Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Revision: SPIT-1-17

Master of Technology (M.Tech.)
in
Electronics & Telecommunication Engineering

First Year Master of Technology
(Sem. I and Sem. II)
Effective from Academic Year 2017 -18

Principal
Sardar Patel Institute of Technology
Bhavans Andheri Campus
Munshi Nagar, Andheri (West),
Mumbai - 400 058.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

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 first year M.Tech. students who secured admission to autonomous Sardar Patel Institute of Technology for 2017-18. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Indian Society and Industries.

The draft of the curriculum is prepared as per the guidelines of AICTE, UGC, IEEE etc. In the proposed curriculum we have made an attempt to provide opportunity for students to develop themselves as researchers with knowledge, skill and ethical behavior required for global career. Curriculum is designed to provide learning opportunities for students to acquire and demonstrate competencies for rewarding careers. The curriculum model is outcome based that focuses on learning by doing. Various steps are taken to transform teaching-learning process to make learning a joyful experience for students. Laboratory based courses are introduced to give more practical exposure to the students. Department level professional elective courses and institute level elective courses gives opportunity for students to select courses of their choice and do interdisciplinary learning.

One of the special features of this curriculum is addition of Massive Open Online Courses (MOOC) which can be recognized as credit courses. Institute will decide which courses available from NPTEL for certification to be considered for MOOC courses. The list of the courses shall be available to the students at the beginning of the semester II based on the courses offered by NPTEL. These courses will motivate the students for self learning and endure characteristics of lifelong learning in them. Preferably the courses on 'Research Methodologies', 'IPR and Patent Drafting', 'Entrepreneurship' and 'Soft Skills' shall be considered under MOOC category.

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 of Curriculum for Electronics and Telecommunication Engineering M.Tech. Program

Scheme for M. Tech. EXTC Engineering (SEM I to SEM IV)						
SEM I						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
ET911	Advanced Digital Signal Processing	PC	4	-	-	4
ET912	Modern Wireless Communication	PC	4	-	-	4
ET913	Embedded System	PC	4	-	-	4
ETL916	PG Laboratory-I	PC	-	-	2	1
ETL917	PG Laboratory-II	PC	-	-	2	1
ETS918	**Seminar-I**	PC	-	-	2	1
ETE91X	**Professional Elective-I**	PE	3	-	-	3
ILE91X	**Institute Elective-I**	PE	3	-	-	3
	Total		18	-	6	21
SEM II						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
ET921	Statistical Signal Processing	PC	4	-	-	4
ET922	Network Security	PC	4	-	-	4
ET923	Antenna Design	PC	4	-	-	4
ETL924	PG Laboratory-III	PC	-	-	2	1
ETL925	PG Laboratory-IV	PC	-	-	2	1
ETS926	**Seminar-II**	PE	-	-	2	1
ETE92X	**Professional Elective-II**	PE	3	-	-	3
ILE92X	**Institute Elective-II**	PE	3		-	3
	Total		18	-	6	21
SEM III						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
ETS931	Seminar-II		-	-	6	3
ETP932	Dissertation-I		-	-	24	12
	Total		-	-	30	15
SEM IV						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
ETP941	Dissertation-II	PR	-	-	30	15
	Total		-	-	30	15

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Code	Professional Elective-I Subjects
ETE91A	Network Architecture and Design
ETE91B	Computer Vision
ETE91C	Machine Learning and Artificial Intelligence

Code	Professional Elective-II Subjects
ETE92A	Error Correcting Code
ETE92B	Internet of Things

Code	Institute Elective-I Subjects
ILE911	Project Management
ILE912	Management Information System
ILE913	Operation Research
ILE914	Cyber Security and Laws
ILE915	Entrepreneurship Development and Management

Code	Institute Elective-II Subjects Massive Open Online Course (MOOC)
ILE921	Department will suggest MOOC courses equivalent to 3 credits.

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SEMESTER I

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET911	Advanced Digital Signal Processing	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		Signals and Systems, Discrete Time Signal Processing
Course Outcomes	CO1	To design multirate DSP systems.
	CO2	Implement adaptive filters for a given application
	CO3	Study and apply the techniques of power spectrum estimation and wavelet theory for various applications.
	CO4	Apply Signal processing tools to bio-medical signal processing.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Discrete Random Signal Processing**	1	08
	1.1	Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem, special types of random process – Signal modeling-Least Squares method, Pade approximation, Prony's method, iterative Prefiltering, Finite Data records,Stochastic Models.		
2		**Spectrum Estimation**	5	08
		Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA, ARMA Signal modeling -Parameter estimation using Yule-Walker method.		
3		**Linear Estimation and Prediction**	5,8	08
	3.1	Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion -Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter - Linear prediction, Prediction error - Whitening filter, Inverse filter -Levinson recursion, Lattice realization, Levinson recursion algorithm for solving Toeplitz system of equations.		
4		**Adaptive Filters**	6	08
	4.1	FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization -		

		Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters - Exponentially weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter.		
5	**5.1**	**Multirate Digital Signal Processing**	5	08
		Mathematical description of change of sampling rate - Interpolation and Decimation -Continuous time model - Direct digital domain approach - Decimation by integer factor -Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Applications to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.		
6		Application of Digital Signal Processing to Biomedical Signal Processing	12	08
	6.1	ECG preprocessing, QRS template, QRS detection methods, performance measure for QRS detection.		
	6.2	Adaptive removal of ocular artifacts from human EEGs- Methods for removal and control of ocular artifacts, online Ocular Artifacts Removal (OAR) algorithm and system, hardware for online OAR system, system testing and experimental results.		
			Total	48

References:

[1] John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing", PHI, 2005.

[2] Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006.

[3] Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw-Hill, 2000.

[4] Simon Haykin, "Adaptive Filter Theory", Prentice Hall, Englehood Cliffs, NJ1986.

[5] S. Kay," Modern Spectrum Estimation Theory And Application", Prentice Hall, Englehood Cliffs, Nj1988.

[6] P. P. Vaidyanathan, "Multirate Systems And Filter Banks", Prentice Hall, 1992.

[7] S. M. Kay, Modern Spectrum Estimation Theory and Application", PHI.

[8] K. P. Soman, K.I. Ramchandran and N. G. Reshmi, "Insight into Wavelets: From theory to practice, Third Edition PHI, 2010.

[9] Rangaraj M. Rangayyan, "Biomedical Signal Analysis- A Case Study Approach", Wiley 2002.

[10] Willis J. Tompkins, Biomedical Digital Signal Processing, PHI, 1999.

[11] Sen M Kuo, Bob H Lee and W Tian, "Real Time Signal processing: Fundamentals, Implementations and Applications" Springer, Wiley Publishers, Third Edition 2013.

[12] S. K. Mitra, "Digital Signal Processing", TMH, 2001

[13] Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing, A Practical Approach", Pearson Education, 2008.

[14] D. C. Reddy, Biomedical Signal Processing Principles and Techniques, Tata Mc Graw-Hill, 2005.

[15] A. H. Sayed, "Adaptive filters", Wiley Student Edition, 2010.

[16] S. Thomas Alexander, Adaptive signal processing-Theory and Applications, Springer – Verlag.

[17] Torrence, Christopher, and Gilbert P. Compo, "A practical guide to wavelet analysis." Bulletin of the American Meteorological society Jan. 1998.

[18] Burrus, C. Sidney, Ramesh A. Gopinath, and Haitao Guo. "Introduction to wavelets and wavelet transforms." Prentice Hall Inc. 1997.

[19] Paul S. Addison, "The illustrated wavelet transform handbook: introductory theory and applications in science, engineering, medicine and finance." CRC press, 2002.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET912	Modern Wireless Communication	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE			MSE		ESE	
		10			30		100 (60% Weightage)	

Pre-requisite Course Codes		Digital Communication, Probability and Random Process,
Course Outcomes	CO1	Understand the market trends, technological and regulatory changes that are shaping the adoption of 4G.
	CO2	Identify the main features of IMT-Advanced and of the principle 4G technology candidates.
	CO3	Describe the planning and design of Wireless Networks
	CO4	Explain the importance of Softaware Defined Radio
	CO5	Examine current pre-4G deployments
	CO6	Analyze the threats and opportunities posed by 4G.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to 3G/4G Wireless Communications**	1,2	10
		UMTS Network Reference Architecture Channel Structure in UMTS Terrestrial Radio Access Network	1	
		Spreading and Scrambling in UMTS UMTS Terrestrial Radio Access Network Overview UTRAN Logical Interfaces Distribution of UTRAN Functions UMTS Core Network Architecture Code Division for Multiple Access (CDMA)	1,3	
2		**LTE**	1,2	10
		Introduction and system overview Frequency bands and spectrum ,network structure, and protocol structure,Frame slots and symbols, modulation, coding, multiple antenna techniques,Logical and Physical Channels: Mapping of data on to logical sub-channels,physical layer procedures, establishing a connection, retransmission and reliability, power control.	1,2	
3		**Emerging Technologies for 4G** Multiple-Input Multiple-Output Wireless Communications Orthogonal Frequency-Division Multiplexing Cognitive Radio/SDR	5	12
4		**The Future of 4 G Technologies** Overview of the market trends, technological and regulatory	1,4	05

		changes that are shaping the adoption of 4G,Analysis of the threats and opportunities posed by 4G.		
5		**Planning and Design of Wide-Area Wireless Networks** Radio Design for a Cellular Network (WCDMA and CDMA2000 RTT, HSDPA +etc)	1,6	12
			Total	**42**

References:

[1] Wireless communications and networking by Vijay K. Garg 1/e, Morgan Kaufmann publications

[2] Principles of Modern Wireless Communication Systems: Theory and Practice by Aditya K. Jagannatham , McGraw-Hill Education

[3] Mobile Communicatins 2/e by Jochen Schiller by Pearson Education

[4] From 4G Roadmap and Emerging Communication Technologies by Young Kyun Kim and Ramjee Prasad, Artech House
(Chapter-4: Emerging Technologies for 4G)

[5] The Future of 4G Technologies: New Opportunities and Changing Business Models for the Emergence of LTE and WiMAX

[6] Indoor Radio Planning: A Practical Guide for GSM, DCS, UMTS, HSPA and LTE, 2nd Edition Morten Tolstrup Wiley Publication

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET913	Embedded System	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		Microprocessors and Microcontrollers
Course Outcomes	CO1	Understand Wireless Sensor Networks architecture and technology.
	CO2	Able to classify functions of WSN protocol stack.
	CO3	Understand various advanced architectures and programming models
	CO4	Able to partition Software and Hardware for a given application
	CO5	Able to understand and design communication protocols
	CO6	Able to model Real-Time signal processing for control applications

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Sensor Networks:**Background of sensor network technology, sensor network architectural elements, design challenges,Technologies for wireless sensor network, sensor node technology, hardware and software, sensor taxonomy, Classification of Sensor Networks,Transmission Technologies for Sensor Networks.	7	07
2		**WSN Protocol Stack:** MAC Layer protocols, Routing Layer protocols,Transport control Protocols, High Level Application Layer Support, Adapting to the Inherent Dynamic Nature of WSNs, Cognitive Radio based sensor Networks. Nano Sensor Networks.	8,9	10
3		Architecture of embedded systems, Programming models for Single-Core and Multi-Core structures.Free RTOS Scheduling and Task Management – Real-time scheduling, Task Creation, Inter task Communication, Pipes, Semaphore, Message Queue, Signals, Sockets, Interrupts.	1,2	10
4		Software / Hardware partitioning - Co design overview - Co simulation, synthesis and verifications - Re-configurable computing - System on Chip (SoC) and IP cores - Low-Power RT Embedded Systems - On-chip Networking .	3	05
5		GPS, GSM, Bluetooth, Zigbee module interfacing, data processing and communication. IoT overview, IoT supported hardware platforms. RTOS for 1D Signal Processing and 2D Signal processing. RTOS for fault Tolerant Applications, and Control Systems.	4,5,6	10
			Total	**42**

References:

[1] Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", John Wiley publication
[2] Richard Barry, Using the FreeRTOS Real Time Kernel - a Practical Guide - Cortex-M3 Edition.
[3] Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide - Designing and Optimizing System Software", 2006, Elsevier.
[4] Communicating Embedded Systems: Networks Applications, Francine Krief (Editor) February 2010, Wiley-ISTE
[5] P Marwedel, "Embedded System Design", Springer publication Christopher Hallinan
[6] "Embedded Linux Primer: A Practical Real-World Approach", Second Edition, Pearson Education Publication
[7] Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", Wiley Student Edition
[8] "Adhoc Wireless Networks Architecture and Protocols" by C.Siva Ram Murthy and B.S.Manoj, Pearson.
[9] 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
ETL916	PG Laboratory-I	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		10		10		60

Pre-requisite Course Codes	--	
Course Outcomes	CO1	To design multirate DSP systems.
	CO2	Implement adaptive filters for a given application
	CO3	Study and apply the techniques of power spectrum estimation and wavelet theory for various applications.
	CO4	Apply Signal processing tools to bio-medical signal processing.

Exp. No.	Experiment Details	Ref.	Marks
1	Demonstrate the application of Periodogram and Spectrogram		5
2	Pre-processing of ECG signal, Simulated generation of ECG signal and isolation of QRS complex		5
3	Wavelet analysis for denoising		5
4	Wavelet transform for audio signal compression		5
5	Simulation of adaptive filtering		5
6	Generation of Chorus and flanging effects for voice record		5
7	Implementation of equalizers		5
8	Analysis of EEG signals		5
		Total Marks	40

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL917	PG Laboratory-II	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		10		10		60

Pre-requisite Course Codes	ET913	
Course Outcomes	CO1	Understand Wireless Sensor Networks architecture and technology.
	CO2	Able to classify functions of WSN protocol stack.
	CO3	Understand various advanced architectures and programming models
	CO4	Able to partition Software and Hardware for a given application
	CO5	Able to understand and design communication protocols
	CO6	Able to model Real-Time signal processing for control applications

Exp. No.	Experiment Details	Ref.	Marks
1	By using ARM cortex controller and IOT platform implement network server connectivity for real-time remote data access		5
2	By using ARM cortex controller interface GSM & GPS communication protocol.		5
3	By using ARM cortex controller interface Bluetooth communication protocol		5
4	By using ARM cortex controller interface Zigbee communication protocol		5
5	Implement File Allocation Table on a FLASH memory card		5
6	Implement RTOS using open source tools		5
7	Implement software and hardware partition using Microcontroller and FPGA		5
8	**Mini-Project:** Design and implement an Real-Time wireless communication application		5
		Total Marks	40

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE91A	Network Architecture and Design	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		Students will be
Course Outcomes	CO1	To understand emerging technologies and design advanced data and computer communications networks.
	CO2	To distinguish between various network topologies in detail.
	CO3	To analyze the networks and carry out requirement analysis
	CO4	To design the LAN and WLAN and WAN
	CO5	To choose correct technology.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Internet Protocol (Configuration of DMZ Servers): Detail Working of DNS, HTTP, FTP and SMTP/POP - Configuration of DNS, Web, FTP, Mail Server.Internet Protocol – Understanding working of TCP, UDP, IP,ARP/ RARP, ICMP.		4
2		Introduction to Network analysis, Architecture and Design Process Model for Network analysis, Architecture, and Design **Requirement Analysis:** User Requirement, Device Requirement, Network Requirement, Performance Requirement, Financial Requirement, Enterprise Requirement		8
3		**Network Architecture:** Component Architecture –Routing, Network Management, Performance, Security. Architectural models: topological, And Routing flow model, Functional model Addressing Architecture, Network Management Architecture, Performance Architecture, Border-less Network Architecture		6
4		**Network Design:** Designing the network topology and solutions-Top down Approach Network Structure Model: Hierarchical Network Model, Enterprise wide network Architecture model- Enterprise Edge Area, E-commerce, Internet Connectivity, remote, enterprise branch and enterprise Data Center module. High Availability Network Services- Workstation to Router redundancy and LAN High Availability protocols, Route, Server		12
5		**Enterprise LAN and WAN Design:** Ethernet Design Rule. 100 Mbps Fast Ethernet Design rules, gigabit		12

		Ethernet Design Rules, 10 Gigabit Ethernet Design rules, 10GE Media types Understanding Working of Repeater, hub, Bridge, routers, Layer2/3 Switch Campus LAN Design Best Practice Server Farm Design, data centre Design Campus LAN QoS consideration Multicast Traffic Consideration. Wireless LAN Design **WAN Technologies:** WAN Transport Technologies, WAN Design Methodology, Traditional WAN Technologies, Remote Access Network Design, VPN Network Design,WAN Backup Design **Network Management Protocols:** SNMP v1,v2,v3, RMON2, Netflow, Syslog		
			Total	**42**

References:

[1] Network Analysis, Architecture, and Design 3rd Edition, Morgan Kaufman, James D.
[2] Data Network Design, Darren L. Spohn, Tata McGraw Hill Edition.
[3] Data Communications and Networking by Behrouz A. Forouzan, 4th Edition, Tata McGraw-Hill,2006.
[4] Data and Computer Communication by William Stalling, 8th Edition,Pearson Education, 2007.
[5] Computer Networking: A Top-Down Approach Featuring the Internet" by 6. James F. Kuross,Keith W. Ross, Third Edition,Addison Wesley, 2004.
[6] Network Management Principles and Practice, Mani Subramanian, Second Edition Pearson Education.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE91B	Computer Vision	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		Image and Video Processing
Course Outcomes	CO1	To understand machine vision and apply the basic concepts of optics in imaging.
	CO2	To learn the various hardware components of an imaging system for machine vision applications.
	CO3	To understand the various image processing and image analysis algorithms and the issues involved in applying them to various machine vision applications.
	CO4	To expose students to various applications of computer vision and challenges involved in each.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Computer Vision**	2	08
	1.1	Human vision – Machine vision and Computer vision – Benefits of machine vision – Block diagram and function of machine vision system implementation of industrial machine vision system – Physics of Light – Interactions of light – Refraction at a spherical surface		
2		**Image Formation and Filtering**	2	08
	2.1	Geometric primitives and transformations: Geometric primitives, 2D transformations, 3D transformations, 3D rotations, 3D to 2D projections, Lens distortions.		
	2.2	Photometric image formation: Lighting, Reflectance and shading, Optics.		
	2.3	The digital Camera: Sampling and aliasing, Color, Compression.		
	2.4	Linear Filtering, Neighborhood operators, Wiener filtering, Wavelets, Geometric transformations.		
3		**Feature Detection and Matching**	2	05
	3.1	Points and patches: Feature detectors, Feature descriptors, Feature matching, Feature tracking.		
	3.2	Edges: Edge detection, Edge linking.		
	3.3	Lines: Successive approximation, Hough transforms, Vanishing		

		points.		
4		**Cameras, Multiple Views and Motion**	2,3,4	08
	4.1	2D and 3D Feature based alignment: 2D alignment using least squares, Application-Panography, Iterative algorithms, Robust least squares and RANSAC, 3D alignment.		
	4.2	Structure from motion: Triangulation, two-frame structure from motion, factorization, Bundle adjustment.		
	4.3	Dense motion estimation: Translational alignment, Parametric motion		
5		**Machine Learning Crash Course**	15	08
		Supervised Learning Algorithms; Unsupervised Learning Algorithms; Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.		
6		**Recognition**	2	06
	6.1	Recognition Overview and Bag of Features, Large-scale, Instance Recognition, Time Warp Design Challenge, Large-scale Category Recognition and Advanced Feature Encoding, Detection with Sliding Windows, Pascal VOC and Big DataSocial Good and Dataset Bias, Feature Limitations and Attributes.		
7		**Introduction to Deep Learning**	15	05
		Neural Networks, Convolutional Networks for RecognitionNeural Network Regularization, R-CNNs and FCNs, Exploring Architectures through at least 3 research papers.		
			Total	48

Assignments/Projects:

Applications of Computer/Machine Vision will be covered through assignments or mini projects. The applications could be (but not limited to) following:

- Image filtering and Hybrid images, Local Feature Machine, Camera calibration and Fundamental Matrix Estimation with RANSAC, Scene Recognition with Bag or words, Face detection with sliding window, Convolutional neural nets.

- Machine Vision applications in manufacturing, electronics, printing, pharmaceutical, textile, applications in non-visible spectrum, metrology and gauging,OCR and OCV, vision guided robotics – Field and Service Applications – Agricultural, and Bio medical field, augmented reality, surveillance, bio-metrics.

References:

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE91C	Machine Learning and Artificial Intelligence	3	--	--	3	--	--	3
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		
Course Outcomes	CO1	To describe the basic concepts and techniques of Machine Learning.
	CO2	To apply knowledge representation, reasoning, and machine learning techniques to real-world problems
	CO3	To use recent machine learning software for solving practical problems.
	CO4	To know various AI algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)

Module No.	Unit No.	Topics	Ref.	Hrs.
1		INTRODUCTION: Definition of learning systems. Goals and applications of machine learning. designing a learning system: training data, concept representation, function approximation. well posed learning problems, perspective & issues in machine learning		06
2		CONCEPT LEARNING: The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypothesis. FIND-S, candidate elimination algorithm		04
3		DECISION TREE LEARNING: Introduction, Decision tree representation,appropriate problems, for decision tree learning, basic decision tree algorithm,hyper space, search in decision tree learning, issues in decision tree learning . BAYESIAN LEARNING: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies. INSTANCE BASED LEANING: Introduction, K-nearest neighbour learning, case based learning, radial basis functions		12
4		CLUSTERING & UNSUPERVISED LEARNING: Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabelled data.		06

5		ARTIFICIAL NEURAL NETWORK: Introduction, neural network representation,problems for neural network learning, perceptrons , multilayer network & Back propagation Algorithm GENETIC ALGORITHMS: Introduction, genetic operators, genetic programming,models of evolution & learning, parallelizing genetic algorithm		12
			Total	**40**

References:

[1] Tom M. Mitchell. "Machine Learning" McGraw-Hill, 1997.
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[4] S. Sivanandam, "Principles of Soft Computing" First Edition Wiley Publications.
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ILE911	Project Management	3	--	--	3	--	--	3
		Examination Scheme						
		ISE	MSE		ESE			
		10	30		100 (60% Weightage)			

Pre-requisite Course Codes		
At the end of successful completion of the course, students will be able to		
Course Outcomes	CO1	Manage the selection and initiation of individual projects in the enterprise.
	CO2	Conduct project planning activities that accurately forecast project costs, timelines, and quality.
	CO3	Implement processes for successful resource, communication, and risk and change management
	CO4	Demonstrate effective project execution and control techniques that result in successful projects
	CO5	Conduct project closure activities and obtain formal project acceptance
	CO6	Demonstrate Team work and team spirit and how to overcome the conflicts

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**1.1**	Project Life cycle	1	8
	1.2	Project selection criteria, Risk considerations in selection	1	
	1.3	Project bid, RFP	1	
	1.4	Managing conflicts and the Art of negotiation	1, 3	
2	**2.1**	Project plan –WBS	1, 2	8
	2.2	Project activity and risk planning	1, 2	
	2.3	RACI Matrix and Agile projects	1	
	2.4	Budgeting , Estimating cost and Risk	1	
3	**3.1**	Scheduling- Network Diagrams	1, 2	10
	3.2	CPM- crashing a project	1, 2	
	3.3	Resource loading and leveling	1, 2	
	3.4	Constrained resource scheduling	1, 2	
4	**4.1**	Monitoring and controlling cycle	1, 3	10
	4.2	Earned value analysis	1, 3	
	4.3	Control of Change and scope creep	1, 3	
5	**5.1**	Project procurement management, outsourcing	3	6
	5.2	Project Auditing	1	
	5.3	Project termination process	1	
			Total	**42**

References:

[1] Jack Meredith and S. J. Mantel, "*Project Management*", Wiley, 8th Edition.

[2] John M. Nicholas, "*Project Management-Business and Technology* ", PHI, 2nd edition

[3] Jack T. Marchewka,"*Information Technology Project Management", Wiley*, 4th Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ILE912	Management Information System(MIS)	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		
At the end of successful completion of the course, students will be able to		
Course Outcomes	CO1	Identify key factors of the business problem. Clearly define a business problem using key facts
	CO2	Critically analyze defined business problem using widely used analytical techniques and models
	CO3	Propose potential alternative solution, evaluate them and recommend an appropriate solution
	CO4	Identify Information Requirements from external Systems in order to integrate different aspects of business
	CO5	Apply MIS concepts in e-Business.
	CO6	Explain ethical, social and security issues in MIS

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction: Level of management activities, Types of MIS	1	6
	1.2	Role of MIS in global business	1,4	
	1.3	Strategic information System, Porter's value-chain Model	1	
2	2.1	Information system planning: Creating an IS plan	2	8
	2.2	IS growth model-Nolan six stage model,	2	
	2.3	Three stages of planning process	2	
3	3.1	Decision Support System: Simon's model of Decision Making	1,2	8
	3.2	Methods for Decision Making, Decision support techniques	1,2	
	3.3	Components of DSS, BI and Knowledge management system	1	
4	4.1	Enterprise systems: Enterprise Resource Planning (ERP) systems	5	8
	4.2	Customer Relationship Management (CRM)	5	
	4.3	Supply Chain Management System (SCM)	5	
5	5.1	E-Business Systems	3	8
	5.2	E-commerce: Digital Markets, Digital Goods	6,4	
	5.3	E-Governance- objectives and delivery models	1	
6	6.1	Ethical and Social Issues in Information Systems	4	4
	6.2	Securing Information Systems	4	
			Total	42

References:

[1] D.P. Goyal, "Management Information Systems- Managerial Perspectives", Vikas publishing House, 4th Edition
[2] Gordon B Davis & Margethe H Olson "Management Information Systems", TMH
[3] James O'Brien, George M. Marakas, Ramesh Behl, "Management Information Systems", McGraw Hill Education, 10th Edition, , 2013.
[4] Kenneth C. Laudon and Jane P. Laudon,"Management Information Systems". Pearson India, 14th edition, 2016
[5] Waman Jawadekar, "Management Information Systems", 4th Edition, Tata McGraw-Hill Publishing Company Limited.
[6] P.T. Joseph, S.J., "E-Commerce: An Indian Perspective", 2nd Edition, Prentice Hall of India

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ILE913	Operations Research(OR)	3	--	--	3	--	--	3
		Examination Scheme						
		ISE	MSE		ESE			
		10	30		100 (60% Weightage)			

Pre-requisite Course	Linear Algebra Analysis of Algorithms	
At the end of successful completion of the course, students will be able to		
Course Outcomes	CO1	Translate real world problems into mathematical formulation
	CO2	Solve problems based on linear programming, Transportation model and Integer programming
	CO3	Design a dynamic system as a queuing model and compute important performance measures
	CO4	Solve problems using dynamic programming
	CO5	Solve network models like the shortest path, minimum spanning tree, and maximum flow problems
	CO6	Develop the mathematical formulation of real world problems using Game theory

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Operations Research :** Introduction to OR Modeling Approach and various real life situations **Linear Programming:** Introduction to linear programming, Formulation of the problem, Graphical method, Simplex method, Duality and Sensitivity analysis **Transportation Model:** Definition of the transportation model, non-traditional transportation models, Transportation algorithm, Assignment model **Integer Programming** Formulations, Zero-one problem-additive algorithm, Gomary's cutting plane algorithm, Branch and bound algorithm for IP	1,2,5,8	14
2		**Dynamic Programming:** Introduction, recursive nature of computations in Dynamic programming, forward and backward recursion, Dynamic programming applications	1,7	6

3		**Network Models:** Minimum spamming trees, Shortest path problems, Maximum flow problems, Minimum cost flow problem, CPM and PERT	1,5,6,8	6
4		**Queuing model:** Introduction, Basic Definitions and Notations, Axiomatic Derivation of the arrival and Departure (Poisson Queue), Pure Birth and Death Models, Poison Queue Models	1,2,6	6
5		**Non linear Programming:** Gradient Method, Kuhn Tucker conditions, Quadratic Programming, Convex programming	1,3,7	5
6		**Game Theory:** Introduction, Two Person zero sum Game, Saddle Point, Mini-Max and Maxi-mini Theorems, Games without saddle point, Graphical Method, Principle of Dominance.	3,5,7	5
			Total	**42**

References:

[1] Hamdy A. Taha, "Operations Research: An Introduction", Prentice-Hall of India, 6th Edition.

[2] F.S. Hiller, G. J. Lieberman, "*Introduction to Operations Research,*", McGraw Hill, 8th Edition.

[3] Kanti Swarup, P. K. Gupta, Man Mohan " *Operations Research,*", S. Chand & Sons, 14th Edition.

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[5] Billey E. Gillett, "*Introduction to Operations Research A Computer-Oriented Algorithmic Approach* ", Tata McGraw Hill Edition

[6] Wayne L. Winston, "*Operations Research Applications and Algorithms*", Cengage Learning, 4th Edition

[7] J. K. Sharma, "*Operations Research Theory and Applications*", MacMillan, 2nd Edition

[8] S. D. Sharma, "*Operations Research",* Kedar Nath and Ram nath

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ILE914	Cyber Security and Laws	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		Communication Networks
After successful completion of the course students will able to:		
Course Outcomes	CO1	Identify and classify various cybercrimes with respect to organizational weaknesses in order to mitigate the security risk and estimate the impact on society and world
	CO2	Interpret and apply Indian IT laws in various legal issues
	CO3	Compute security risk and analyze it
	CO4	Analyze the results of vulnerability scans of vulnerability assessment and generate report with penetration testing
	CO5	Apply Information Security Standards compliance during software design and development

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Cyber Security**	1,2	10
		Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	1	
		Cyber offenses & Cybercrimes: How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices	1,7	
2		**Tools and Methods Used in Cybercrime:** Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks,Identity Theft (ID Theft)	1,2	06
3		**Security Risk Assessment and Risk Analysis:** Risk Terminology, Laws, Mandates, and Regulations,Risk Assessment Best Practices,The Goals and Objectives of a Risk Assessment, Best Practices for Quantitative and Qualitative Risk Assessment. **Vulnerability Assessment and Penetration Testing (VAPT):** VAPT An Overview,Goals and Objectives of a Risk and	7,8,10	12

		Vulnerability Assessment,Vulnerability Assessment Phases-Discovery,Exploitation/Analysis , Reporting Penetration Testing Phases-Discover/Map,Penetrate Perimeter,Attack Resources, Network and Web VAPT Process		
4		**Cyber Security Laws and Legal Perspectives:** The Concept of Cyberspace E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Global Trends in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	1,4	08
5		**Indian IT Act:** Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments **Information Security Standard compliances:** SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI-DSS	1,2,4, 6	04
			Total	**40**

References:

[1] Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi.
[2] The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
[3] The Information technology Act, 2000; Bare Act- Professional Book Publishers, NewDelhi.
[4] Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
[5] Nina Godbole, Information Systems Security, Wiley India, New Delhi
[6] Kennetch J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
[7] Michael Gregg & David Kim,Inside Network Security Assessment: Guarding Your IT Infrastructure, Pearson Publication
[8] M. L. Srinivasan, CISSP in 21 Days - Second Edition PACT Publication
[9] Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson Publication
[10] Douglas J. Landoll, The Security Risk,Assessment Handbook-Second Edition ,Auerbach Publications
[11] Websites for more information is available on : The Information Technology ACT, 2008-TIFR : https://www.tifrh.res.in
[12] Website for more information , A Compliance Primer for IT professional:
[13] https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ILE915	Entrepreneurship Development and Management(EDM)	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		
At the end of successful completion of the course, students will be able to		
Course Outcomes	CO1	Understand the concept of entrepreneurship with strategic planning
	CO2	Analyze the international market for entrepreneurship
	CO3	Study of e- governance in Entrepreneurship
	CO4	Acquaint with entrepreneurship and management of business with IT
	CO5	Understand data science for Entrepreneurship and generate knowledge base of technology entrepreneurship

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Entrepreneurship**	1	6
	1.1	Importance Of Entrepreneurship, concept of Entrepreneurship, characteristics of successful Entrepreneur, classification of Entrepreneur		
	1.2	Myths of Entrepreneurship, Entrepreneurial development models, problems faced by Entrepreneurs and capacity building for Entrepreneurship, profile of successful Entrepreneurship		
2		**Setting up a small business enterprise**	1	6
	2.1	Identifying the business opportunity, Business opportunities in various sector		
	2.2	Formalities for setting up of a small business enterprise, Environment pollution related clearance		
3		**Strategic management in small business**	1	6
	3.1	Organic life cycle		
	3.2	Strategic management, The essence of business ethics		
4		**Corporate governance**	2	6
	4.1	Introduction, role for board of directors, size and composition of board of directors, board structure, agency theory, board committee, two tier boards, effectiveness of BoD role of CEO role top management skill required corporate values style of strategic management		
	4.2	Factors affecting Entrepreneurship growth, Factors affecting Entrepreneurship: economic factors, non-economic factors, Government action	3	

5		**Selecting international business opportunities**	7	6
	5.1	Foreign in market selection model, Developing foreign market indicators, Primary Vs secondary foreign market data		
	5.4	Sources of country market data, Competitive positioning International competitive information		
6		**IT for entrepreneurship innovation**		6
	6.1	Enlisting online communication in web 2.0	4	
	6.2	Role of websites and E-commerce in the development of global start-ups, E- entrepreneurship the principle of funding electronics venture, The relationship between internet entrepreneurs idea generation and porter's generic strategies e- learning the cornerstone to transferring entrepreneurship knowledge	5	
7		**The knowledge base of technology entrepreneurship**	6	6
	7.1	Capitalization of science and technology knowledge practices trends and impact on techno entrepreneurship		
	7.2	Drivers for green strategy for enhancing sustainable techno entrepreneurship in emerging economics		
			Total	**42**

References:

[1] Poornima Charantimath, "*Entrepreneurship development and Small Business Enterprise",* Pearson

[2] R. Srinivasan "*Strategic Management: The Indian Context*"

[3] S S Khanka "*Entrepreneurial Development*"

[4] Tobias Kollmann, Andreas Kuckertz "*E-entrepreneurship and ICT Ventures: Strategy… (Hardcover*)"

[5] Zhao, Fang "*Information Technology Entrepreneurship and Innovation*"

[6] François Thérin "*Handbook of Research on Techno-Entrepreneurship*", Second Edition

[7] Robert D. (Dale) Hisrich "*International Entrepreneurship: Starting, Dev*" (Paperback)

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SEMESTER II

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET921	Statistical Signal Processing	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		--
Course Outcomes	CO1	Generalize the properties of statistical models in the analysis of signals using Stochastic processes
	CO2	Outline various estimation methods to accomplish the signal modeling
	CO3	Principle of various estimators and choose right one for an application
	CO4	Design and development of filters using classical and adaptive algorithms.
	CO5	Differentiate the importance of various spectral estimation techniques

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Review of random variables:** Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Schwarz Inequality Orthogonalit principle in estimation, Central Limit theorem, Random processes, wide-sense stationary processes, autocorrelation and autocovariance functions, Spectral representation of random signals, Wiener Khinchin theorem Properties of power spectral density, Gaussian Process and White noise process, Linear System with random input, Spectral factorization theorem and its importance, innovation process and whitening filter, .Random signal modelling: MA(q), AR(p) , ARMA(p,q) models.		8
2		**Classical Detection and Estimation Theory: Introduction, simple binary hypothesis tests, M Hypotheses, estimation theory, composite hypotheses, general Gaussian problem, performance bounds and approximations.**		10
3		**Detection of Signals – Estimation of Signal Parameters:** Introduction, detection and estimation in white Gaussian noise, detection and estimation in nonwhite Gaussian noise, signals with unwanted parameters, multiple channels and multiple parameter estimation		10
4		**Estimation of Continuous Waveforms: Introduction, derivation of estimator equations, a lower bound on the mean-square**		10

		estimation error, multidimensional waveform estimation, nonrandom waveform estimation.		
5		**Linear Estimation:** MA, AR, ARMA processes and their properties, MMSE linear estimate. Weiner Filter. Kalman Filter. Lattice filter structure, Levinson Durbin and innovation algorithms.		10
6		**Spectral analysis:** Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Blackman and Tukey method of smoothing periodogram, Parametric method, AR spectral estimation and detection of Harmonic signals, MUSIC algorithm		10
			Total	**48**

References:

[1] H. L. Van Trees. (1968). Detection, Estimation, and Modulation Theory, vol. I, John Wiley & Sons.
[2] Steven Kay. (1993). Fundamentals of Statistical Signal Processing Volume II: Detection Theory. Prentice Hall.
[3] M. Hays: Statistical Digital Signal Processing and Modelling, John Willey and Sons, 1996.
[4] S. M. Kay: Modern Spectral Estimation, Prentice Hall, 1987.
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET921	Network Security	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		--
Course Outcomes	CO1	Describe security threats and apply security techniques using cryptosystems.
	CO2	Explain the key terms and concepts in cyber law, intellectual property and cyber crimes, trademarks and domain theft
	CO3	Build and configure firewall and intrusion detections systems' using GNU open source security tools.
	CO4	Incorporate approaches for incident analysis and response, for risk management and best practices and digital evidence collection, and evidentiary reporting in forensic acquisition

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Network and Cybersecurity:** Recap: • Need for network security, Attacks and Their classification • Network Vulnerabilities and control • Security services and mechanisms, • Impact of Security on Enterprises • Risk Factors and Cost Analysis.	1,2,3	8
2		Cryptography and Cryptosystems: Recap: • Classical and modern cryptography, stream and block ciphers, • Message digest,digital signature, digital certificate, certificate authority, cryptanalysis • DES/AES/RSA/RC4/MD5/SHA algorithms • Secure protocols SSL, IPSec, VPN,PKI Implementing security using symmetric and Public-Key crytography.	1	10
3		Ethical Hacking and Network defences • Cybercrimes, Cybercriminals, Cyberoffences, Cybercrimes in Mobile and Wireless Devices, Tools and Methods used in Cybercrimes • Network reconnaissance, scanning and sniffing, gaining	6, 7	10

		access. • Security Technologies:Firewall, IDS and Antivirus, Reverse proxy • L7 content filtering firewall, NAT & reverse proxy, Firewall deployment and limitations, selection of firewalls. Performance analysis of firewall. • Signature and Anamoly based IDSs, IDS deployment, zone diagram, performance analysis of IDS, strengths and limitations of IDS. Biometrics for security		
4		Cybersecurity principles and best practices: • Layered Defense,Surveillance and Reconnaissance Outsider/Internal Threat Protection, Privacy,Intellectual Property,Professional Ethics,Freedom of Speech ,Fair User and Ethical Hacking,Trademarks ,Internet Fraud ,Electronic Evidence.	2,7	10
5		Cybersecurity implications on Organizations, standards and Cyber laws: • Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification ,Risk Quantification ,Risk Response Development and Control Security Policy, Compliance, and Business Continuity. • Cyber Incident Preparation: Incident Detection and Analysis, Containment, Eradication, and Recovery ,Proactive and Post-Incident Cyber Services • Forensics: Forensic Technologies ,Digital Evidence Collection ,Evidentiary Reporting The Indian IT Act and new amendments.	6,7	10
6		System Security and Case-Study: • Security Operations Center (SOC), Network Operations Center (NOC) • Network Security Audit • SET, Biometric Security, Digital Immune System Cloud Security. Wi-Fi Security, Mobile and Cellular Security	6	10
			Total	**48**

References:

[1] Cryptography and Network Security by Behrouz Forouzan McGrawHill Publications

[2] Security in Computing by Pfleeger and Pfleeger, Pearson Publications

[3] Management of Information Security by M. Whitman Cengage Publications

[4] Cryptography and Network Security by B. Menzanes, Elsevier

[5] Computer Security by Matt Bishop, Pearson Publication

[6] Cryptography and Network Security by William Stallings, Pearson publications.

[7] Cyber Security by Nina Godbole, John Wiley Publications

[8] Information Security: Principles and Practice, 2nd edition by Mark Stamp and Deven Shah

[9] Data Communication & Network Security by Houston Carr and Charles Snyder, McGraw-Hill Publication

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET923	**Antenna Design**	4			4			4
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE		
		10		30		60		

Pre-requisite Course Codes		Electromagnetic Wave Propagation
Course Outcomes	The student will be able to:	
	CO1	understand the fundamental principles of antenna Theory
	CO2	apply antenna theory to analyze the performance of various antenna arrays.
	CO3	design planar antennas
	CO4	evaluate and select antenna on the basis applications.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Fundamentals of Antenna**	1	09
	1.1	**Antenna Parameters:** Radiation pattern,Radiation power density,Radiation Intensity, Gain, Directivity, HPBW, FNBW,Beam efficiency, Bandwidth , Polarization, Input Impedance, Antenna Effficiency, Effective Aperture.		
	1.2	**Types of Antenna**: Dipole, Monopole, Loop and Slot Antennas , Helical Antennas & Horn antennas		
2		**Linear and Planar Arrays**	1	09
	2.1	N element linear arrays – uniform amplitude and spacing- - Directivity of Broadside and End fire arrays. Three dimensional characteristics - Pattern multiplication- Binomial arrays and Dolph-Tchebycheff arrays. Circular array. Mutual coupling in arrays, multidimensional arrays-phased arrays and array feeding techniques.		
3		**Microstrip Antennas**	1,2	09
	3.1	**Introduction:**Rectangular Patch, Circular Patch,Quality Factor, Bandwidth, and Efficiency,Input Impedance,Coupling, Circular Polarization, Arrays and Feed Networks, Corporate and Series Feeds, Reflect array.		
4		**Broadband microstrip antennas**	2	07

	4.1	Introduction, Mechanism of Parasitic Coupling for Broad BW, Gap-Coupled RMSAs, Radiating-Edge Gap-Coupled RMSAs, Nonradiating-Edge Gap-Coupled RMSAs, Gap and Hybrid-Coupled MSA,Multilayer Broadband MSA, Electromagnetically Coupled MSAs, stack multi resonator MSA , Design Examples.		
5		**Compact microstrip antennas**	2	07
	5.1	Introduction, Compact Shorted RMSAs, Partially Shorted RMSAs, Effect of Dimensions of RMSAs with a Single Shorting Post, Effect of the Position of the Single Shorting Post, Compact Shorted CMSA and Its Variations.		
6		**Planar monopole antennas**	2	07
		Introduction, Planar Rectangular and Square Monopole Antennas, RMSA Suspended in Air with Orthogonal Ground Plane, Calculation of the Lower Frequency of the Planar Monopole Antennas, Effect of Various Parameters of Planar Rectangular Monopole Antennas, Radiation Pattern of RM Antennas, Various Planar RMs with Equal Areas, Planar Circular Monopole Antennas.		
			Total	**48**

References:

[1] Antenna Theory- C. A. Balanis- Wiley and sons

[2] Broadband Microstrip antennas – Girish Kumar and K.P. Ray, Artech House

[3] Antennas – John. D. Krauss- TMH ed.

[4] R. James and P.S. Hall, Handbook of Microstrip Antennas , Peter Peregrinus, 1989

[5] W.L. Stutzman and G.A. Thiele, Antenna Theory and Design, John Wiley, 2012

[6] R.C. Johnson, Antenna Engineering Handbook, McGraw Hill,1993

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL924	PG Lab-III	--	--	2	--	--	1	1
		Examination Scheme						
		Term Work			Practical		Oral	Total
		40			10		10	60

Pre-requisite Course Codes		Electromagnteic Wave Theory
Course Outcomes	CO1	Ability to use Vector Network Analyzer
	CO2	Ability to apply and design antenna theory to analyze the performance of RMSA.
	CO3	Ability to apply and design antenna theory to analyze the performance of various antenna arrays.
	CO4	Ablitiy to fabricate and test Antennas

Exp. No.	Experiment Details	Ref.	Marks
1	Study and calibration of Vector Network Analyzer		5
2	Design and Analysis of Rectangular/Circular Microstrip patch Antenna using CAD tools.		5
3	Design and Analysis of Antenna Array using CAD tools.		5
4	Design and Analysis of Broadband Antenna Microstrip patch Antenna using CAD tools.		5
5	Design and Analysis of Gap-Coupled RMSAs using CAD tools.		5
6	Design and Analysis of Compact Antenna using CAD tools.		5
7	Design and Analysis of Monopole Antenna using CAD tools.		5
8	Mini Project		5
		Total Marks	40

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL925	PG Lab-IV	--	--	2	--	--	1	1
		Examination Scheme						
		Term Work			Practical		Oral	Total
		40			10		10	60

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Indentify and select the suitable components for IoT implementation
	CO2	Use the various hardware development platforms for IoT
	CO3	Use the various software frameworks for IoT
	CO4	Interface IoT with cloud and carry out the analytics

Exp. No.	Experiment Details	Ref.	Marks
1	IoT Components and Set-up		5
2	IoT Sensors and Actuators		5
3	IoT Development Platform		5
4	IoT Development Framework		5
5	IoT and Cloud		5
6	IoT analytics		5
7	Mini Project		10
8			
		Total Marks	40

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE92X	Error Correction Code	4	--	--	4	--	--	4
		Examination Scheme						
		Theory Marks						
		ISE			MSE		ESE	
		10			30		100 (60% Weightage)	

Pre-requisite Course Codes		Digital Communication
After successful completion of the course students will able to:		
Course Outcomes	CO1	Apply Galois field theory to Error correction codes
	CO2	Design methodology of Error correction codes for wired/wireless communication systems
	CO3	Analyzing algorithms for Error correction codes
	CO4	Improving depth of Concepts through case studies

Module No.	Unit No.	Topics	Ref.	Hr.
1		**Introduction to Algebra:** Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF (2m) and its basic properties, Computation using Galois Field GF (2m) Arithmetic, Vector spaces and Matrices**.**		8
2		**Linear Codes:** Block codes: Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes, Reed – Muller codes, Golay code, Product codes and Interleaved codes. Cyclic Codes: Introduction, Generator and Parity check Polynomials, Encoding using Multiplication circuits, Systematic Cyclic codes – Encoding using Feedback shift register circuits, Generator matrix for Cyclic codes, Syndrome computation and Error detection, Meggitt decoder, Error trapping decoding, Cyclic Hamming codes, Golay code, Shortened cyclic codes.		10
3		**BCH Codes** Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non – binary BCH codes: q – ary Linear Block Codes, Primitive BCH codes over GF (q), Reed – Solomon Codes, Decoding of Non – Binary BCH and RS codes: The Berlekamp - Massey Algorithm.		10
4		**Convolutional Codes:** Encoding of Convolutional codes, Structural properties, Distance		10

		properties, Viterbi Decoding Algorithm for decoding, Soft – output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding.		
5		**Concatenated Codes and Turbo Codes:** Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes		10
6		**Applications:** Case studies of ECC related to various wired and wireless Communication Networks, Neural Networks, DVB and DAB, Cognitive Radio		10
			Total	48

References:

[1] Shu Lin & Daniel J. Costello, Jr. "Error Control Coding" Prentice Hall, Second Edition, 2004.
[2] S. B Wicker, Error Control Systems for Digital Communication and Storage, Prentice Hall International, 1995.
[3] Blahut R. E, Theory and Practise of Error Control Codes, Addisson Wesley, 1983
[4] Blahut R.E., Algebraic codes for Data transmission, Cambridge University Press, 2003

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE92X	Internet of Things(IOT)	3	--	--	3	--	--	3
		Examination Scheme						
		ISE			MSE	ESE		
		10			30	100 (60% Weightage)		

Pre-requisite Course Codes		
At the end of successful completion of the course, students will be able to		
Course Outcomes	CO1	Define Internet of Things and its components.
	CO2	Perform IoT Systems management.
	CO3	Design IoT systems through Python, Physical Servers and Cloud Solution.
	CO4	Analyze the system through Data Analytics tools.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to IoT –** Definition, Characteristics, Physical and Logical Designs, IoT Protocols, IoT Communications Models and API, IoT Enabling Technologies, IoT Levels and Deployment Templates, IoT Examples, M2M	1	3
	1.2	**RFID Technology** – Working of RFID, Components of an RFID system, RFID Transponder (tag) classes, Standards, System architecture, Localization and Handover Management, Technology considerations, Performance Evaluation, Applications	2	4
	1.3	**Wireless Sensor Networks** – History, Sensor Nodes, Connecting Nodes, Networking Nodes, Securing Communication	2	2
2	2.1	**IoT System Management** – SNMP, Network Operator Requirements,	1	3
	2.2	**IoT System Management** – NETCONF, YANG	1	2
	2.3	**IoT Platform Design Specification –** Requirements, Process, Domain Model, Service, IoT Level, Function, Operational view, Device and Component Integration, Application Development	1	3
3	3.1	**IoT Systems Logical Design** – Python Data Types, Type conversion, Control Flow	1	3
	3.2	**IoT Systems Logical Design** – Python Functions, Modules, File Handling, Classes, Python Packages for IoT.	1	2
	3.3	**IoT Physical Servers –** Cloud Storage Models, Communication APIs, WAMP, Xively Cloud, Django	1	3
4	4.1	**IoT Cloud Services** - RESTful Web API, Amazon Web Services for IoT	1	2
	4.2	**IoT Data Analytics** – Apache Hadoop, Batch Data Analysis,	1	3

		Hadoop YARN		
	4.3	**IoT Data Analytics** – Apache Oozie, Apache Spark, Apache Storm, Chef, Chef Case Studies, Puppet**,** NETCONF-YANG	1	3
5	**5.1**	**Arduino Programming Building Blocks** – Basics, Internet Connectivity, Communication Protocols.	3	4
	5.2	**IoT Patterns**: Real-time Clients, Remote control, On-demand Clients, Web Apps.	3	3
	5.3	**IoT Patterns:** Machine to Human, Machine to Machine, Platforms	3	2
Total				**42**

In-Semester Examination (ISE): The assessment includes the submission of a term paper by each student on the contemporary work related to Internet of Things.

References:

[1] Arsheep Bahga, Vijay Madisetti, "*internet of Things: A Hands-On Approach*", University Press, FIRST Edition, 2015.

[2] Hakima Chaouchi, "*The Internet of Things: Connecting Objects*", Wiley-ISTE, FIRST Edition, 2010.

[3] Adeel Javed, "*Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications*", Apress, FIRST Edition, 2016.