TMN) architecture:** Terminology, functional architecture, information architecture, physical architecture, TNN cube, TMN and OSI .	**8hrs**

3	**Common management information service element (CMISE):** CMISE model, service definitions, errors, scooping and filtering features, synchronization, functional units, association services, common management information protocol (CMIP) specification.	**8hrs**
4	**Information Modeling for TMN:** Rationale for information modeling, management information model, object oriented modeling paradigm, structure of management information, managed object class definition, management information base (MIB)	**8hrs**
5	**Simple network management protocol (SNMP):** SNMPv1: managed networks, SNMP models, organization model, information model, SNMPv2 communication model, functional model, major changes in SNMPv2, structure of management information (SMI), MIB, SNMPv2 protocol, compatibility with SNMPv1, SNMPv3, architecture, applications, MIB security, remote monitoring (RMON) SMI and MIB, RMQN1 and RMON2.	**8hrs**
6	**Network management examples:** ATM integrated local management interface, ATM MIB. M1, M2,M3, M4, interfaces, ATM digital exchange interface management, digita1 subscriber loop (DSL) and asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management **Network management tools:** Network statistics management, network management system, management platform case studies: OPENVIEW, ALMAP.	**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 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.

Recommended Books:

Text Books:

1. Network Management: Principles and Practice - Mani Subramanian, Addison Wesley, Pearson Education Asia publication.

2. Fundamentals of Telecommunication Network Management - Lakshmi Raman IEEE Communication Society, Prentice Hall of India Edition 1999

3.Telecommunication Network Management: Technologies and Implementations - Airdarous Salah, Plevyak Thomas. Prentice Hall of India

Reference Books:

1. Telecommunication Network Management - Haojin Wang
Mc- Graw Hill Professional Publication

University of Mumbai			
CLASS: B.E. (Electronics & Telecommunication Engineering)		**Semester – VIII Elective**	
SUBJECT: Microwave Integrated Circuits			
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 understand the integration of microwave devices in the form of IC.**	-
1	**Hybrid MICs :** Definition, characteristics, comparison with conventional circuits, fields of application and limitations and criteria for the choice of substrate material; thin film hybrid circuits, thick film hybrid circuits, artwork, mask making, photolithography, resistor stabilization, sawing, brazing process, wire bonding.	**9hrs**
2	**Monolithic MICs:** Definition, substrate structure, doping by ion implantation ohmic contact, metal resistive layers, gate metal, dielectric second level metal, dielectric and air bridge vias, substrate vias, final wafer process steps.	**9hrs**
3	**Micro strip Lines:** Planar wave guides, non- TEM propagation, line impedance definitions, quasi-static approximations, quasi-static line parameters, micro strip open circuits and gaps, micro strip corners, step changes in width, dispersion analysis, micro strip characteristic impedance, symmetric T junction, full wave analysis of micro strip propagation, LSE and LSM potentials, spectral domain analysis, dispersion relation for open micro strip, spectral domain impedance analysis, dispersion relation for open micro strip, spectral domain impedance analysis, Green's functions, millimeter wave modeling of micro strip lines.	**9hrs**
4	**Coupled Line Propagation:** Wave equations for coupled lines, propagation models, coupled line parameters, coupled line parameter variations with frequency, directional couplings, Lange coupler coupled line	**9hrs**

	pair treated as a four port, coupled line pair operated as a two port assuming Oe = 0o, low pass filtel design assuming Oe =0o, coupled line pair analysed to a two port Oe not equal to 0o, narrow band filter using coupled resonator, narrow band coupled line filters, suspended substrate strip lined filters, suspended substrate strip line filter design using method 1 and method 2.	
5	**Slot Lines:** Analysis, design consideration, transitions and applications. **Coplanar Waveguide:** Analysis, design considerations and coplanar line circuits. **Devices:** GaAs FET, HEMT, gunn diode, varactor diodes, PIN diodes YIC resonators, dielectric resonators & their application in oscillator mixer and amplifiers.	**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 six 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. Microstrip Circuit Analysis - David H. Schrader, Prentice Hall PTR, New Jersey

2. Microstrip lines and Slot lines- KC. Gupta, R. Gargand I.J. Bahl , Artech House.

3. MIIC Design: GaAs FETs and HEMTs- Peter Ladbrooke ,Artech House.

4. Foundations for Microstr!p Circuit Design -T.C. Edwards,John Wiley and Sons

Reference Books:

1. MIC and MMIC Amplifier and Oscillator Circuit Design- Allen Sweet, Artech House.

2. Handbook of Microwave Integrated Circuits- Reinmut K Hoffman, Artech House.

B.E. Electronics & Telecommunication Engineering	
VII-Seventh Semester (R2001) - Old	**Equivalent VII-Seventh Semester (R2007)-Revised**
1. Digital Communication	Digital Communication (TE, VI sem R-2007)
2. Mobile Communication Systems	Mobile Communication Systems
3. Microwave Devices and Circuits	Fundamentals of Microwave Engineering
4. Discrete Time Signal Processing	Discrete Time Signal Processing
5. Elective – I	
Radar Engineering	Radar Engineering(TE, VI sem R-2007)
Image Processing	Image Processing(BE, VIII sem R-2007)
Data Compression and encryption	DATA COMPRESSION AND ENCRYPTION
Microwave Integrated Circuits	MICROWAVE INTEGRATED CIRCUITS(BE, VIII sem R-2007)
Simulation of Communication Systems	No Equivalent*

* Student needs to appear in the same subject of R-2001

B.E. Electronics & Telecommunication Engineering	
VIII-Eighth Semester (R2001) - Old	**Equivalent VIII-Eighth Semester (R2007)-Revised**
1. Satellite Communication	SATELLITE COMMUNICATION
2. Optical Fiber Communication	Optical Fibre Communication
3. Computer Communication Networks	Computer Communication Network(VII –R2007)
4. Elective – II	
Wireless Networks	Wireless Network
Digital Voice Communication	Digital Telephony (TE, VI sem R-2007)
Telecommunication Network Management	TELECOM NETWORK MANAGEMENT
Microwave Amplifier and Oscillator Design	Advance Microwave Engineering
Optical Networks	No Equivalent*
Internet Communication Engineering	No Equivalent*

* Student needs to appear in the same subject of R-2001