Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Bachelor of Engineering/Technology (B.E./B.Tech)
in
Electronics and Telecommunication Engineering

Final Year Engineering
(Sem. VII and Sem. VIII)
Effective from Academic Year 2017 -18

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Preamble:

Concept of academic autonomy is based on the argument that Institutions can undertake the work expected of them by all stakeholders such as Students, Parents, University, Industry, Society in general, only if they have freedom of choice and action.

We at S.P.I.T. would like to believe that this freedom of choice and action as far as academics is concerned will make us more Proactive in our offerings.

An academic autonomy is as good as its Curricula and execution of it is as well as its faculty. S.P.I.T. is confident of succeeding on both the fronts.

In the first offering we have tried to pro-actively bridge the ever discussed "Industry-academic gap" by way of our SCOPE program. The issue about sensitizing students to social needs is being addressed by special activity based courses. Liberal arts courses have been introduced to enhance functionality of both sides of brain. In all this the professional core has not been overlooked. Thus the curricula are designed to achieve multi dimensional outcomes.

The evaluation mechanism is tuned for assessing the attainment of the designed outcomes and is designed as a fair mechanism.

As our learning cycle begins from July 2017, I wish to place on record that entire S.P.I.T. staff and faculty will work with singular focus and commitment towards the success of this endeavour.

Dr. Prachi Gharpure
Principal, S.P.I.T.

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From the Desk of Dean Academics

Greetings and congratulations to all the students, teaching and supporting staff of Sardar Patel Institute of Technology for getting autonomous status to the institute from the year 2017-18. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Indian Society and Industries.

In the proposed curriculum we have made an attempt to provide opportunity for students to develop themselves as competent engineering graduates with knowledge, skill and ethical behavior required for global career. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. The curriculum model is outcome based that focuses on learning by doing. This is achieved through activity based learning, minor projects, problem solving and innovative styles of pedagogy. Various steps are taken to transform teaching-learning process to make learning a joyful experience for students. Special laboratory based courses are introduced to give more practical exposure to the students.

To create socially responsible citizen curriculum offers courses like Constitution of India, Environmental Studies and Human Health Systems Approach. Also various activity based learning modules like 'Building Automation, Fire Safety and Electronic Security', 'Occupational Safety & Legal Studies for Engineers', 'Technical Presentation Skills', 'Technical Paper and Patent Drafting', 'Engineering Solution for Environmental Problems' and 'Financial Planning, Taxation Policies and Investment' are introduced. For overall development of the learner, various elective courses like Yoga Vidya, Music Appreciation, Dramatics, Industrial and Organizational Psychology, Law for Engineers, French Language, German Language etc. are introduced. To encourage interdisciplinary studies institute level Open Elective courses are offered.

One of the special feature of this curriculum is Skill development programme called SCOPE (Skill Certification for Outcome-Based Professional Education) planned to enhance employability, innovation and research culture in the institute. Every department is offering six domain specific tracks, each track containing six courses. Student will have an opportunity to enroll for more than 140 courses in any of the department of his choice. Some of the courses under SCOPE will be delivered in co-ordination with industries.

We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units. Faculty of S.P.I.T. deserves a special appreciation for their relentless efforts in designing curriculum and assessment instruments which will bring transformation in the quality and transparency in assessment of learners.

Looking forward for your active cooperation and constructive feedback to create vibrant and joyful learning environment at Sardar Patel Institute of Technology.

Dr. Surendra Singh Rathod
Professor and Dean Academics

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Message from Head of the Department

The Electronics & Telecommunication Engineering department has highly qualified and professionally skilled faculty members, who regularly conduct training programs in the areas of Network Administration, Communication, Design & Optimization, Network Security, Embedded Systems, Real-time DSP applications, VLSI design and RTOS. The department has signed MoU with companies like Tata Consultancy Services, Sony Ericsson India Ltd to train and significantly improve technical knowledge and skills of students. Department faculties are rigorously involved in R&D activities. The research work is published in reputed international journals like IEEE, IET, AIP, ASP, Elsevier etc. and also in international conferences.

The department is actively involved in research areas ranging from Cyber-physical systems to Computation Engineering. The following is a broad research areas:

- Embedded and Cyber-Physical Systems
- Signal Processing and Control System
- Communication
- RF System and Design
- Networking and Security
- Simulation and Modeling
- Computational Engineering

The department expects graduates **establish** themselves in their **chosen career paths** by utilizing technical, leadership, communication and interpersonal skills, while complying with ethical standards. Graduates through their excellence, contribute towards the next generation of telecommunication by **engaging in Research and Development**. Graduates demonstrate personal growth by pursuing or successfully **completing advanced degrees and professional development courses** in the field of engineering.

Dr. Y. S. Rao
Head of Electronics & Telecom. Engg. Department

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Scheme for B.E./B.Tech Electronics and Telecommunication Engineering					
SEM -VII					
Course Code	**Course Name**	**Teaching Scheme (Hrs/week)**			**Credits**
		L	**T**	**P**	**Total**
ETC701	Image and Video Processing	4	--	--	4
ETC702	Mobile Communication	4	--	--	4
ETC703	Optical Communication and Networks	4	--	--	4
ETC704	Microwave and Radar Engineering	4	--	--	4
ETE70X	Elective	4	--	--	4
ETL701	Image and Video Processing Laboratory	--	--	2	1
ETL702	Advanced communication Engineering. Laboratory- I	--	--	2	1
ETL703	Advanced communication Engineering. Laboratory -II	--	--	2	1
ETEL70X	Elective	--	--	2	1
ETP701	Project (Stage I)	--	--	*	3
	Total	20	--	8	27

Course Code (ETE70X)	**Sem. VII Elective**
ETE 701	Data Compression and Encryption
ETE 702	Statistical Signal Processing
ETE 703	Neural Network and Fuzzy Logic
ETE 704	Analog and Mixed Signal VLSI

*** Work load of learner in Semester VII is equivalent to 6 hours /week**

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Scheme for B.E./B.Tech Electronics and Telecommunication Engineering					
SEM -VIII					
Course Code	**Course Name**	**Teaching Scheme (Hrs/week)**			**Credits**
		L	**T**	**P**	**Total**
ETC801	Wireless Networks	4	--	--	4
ETC802	Satellite communication and Networks	4	--	--	4
ETC803	Internet and Voice Communication	4	--	--	4
ETE80X	Elective	4	--	--	4
ETL801	Wireless Networks Laboratory	--	--	2	1
ETL802	Satellite communication and Networks Laboratory	--	--	2	1
ETL803	Internet and Voice Communication Laboratory	--	--	2	1
ETEL80X	Elective Laboratory	--	--	2	1
ETP801	Project (Stage II)	--	--	**	6
	Total	16	--	8	26

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

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

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SEMESTER - VII

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC701	Image and Video Processing	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	ETC 405: Signals and Systems ETC 602: Discrete Time Signal Processing	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To cover the fundamentals and mathematical models in digital image and video processing.
	CO2	To develop time and frequency domain techniques for image enhancement.
	CO3	To expose the students to current technologies and issues in image and video processing.
	CO4	To develop image and video processing applications in practice.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Image Fundamentals**		1,2	04
	1.1	Image acquisition, sampling and quantization, image resolution, basic relationship between pixels, color images, RGB, HSI and other models		
2	**Two Dimensional Transforms**		3	06
	2.1	Discrete Fourier Transform, Discrete Cosine Transform, KL Transform, and Discrete Wavelet Transform		
3	**Image Enhancement**		1,4	08
	3.1	**Spatial Domain** **Point Processing:** Digital Negative, contrast stretching, thresholding, gray level slicing, bit plane slicing, log transform and power law transform. **Neighborhood Processing**: Averaging filters, order statistics filters, high pass filters and high boost filters		
	3.2	**Frequency Domain:** DFT for filtering, Ideal, Gaussian and Butterworth filters for smoothening and sharpening, and Homomorphic filters		
	3.3	**Histogram Modeling:** Histogram equalization and histogram specification.		
4	**Image Segmentation and Morphology**		2,3	07
	4.1	Point, line and edge detection, edge linking using Hough transform		

		and graph theoretic approach, thresholding, and region based segmentation.		
	4.2	Dilation, erosion, opening, closing, hit or miss transform, thinning and thickening, and boundary extraction on binary images		
5	**Image Restoration:**		1,2,3	07
	5.1	Degradation model, noise models, estimation of degradation function by modeling, restoration using Weiner filters and Inverse filters .		
6	**Video Formation, Perception and Representation**		1,2	08
	6.1	Digital Video Sampling, Video Frame classifications, I, P and B frames, Notation, ITU-RBT 601Digital Video formats, Digital video quality measure.		
	6.2	**Video Capture and display:** Principle of colour video camera, video camera, digital video		
	6.3	**Sampling of video Signals:** Required sampling rates, sampling in two dimensions and three dimensions, progressive virus interlaced scans .		
7	**Two Dimensional Motion Estimation**		2,3	12
	7.1	**Optical Flow:** 2-D motion Vs optical flow, optical flow equations, motion representation, motion estimation criteria, optimization method.		
	7.2	**Pixel based motion estimation:** Regularization using motion smoothing constraints, using multipoint neighborhood.		
	7.3	**Block Matching Algorithms:** Exhaustive block matching algorithms, phase correlation method, Binary feature matching.		
	7.4	**Multi resolution Motion Estimation:** General formulation, Hierarchical blocks matching Algorithms.		
			Total	**52**

References:

1. Gonzales and Woods, ―*Digital Image Processing*‖ , Pearson Education, India, Third Edition,
2. Anil K.Jain, ―*Fundamentals of Image Processing*‖ , Prentice Hall of India, First Edition, 1989.
3. Murat Tekalp, ―*Digital Video Processing*‖ , Pearson, 2010.
4. John W. Woods, ―*Multidimensional Signal, Image and Video Processing*‖ , Academic Press 2012
5. J.R.Ohm , ―*Multimedia Communication Technology*", Springer Publication.
6. A.I.Bovik, ―*Handbook on Image and Video Processing*", Academic Press.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC702	Mobile communication	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC 601 Digital Communication ETC 603 Computer Communication and Networks
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Understand GSM, CDMA concepts and architecture frame structure, system capacity, service provided.
	CO2	Study of evolution of mobile communication generations 2G,2.5 G,3G with their characteristics and limitations.
	CO3	Understand Emerging Technology required for fourth generation mobile systems such as SDR, MIMO etc.
	CO4	Understand different indoor and outdoor propagation models related to losses and different type of fading.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Fundamentals of Mobile Communication**		1,3	10
	1.1	Introduction to wire1ess communication		
	1.2	Frequency Division Multiple access, Time Division Multiple access, Spread Spectrum Multiple access, Space Division Multiple access, and OFDM		
	1.3	Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trunking and grade of service, improving the capacity of cellular systems. and related design problems		
2	**2G Technologies**		1,3,	13
	2.1	GSM Network architecture, signaling protocol architecture, identifiers, channels, introduction frame structure, speech coder RPE-LTP, authentication and security, call procedure, handoff procedure, services and features		
	2.2	**GSM evolution in GPRS and EDGE:** Architecture and services offered		
	2.3	**IS-95 A& B(CDMA-1):** Frequency and channel specifications of forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management		
3	**3G Technology**		1,2,3	09
	3.1	**IMT-2000/UMTS:** Network architecture, air Interface		

		specification, forward and reverse channels in W-CDMA and CDMA 2000, spreading and modulation.		
	3.2	Cell search and synchronization, establishing a connection, hand off and power control in 3G system		
4	**3GPP LTE**		1,4	08
	4.1	Introduction and system overview		
	4.2	Frequency bands and spectrum ,network structure, and protocol structure		
	4.3	Frame slots and symbols, modulation, coding, multiple antenna techniques		
	4.4	**Logical and Physical Channels:** Mapping of data on to logical sub-channels physical layer procedures, establishing a connection, retransmission and reliability, power control.		
5	**Emerging Technologies for 4G**		4	06
	5.1	4G Introduction and vision		
	5.2	Multi antenna Technologies: MIMO; software defined radio		
	5.3	Adaptive multiple antenna techniques, radio resource management, QOS requirements		
	5.4	Overview of 4G research initiatives and developments		
6	**Mobile Radio Propagation**		5,6	06
	6.1	Study of indoor and outdoor propagation models		
	6.2	Small scale fading and multi-path Small-scale multi-path propagation, parameter of multi-path channels, types of small scale fading, Raleigh and Ricean distribution,		
			Total	**52**

References:

1. Theodore S. Rappaport , ―*Wireless Communications*‖ , Prentice Hall of India, PTR publication

2. Andreas Molisch , ―*Wireless Communications*‖ , Wiley, Student second Edition.

3. Vijay Garg , ―*Wireless Network Evolution 2G-3G*‖ , Pearson Education.

4. Young Kyun Kim and Ramjee Prasad, ―*4 G Roadmap and Emerging Communication Technologies* ―, Artech house.:

5. Raj Pandya , ―*Mobile And Personal Communications Systems And Services*‖ , Prentice hall.

6. Singhal , ―*Wireless Communication*‖ , TMH

7. C.Y Lee , ―Mobile Communication‖ , Wiley

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC703	Optical Communication and Networks	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	ETC404 Wave Theory and Propagation ETC502 Analog Communication ETC601 Digital Communication.	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Apply fundamental principles of optics and light waves to design optical fiber communication systems.
	CO2	Identify structures , functions materials and working principles of optical fibers, light sources, couplers, detectors and multiplexers.
	CO3	Design optical fiber communication links using appropriate optical fiber, lights sources, couplers, detectors and multiplexers.
	CO4	Explore concept of designing and operating principles of modern optical communications systems and networks.
	CO5	Apply the knowledge developed in class to contemporary optical fiber communication research and industrial areas.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Optical Fiber Communication Technology**		1,2	10
	1.1	Block diagram**,** advantages**,** loss and bandwidth window**,** ray theory transmission, total internal reflection, acceptance angle, numerical aperture, and skew rays		
	1.2	EM waves, modes in planer guide, phase and group velocities, types of fibers according to refractive index profile and mode transmission.		
	1.3	Fiber material, fiber cables and fiber fabrication, fiber joints, fiber connectors, splices.		
2	**Transmission Characteristic of Optical Fiber**		1,2	08
	2.1	Attenuation, absorption, linear and nonlinear scattering losses, bending losses, modal dispersion, waveguide dispersion, dispersion and pulse broadening, dispersion shifted and dispersion flattened fibers, and non linear effects		
	2.2	Measurements of attenuation, dispersion and OTDR		
3	**Optical Communication Systems**		1,2,3	08

	3.1	Working principle and **c**haracteristics of sources (LED, LASER), and optical amplifiers		
	3.2	Working principle and characteristics of detectors (PIN, APD), noise analysis in detectors, coherent and non-coherent detection, receiver structure, bit error rate of optical receivers, and receiver performance.		
	3.3	Point to point links system considerations, link power budget, and rise time budget		
4	**Optical Network System Components and Optical Networks**		1,4,5	10
	4.1	Couplers, isolators, circulators, multiplexers, filters, **f**iber gratings, Fabry Perot filters, **a**rrayed waveguide grating, switches and wavelength converters		
	4.2	SONET and SDH standards, architecture of optical transport networks (OTNs), network topologies, protection schemes in SONET/SDH, and wavelength routed architectures.		
	4.3	Operational principle of WDM, WDM network elements and Architectures, Introduction to DWDM, Solitons.		
5	**Packet Switching and Access Networks**		5	08
	5.1	OTDM, multiplexing and de-multiplexing, synchronization and broadcast OTDM networks.		
	5.2	Network architecture overview, OTDN networks, optical access networks, and future access networks.		
6	**Network Design and Management**		2,5,6	08
	6.1	Transmission system model, power penalty-transmitter, receiver optical amplifiers, crosstalk, dispersion, wavelength stabilization.		
	6.2	Network management functions, configuration management, performance management, fault management, optical safety, and service interface		
			Total	**52**

References:

1. John M. Senior, ―*Optical Fiber Communication*‖ , Prentice Hall of India Publication, Chicago, 3rd Edition, 2013
2. Gred Keiser, ―*Optical Fiber Communication*‖ , Mc-Graw Hill Publication , Singapore, 4th Edition, 2012
3. G Agrwal, ―*Fiber optic communication Systems*‖ , John Wiley and Sons, 3rd Edition, New York 2014
4. Rajiv Ramaswami and Kumar N. Sivarajan, ―*Optical Networks: A Practical Perespective*‖ , Elsevier Publication Elsevier India Pvt.ltd, 3rd Edition, 2010
5. P.E.Green, ―*Optical Networks*‖ , Prentice Hall,1994
6. Biswanath Mukherjee, ―*Optical Communication Networks*‖ , McGraw-Hill, 1997.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC704	Microwave and Radar Engineering	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		ETC 404 Wave Theory and Propagation ETC 504 RF Modeling and Antenna
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To Analyze the microwave passive circuit components and design the tuning and matching networks.
	CO2	Identify the state of art in microwave tubes and semiconductors and their uses in real life.
	CO3	Apply the microwave devices and RADAR for industrial and scientific purposes.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Waveguides and Microwave Components**		1,4	10
	1.1	Frequency bands and characteristics of microwaves		
	1.2	Rectangular and circular waveguides, mode analysis		
	1.3	Resonators, reentrant cavities, scattering parameters, tees, hybrid ring, directional couplers, phase shifters, terminations attenuators, ferrite devices such as isolators, gyrators, and circulators.		
2	**Impedance Matching and Tuning**		1,2,5	08
	2.1	Lumped element matching		
	2.2	Single stub tuning, double stub tuning, triple stub tuning		
	2.3	Quarter wave transformer		
3	**Generation and Amplification of Microwaves**		1,2,5	10
	3.1	Two Cavity Klystron and Reflex Klystron		
	3.2	Helix Travelling Wave Tube and Backward Wave Oscillator		
	3.3	Cross Field Amplifier, Cylindrical Magnetron, and Gyrotrons		
4	**Semiconductor Microwave Devices** (construction, working, equivalent circuit and performance characteristics)		1,2	10
	4.1	Varactor, PIN, Tunnel, Point Contact, Schottky Barrier, Gunn, IMPATT, TRAPATT, and BARITT.		
	4.2	BJT, Hetro junction BJT, MESFET, and HEMT		
	4.3	Parametric Amplifiers		
5	**RADAR**		1,3	08
5	5.1	Basics of RADAR and RADAR range equation		
	5.2	**Types of RADAR:** Pulsed, Continuous wave and FMCW, Doppler,		

		MTI, and Phased Array		
	5.3	Types of displays and Clutter		
	5.4	**Tracking RADAR**: Monopulse, Conical, Sequentiallobing		
6	**Microwave Applications**		1,3	06
	6.1	Microwave heating and bio-medical applications		
	6.2	Remote sensing RADAR, MSTRADAR, radiometer, instrumentation landing system, and RADAR based navigation		
			Total	**52**

References:

1. David M Pozar, ―*Microwave Engineering*‖ , John Wieley & Sons,Inc. Hobokenh,New Jersey, Fourth Edition, 2012.
2. Samuel YLiao, ―*Microwave Devices and Circuits*‖ , Pearson Education, Third Edition
3. Merill Skolnik, ―*Introduction to RADAR Systems*‖ , TataMcgraw Hill , Third Edition
4. Annapurna Das and Sisir K Das, ―*Microwave Engineering*‖ , Tata McGraw Hill,New Delhi, Second Edition, 2009
5. K. T. Matthew, ―*Microwave Engineering*‖ , Wieleyindia, ,2011

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE701	Data Compression and Encryption	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC 503 Random Signal Analysis ETC 601 Digital Communication ETC 603 Computer Communication and Networks
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To understand the concept of Data Compression through source coding principles and various methods.
	CO2	To understand the principal of Encryption and steganography through various methods, architecture and crypto algorithm.
	CO3	To categorize and analyze various compression algorithm/standards for Text, Audio and Video.
	CO4	To identify system or data vulnerabilities and apply/design suitable crypto algorithm/mechanism to protect software/hardware configurations.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Data Compression**		1,3,5	08
	1.1	**Compression Techniques:** Loss less compression, Lossy compression, measure of performance, modeling and coding, different types of models, and coding techniques		
	1.2	**Text Compression**: Minimum variance Huffman coding, extended Huffman coding, Adaptive Huffman coding. Arithmetic coding, Dictionary coding techniques ,LZ 77, LZ 78, LZW		
2	**Audio Compression**		1,3	04
	2.1	High quality digital audio, frequency and temporal masking, lossy sound compression, μ-law and A-law companding, and MP3 audio standard		
3	**Image and Video Compression**		3,5	12
	3.1	PCM, DPCM JPEG, JPEG –LS , and JPEG 2000 standards		
	3.2	Intra frame coding, motion estimation and compensation, introduction to MPEG -2 H-264 encoder and decoder		
4	**Data Security**		4.5	12
	4.1	Security goals, cryptography, stenography cryptographic attacks, services and mechanics.		

	4.2	Integer arithmetic, modular arithmetic, and linear congruence		
	4.3	Substitution cipher, transposition cipher, stream and block cipher, and arithmetic modes for block ciphers		
	4.4	Data encryption standard, double DES, triple DES, attacks on DES, AES, key distribution center.		
5	**Number Theory and Asymmetric Key Cryptography**		4,5	12
	5.1	Primes, factorization, Fermat's little theorem, Euler's theorem, and extended Euclidean algorithm		
	5.2	RSA, attacks on RSA, Diffie Hellman key exchange , key management, and basics of elliptical curve cryptography		
	5.3	Message integrity, message authentication, MAC, hash function, H MAC, and digital signature algorithm		
6	**System Security**		3,4,5	04
	6.1	Malware, Intruders, Intrusion detection system, firewall design, antivirus techniques, digital Immune systems, biometric authentication, and ethical hacking.		
			Total	**52**

References:

1. Khalid Sayood, ―*Introduction to Data Compression*‖ ,Morgan Kaufmann, 2000
2. David Saloman, ―*Data Compression: The complete reference*‖ , Springer publication

3. Behrous Forouzen, ―*Cryptography and Network Security*‖ , Tata Mc Graw –Hill Education 2011
4. Berard Menezes, ―Network Security and Cryptography‖ , learning publication Cengage
5. William Stallings, ―Cryptography and Network Security‖ , Pearson Education Asia Publication, 5th edition

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE702	Statistical Signal Processing	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC 405 Signals and Systems, ETC503 Random Signal Analysis
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Design System for estimation, spectral estimation
	CO2	To perform wave formation analysis of the system
	CO3	Understand role of statistical fundamentals in real world applications

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Review of Signals and Systems**			06
	1.1	Review of stochastic Processes		
	1.2	Gauss-Markow models, representation of stochastic process, likelihood and sufficiency		
2	**Detection Theory**			08
	2.1	One way, two way ANOVA table, hypothesis testing, decision criteria		
	2.2	Multiple measurements, multiple-hypothesis testing, and composite		
	2.3	Chi-square testing , asymptotic error rate of LRT for simple hypothesis testing, CFAR detection, sequential detection and Wald's test.		
3	**Detection of Signals in Noise**			08
	3.1	Detection of known signals in white noise		
	3.2	Correlation receiver and detection of known signals in colored noise		
	3.3	Detection of known signals in noise and maximum SNR criterion		
	3.4	Solution of integral equations and detection of signals parameters		
4	**Estimation Theory**			10
	4.1	Estimation of Parameters		
	4.2	Bayes Estimates and estimation of nonrandom parameters		
	4.3	Properties of estimators, linear mean-square estimation, and reproducing densities		
5	**Estimation of Waveforms**			10
	5.1	Linear MMSE Estimation of Waveforms		
	5.2	The Wiener Filter for estimation of stationary processes		
	5.3	Kalman Filter for estimation of non-stationary processes		

	5.4	Relation between the Kalman and Wiener Filters, nonlinear estimation, and nonparametric detection		
6	**Applications**			10
	6.1	Spread spectrum communications		
	6.2	RADAR target models, and target detection		
	6.3	Parameter estimation in RADAR systems		
	6.4	Dynamic Target Tracking, pattern classification and system identification		
			Total	**52**

References:

1. M.D. Srinath, P.K. Rajasekaran, and R. Viswanathan, ―*Introduction to Statistical Signal Processing with Application*‖ , Pearson Education
2. Robert M. Gray and Lee D. Davisson, ―*An Introduction to Statistical Signal Processing*‖ , Pearson Education
3. Steven Kay, ―*Fundamentals of Statistical Signal Processing Volume-I: Estimation Theory*‖ , Prentice hall publication
4. Steven Kay, ―*Fundamentals of Statistical Signal Processing Volume-II: Detection Theory*‖ , Prentice hall publication
5. Steven Kay, ―*Fundamentals of Statistical Signal Processing Volume-III: Practical Algorithm Development*‖ , Prentice hall publication

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE703	Neural Networks and Fuzzy Logic	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		FEC 101 Applied Mathematics I
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Basic Concepts and understanding of artificial neural networks
	CO2	Knowledge about the Design of different neural networks, their architecture and training algorithm
	CO3	Basic Concept of Fuzzy logic, Fuzzy Sets, fuzzy rules and fuzzy reasoning.
	CO4	Design the applicability of neural networks and fuzzy logic

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Introduction to Neural Networks and its Basic Concepts:**			08
	1.1	Biological neurons and McCulloch and Pitts models of neuron	1,2,4	
	1.2	Types of activation functions		
	1.3	Neural networks architectures		
	1.4	Linearly separable and linearly non-separable systems and their examples		
	1.5	Features and advantages of neural networks over statistical techniques		
	1.6	Knowledge representation, learning process, error-correction learning, concepts of supervised learning, and unsupervised learning		
2	**Supervised Learning Neural Networks:**		2,3	07
	2.1	Single layer perception and multilayer perceptron neural networks, their architecture		
	2.2	Error back propagation algorithm, generalized delta rule, learning factors, step learning		
	2.3	Momentum learning		
	2.4	Concept of training, testing and cross-validation data sets for design and validation of the networks		
3	**Unsupervised Learning Neural Networks:**		2,3,4	09
	3.1	Competitive earning networks, kohonen self-organizing networks		
	3.2	K-means and LMS algorithms		
	3.3	RBF neural network, its structure and Hybrid training algorithm for		

		RBF neural networks		
	3.4	Comparison of RBF and MLP networks Learning		
	3.5	Vector Quantization neural network architecture and its training algorithm		
	3.6	Hebbian learning, Hopfield networks.	1,5	
4	**Applications of Neural Networks:**			06
	4.1	Pattern classification		
	4.2	Handwritten character recognition		
	4.3	Face recognition		
	4.4	Image compression and decompression		
5	**Fuzzy logic**		1,2,5	14
	5.1	Basic Fuzzy logic theory, sets and their properties		
	5.2	Operations on fuzzy sets		
	5.3	Fuzzy relation and operations on fuzzy relations and extension principle		
	5.4	Fuzzy membership functions and linguistic variables		
	5.5	Fuzzy rules and fuzzy reasoning		
	5.6	Fuzzification and defuzzification and their methods		
	5.7	Fuzzy inference systems, Mamdani Fuzzy models, and Fuzzy knowledge based controllers		
6	**Applications of Fuzzy Logic and Fuzzy Systems:**		3,4,6	08
	6.1	Fuzzy pattern recognition		
	6.2	Fuzzy image processing		
	6.3	Simple applications of Fuzzy knowledge based controllers like washing machines, traffic regulations, and lift control		
			Total	**52**

References:

1. S. Rajsekaran and G. A. Vijaylakshmi Pai, ―*Neural Networks, Fuzzy Logic, and Genetic Algorithms*‖ , PHI
2. Simon Haykin, ―*Neural Network- A Comprehensive Foundation*‖ , Pearson Education
3. Thimothy J. Ross, ―*Fuzzy Logic with Engineering Applications*‖ , Wiley India Publications
4. Laurence Fausett, ―*Fundamentals of Neural Networks*‖ , Pearson Education
5. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, ―*Introduction to Neural Network Using MATLAB",* Tata McGraw-Hill Publications
6. Bart Kosko, ―*Neural networks and Fuzzy Systems"*, Pearson Education

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE704	Analog and Mixed Signal VLSI	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC302: Analog Electronics I ETC303. Digital Electronics ETC402: Analog Electronics II ETC 505: Integrated Circuits ETC 606 :VLSI Design
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Differentiate between Analog, Digital and Mixed Signal CMOS Integrated Circuits.
	CO2	Analyze and design current sources and voltage references for given specifications
	CO3	Analyze and design single stage MOS Amplifiers
	CO4	Analyze and design Operational Amplifiers.
	CO5	Analyze and design data converter circuits.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Fundamental Analog Building Blocks**			08
	1.1	MOS Transistor as sampling switch, active resistances, current source and sinks, current mirror and current amplifiers		
	1.2	Voltage and current references, band gap voltage reference, Beta-Multipler referenced self-biasing		
2	**Single Stage MOS Amplifiers**			14
	2.1	Common-source stage (with resistive load, diode connected load, current-source load, triode load, source degeneration), source follower, common-gate stage, cascode stage, folded cascade stage, simulation of CMOS amplifiers using SPICE		
	2.2	Single-ended operation, differential operation, basic differential pair, large-signal and small-signal behavior, common-mode response, differential pair with MOS loads, simulation of differential amplifiers using SPICE		
	2.3	Noise characteristics in the frequency and time domains, thermal noise, shot noise, flicker noise, popcorn noise, noise models of IC components, representation of noise in circuits, noise in single-stage amplifiers (CS, CD and CG stages), noise in differential pairs, noise		

		bandwidth, noise figure, noise temperature.		
3	**MOS Operational Amplifiers Desing**			08
	3.1	Trans-conductance operational amplifier (OTA), two stage CMOS operational amplifier		
	3.2	CMOS operational amplifiers compensation, cascade operational amplifier and folded cascade		
4	**Non-Linear & Dynamic Analog Circuits**			08
	4.1	Switched capacitor amplifiers (SC), switched capacitor integrators, first and second order switched capacitor circuits.		
	4.2	Basic CMOS comparator design, adaptive biasing, analog multipliers		
5	**Data Converter Fundamentals**			06
	5.1	Analog versus digital discrete time signals, converting analog signals to data signals, sample and hold characteristics		
	5.2	DAC specifications, ADC specifications, mixed-signal layout issues		
6	**Data Converter Architectures**			08
	6.1	DAC architectures, digital input code, resistors string, R-2R ladder networks, current steering, charge scaling DACs, Cyclic DAC, pipeline DAC.		
	6.2	ADC architectures, flash, 2-step flash ADC, pipeline ADC, integrating ADC, and successive approximation ADC		
			Total	**52**

References:

1. B. Razavi, **"***Design of Analog CMOS Integrated Circuits***"**, first edition, McGraw Hill,2001.
2. Harry W. Li and David E Boyce, **"***CMOS Circuit Design, Layout, Stimulation***",** PHI Edn, 2005
3. P.E.Allen and D R Holberg, **"***CMOS Analog Circuit Design***"**, second edition, Oxford University Press, 2002.
4. Gray, Meyer, Lewis and Hurst **"***Analysis and design of Analog Integrated Circuits***"**, 4th Edition Willey International, 2002

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL701	Image and Video Processing Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes	ETC 701: Image and Video Processing	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Understand how to mathematical model image and video processing.
	CO2	Learn different techniques for image enhancement.
	CO3	Implement various techniques for image and video processing.

Exp. No.	Experiment Details	Ref.	Marks
1	To study different Image File formats.		5
2	To perform different operations on image. a) Sampling. b)Quantization. c)Negation. d)image conversion		5
3	Image enhancement by point operations. Contrast stretching, Thresholding, Gray level slicing, Brightness enhancement , Log Transform, Power Law Transform.		5
4	Image processing by Histogram Processing. Histogram Equalization, Histogram Specifications.		5
5	Spatial domain filtering using low pass filter, high pass filter and median filter.		5
6	To perform Homomorphic filtering.		5
7	Image segmentation using edge detection.		5
8	Morphological segmentation by Erosion and Dilation.		5
9	To perform edge detection in video .		5
10	To detect white cars in video of traffic.		5
11	Application in image and video processings.		5
*Any 08 Experiment to be performed.		Total Marks	40

References:

As per recommended by faculty.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL702	Advanced Communication Engineering Laboratory I	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		ETC 702: Mobile Communication
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Understand hardware components of Mobile Communications Systems using Open Source SMS Gateway.
	CO2	Use of Modulation Techniques using GNU Radio, Mobile Tx/Rx using USRP

Exp. No.	Experiment Details	Ref.	Marks
1	Study of Hardware components of Mobile Communications Systems		5
2	Study of GSM modem: i]Install and configure minicom, wvdial & AT Commands ii]python scripting iii]Open Source SMS Gateway [Bonus]		5
3	Channel Allocation Techniques		5
4	Modulation Techniques using GNU Radio		5
5	Mobile Tx/Rx using USRP		5
6	Virtual Lab		5
7	Spread Spectrum Modulation		5
8	Wireless Path Loss Computations: i]Free-space Propagation Path Loss Model ii] Outdoor Propagation Model - Okumura Model iii] Outdoor Propagation Model - Hata Model		5
9	RF Propagation Models in Network Simulator (ns-2)		5
10	Open Source LTE/EPC Network Simulator using ns-3		5
11	Open Wireless Network Simulator (openWNS)		5
***Any 08 Experiment to be performed.**		**Total Marks**	**40**

References:

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL703	Advanced Communication Engineering Laboratory II	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		ETC 703: Optical Communication and Network ETC 704: Microwave and Radar Engineering
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Apply fundamental principles of optics and light waves to design optical fiber communication systems.
	CO2	Understand the working principles of optical fibers, light sources, couplers, detectors and multiplexers.
	CO3	Design optical fiber communication links using appropriate optical fiber, lights sources, couplers, detectors and mux.
	CO4	To Analyze the microwave passive circuit components and design the tunning and matching networks.
	CO5	Identify the state of art in microwave tubes and semiconductors and their uses in real life.
	CO6	Apply the microwave devices and RADAR for industrial and scientific purposes

Exp. No.	Experiment Details	Ref.	Marks
1	Measurement of Numerical Aperture of a given optical fiber.		5
2	Measurement of propagation loss and bending loss of two different wavelength.		5
3	Study of characteristics of fiber optics LED and photodetector.		5
4	Study the characteristics of LASER.		5
5	Study of Eye Pattern.		5
6	Study and measurement of bit error rate.		5
7	Study the characteristics of GUNN.		5
8	Study the characteristics Klystron .		5
9	To determine the frequency and wavelength in rectangular waveguide working on TE mode.		5
10	To determine SWR and Reflection Co-efficient.		5
11	To determine the function of multihole directional coupler by measuring the coupling factor and directivity.		5
12	To measure the polar and gain of a waveguide horn antenna.		5
***Any 08 Experiment to be performed.**		**Total Marks**	**40**

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETEL701	Data compression and Encryption	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes	ETC 503 Random Signal Analysis ETC 601 Digital Communication ETC 603 Computer Communication and Networks	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To understand the operational concept of Data Compression algorithms through source coding principles and various methods using software simulation tools.
	CO2	To get familiar with the operational concept of encryption and steganography algorithm through software simulation tools.

Exp. No.	Experiment Details	Ref.	Marks
1	For Huffman code for a particular message- "My name is ___".		5
2	To study qualitative performance data compression by applying compression in different formats on image, audio, video.		5
3	Significance of knowledge of probability and context based probability for text compression (Markov chain)		5
4	To get familiar with the concept of secret key encryption through 1) Encryption Algorithm (eg 3DES,AES etc), 2) Encryption modes(CBS,ECB), 3)Padding, 4) Initialization vector (IV).		5
5	To implement and test. a) Substitution, ROT13, Transposition, Double Transposition, Vernam Cipher in C/Python. b) Diffe-Hellman key management algorithm in C/Python.		5
6	To study personal firewell (FW) of host system using iptables configuration.		5
7	Design Project: Digital Audio Procesing Learn the fundamental of perceptual coding of audio.		5
8	Design a digital audio watermarking system in time and frequency domains.		
***Any 08 Experiment to be performed.**		**Total Marks**	**40**

References:

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETEL703	Neural Network and Fuzzy Logic	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		FEC 101 Applied Mathematics I
After successful completion of the course, student will be able to		
Course Outcomes	CO1	By using the basic concepts of neural network students will able to design of different neural networks, their architecture and training algorithm using Simbrain/Scilab/Matlab
	CO2	By using the basic concept of Fuzzy logic, Fuzzy Sets, fuzzy rules and fuzzy reasoning Students Design the applicability of neural networks and fuzzy logic using Scilab/Matlab

Exp. No.	Experiment Details	Ref.	Marks
1	Study and write program for perceptron learning rule for basic gates		5
2	Study and write program using C for perceptron learning rule for XOR gates		5
3	Study and write program for backpropogation network		5
4	Study and write program for Adaline and madaline network		5
5	Study &Design Competitive Learning network using Simbrain		5
6	Design Competitive Learning network using Simbrain for given problem		5
7	Design Hopfield network for given problem using Simbrain for given problem		5
8	Design Hebb network for given problem		5
9	To study & Design a Fuzzy model for given problem using Scilab Fuzzy Editor		5
10	Study and write program using Scilab Fuzzy Editor for image edge detection		5
*Any 08 Experiment to be performed.		Total Marks	40

References:

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETP701	Project (Stage I)	--	--	6	--	--	3	3
		Examination Scheme						
		Term Work		Practical		Oral		Total
		Phase-I:20 Phase-II:30		--		50		100

Term Work:

The final year students have already under gone project assignment in their pre-final year in Mini Project I and II. In final year group of maximum **four** students will be completing a comprehensive project work based on the courses studied. The project work may be internally assigned or may be externally assigned by the research institutes, industry etc. Each group will be assigned one faculty as a supervisor. This project work in final year may be extension of the Mini Project work done in pre-final year.

The main intention of Project work is to enable students to apply the knowledge and skills learned out of courses studied to solve/implement predefined practical problem. The Project work may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be

- Learning additional skills
- Development of ability to define, design, analysis and implementation of the problem and lead to its accomplishment with proper planning
- Learn the behavioral science by working in a group
- The project area may be selected in which the student intend to do further education and/or may be either intend to have employment or self employment
- The topic of project should be different and / or may be advancement in the same topic of Mini Project
- The students may use this opportunity to learn different computational techniques as well as some model development. This they can achieve by making proper selection of Project work.

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)
- 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.

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SEMESTER – VIII

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC801	Wireless Networks	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC 603 Computer Communication and Networks ETC 702 Mobile Communication
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Design the phases of planning and design of mobile wireless networks.
	CO2	List and compare personal area network (PAN) technologies such as Zig bee, Bluetooth.
	CO3	Understand details of sensor network architecture ,traffic related protocols, transmission technology etc.
	CO4	Understand middle ware protocol and network management issues of sensor networks.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Overview of Cellular Systems**		1,3	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**		1,2,3	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**		2,3,4	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**		3,4	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		
5	**Middleware for Sensor Networks & Network Management**		3,4,5	10
	5.1	Middleware principles		
	5.2	Middleware architecture, existing middleware		
	5.3	Network management, requirements		
	5.4	Network management models, design issues		
			Total	**52**

References:

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—Elsevier

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

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC 802	Satellite Communication and Network	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		ETC 502: Analog communication ETC 601: Digital Communication
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Explain the basics of satellite communication
	CO2	Explain and analyzes link budget of satellite signal for proper communication
	CO3	Use the system for the benefit of society
	CO4	Use the different application of satellite communication

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Overview of Satellite Systems, Orbits and Launching**		1,2	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**		1,2,3	08
	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**		1,2	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.**		1,3	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.**		1,3	08
	5.1	Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation		
	5.2	**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		
	5.3	**Code Division Multiple Access**: Direct-sequence spread spectrum–acquisition and trackling, spectrum spreading and dispreading – CDMA throughput		
6	**Satellite Networking**		2,3	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		
	6.2	**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**

References:

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

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETC803	Internet and Voice Communication	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	ETC 502: Analog communication ETC 601: Digital Communication ETC 604: Computer Communication and Networks	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To implement LAN using both static and dynamic addressing techniques including subnetting and explain the components of a router including DHCP, NAT/PAT, routing function, switching function.
	CO2	Install, Configure troubleshoot and upgrade client and server operating systems and working of DNS as global internet including caching and primary servers.
	CO3	Explain how TCP byte stream sliding window is related to a traditional packet based sliding window algorithm, the concept of encapsulation and its relationship to layering in the network model.
	CO4	Implement VoIP and explain about the real time interactive audio video systems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Review of TCP /IP:**		1,2	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:**		1,2	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:**		1,2	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:**		1,3,4	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**		1,4	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**

References:

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

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE801	Speech Processing	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC405 Signals and Systems ETC602 Discrete Time Signal Processing
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Demonstrate basic knowledge in speech processing production mechanism, phoneme classification, digital models for speech production, Homomorphic speech processing and LPC analysis.
	CO2	Demonstrate applications of signal processing theory for estimation of speech parameters in time and frequency domain including pitch and formants.
	CO3	Analyze application of speech processing in speech compression, speech recognition and speech synthesis.
	CO4	Enhance their written and oral technical communication skills related to speech processing subjects and will better prepared for higher study and life long learning.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Speech Production, Acoustic Phonetics and Auditory Perception**		2,3	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**		1,2,3	06
	2.1	Time energy, average magnitude, and zero-crossing rate, speech vs silence discrimination		
	2.2	Short-time autocorrelation, pitch period estimation using short-time autocorrelation, median smoothing		
3	**Speech Analysis in Frequency Domain:**		4,5	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**		1,2	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**		3,4,5	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**		2,3,5	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**

References:

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).

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE802	Telecom Network Management	4	--	--	-	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC 603: Computer Communication and Networks
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Explain the need for interoperable network management & analyze the trends and development of the Telecommunications Network Management.
	CO2	Demonstrate broad knowledge of fundamental principles and technical standards underlying
	CO3	Describe the concepts and architecture behind standards based network management associated with SNMP and CMIP.
	CO4	Apply basic of telecommunication, networking and information technologies and architect and implement networked informative systems.
	CO5	Continuously improve their technology knowledge and communication skills.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Overview of Network Management**		**2,3**	**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**		2,3	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)**		1,2,3	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**		1,3	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**		2,3	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	1,2,3	
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**

References:

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.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE803	Microwave Integrated Circuit	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		ETC 403: Wave Theory and Propagation ETC 504: RF Modeling and Antennas ETC 704: Microwave and Radar Engineering
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Design and implement the microwave layouts
	CO2	Design and implement the microwave amplifier, oscillator, and mixer circuits.

Module No.	Unit No.	Topics	Ref.	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**

References:

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.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE804	Ultra Wide Band Communication	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		ETC 504: RF Modeling and Antennas.
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Understand nuances of planning and design of RF network
	CO2	Work professionally in the area of Antenna design and Radio Propagation
	CO3	Apply the knowledge of mathematics and engineering to solve practical EM engineering problems

Module No.	Unit No.	Topics	Ref.	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**

References:

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

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL 801	Wireless Networks Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		ETC 801: Wireless Network
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Students will be able to install NS-3 and OMNET++.
	CO2	Students can generate and simulate wireless network scenario in NS3 & OMNET++.
	CO3	Students can verify results by plot in GNU plot and capture packets in Wire-shark.

Exp. No.	Experiment Details	Ref.	Marks
1	Installation of ns-3 and Omnet++.		5
2	Perform UDP communication between two nodes. Display the results using NetAnim, GNUplot and wireshark.		5
3	Perform UDP communication between three nodes with variable data rates.		5
4	Design basic LTE communication using ns-3.		5
5	Perform communication between mobile phone and Bluetooth Hardware Module.		5
6	Design LTE mobility using handover using ns-3.		5
7	Design Wimax communication using ns-3.		5
8	Design simple Wi-fi communication using ns-3.		5
9	Design Mesh Wi-fi communication using ns-3.		5
10	Design MAC Protocols for WSN and Simulate in Omnet++.		5
11	Design Routing Protocol for WSN and Simulate in Omnet++.		5
12	*Design Transport Control Protocol for WSN and Simulate in Omnet++.		5
13	*Prepare A Survey Report on Middlewares used in Sensor Netwoks.		5
*Any 08 Experiment to be performed.		Total Marks	40

References:

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL 802	Satellite Communication and Networks Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		ETC 802: Satellite Communication and Network
After successful completion of the course, student will be able to		
Course Outcomes	CO1	By Using basic concepts of satellite communication students will able to write programs for orbital parameters calculations.
	CO2	Students will able to Analyzes link budget of satellite signal for proper communication for given problem.
	CO3	Students will able to study satellites the benefit of society by using case study.

Exp. No.	Experiment Details	Ref.	Marks
1	To establish a direct communication link between Uplink Transmitter and Down Receiver using tone signal.		5
2	To communicate VOICE signal through satellite link.		5
3	To transmit and receive PC data through satellite link.		5
4	To perform a case study on Iridium Satellite.		5
5	To study Link Budget for uplink and downlink for satellite communication.		5
6	To find the orbital parameters of Lower Earth Orbit Satellite (SARAL –Satellite ARGOS and ALTIKA).		5
7	To perform a case study on International Space Station.		5
8	To study GPS module and find the current location using latitude and longitude		5
9	To design an Earth Station using any programming language.		5
10	To create a system with (BPSK/QPSK)modulator and demodulator.		5
11	To perform a case study on laser satellite.		5
12	To perform a case study on Satellite Link Routing.		5
*Any 08 Experiment to be performed.		Total Marks	40

References:

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL 803	Internet and Voice Communication Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes	ETC 803: Internet and Voice Communication	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Implement, configure and analyze different TCP/IP protocols using the simulation software tools like Packet Tracer and Wireshark.
	CO2	Install software packages required to configure some protocols and multimedia handling using open source tools.
	CO3	Install software packages required for multimedia handling using open source tools.
	CO4	To be able to documents the experiments.

Exp. No.	Experiment Details	Ref.	Marks
1	To install and configure primary DNS server.		5
2	To install and configure DHCP client/server.		5
3	To install and configure advanced email server.		5
4	Configuring VoIP in single network using CISCO PACKET Tracer.		5
5	Configure VoIP in network to network using CISCO PACKET Tracer.		5
6	To perform multimedia handling using ffmpeg and OpenCV.		5
7	To study virtual hosting concept and create a virtual host.		5
8	To perform LAN Telephony using Asterisk Server.		5
9	Live streaming using VLC Client/Server.		5
10	To study different audio and video format.		5
11	Mini project in internet and voice communication.		5
***Any 08 Experiment to be performed.**		**Total Marks**	**40**

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETEL 801	Speech Processing	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		ETE801 Speech Processing
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Demonstrate basic knowledge in speech processing production mechanism, phoneme classification, digital models for speech production, Homomorphic speech processing and LPC analysis.
	CO2	Demonstrate applications of signal processing theory for estimation of speech parameters in time and frequency domain including pitch and formants.
	CO3	Analyze application of speech processing in speech compression, speech recognition and speech synthesis.
	CO4	Enhance their written and oral technical communication skills related to speech processing subjects and will better prepared for higher study and life long learning.

Exp. No.	Experiment Details	Ref.	Marks
1	To understand the difference between stationary and non-stationary signals. To understand the limitations of Fourier transform in case of non-stationary signals.		5
2	Study of speech signals. To get feel about the non-stationary nature of speech signals. Limitations of Fourier transform in speech signals.		5
3	To study different sound units present in majority of Indian languages. To understand the production mechanism of each sound units To learn the time and frequency domain characteristics of different sound units.		5
4	To understand need for short term processing of speech To understand short term energy and study its significances.		5

5	To understand Zero crossing Rate and find out pitch frequency.		**5**
6	To compute short term autocorrelation and study its significances. To perform voiced/unvoiced/silence classifications of speech using short term time domain parameters.		**5**
7	To understand the limitations of DTFT for spectral analysis of speech. To understand the development of short term fourier transform (STFT) representation. To plot STFT of a speech signal.		**5**
8	To understand the effect of rectangular hamming and Hanning window functions on short term spectral analysis. To understand the effect of frame size on short term spectral analysis.		**5**
9	To understand the basic Cepstral Analysis approach. To perform vocal tract and source information separation by cepstral analysis.		**5**
10	To compute LP coefficient and LP residual of a given speech signal. To compute the format parameters by LP analysis. To compute the excitation parameters like pitch by LP analysis.		**5**
***Any 08 Experiment to be performed.**		**Total Marks**	**40**

References:

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETEL 802	Telecom Network Management	--	--	2	--	--	1	1
		Examination Scheme						
		ISE	ESE					Total
			Practical		Oral			
		40	10		10			60

Pre-requisite Course Codes	ETC 603: Computer Communication and Networks ETE802 Telecom Network Management	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Apply basic of telecommunication, networking and information technologies and architect and implement networked informative systems.
	CO2	Use network management tools and maintain the network by performing routine maintenance tasks.
	CO3	Install, configure, diagnose, repair, implement, and evaluate a computer-based system, process, component, or program to meet desired needs and to use current techniques, skills, and tools necessary for network management practice.

Exp. No.	Experiment Details	Ref.	Marks
1	Network Monitoring tools a) Status b)Route c)Traffic Tools		5
2	Network Audit using NMAP GUI.		5
3	Monitoring and management network using SNMP a) Basic SNMP, b) Advanced SNMP v3 Authentication/Encryption and ACL , c) SNMP Trap Daemon Implementation		5
4	Configuration SNMP Protocol on Cisco Router using Packet Tracer		5
5	Install and configure SNMP MIB browser a) qtmib b)snmpB c) OpManager MIB browser		5
6	Configuration manageable Switch: Dlink DES 3026 24 Port L2 Switch.		5
7	Network Statistics and measurement a) LAN Traffic Monitoring b) Protocol statistics		5
8	LAN Troubleshooting using Wireshark		5
9	Monitoring of services and Servers using Icinga		5
10	Monitoring of services and Servers using Cacti		5
11	Install and configure NAGIOS and monitor server		5
12	To study log system using open source tools.		5

13	Installation and Configuration of OpenNMS as a NMS.		**5**
14	Implementation of Centralized Log Management System: Syslog-ng		**5**
15	Study of commercial network management tools: HPOpenView, OpManager, GFILanguard and IBM NMS.		**5**
16	Class Project		**5**
***Any 08 Experiment to be performed.**		**Total Marks**	**40**

References:

As per recommended by faculty.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETP801	Project (Stage II)	--	--	12	--	--	6	6
		Examination Scheme						
		Term Work		Practical		Oral		Total
		Phase-III:50 Phase-IV:50 TPP:25 PE:25		--		50		200

TPP: Technical Paper Presentation; PE: Project Exhibition

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.
- ExtensiveLiterature 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.