Semester VIII

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETC801	Wireless Networks	04	--	--	04	--	--	04
ETC802	Satellite communication and Networks	04	--	--	04	--	--	04
ETC803	Internet and Voice Communication	04	--	--	04	--	--	04
ETE80X	Elective	04	--	--	04	--	--	04
ETL801	Wireless Networks Laboratory	--	02	--	--	01		01
ETL802	Satellite communication and Networks Laboratory	--	02	--	--	01		01
ETL803	Internet and Voice Communication Laboratory	--	02	--	--	01		01
ETEL80X	Elective Laboratory	--	02	--	--	01		01
ETP801	Project (Stage II)	--	**	--	--	06		06
Total		**16**	**08**	**--**	**16**	**10**		**26**

Course Code (ETE 80X)	Sem. VIII Elective
ETE 801	Speech Processing
ETE 802	Telecom Network Management
ETE 803	Microwave Integrated Circuits
ETE 804	Ultra Wideband Communication

**** Work load of learner in Semester VIII is equivalent to 12 hours /week.**

Semester VIII

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. of Test 1 & Test 2					
ETC801	Wireless Networks	20	20	20	80	--	--	--	100
ETC802	Satellite communication and Networks	20	20	20	80	--	--	--	100
ETC803	Internet and Voice Communication	20	20	20	80	--	--	--	100
ETE80X	Elective	20	20	20	80	--	--	--	100
ETL801	Wireless Networks Laboratory	--	--	--	--	25	--	25	50
ETL802	Satellite communication and Networks Laboratory	--	--	--	--	25	--	25	50
ETL803	Internet and Voice Communication Laboratory	--	--	--	--	25	--	25	50
ETEL80X	Elective Laboratory	--	--	--	--	25	--	25	50
ETP801	Project (Stage II)	--	--	--	--	50	--	50	100
Total		**80**	**80**	**80**	**320**	**150**		**150**	**700**

Subject Code	Course Name	Teaching Scheme	Credits Assigned					
		Theory	Practical	Tutorial	Theory	TW/ Practical	Tutorial	Total
ETC801	Wireless Networks	04	--	--	04		--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
ETC801	Wireless Networks	20	20	20	80	--	--	--	100

Course Pre requisites :

- ETC 603 Computer Communication and Networks
- ETC 702 Mobile Communication

Course Objectives:

- Introduction to planning and design of wireless networks
- Introduction to HSPA systems
- To study emerging technologies like Bluetooth, zigbee, Wimax
- Understanding the wireless sensor network architecture and the protocol stack and WSN applications.

Course Outcomes: The students will be able to:

- Describe the phases of planning and design of mobile wireless networks
- List and compare personal area network (PAN) technologies such as Zigbee, Bluetooth etc
- Students will details of sensor network architecture, traffic related protocols , transmission technology etc
- Understand middleware protocol and network management issues of sensor networks

Module No.		Topics	Hrs.
1		**Overview of Cellular Systems**	**08**
	1.1	Mobile telephony, introduction to GSM.	
	1.2	Universal mobile telecommunication system	
	1.3	Introduction to HSPA, Advanced Antenna Systems for HSPA + and LTE	
2		**Planning and Design of Wide-Area Wireless Networks**	**12**
	2.1	Basics of indoor RF planning	
	2.2	Three phases of wireless network design	
	2.3	Indoor coverage from the macro layer	
	2.4	Link budgets for GSM, CDMA, CDMA2000, HSDPA systems, indoor UMTS/HSPA challenge, common UMTS rollout mistake	
3		**Emerging Wireless Technologies**	**10**
	3.1	**Bluetooth:** concepts of Pico net , scatter net etc., protocol stack, link types, security, network connection establishments, usage models, etc.	
	3.2	**ZigBee**: components, architecture, network topologies, protocol stack etc.	
	3.3	**UWB and RFID:** technical requirements, components and characteristics, applications	
	3.4	**WiMAX:** 802.16 based protocol architecture, physical layer, fixed and mobile WiMAX	
4		**Overview of Wireless Sensor Network**	**12**
	4.1	Background of sensor network technology, sensor network architectural elements, historical survey of sensor networks	
	4.2	Applications of wireless sensor network, range of applications, examples of category 1 and 2 WSN Applications	
	4.3	Technologies for wireless sensor network, sensor node technology, hardware and software, sensor taxonomy	
	4.4	Wireless network, operating environment, wireless network trends, transmission technology	
	4.5	Medium access control protocols, routing protocols, transport control protocols	
6		**Middleware for Sensor Networks & Network Management**	**10**
	6.1	Middleware principles	
	6.2	Middleware architecture, existing middleware	
	6.3	Network management, requirements	
	6.4	Network management models, design issues	
Total			**52**

Recommended Books:

1. Indoor Radio Planning: A Practical Guide for GSM, DCS, UMTS, HSPA and LTE, 2nd Edition Morten Tolstrup ISBN: 978-0-470-71070-8 480 - July 2011 -Wiley
2. Vijay K. Garg, "*Wireless Communication and Networking*", Morgan -Kaufmann Series in Networking—Elsevi**er**
3. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "*Wireless Sensor Networks: Technology, Protocols, and Applications*", Wiley Student Edition
4. Feng Zhao and Leonidas Guibas, "*Wireless Sensor Networks, An Information Processin Approach*",--Morgan Kaufmann
5. Holger and Andreas Willig, "*Protocols and Architectures for WSN*", Wiley student edition

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining questions will be selected from all the modules

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETC 802	Satellite Communication and Network	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETC 802	Satellite Communication and Network	20	20	20	80	-	-	-	100

Pre-requisites:

- ETC 502: Analog communication
- ETC 601: Digital Communication

Course Objective:

- To provide an in-depth understanding of different concepts used in a satellite communication system.
- To explain the tools necessary for the calculation of basic parameters in a satellite communication system.
- To get knowledge of every aspects of satellite communication like orbital mechanics, launching techniques, satellite link design, earth station technology and different access system towards a satellite.

Course Outcome: The Students will be able to

- Explain the basics of satellite communication
- Explain and analyzes link budget of satellite signal for proper communication
- Use the system for the benefit of society
- Use the different application of satellite communication

Module No.		Topics	Hrs.
1.		**Overview of Satellite Systems, Orbits and Launching**	10
	1.1	Frequency allocation for satellite services, system design consideration, satellite services-VSAT, global positioning satellite system, maritime satellite services, gateways	
	1.2	Polar orbiting satellites, Kepler's First, second and third law, orbital elements, apogee, perigee heights, orbital perturbations, effects of a non-spherical earth, atmospheric drag	
	1.3	Sub-satellite Point, predicting satellite position, antenna look angels, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage	
	1.4	Selection of launching site, launch window, zero and non-zero degree latitude launching, sea launch, launch vehicles; satellite launch vehicle (SLV), augmented satellite launch vehicle (ASLV), polar SLV, geostationary satellite launch vehicle (GSLV)	
2		**Space Segment**	8
	2.1	Attitude control, spinning satellite stabilization, momentum wheel stabilization, station keeping, thermal control, TT and C subsystem, transponders, wideband receiver, input de-multiplexer, power amplifier, antenna subsystem	
	2.2	Equipment reliability and space qualification	
3		**Satellite Links**	12
	3.1	Isotropic radiated power, transmission losses, free-space transmission, feeder losses, antenna misalignment losses, fixed atmospheric and ionospheric losses, link power budget	
	3.2	System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio	
	3.3	**Uplink:** Saturation flux density, input back off, earth station HPA, **Downlink:** Output back off, satellite TWTA output	
	3.4	Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, inter-modulation noise	
4		**Earth Station.**	04
	4.1	Design considerations, receive-only home TV systems, outdoor–indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations	
	4.2	Community antenna TV systems	
5		**The Space Segment Access and Utilization**.	8
		Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation	
		TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA	
		Code Division Multiple Access: Direct-sequence spread spectrum–acquisition and trackling, spectrum spreading and dispreading – CDMA throughput	
6		**Satellite Networking**	10
	6.1	**Satellite Network:** net work reference models and protocols, layering principle, open system interconnection (OSI), reference model, IP reference model, reference architecture for satellite networks, basic characteristics of satellite networks, onboard connectivity with transparent processing, analogue transparent switching, Frame organization, Window organization, On board connectivity with beam scanning	
	6.1	**Laser Satellite Communication:** Link analysis, optical satellite link transmitter, optical satellite link receiver, satellite beam acquisition, tracking & positioning, deep space optical communication link	
		Total	**52**

Recommended Books:

1. Dennis Roddy, *"Satellite Communications"*, 3rd Ed., Mc. Graw-Hill International Ed. 2001.
2. Wilbur L. Pritchard, Henri G. Suyderehoud, and Robert A. Nelson, *"Satellite Communication systems Engineering",* Pearson Publication
3. Gerard Maral and Michel Bousquet, *"Satellite Communication Systems"*, 4th Edition Wiley Publication
4. Timothy Pratt, Charles Bostian, and Jeremy Allmuti, *"Satellite Communications"*, John Willy & Sons (Asia) Pvt. Ltd. 2004
5. M. Richharia, "*Satellite Communication Systems Design Principles*", Macmillan Press Ltd. Second Edition 2003.
6. Gerard Maral, "*VSAT Networks*", John Willy & Sons

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining question will be selected from all the module

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETC803	**Internet and Voice Communication**	20	20	20	80	-	-	-	100

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETC803	**Internet and Voice Communication**	20	20	20	80	-	-	-	100

Course Pre requisite :

- ETC 502: Analog communication
- ETC 601: Digital Communication
- ETC 604: Computer Communication and Networks

Course Objectives:

- To focus on Internet protocol, standards, services and administration.
- To discuss voice over IP as a real-time interactive audio/video service.

Course Outcomes: The students will be able to:

- Implement local area networks using both static and dynamic addressing techniques including sub netting.
- Install, configure, and troubleshoot server and client operating systems.
- Disassemble, troubleshoot/debug, upgrade, replace basic components, and reassemble servers and client systems.
- Explain the concept of encapsulation and its relationship to layering in the network models.
- Explain how TCP's byte-stream sliding window is related to a traditional packet-based sliding window algorithm.
- Explain the operation of the components of a router including, DHCP, NAT/PAT, Routing function, Switching function.
- Describe how DNS works in the global Internet including caching and root servers.

Module No.		Topics	Hrs.
1.		**Review of TCP /IP:**	**06**
	1.1	TCP /IP networking model, layer functions.	
	1.2	TCP/IP protocols, services, sockets and ports, encapsulations, difference between ISO and Internet layering.	
2		**Application Layer:**	**08**
	2.1	Host configuration, DHCP	
	2.2	Domain Name System (DNS), remote Login, TELNET and SSH	
	2.3	FTP and TFTP, World Wide Web, HTTP, electronic mail, SMTP, POP, IMAP, and MIME	
3		**Transport Layer:**	**12**
	3.1	User datagram protocol(UDP) header fields and their functions, pseudo header	
	3.2	Transmission control protocol (TCP), need for stream delivery, properties of reliable stream delivery, TCP header fields, ports, connections, end points, passive and active open, segment, stream and sequence numbers, variable window size and flow control.	
	3.3	Out of band data, checksum, acknowledgement and retransmission, round trip samples	
	3.4	Karn's algorithm, timer back off, response to delay variation and congestion, TCP state machine, connection establishment	
4		**Internetworking layer:**	**08**
	4.1	Internet protocol (IP) datagram, header fields and their functions	
	4.2	Internet control message protocol, IP address classes, broadcast, multicast and special addresses, network space and host space, subnets and supernets	
	4.3	Private IP addresses, classless inter domain routing (CIDR), CIDR subnet addressing, variable length in CIDR subnet addressing	
5.		**Voice Communication**	**04**
	5.1	Digitizing audio and video, audio compression, video compression	
6.		**Real-Time Interactive Audio and Video**	**16**
	6.1	Characteristics, RTP, RTP packet format	
	6.2	UDP port, RTCP, sender report, receiver report, source description message, bye message, application-specific message, UDP port	
	6.3	SIP,H.323	
	6.4	Flow characteristics, flow classes, techniques to improve QOS, resource reservation, admission control	
Total			**52**

Recommended Books:

1. B. Forouzan, "*TCP/IP Protocol Suite*", 4th Edition, McGraw-Hill Publication
2. Leon Garcia, "*Communication Networks*", 2nd Edition McGraw-Hill Publication
3. Kurose and Ross, "*Computer Networking*", 5th Edition Pearson Publication
4. Ted Wallingford, "*Switching to VoIP*", Oreilly Publication

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining question will be selected from all the modules.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETE801	Speech Processing	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETE801	Speech Processing	20	20	20	80	-	-	-	100

Course Pre-Requisites:

- ETC405 Signals and Systems
- ETC602 Discrete Time Signal Processing

Course Objective:

- To introduce the models of speech production and acoustic phonetics
- To teach time and frequency domain techniques for estimating speech parameters
- To teach predictive techniques for speech coding
- To introduce speech recognition and speech synthesis applications

Course Outcomes: Students will be able to:

- Demonstrate basic knowledge in speech production mechanism, phoneme classification, digital models for speech production, Homomorphic speech processing and LPC analysis
- Demonstrate applications of signal processing theory for estimation of speech parameters in time and frequency domain including pitch and formants
- Analyze application of speech processing in speech compression, speech recognition, and speech synthesis
- Enhance their written and oral technical communication skills related to speech processing subject and will be better prepared for higher study and lifelong learning

Module No.		Topics	Hrs.
1.		**Speech Production, Acoustic Phonetics and Auditory Perception**	10
	1.1	Anatomy and physiology of speech organs, articulatory phonetics, acoustic phonetics, acoustic theory of speech production, discrete time model for speech production	
	1.2	Ear physiology and psychoacoustics	
2		**Speech Analysis in Time Domain**	06
	2.1	Time energy, average magnitude, and zero-crossing rate, speech vs silence discrimination	
	2.1	Short-time autocorrelation, pitch period estimation using short-time autocorrelation, median smoothing	
3		**Speech Analysis in Frequency Domain:**	06
	3.1	Time dependent Fourier representation for voiced and unvoiced speech signals, linear filtering interpretation, spectrographic displays	
	3.2	Pitch period estimation based on FFT and harmonic peak detection method, estimation of formants using log spectrum	
4		**Homomorphic Speech Processing**	08
	4.1	Cepstral analysis of speech, mel frequency cepstral coefficients (MFCC), perceptual linear prediction (PLP)	
	4.2	Pitch period estimation in cepstral domain, evaluation of formants using cepstrum	
5		**LPC and Parametric Speech Coding**	12
	5.1	Review of lattice structure realization, forward and backward error filters, normal equations & its solutions, levinson-durbin algorithm, covariance method, Berg's algorithm	
	5.2	Channel Vocoders, linear prediction (LP) based vocoders, residual excited LP (RELP) based Vocoders, voice Excited LP (VELP) based vocoders, multi-pulse LP (MPLP) based vocoders, code excited LP (CELP) based vocoders	
6		**Speech Processing Applications**	10
	6.1	Speech recognition systems, deterministic sequence recognition for ASR, statistical sequence recognition for ASR (Hidden Markov Model (HMM))	
	6.2	Text to speech system (TTS), concatenative synthesis, synthesis using formants, LPC synthesizer	
		Total	52

Recommended Books:

1. Rabiner and Schafer, "*Digital Processing of Speech Signals*", Pearson Education, Delhi, 2004.
2. Shaila D. Apte, "*Speech and Audio Processing*", Wiley India, New Delhi, 2012.
3. Douglas O'Shaughnessy, "*Speech Communications: Human & Machine*", Universities Press, Hyderabad, Second Edition, 2001.
4. Ben Gold and Nelson Morgan, "*Speech and Audio Signal Processing*", Wiley India (P) Ltd, New Delhi, 2006.
5. Thomas F. Quatieri, "*Discrete-Time Speech Signal Processing: Principles and Practice*", Prentice Hall, 2001.
6. J. L. Flanagan, "*Speech Analysis Synthesis and Perception*", Second edition, Springer-Verlag (1972).

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining question will be selected from all the modules.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETE802	Telecom Network Management	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETE802	Telecom Network Management	20	20	20	80	-	-	-	100

Prerequisite: ETC 603: Computer Communication and Networks

Course Objective:

- To familiarize the student with the design, analysis operation and management of modern data communications networks.
- To provide the student with a working knowledge of the types of communications network management systems and their strengths and limitations in solving various information network management problems.

Course Outcomes: The students will be able to:

- Demonstrate broad knowledge of fundamental principles and technical standards underlying
- Understand basic of telecommunication, networking and information technologies.
- Architect and implement networked informative systems.
- Continuously improve their technology knowledge and communication skills.
- Anticipate the way technological change and emerging technologies might alter the assumptions underlying architectures and systems.

Module No.		Topics	Hrs
1.		**Overview of Network Management**	06
	1.1	Case histories on network, system and service management, challenges of IT managers	
	1.2	Network Management: Goals, organization and functions	
	1.3	Network management architecture and organization network management perspectives	
2		**OSI Network Management**	08
	2.1	Network management standards	
	2.2	Network management models	
	2.3	Organization model	
	2.4	Information model	
	2.5	Communication model and functional model	
	2.6	Abstract syntax notation – encoding structure, macros functional model CMIP/CMISE	
3		**Internet Management (SNMP)**	13
	3.1	SNMP-organizational model-	
	3.2	System overview.	
	3.3	Information model, communication model, functional model	
	3.4	SNMP proxy server, Management information, Protocol	
	3.5	Remote monitoring. RMON	
4		**Broadband Network Management**	10
	4.1	Broadband networks and services, ATM Technology – VP, VC, ATM Packet, Integrated service, ATM LAN emulation, Virtual LAN	
	4.2	ATM Network Management – ATM network reference model, integrated local management interface. ATM management information base, role of SNMP and ILMI in ATM management.	
	4.3	M1, M2, M3, M4 interface. ATM digital exchange interface management	
5		**Network Management Applications**	08
	5.1	Configuration management.	
	5.2	Fault management	
	5.3	Performance management	
	5.4	Event correlation techniques	
	5.5	Security management	
	5.6	Accounting management, report management, policy based management services	
	5.7	Level management	
6		**Telecommunication Management Networks(TMN)**	07
	6.1	Need for TMN	
	6.2	Conceptual model	
	6.3	TMN standards	
	6.4	TMN management services architecture and TMN implementation	
Total			**52**

Recommended Books:

1. Mani Subramaniam, "*Network Management Principles and Practise"*, Addison Wisely, New York, 2000.
2. Lakshmi G. Raman, " *Fundamental of Telecommunications Network Management"* Eastern Economy Edition, IEEE Press New Delhi.
3. Salh Aiidarons, Thomas Plevoyak "*Telecommunications Network Technologies and implementations"* Eastern Economy Edition, IEEE press New Delhi-1998.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining question will be selected from all the modules.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETE803	Microwave Integrated Circuit	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETE803	Microwave Integrated Circuit	20	20	20	80	-	-	-	100

Course pre requisite:

- ETC 403: Wave Theory and Propagation
- ETC 504: RF Modeling and Antennas
- ETC 704: Microwave and Radar Engineering
-

Course Objective:

- To understand the integration of microwave devices in the form of IC.
- To understand the basic principles and advanced applications of Microwave Engineering,
- To design different amplifier, oscillator and mixers for various applications.

Course outcome: The students will be able to

- Design and implement the microwave layouts.
- Design and implement the microwave amplifier, oscillator, and mixer circuits.

Module No.		Topics	Hrs.
1.		**Hybrid MICs And Monolithic MICs**	**08**
	1.1	Definition, characteristics, comparison with conventional circuits, field of application and limitations and criteria for the choice of substrate material in HMICS and MMICS.	
	1.2	Thin film hybrid circuits, thick film hybrid circuits, art work, masking, photolithography, resistor stabilization, sawing, brazing process, wire bonding.	
	1.3	Monolithic MICs: Doping by ion implantation, Ohmic contacts, metal resistive layers, gate metal, dielectric and air-bridge vias, wafer process steps.	
2		**Micro Strip Lines**	**08**
	2.1	Planar wave guides, non-tem propagation, line impedance definitions, quasi-static approximations, quasi-static line parameters.	
	2.2	Micro strip open circuits and gaps, micro strip corners, step change in width.	
	2.3	Dispersion analysis, micro strip characteristic impedance, symmetric t junction, green's functions, millimeter wave modeling of micro strip lines.	
3		**Coupled Line Propagation**	**10**
	3.1	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 pair operated as a four port.	
	3.2	Coplanar wave guides: design considerations and coplanar line circuits.	
4		**Microwave Amplifier Design**	**12**
	4.1	Introduction, derivation of transducer power gain, stability, power gains, voltage gains, and current gains, single-stage transistor amplifier design.	
	4.2	Power amplifier design: device modeling and characteristics, optimum loading.	
	4.3	Single-stage power amplifier design and multi-stage design.	
	4.4	Power distributed amplifiers. class of operation, power amplifier stability, amplifier linearization methods.	
5		**Microwave Oscillator Design**	**08**
	5.1	Introduction, compressed smith chart, series of parallel resonance, resonators, two-port oscillator design, negative resistance from transistor model, oscillator q and output power.	
	5.2	Noise in oscillators: linear approach, analytical approach to optimum oscillator design using s parameters, nonlinear active models for oscillators.	
	5.3	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.	
6		**Microwave Mixer Design**	**06**
	6.1	Introduction, diode mixer theory, single-diode, single-balanced and double-balanced mixers.	
	6.2	FET mixer theory, balanced FET mixers, special mixer circuits, mixer noise.	
Total			**52**

Recommended Books:

1. D. H. Schrader, "*Microstrip Circuit Analysis*", Prentice Hall PTR, New Jersey.
2. D. M. Pozar, "*Microwave Engineering*", John Wiley & Sons Publication, 2013.
3. K. C. Gupta, R. Garg, and I. J. Bahl, "*Microstrip Lines and Slot Lines*", Artech House.
4. M. M. Radmanesh, "*Radio Frequency and Microwave Electronics*", Pearson Education, 2006.
5. D. Vendelin, A. M. Pavio, and U. L. Rohde, "*Microwave Circuit Design*", John Wiley & Sons Publication.
6. Sweet, "*MIC and MMIC Amplifier and Oscillator Design*", 1990 Edition, Artech House.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2to 5 marks will be asked.
4. Remaining question will be selected from all the modules.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETE804	Ultra Wide Band Communication	04	--	--	04		--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETE804	Ultra Wide Band Communication	20	20	20	80	-	-	-	100

Prerequisite: ETC 504: RF Modeling and Antennas.

Course Objective:

- To focuses on the basic techniques that concerns present and future dynamic UWB communication systems.
- To encompass all areas of design and implementation of UWB systems.
- To develop a comprehensive overview of UWB system design that spans propagation, transmit and receive antenna implementations, standards and advanced topics, modulation and multiple access, network issues, and applications.

Course Outcomes: Students will be able to;

- Understand nuances of planning and design of RF network
- Work professionally in the area of Antenna design and Radio Propagation.
- Apply the knowledge of mathematics and engineering to solve practical EM engineering problems.

Module No.		Topics	Hrs.
1.		**Introduction**	**10**
	1.1	UWB BASICS.	
	1.2	Regulatory bodies	
	1.3	UWB signals and systems with UWB waveforms	
	1.4	Power spectral density, Pulse shape, Pulse trains, Spectral masks	
	1.5	Multipath, penetration characteristics, spatial and spectral capacities – speed of data transmission	
	1.6	Gaussian waveforms, Designing waveforms for specific spectral masks.	
	1.7	Practical constraints and effects of imperfections.	
2		**Signal Processing Techniques For UWB Systems And UWB Channel Modeling**	**10**
	2.1	Effects of lossy medium on UWB transmitted signal	
	2.2	Time domain analysis, frequency domain analysis	
	2.3	Detection and Amplification,	
	2.4	Two ray UWB propagation model,	
	2.5	Frequency domain auto regressive model, IEEE proposals for UWB channel models	
3		**UWB Communications**	**05**
	3.1	UWB modulation methods, pulse trains	
	3.2	UWB transmitter/receiver	
	3.3	Multiple access techniques in UWB, capacity of UWB systems	
4		**Advanced UWB Pulse Generation**	**05**
	4.1	Comparison of UWB with other wideband communication systems	
	4.2	Interference and coexistence of UWB with other systems	
	4.3	Hermite pulses: orthogonal prolate spheroidal wave functions	
	4.4	Wavelet packets in UWB PSM	
	4.5	Applications of UWB communication systems	
5		**UWB Antennas and Arrays, Position and Location with UWB Signals**	**10**
	5.1	Antenna fundamentals: Antenna radiation for UWB signals	
	5.2	Conventional antennas and Impulse antennas for UWB systems	
	5.3	Beam forming for UWB signals: radar UWB array systems	
	5.4	Wireless positioning and location: GPS techniques, Positioning techniques time resolution issues, UWB positioning and communications	
6		**UWB Communication Standards and Systems**	**12**
	6.1	UWB standardization in wireless personal area networks	
	6.2	DS-UWB proposal, MB-OFDM UWB proposal: IEEE proposals for UWB channel models	
	6.3	UWB ad-hoc and sensor networks	
	6.4	MIMO and Space-time coding for UWB systems	
	6.5	Self-interference in high data-rate UWB communications, coexistence of DS-UWB with WIMAX	
Total			**52**

Recommended Books:

1. M. Ghavami, L. B. Michael and R. Kohno, "*Ultra Wideband Signals and Systems In Communication Engineering*", 2nd Edition, John Wiley & Sons, NY, USA, 2007.
2. Jeffrey H. Reed, "*An Introduction To Ultra Wideband Communication Systems*", Prentice Hall Inc., NJ, USA, 2005.
3. Ian Oppermann, Matti Hamalainen and Jari Iinatti "*UWB Theory and Applications*", John Wiley & Sons Ltd, 2004

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining question will be selected from all the modules.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETL 801	Wireless Networks Laboratory	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETL801	Wireless Networks Laboratory	--	--	--	--	25	--	25	50

Term Work:
At least ten experiments covering entire syllabus of ETC 801: Wireless Network be set to have predefined inference and conclusion. Simulation based experiments are also encouraged. An attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment graded. The average of grades converted in to marks should be taken into account for term work assessment
Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETL 802	Satellite Communication and Networks Laboratory	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETL802	Satellite Communication and Networks Laboratory	--	--	--	--	25	--	25	50

Term Work:
At least ten experiments covering entire syllabus of ETC 802: Satellite Communication and Network be set to have predefined inference and conclusion. Simulation based experiments are also encouraged. An attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment graded. The average of grades converted in to marks should be taken into account for term work assessment.
Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETL 803	Internet and Voice Communication Laboratory	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETL803	Internet and Voice Communication Laboratory	--	--	--	--	25	--	25	50

Term Work:
At least ten experiments covering entire syllabus of ETC 803: Internet and Voice Communication Laboratory be set to have predefined inference and conclusion. Simulation based experiments are also encouraged. An attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment graded. The average of grades converted in to marks should be taken into account for term work assessment
Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETEL 80X	Elective	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETEL 80X	Elective	--	--	--	--	25	--	25	50

Term Work:
At least ten experiments covering entire syllabus of respective Elective subject be set to have predefined inference and conclusion. Simulation based experiments are also encouraged. An attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment graded. The average of grades converted in to marks should be taken into account for term work assessment
Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETP801	Project (Stage II)	--	04	--	--	02	--	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETP801	Project (Stage II)	--	--	--	--	50	-	50	100

Term Work:

The final year students have already under gone project assignment in their seventh semester and in this semester the students are expected to continue the project work of stage I.

The college should keep proper assessment record of the progress of project and at the end of the semester it should be assessed for awarding TW marks. The TW should be examined by approved internal faculty appointed by the head of the institute on the basis of following:

- Scope and objective of the project work.
- Extensive Literature survey.
- Progress of the work (Continuous assessment)
- Design, implementation, and analysis of the project work.
- Results, conclusions and future scope.
- Report in prescribed University format.

An approved external examiner and internal examiner appointed by the head of the institute together will assess during oral examination. The oral examination is a presentation by the group members on the project along with demonstration of the work done. In the examination each individual student should be assessed for his/her contribution, understanding and knowledge gained.