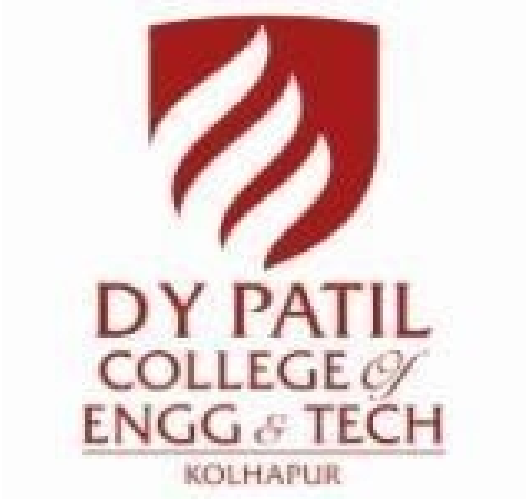

D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

M. Tech. Programme Structure

(Autonomous)

(Department of Electronics & Telecommunication Engineering)

2020-21

Structure for First Year M. Tech. Programme in Engineering

(Semester-I)

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme per Week				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max Marks	Min. Marks for Passing	
1	202ETL601	PCC	Random Processes	3	1	0	4	100	ISE MSE ESE	20 30 50	20 20	40
2	202ETL602	PCC	Embedded System Design & Linux	3	0	0	3	100	ISE MSE ESE	20 30 50	20 20	40
3	202ETL603	PEC1	Elective – I	3	0	0	3	100	ISE MSE ESE	20 30 50	20 20	40
4	202ETL604	PEC2	Elective – II	3	1	0	4	100	ISE MSE ESE	20 30 50	20 20	40
5	202ETP602	PCC-LC	Embedded System Design & Linux Lab	0	0	2	1	25	ISE	25	10	10
6	202ETP603	PEC1-LC	Elective-I Lab	0	0	2	1	25	ISE	25	10	10
7	202ETP610	PCC - LC	Simulation Lab	0	0	2	1	50	ISE	50	20	20
8	202ETP611	PCC - LC	Seminar-I	0	0	2	1	50	ISE	50	20	20
9	202ETP612	MC	Pedagogic Studies (Non-Credit Mandatory Course)									
			Total:	**12**	**2**	**8**				**550**		
				22			**18**	**550**				

Structure for First Year M. Tech. Programme in Engineering

(Semester-II)

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme per Week				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		TYPE	Max. Marks	Min. Marks for Passing	
1	202ETL605	PCC	Design of VLSI System	3	0	0	3	100	ISE MSE ESE	20 30 50	20 20	40
2	202ETL606	PCC	Patten recognition and Machine Learning	3	0	0	3	100	ISE MSE ESE	20 30 50	20 20	40
3	202ETL607	PCC	Research Methodology & IPR	3	0	0	3	100	ISE MSE ESE	20 30 50	20 20	40
4	202ETL608	PEC 3	Elective – III	3	1	0	4	100	ISE MSE ESE	20 30 50	20 20	40
5	202ETL609	PEC 4	Elective – IV	3	1	0	4	100	ISE MSE ESE	20 30 50	20 20	40
6	202ETP605	PCC-LC	Design of VLSI System Lab	0	0	2	1	25	ISE	25	10	10
7	202ETP606	PCC-LC	Patten recognition and Machine Learning Lab	0	0	2	1	25	ISE	25	10	10
8	202ETP613	PCC-LC	Seminar II	0	0	2	1	50	ISE	50	20	20
9	202ETP614	MC	Stress Management by Yoga (Non-Credit Mandatory Course)									
			Total:	15	2	6	20	**600**		**600**		
				23								

Structure for Second Year M. Tech. Programme in Engineering

(Semester-III)

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme per Week				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. Marks for Passing	
1	202ETL701	SLC	Massive open online course / NPTEL etc.	0	1	0	1	50	ISE	50	20	20
2	202ETP702	PCC-LC	Seminar-III	0	0	2	1	50	ISE	50	20	20
3	202ETP703	PROJ	Dissertation Phase – I	0	0	24	12	100	ISE	50	20	20
									ESE-POE	50	20	20
				0	1	26	14			**200**		
			Total:	**27**				**200**				

Structure for Second Year M. Tech. Programme in Engineering

(Semester-IV)

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme per Week				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max Mks	Min. Marks for Passing	
1	202ETP704	PROJ	Dissertation Phase – II	-	-	32	16	200	ISE	100	40	80
									POE	100	40	
			Total:			32	16	**200**		**200**		
				32								

Program Electives:

Sr. No.	Elective – I	Elective – II	Elective – III	Elective – IV
1	Wireless & Mobile Communication	Industrial Automation and Process Control	Error Control Coding Techniques	Internet of Things
2	Wireless Sensor Networks	Application Specific Integrated Circuit (ASIC) Design	Network Security & Cryptography	Multiple Input Multiple Output System

Note:

1) Tutorials and practicals shall be conducted in batches with batch size of 9 students maximum.
2) For Pre-Dissertation Seminar, work load will be for two students
3) Dissertation Phase I & Dissertation phase II work load will be for one student.
4) Self-Learning Course (SLC) should be preferably on dissertation area and it should be completed before the end of semester III
5) Pedagogic Studies & Stress Management by Yoga(Non-Credit Mandatory Course) :
   a. This course is self-study course
   b. This Course will be assessed by conducting objective type examination for 50 marks for which criteria for passing is 40% (20 marks).
   c. Result of student will be declared only if student passes this course.

Evaluation Methods:

1) **In Semester Evaluation (ISE-Theory) 20 marks:** ISE-1 and ISE-2 can be done by using following modes
    1) Online test
    2) Surprise test
    3) Open book-test
    4) Self-Study
    5) Self-learning topic
    6) Case study
    7) Demonstrations
    8) Seminars
    9) Assignments
    10) Active learning methods

   ISE (Lab) 25 marks: Lab assessment is to be done using continuous assessment method in which faculty has to evaluate student's performance based upon defined rubrics only and shown to the students

2) **Mid Semester Examination (MSE)** will be conducted for 30 marks

3) **End Semester Examination (ESE) 50 marks :-** ESE will be conducted on entire syllabus for 100 marks for 3 hours duration and converted to 50 marks

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Course Title : **Random Processes**	
Course Code : **202ETL601**	**Semester : I**
Teaching Scheme : L-T-P : **3-1-0**	Credits : **4**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course introduces the fundamental concepts of probability theory, random processes, queuing theory and Markov chain. These are the essential building blocks of any **random** system, used in telecommunications network, hospital waiting list, transport system, etc.

Course Objectives:

1. To develop the logical concepts of probability theory.
2. To understand basic concepts of Random variables & Random Processes.
3. To Study concept of Markov Chain and Queuing Theory.

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Solve Probability Problems
2	Apply statistical measures in Practical problems
3	Apply Markov Chain & Queuing Theory to solve Problems

Prerequisite:	Basic Math's, Set Theory

Content	Hours
Unit 1 –:Probability Theory The concept of Probability, the axioms of Probability, sample space and events, Conditional probability and Baye's theorem, Independence of events, Bernoulli trails.	6
Unit 2 -: Random Variables Introduction to Random Variables, Discrete Random Variable, Continuous Random Variable, Expectation of Random Variable, Moments of Random Variable(mean, mode variance, skewness, Kurtosis).	6
Unit 3 –: Multiple Random Variables Cumulative distribution function and probability density function of single and multiple Random Variables, statistical properties, Jointly distributed Gaussian random variables, Conditional probability density, properties of sum of random variables, Central limit theorem, Estimate of population means, Expected value and variance and covariance.	6
Unit No. 4 -: Random Processes & Spectral Density Classification of Processes, Properties, Auto correlation and cross correlation Function, Estimate of auto correlation function. Spectral Density: Definition, Properties, white noise, Estimation of auto- correlation function using frequency domain technique, Estimate of spectral density, cross spectral density and its estimation, coherence.	6
Unit 5 –: Markov Chain Chapman Kolmogorov equation, Classification of states, Limiting probabilities, Stability of Markov system, Reducible chains, Markov chains with continuous state space.	6
Unit 6 -: Queuing Theory Elements of Queuing System ,Little's Formula, M/M/1 Queue, Multi server system	6

Note:- Minimum eight tutorials should be performed on entire syllabus.

References:

1) Introduction to probability Models, Sheldon M. Ross, Academic Press
2) Probability and Random Processes for Electrical Engg., Alberto Lean, Pearson.
3) Probability, Random Variables and Stochastic Processes, Athanasios Papoulis, S. Unnikrishna Pillai, PHI
4) Samuel Greenguard, "Internet of things", MIT Press, 2015.

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Course Title : **Embedded System Design & Linux**	
Course Code : **202ETL602**	**Semester : I**
Teaching Scheme : L-T-P : **3-0-0**	Credits : **3**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course aims to provide exposure to the advanced microcontrollers such as ARM 1768 cortex M3, M4 series and Embedded Linux.

Course Objectives: At the end of this course, students will be able to

1. Understand ARM processor core architecture along with on chip peripherals available on various embedded Cortex- M processors.
2. Understand interrupts and its programming with peripherals.
3. Develop small embedded system by using the ARM processor core based systems & its software.
4. Use EDA tools to design embedded system PCB.
5. Install and use the embedded Linux operating system.
6. learn the fundamentals of Linux as applied to embedded hardware.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO1	Illustrate cortex-M processor features and its architecture
CO2	Develop programs for on chip peripherals and its interrupts.
CO3	Design embedded system hardware.
CO4	Develop embedded system software.
CO5	Apply the basic concepts of Linux for various case studies.
CO6	Apply the various Linux commands and shell scripting for basic administration.

Prerequisite:	Microprocessors/Microcontroller, Operating system, C Programming

Content	Hours
Unit 1 – ARM Cortex-M Architecture and programming ARM Cortex M3/M4 Architecture, registers, status, clock generation, memory organization, instruction set, programmers model-registers, operating modes, programming	6
Unit 2 –Cortex M CPU Interrupts Nested vectored interrupt controller(NVIC), vector table, interrupt priorities, interrupt inputs & pending behaviour, fault exceptions, supervisor and pendable service call, systick timer, interrupt sequences, exits, tail chaining, interrupt latency, start up file, initialization of peripheral interrupts, interrupt programming	6
Unit 3 –ARM Peripherals and programming(ARM LPC 1768) On chip peripherals-features , interfacing & programming- GPIO,RTC, WATCHDOG, I2C, I2S ADC & SPI, repetitive interrupt timer, PWM, CAN bus, DMA, writing LCD drivers, drivers for serial port communication	8
Unit 4 –Embedded system design & testing Designing embedded system with cortex M3/M4 processors with SPI,UART,ADC,DAC,PWM Peripherals, hardware design issues, selection of electronic components, reading schematics, datasheets, footprint of different components, EDA tool for PCB design, hierarchical design, schematic & board layout design	8
Unit 5 –Introduction to Linux Linux Distributions, Open source Software, GPL, Embedded Linux Boards used in Industry/Market, Important Accessories of Linux boards available/used in industry, Development Setup for Embedded Linux, OS installation, init process, initrd, boot loaders, lilo and GRUB boot loaders, Case studies of Embedded Linux Based Systems	4
Unit 6- Linux file system and commands Linux File System, Permissions, CLI and Linux Shells, Linux Commands, Linux concepts, Shell Script, Linux commands for file and process management. Linux Programming, Multi-file C programming Using make utility, Make file, GNU debugger. Linux Kernel	4

References:

1. Joseph Yiu, “The definitive guide to ARM Cortex-M3”, Elsevier, 2nd Edition
2. Frank Vahid and Tony Givargis, “Embedded System Design”, Wiley
3. Christopher Hallinan,“*Embedded Linux Primer:A Practical Real-World Approach”*,PrenticeHall;1st edition(September28, 2006),ISBN 978-0137017836
4. Richard Stones, NeilMatthew,“*Beginning Linux Programming”*, Wiley; Fourth edition(2008)
5. Felix Alvaro, “LINUX: Easy Linux ForBeginners”,Amazon.com
6. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, Philippe Gerum, *“Building Embedded Linux Systems”*,O'Reilly Media; Second Edition (August22, 2008) ISBN: 978-0596529680
7. Sloss Andrew N, Symes Dominic, Wright Chris, “ARM System Developer’s Guide:
8. Designing and Optimizing”, Morgan Kaufman Publication
9. Steve furber, “ARM System-on-Chip Architecture”, Pearson Education
10. Technical references and user manuals on www.arm.com, NXP Semiconductor
11. www.nxp.com and Texas Instruments www.ti.com, ST Microelectronics www.st.com.

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Course Title : **Wireless and Mobile communication (Elective-I)**	
Course Code : **202ETL603**	**Semester : I**
Teaching Scheme : L-T-P : **3-0-0**	Credits : **3**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course provides fundamental knowledge of 2G-4G technologies and introduction to 5G-6G technologies.

Course Objectives:

1. To understand the concepts of Mobile communication.
2. To analyze various multiple access techniques.
3. To differentiate between 2G mobile communication.
4. To identify mobile radio propagation issues.
5. To explore next generation technologies.

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Understand cellular concept in mobile communication in terms of frequency reuse, interference, sectoring, cell splitting, system capacity, handoff techniques.
2	Analyze various multiple access techniques for mobile communications e.g. FDMA, TDMA, CDMA, based on spectral efficiency, advantages, disadvantages and applications.
3.	Differentiate between 2G mobile communication systems: GSM, CDMA.
4	Identify mobile radio propagation issues related to wireless telephony and their effects on mobile communication system's performance and corrective techniques.
5	Explore higher generation cellular standards, upcoming technologies 4G, 5G etc

Prerequisite:	Digital Communication

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Content	Hours
Unit 1 –:Cellular Communication Fundamentals and GSM: Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, GSM architecture, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards, High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), EDGE.	6
Unit 2 -: Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas.	5
Unit 3 –:Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Ground Reflection (Two-Ray) Model, Outdoor Propagation Models, Indoor Propagation Models, Small Scale Fading and Multipath Propagation, Impulse Response Model, Types of Small Scale Fading: Time Delay Spread, Flat, Frequency selective, Doppler Spread, Fast and Slow fading.	7
Unit 4 - : Equalization & Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.	6
Unit 5 -:Higher Generation Cellular Standards:3G Standards, evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, UMTS.	6
Unit 6-: Introduction to 5G & 6G rolls of different technologies in 5G/6G, Applications and challenges.	6

Reference Books:

1. V. K. Garg, J. E. Wilkes, “Principle and Application of GSM”, Pearson Education, 5th edition, 2008.
2. T.S. Rappaport, “Wireless Communications Principles and Practice”, 2nd edition, PHI,2002.
3. V. K. Garg, “IS-95 CDMA & CDMA 2000”, Pearson Education, 4th edition, 2009.
4. William C. Y. Lee, “Mobile Cellular Telecommunications Analog and Digital Systems”, 2nd edition, TMH, 1995.
5. Asha Mehrotra, “A GSM system Engineering” Artech House Publishers Bosten, London, 1997.

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Course Title : **Wireless Sensor Networks (Elective-I)**	
Course Code : **202ETL603**	**Semester:I**
Teaching Scheme : L-T-P : **3-0-0**	Credits : **3**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course provides exposure to the Wireless Sensor Networks which are emerging technology in today's era of IOT.

Course Objectives: At the end of this course, students will be able to:

1. Design wireless sensor network system for different applications under consideration.
2. Understand the hardware details of different types of sensors and select right type of sensor for various applications.
3. Understand radio standards and communication protocols used by wireless sensor network based systems.
4. Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
5. Handle special issues related to sensors like energy conservation and security challenges.

Course Outcomes (COs):

At the end of the course the student should be able to:

CO1	Design techniques for wireless Sensor Network system.
CO2	Understand the hardware details of different sensors as per the need of applications.
CO3	Understand radio standards and communication protocols used by wireless sensor network based systems.
CO4	Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
CO5	Handle special issues related to sensors like energy conservation and security challenges.

Prerequisite:	Wireless communication, Computer Network

Content	Hours
Unit 1-: Introduction and overview: Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.	6
Unit 2 –: Enabling technologies: Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and SunSPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki.	6
Unit 3 -: Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet).	8
Unit4-: Overview of sensor network protocols:(details of at least 2 important protocol per layer):Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth.	8
Unit 5 –: Data dissemination and processing; differences compared with other database management systems, data storage; query processing.	4
Unit6-: Specialized features: Energy preservation and efficiency, security challenges, fault-tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms, cover age issues, sensor Web, sensor Grid, Open issues for future research and Enabling technologies in wireless sensor network.	4

Reference Books:

1. H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India, 2012.
2. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “Wireless Sensor Networks”, Springer Verlag, 1st Indian reprint, 2010.
3. F. Zhao and L. Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Morgan Kaufmann, 1st Indian reprint, 2013.
4. Yingshu Li, MyT. Thai, Weili Wu, “Wireless sensor Network and Applications”, Springer series on signals and communication technology, 2008.

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Course Title : **Industrial Automation and Process Control (Elective II)**	
Course Code : **202ETL604**	**Semester : I**
Teaching Scheme : L-T-P : **3-1-0**	Credits : **4**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course is introduced in M.Tech syllabus to understand different processes in industries, studying and developing the different types of automations carried out in today's industries. This is useful to enhance the production and reduce the human intervene in the production process**.**

Course Objectives: The course aims to

1. Describe different types of processes and role of automations in industries data base management.
2. Analyze and develop Advanced Process Control and hybrid control system
3. Study the advanced tools available like DCS, SCADA and PLCs

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Apply the knowledge of automation in the field of industrial process control.
2	Design the plant-wide architecture of the control system for a process industry.
3	Develop network architecture and detailed specifications of network components.
4	Solve engineering solution for fast growing industrial sector with reliable atomized system using PLC and DCS system.

Prerequisite:	Basic Industrial Electronics and control system engineering knowledge

Content	Hours
Unit 1-: Different types of processes. Typical examples of continuous, batch, discrete and hybrid processes. Study of Process flow, detailed P & ID, Critical loops, Safety and Alarms, Reliability and Fail-safe operation requirements, efficient running and adhering to standards.	6
Unit 2-: Role of automation in industries, Benefits of automation. Distributed Control Systems (DCS) system architecture, system elements, data communication links, DCS Engineering and Design, detailed engineering, specifications, configuration and programming.	6
Unit 3-: Functions Database management, reporting, Sequential event recording alarm management, communication, third party interface, control, display.	6
Unit 4-: Enhanced functions Advance Process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc.	5
Unit No.5 Performance Criteria for DCS and other automation tools. Selection and control of different processes with advanced tools available with DCS, SCADA and PLCs.	6
Unit 6-: Discussion about hybrid control system. HART, Foundation field bus, Profi bus protocol introduction, frame structure, programming, implementation examples, Benefits, Advantages and Limitations. Comparison w i t h other field bus standards including device net, Profi bus, Control net, CAN, Industrial Ethernet etc. Test and validation of system architecture.	7

References :

1. Popovic and Bhatkar , — Distributed Computer Control For Industrial Automation , Taylor & Francis group, 2011.
2. Webb and Reis, —Programmable Logic Controllers: Principles and Applications, PHI, 2009.
3. S. K. Singh, —Computer Aided Process Control, PHI, 2009.

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Course Title : **Application Specific Integrated Circuit (ASIC) Design (Elective II)**	
Course Code : **202ETL604**	**Semester : I**
Teaching Scheme : L-T-P : **3-1-0**	Credits : **4**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Objectives:

1. To learn the fundamentals of ASIC and its design methods
2. To gain knowledge on programmable architectures for ASICs
3. To understand the physical design of ASIC.

Course Outcomes (COs):

At the end of the course the student should be able to:

1	To learn the fundamentals of ASIC and its design methods
2	To gain knowledge on programmable architectures for ASICs & physical design of ASIC
3	To prepare the student to be an entry level industrial standard cell ASIC or FPGA designer
4	To give the student an understanding of issues and tools related to ASIC/FPGA design.

Prerequisite:	Basics of VLSI Design

Content	Hours
Unit 1 -: Introduction to ASIC'S Types of ASICs ,Design flow, CMOS transistors CMOS Design rules, Combinational Logic Cell, Sequential logic cell, Data path logic cell, Transistors as Resistors, Transistor Parasitic, Capacitance, Logical effort, Library cell design, Library architecture	6
Unit 2 -: Programmable ASIC'S Anti fuse , static RAM , EPROM and EEPROM technology , PREP benchmarks ,Actel ACT , Xilinx LCA ,Altera FLEX , Altera MAX, DC & AC inputs and outputs ,Clock & Power inputs , Xilinx I/O blocks.	6
Unit 3 –: Programmable ASIC Logic Cells Actel ACT ,Xilinx LCA , Xilinx EPLD , Altera MAX 5000 and 7000 , Altera MAX 9000 , Altera FLEX ,Design systems , Logic Synthesis , Half gate ASIC, Schematic entry , Low level design language , PLA tools ,EDIF, CFI design representation**.**	6
Unit 4 -: ASIC Floor Planning, Placement And Routing ASIC Construction: Physical Design, System Partitioning, FPGA Partitioning-Partitioning Methods. Floor planning and Placement: Floor planning- Placement-Physical Design Flow. Routing: Global Routing - Detailed Routing- Special Routing. Design checks	6
Unit 5 –: OPTIMIZATION ALGORITHMS Planar subset problem(PSP) ,single layer global routing single layer detailed routing wire length and bend minimization technique ,over the cell(OTC) Routing-multichip modules(MCM).	6
Unit 6-: PROGRAMMABLE LOGIC ARRAYS- Transistor chaining, Weinberger Arrays, Gate Matrix Layout,1D compaction,2D compaction	6

Note:- Minimum six tutorials should be performed on entire syllabus.

References:

1. M. J. S. Smith , "Application Specific Integrated Circuits", Addison - Wesley Longman Inc., 1997.
2. Farzad Nekoogar and Faranak Nekoogar, "From ASICs to SOCs: A Practical Approach", Prentice hall PTR, 2003.

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Course Title : **Embedded System Design & Linux Lab**	
Course Code : **202ETP602**	**Semester : I**
Teaching Scheme : L-T-P : **0-0-2**	Credits : **1**
Evaluation Scheme : ISE Marks : **25**	

Course Description: The Lab course

Course Objective: At the end of this course, students will be able to

1. Understand ARM processor core architecture along with on chip peripherals available on LPC1768 embedded Cortex-M processors.
2. Understand interrupts and its programming with peripherals
3. Develop small embedded system by using the ARM processor core based systems and application software for it.
4. Use EDA tools to design embedded system PCB.
5. Install and use the embedded Linux operating system.
6. L earn the fundaments of Linux as applied to embedded hardware

Course learning outcomes (COs)-

At the end of the course the student should be able to:

CO1	Illustrate Cortex M processor architecture and its features.
CO2	Develop and execute programs for peripherals and interrupts
CO3	Design and execute embedded system software
CO4	Design embedded system PCB
CO5	Apply the basic concepts of Linux for various case studies.
CO6	Apply the various Linux commands and shell scripting for basic administration.

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List of Experiments	
Expt. No.	**Name of Experiment**
1	Write Simple C Program with header files for array manipulations
2	Write C programs for GPIO and debug programs, observe variables.
3	Write programs for UART in polling mode.
4	Write programs for ADC in polled/Interrupt mode.
5	Write programs for Timers of ARM LPC 1768.
6	Write programs for interrupt of ARM LPC 1768.
7	Write Programs for RTC & LCD using ARM LPC 1768.
8	Design Embedded system using various peripherals.
9	Design PCB schematic for embedded system using LPC1768.
10	Design Layout for schematic generated in Exp. 9
11.	Write program using the basic concepts of embedded Linux for various case studies.
12.	Write, compile multi-file, multi-threaded programs using make and debug using gdb.

* Note:- Minimum eight experiments should be performed to cover the entire curriculum of course.

References:

1. Joseph Yiu, “The definitive guide to ARM Cortex-M3”, Elsevier, 2nd Edition
2. Frank Vahid and Tony Givarg is, “Embedded System Design”, Wiley
3. User and reference guide ofLPC1768
4. Rigid Flex PCB design– by Ben Jordan
5. Sloss Andrew N, Symes Dominic, Wright Chris, “ARM System Developer's Guide: Designing and Optimizing”, Morgan Kaufman Publication
6. Steve furber, “ARM System-on-Chip Architecture”, Pearson Education
7. Technical references and user manuals on www.arm.com,NXP Semiconductor www.nxp.com and TexasInstruments www.ti.com, ST Microelectronics www.st.com.

Course Title : : **WMC & WSN-LAB (Elective – I)**	
Course Code : **202ETL603**	**Semester : I**
Teaching Scheme : L-T-P : **0-0-2**	Credits : **1**
Evaluation Scheme : ISE Marks : **25**	

Course Description: The Lab course.

Course Objective:

1. To study GSM by experimentation and fault insertion techniques.
2. To understand 3G communication system.
3. To Analyze various propagation models.
4. To evaluate the Performance IEEE 802.15.4.

At the end of the course the student should be able to:

1	Understanding Cellular concepts, GSM and CDMA networks.
2	Understand 3G communication system.
3	Analyse various propagation model.
4	Evaluate the Performance IEEE 802.15.4.

List of Experiments for Elective: WMC and WSN	
Expt. No.	**Name of Experiment**
1	Study of various functions in GSM and CDMA architecture network.
2	Study of GSM for various signalling.
3	To study various GSM AT Commands.
4	Study of free space propagation model.
5	Study of Ricans model.
6	Study of Rayleigh fading channel.
7	Performance analysis of IEEE 802.15.4.
8	Study the super frame structure and analyse the effect of its order on throughput.
9	Performance analysis of MANET.
10	Study of multi hop communication in MANET.

* Minimum eight experiments should be performed to cover the entire curriculum of course.

Course Title : **Simulation Lab**	
Course Code : **202ETP610**	**Semester : I**
Teaching Scheme : L-T-P : **0-0-2**	Credits : **1**
Evaluation Scheme : ISE Marks : **50**	

Course Description: The Lab course

Course Objective:

1. To develop problem solving skills and their implementation through basic python.
2. To understand and implement concepts of decision making statements.
3. To understand & implement programs based on built in functions.
4. To implement programs based different data collection concepts.

At the end of the course the student should be able to:

1	Understand the python programming basics.
2	Able to solve programs on decision making & looping statements in python.
3	Implement built in functions to solve problems.
4	Understand & implement python list, tuple, set and dictionary collection concepts.

List of Experiments	
Expt. No.	**Name of Experiment**
1	Write a python program to demonstrate basic data types in python
2	Write python program to study Arithmetic, relational and logical operators and Operands in Python.
3	Write python programs to study if, if else , if else if statements
4	Write python programs to study looping statements using “while” syntax
5	Write python programs to study looping statements using “for” syntax
6	Write python programs to study built in functions of string and math packages
7	Write python programs to study list access using membership operators.
8	Write python programs to study tuple using inbuilt functions
9	Write python programs to study set operations
10	Write python programs to study dictionary traversing

Note:- Minimum eight experiments should be performed to cover the entire curriculum of course.

References:

1. Martin C. Brown, "Python: The Complete Reference", Tata McGraw Hill Publication, Edition 2018
2. Mark Lutz, "Learning Python", O'Reilly Publication, Edition 2013
3. Michael Dawson, "Python Programming for Absolute Beginner", Cengage Learning, Edition 2010
4. David Beazley, "Python Essential Reference", 4th edition, Developers library.

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Course Title : **Pedagogic Studies**	
Course Code : **202ETL612**	**Semester : I**
Teaching Scheme : L-T-P : **2-0-0**	Credits : **(Non-credit Mandatory course)**
Evaluation Scheme: This Course will be assessed by conducting objective type examination for 50 marks for which criteria for passing is 40% (20 marks).Result of student will be declared only if student passes this course.	

Course Description:
This course aims to define the basic concepts, define the notion of pedagogy and its status and relation to other sciences, processes and stages of education in pedagogical forms.

Course Objectives: At the end of this course, students will be able to

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Recognize pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
2	Identify the evidence on the effectiveness of these pedagogical practices, conditions, and population of learners.
3	Identify the best support effective pedology for teacher using guidance.

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Content	Hours
Unit No. 1–: Introduction: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**,** overview of methodology and Searching.	4
Unit No. 2–: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	3
Unit No. 3–:Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: Quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	4
Unit No. 4 –: Professional development: Alignment with classroom practices and follow- up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes	4
Unit 5 –: Research Aspects: Research design, Contexts, Pedagogy. Teacher education, Curriculum and assessment, Dissemination and research impact.	3

Note: This course is self-study course

References:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic math's and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3):272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read 'campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

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Course Title **: Design of VLSI system**	
Course Code : **202ETL605**	**Semester : II**
Teaching Scheme : L-T-P : **3-0-0**	Credits : **3**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Objectives:

1. The student will learn the basic CMOS circuit, characteristics and performance.
2. The student will learn design metric concepts to simple and complex digital circuits using CMOS.
3. The student will learn simple and complex circuits to create the building blocks of a system.
4. The student will learn rapid advances in CMOS Technology

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Understand the basic CMOS circuit, characteristics and performance
2	Understand and apply design metric concepts to simple and complex digital circuits using CMOS.
3	Analyze and design the simple and complex circuits to create the building blocks of a system.
4	Understand the rapid advances in CMOS Technology

Prerequisite:	Basics Analogy & Digital Electronics Engineering.

Content	Hours
Unit 1 - Basics OF VLSI: Introduction to VLSI, Manufacturing process of CMOS integrated circuits, CMOS n-well process design rules, packaging integrated circuits, trends in process technology.	4
Unit 2 - MOS Transistors: Threshold voltage- characteristics of MOS transistor ,channel length modulation, short channel effects, Design of Logic gates using NMOS, PMOS and CMOS, Stick diagrams, Transfer characteristics of CMOS inverter, Power dissipation – Delay and sizing of inverters.	8
Unit 3 –: Quality metrics of a Digital Design: Cost, Functionality, Robustness, Power, and Delay. CMOS inverter: Switching Threshold, Noise Margin, Dynamic behaviour, computing capacitances, propagation delay, Dynamic & static power consumption, energy and energy delay product calculations, stick diagram, IC layout design and tools.	6
Unit 4 -: CMOS – Combinational Circuits: Static CMOS design, Logic effort, Ratioed logic, Pass transistor logic, Dynamic logic, Speed and power dissipation in dynamic logic, Cascading dynamic gates, CMOS transmission gate logic.	6
Unit 5 –CMOS-SEQUENTIAL LOGIC: Static latches and registers, Bi-stability principle, MUX based latches, Static SR flip-flops, Master-slave edge-triggered register, Dynamic latches and registers, Concept of pipelining, Pulse registers	8

Unit 6- ADVANCED TECHNOLOGIES: 4
Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology, Fin FET, TFET.

References:

1. Jan M Rabaey, Anantha Chadrakasan, Borivoje Nikolic, “Digital integrated circuits a design perspective”, Pearson education.
2. Sung Mo Kang, Yusuf Leblebici, “CMOS digital integrated circuits”, Tata McGraw Hill Publication.
3. Neil E Weste, Kamran Eshraghian, “Principle of CMOS VLSI Design”, Pearson education.
4. Baker Li Boyce, “CMOS Circuit Design, Layout, and Simulation”, Wiley, 2nd Edition.
5. Pucknell, D.A. and Eshraghian, K., “Basic VLSI Design”, PHI, 3rd Edition.

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Course Title : **Patten recognition and Machine Learning**	
Course Code : **202ETL606**	**Semester : II**
Teaching Scheme : L-T-P : **3-0-0**	Credits : **3**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

Course consists of methods for the classification of different patterns, objects, signals, and processes. It also includes machined learning techniques.

Course Objectives:

1. To study the concepts parametric and linear models for classification
2. To study the neural network and SVM for classification.
3. To study machine independent and unsupervised learning techniques.

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Describe parametric and linear models for classification
2	Design neural network and SVM for classification
3.	Develop machine independent and unsupervised learning techniques.

Prerequisite:	Basic Mathematics & Probability Theory

Content	Hours
Unit 1 Introduction to Pattern Recognition: Problems, learning and adaptation, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions	5
Unit 2 Linear models: Linear Models for Regression, linear regression, logistic regression Linear Models for Classification	7
Unit 3 Neural Network: **P**erceptron, multi-layer Perceptron, back propagation algorithm, error surfaces, practical techniques for improving back propagation	6
Unit No. 4 Linear discriminant functions : Decision surfaces, two-category, multi-category, minimum-squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine	8
Unit 5 - Algorithm independent machine learning : Lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers	6
Unit 6 Unsupervised learning and clustering : K-means clustering, fuzzy k-means clustering, hierarchical clustering	5

References

1) Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition John Wiley & Sons, 2001.
2) C. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
3) Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, “The Elements of Statistical Learning”, 2nd Edition, Springer, 2009.

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Course Title : **Research Methodology and IPRs**	
Course Code : **202ETL607**	**Semester : II**
Teaching Scheme : L-T-P : **3-0-0**	Credits : **3**
Evaluation Scheme : ESE Marks : 1**00**	

Course Description:
This course is introduced to understand how to define a problem for research work, how literature Survey is carried out. What is plagiarism and how it is checked. What are the research ethics? The course is also intended to understand the types of Intellectual Property Rights and the process of filing the IPRs

Course Objectives: This course aims to

1. Understand and define different research problems, literature studies and approaches
2. Describe what Plagiarism is, and Research ethics.
3. Describe the concepts of Property, Intellectual Property rights and Process of Patenting and Development.

Course Outcomes

At the end of the course the student should be able to:

1	Understand research problem formulation and approaches of investigation of solutions for research problems.
2	Learn ethical practices to be followed in research and apply research methodology in case studies and acquire skills required for presentation of research outcomes.
3	Discover how IPR is regarded as a source of national wealth and mark of an economic leadership in context of global market scenario.
4	Summarize that it is an incentive for further research work and investment in R & D, leading to creation of new and better products and generation of economic and social benefits.

Content	Hours
Unit 1-: Meaning of research problem: Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations.	6
Unit 2-: Effective literature studies approaches: Analysis, Use, Design of Experiments /Taguchi Method to plan a set of experiments or simulations or build prototype. Analyze your results and draw conclusions or Build Prototype, Test and Redesign.	6
Unit 3-: Plagiarism, Research ethics: Effective technical writing, how to write report, Paper. Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	6
Unit 4-: Introduction to the concepts Property and Intellectual Property: Nature and Importance of Intellectual Property Rights, Objectives and Importance of understanding Intellectual Property Rights.	5
Unit 5-: Understanding the types of Intellectual Property Rights: Patents-Indian Patent Office and its Administration, Administration of Patent System – Patenting under Indian Patent Act , Patent Rights and its Scope, Licensing and transfer of technology, Patent information and database. Provisional and Non Provisional Patent Application and Specification, Plant Patenting, Idea Patenting, Integrated Circuits, Industrial Designs, Trademarks (Registered and unregistered trademarks), Copyrights, Traditional Knowledge, Geographical Indications, Trade Secrets, Case Studies	7
Unit 6-: New Developments in IPR, Process of Patenting and Development: Technological research, innovation, patenting, development, International Scenario: WIPO, TRIPs, Patenting under PCT.	6

References:

1. Aswani Kumar Bansal: Law of Trademarks in India
2. B L Wadehra : Law Relating to Patents, Trademarks, Copyright, Designs and Geographical Indications.
3. G.V.G Krishnamurthy, “The Law of Trademarks, Copyright, Patents and Design”
4. Satyawrat Ponkse, “The Management of Intellectual Property”
5. S K Roy Chaudhary & H K Saharay, “ The Law of Trademarks, Copyright, Patents”
6. T. Ramappa, S. Chand,“Intellectual Property Rights under WTO”
7. Manual of “Patent Office Practice and Procedure”
8. WIPO: “WIPO Guide To Using Patent Information”
9. Halbert, Taylor & Francis,“Resisting Intellectual Property”
10. Mayall, “Industrial Design”, Mc Graw Hill
11. Niebel, “Product Design”, Mc Graw Hill
12. Asimov, “Introduction to Design”, Prentice Hall
13. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”

Course Title : **Error Control Coding Techniques (Elective III)**	
Course Code : **202ETL608**	**Semester : II**
Teaching Scheme : L-T-P : **3-1-0**	Credits : **4**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

Error-control codes form an integral part of all digital communications systems, and every communications engineer should have a good working knowledge of the theory underlying these codes. This course aims to introduce the fundamentals of error control coding techniques and application

Course Objectives:

1. To understand need and objective of Error Control Coding and mathematical concepts related to coding.
2. To understand encoding & decoding techniques for Linear Block Codes and Cyclic Codes.
3. To understand the formulation and computation related to encoding & decoding of Binary BCH Codes. & RS Code.
4. To understand encoding & decoding procedure in Convolutional Codes and different algorithms associated with Convolutional Coding& iteratively codes

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Understand identify the role of Error Control Coding techniques and mathematical concepts related to coding
2	Understand to Analyze& design the encoder & decoder for Linear Block Codes & Cyclic Codes.
3	Understand to Analyze & design the encoder & decoder for BCH & RS Code.
4	Analyze the concept of encoding& decoding for Convolutional codes and different algorithms associated with convolutional Coding & iteratively decoded codes.

Prerequisite:	Digital Communication, Applied Mathematics

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Content	Hours
Unit 1 -: Coding for Reliable Digital Transmission Types of Codes, modulation & coding, Error Control Coding: Need, Objectives, approaches, Types of Errors & Error control strategies, Performance measures. Introduction to Algebra: Definitions, Groups & fields, Binary field arithmetic, factorization of $(X^n - 1)$ over a finite field, Construction of Galois field $GF(2^m)$ and its basic properties, Computations, Vector spaces, Matrices.	4
Unit 2-: Linear block codes Introduction, Structure, Parameters, Generator & Parity Check Matrix, Encoding circuit, Syndrome & Error detection, Syndrome circuit, Distance Properties, Error detecting & Correction Capabilities, Standard Array & Syndrome decoding for (n, k) linear Block Code. Hamming Codes, Product codes, Repetition code, Hadamard codes (Wash Code), Dual Code, Shortened and Extended linear Codes, Reed Muller (RM) Codes.	7
Unit 3-: Cycliccodes: Algebraic structure, Polynomial representation of codeword, Generator polynomial, Non-systematic & Systematic Cyclic Codes, Generator & Parity Check Matrices for cyclic code, Structure of Cyclic Encoder & Syndrome calculator, Encoding of cyclic code using feedback shift register circuit, Syndrome computation and Error detection, Decoding of Cyclic code, Error- Trapping Decoding. Cyclic Redundancy Check Code, Cyclic Hamming Codes, Golay Code, Shortened Cyclic Codes.	7
Unit 4-: BCH & RS Code: BCH Code: Primitive Element, Primitive Polynomial, Binary Primitive BCH Code, Minimal & Generator Polynomial for BCH Code, Decoding of BCH Code, Peterson-Gorenstein - Zierler decoder, Error Location & Error Evaluation polynomials, Implementation of Error Correction. RS Code: Introduction, Error correction capability of RS code, RS code in Non-systematic & Systematic form, Syndrome decoding, Error location & Error Evaluation Polynomials, Decoding of RS code & Nonbinary BCH codes using the Berlekamp Algorithm.	7
Unit 5-: Convolution Codes: Introduction, Encoding of Convolutional Codes, Generator matrix, Convolutional code representation: Code Tree, State diagram & Trellis diagram, Structural & Distance properties of Convolutional codes, Transfer Function of Convolution Code. Optimum decoding of Convolutional Codes: Maximum Likelihood decoding, The Viterbi Algorithm, Sequential Decoding, Majority Logic Decoding.	7
Unit 6-: Turbo Code & Low Density parity check Codes (LDPC): Turbo Code: Introduction, Basic Turbo Encoding Structure,, Decoding Algorithms: Maximum Posterior decoding Algorithm. Low Density Parity Check Codes (LDPC): Introduction, Construction, Tanner Graph, Decoding LDPC Code: Hard & Soft decoding.	4

Note:- Minimum eight tutorials should be performed on entire syllabus.

References:

1. Shu Lin, Daniel J.Costello, Jr.,"***Error Control Coding***", II[nd] Edition 2011, Pearson Education.
2. Salvatore Gravano, "***Introduction to Error Control Codes***",South Asia Edition, Oxford UniversityPress
3. W.CaryHuffman and Vera Pless, "***Fundamentals of Error correcting Codes***", First Edition, Cambridge University Press.
4. Todd K Moon,"***Error Correction Coding***", Wiley student, Edition 2006
5. Blahut R.E., "***Algebraic codes for Data transmission***", Cambridge University Press,2003
6. Bernard Sklar, Pabitra Kumar Ray, "***Digital Communications Fundamentals and Applications***," Pearson Publications, Second Edition, 2009.
7. William Ryan and Shu Lin, "***Channel Codes: Classical and Modern***", Cambridge University Press, 2009.
8. Peter Sweeney, "***Error Control Coding***", John Wiley & Sons, 2002.

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Course Title : **Network Security & Cryptography (Elective III)**	
Course Code : **202ETL608**	**Semester : II**
Teaching Scheme : L-T-P : **3-1-0**	Credits : **4**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course aims to introduce the student to the areas of network security & cryptography. This course develops a basic understanding of the algorithms used to protect the users. The course emphasizes to give a basic understanding of attacks on cryptosystems with the aim of preventing the attacks.

Course Objectives: At the end of this course, students will be able to

1. Understand Block Chiper and DES principles
2. Understand Symmetric Encryption Methods
3. Identify network security threat

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Implement Cryptography methods on Network Security concepts and Application
2	Implement Symmetric methods
3	Implement Message authentication and Hash Functions
4	Identify the attacks and methods of web security

Prerequisite:	Computer Networks

Content	Hours
Unit 1 – Overview: Services, Mechanisms, and attacks, The OSI Security Architecture, A modelfor network security, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, and Steganography	5
Unit 2 – Block Ciphers and the Data Encryption Standard: Simplified DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Differential Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation.	5
Unit 3 –Contemporary symmetric Ciphers: Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, Confidentially using symmetric Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, and Random Number Generation	5
Unit No. 4 - Public Key Cryptography and RSA: Principles of Public Key cryptosystems, The RSA Algorithm, Key Management, other Public Key Crypto systems key Management, Diffle-Hellman Key exchange	5
Unit 5 - Message Authentication and hash functions: Authentication Requirements, Authentication Function, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs. **Hash Algorithms:** MD5 Message Digest Algorithm, Secure Hash Algorithm. Digital signatures and Authentication protocols: Digital signatures, Authentication protocols and Digital signature Standard	8
Unit 6- Authentication Applications: Kerberos, X. 509 Authentication Service. Electronic Mail Security: Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentications, Header, Encapsulating Security Payload, Combining Security Associations, Key Management. **Web Security:** Web Security Considerations, Secure socket layer and Transport layer security. Secure electronic transaction. System Security: Intruders, Intrusion detection, password management. Malicious Software, Viruses, Viruses and Related Threats, Firewalls: Firewall Design Principles, Trusted systems.	8

Note:-Minimum eight tutorials should be performed on entire syllabus.

References:

1. Willam Stallings, Cryptography and Network Security, Third Edition, Pearson Education
2. Network Algorithmic: An Interdisciplinary Approach to Designing Fast networked Devices George Varghese (Morgan Kaufmann Series in Networking
3. Atul Kahate, Cryptography and Network Security, Tata Mc Grawhill, 2003

Course Title : **Internet of Things (Elective IV)**	
Course Code : **202ETL609**	**Semester : II**
Teaching Scheme : L-T-P : **3-1-0**	Credits : **4**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course is designed to give the technical knowledge and skills to build IoT systems. It provides knowledge of advanced data collection, connectivity and analysis of information communicated with end entities.

Course Objectives:

1. To understand the concepts of IoT Technologies
2. To understand the types of IoT Technologies & it's implementations
3. To apply IoT Technologies for implementing prototype model of particular application

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Understand what IoT technologies are used for today, and what is required in certain scenarios.
2	Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.
3.	Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications.

Prerequisite:	Computer Networks

Content	Hours
Unit 1 –: Smart cities and IoT revolution: Fractal cities, From IT to IoT, M2M and peer networking concepts, IPV4 and IPV6.	5
Unit 2 -:Software Defined Networks SDN: From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog.	8
Unit 3 –: Wireless sensor networks: Introduction, IOT networks (PAN, LAN and WAN), Edgere source pooling and caching, client side control and configuration.	5
Unit 4 -:Smart objects as building blocks for IoT: Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, C Programming, multithreading concepts.	6
Unit 5 -: Operating systems requirement of IoT environment: Study of mbed, RIoT and Contiki operating systems. Introductory concepts of big data for IoT applications.	6
Unit 6-: Applications of IoT: Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.	6

Note:- Minimum six tutorials should be performed on entire syllabus.

References:

1.A Bahaga, V. Madisetti, “Internet of Things- Hands on approach”, VPT publisher, 2014.

2.A.McEwen, H. Cassimally, “Designing the Internet of Things”, Wiley, 2013.

3. CunoPfister, “Getting started with Internet of Things”, Maker Media, 1st edition, 2011

4. Samuel Greenguard, “Internet of things”, MIT Press, 2015.

5. http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html

6. https://developer.mbed.org/handbook/AnalogIn

7. http://www.libelium.com/50_sensor_applications/

8. M2MLabs Mainspring http://www.m2mlabs.com/framework Node-RED http://nodered.org/

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Course Title : **Multiple Input Multiple Output System (Elective IV)**	
Course Code : **202ETL609**	**Semester : II**
Teaching Scheme : L-T-P : **3-1-0**	Credits : **4**
Evaluation Scheme : ISE + MSE Marks : **20 + 30**	ESE Marks : **50**

Course Description:

This course covers the fundamentals of MIMO technology with multiple antennas at transmitter and receivers. Its helps to design wireless communication systems

Course Objectives:

1. To understand the performance of MIMO system
2. To analyze various space time codes (STBC)
3. To understand the Alamouti schemes of channel estimation

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Understand the basic concepts of MIMO system.
2	Evaluate the performance of various space time coding schemes in different fading channel scenario
3	Solve the engineering problems related to space time coding using in MIMO-OFDM system in different fading channels.

Prerequisite:	Digital & Wireless Communication

Content	Hours
Unit 1 –: Introduction: MIMO wireless communication, MIMO channel and signal model, A fundamental trade-off, MIMO transceiver design, MIMO in wireless networks, MIMO in wireless standards. Equalizer Noise Enhancement, Equalizer Types, Folded Spectrum and ISI- Free Transmission, Linear Equalizers, Zero Forcing (ZF) Equalizers, Minimum Mean Square Error (MMSE) Equalizer, Maximum Likelihood Sequence Estimation., Decision- Feedback Equalization	6
Unit 2 -: Performance Limits Of Multiple-Input Multiple-Output Wire Less Communication Systems: MIMO System Model, Capacity in AWGN, Channel Side Information at Transmitter and Receiver, Capacity of Frequency-Selective Fading MIMO System Capacity Derivation, Capacity of MIMO Systems with Random Channel Coefficients Channels, Capacity of MIMO Systems with Static , Capacity of MIMO Systems with Fading Channels	6
Unit 3-: Multiple Antennas and Space-Time Communications: Narrowband MIMO Model, Parallel Decomposition of the MIMO Channel MIMO Diversity Gain: Beamforming, Diversity/Multiplexing Tradeoffs, Space-Time Modulation and Coding. ML Detection and Pair Wise Error Probability	6
Unit No. 4 -: Space-Time Block Codes: Alamouti Space-Time Code with Multiple Receive Antennas, Space- Time Block Codes (STBC), STBC for Real Signal Constellations, STBC for Complex Signal Constellations, Decoding of STBC, Performance of STBC, Effect of Imperfect Channel Estimation and Antenna Correlation on Performance	6
Unit 5 -: Layered Space-Time Codes: LST Transmitters, LST Receivers, QR Decomposition, Interference Minimum Mean Square Error (MMSE) Suppression Combined with Interference Cancellation, Iterative LST Receivers, An Iterative Receiver with PIC, An Iterative MMSE Receiver, Comparison of the Iterative MMSE and the Iterative PIC-DSC Receiver, VBLAST architecture, DBLAST Architecture.	6
Unit 6-: Space-Time Trellis Codes: Encoder Structure for STTC, Generator Description, Optimal STTC Based on the Rank, Determinant and Trace Criterion, Performance Comparison for Codes Based on Different Design Criteria, The Effect of Imperfect Channel Estimation on Code Performance, Design of Space-Time Trellis Codes on Fast Fading Channels, Construction of Recursive STTC	6

Note:- Minimum eight tutorials should be performed on entire syllabus.

References:

1. Larsson, Erik G. and Petre Stoica, Space-Time Block Coding for Wireless Communications, Cambridge University Press (2008).
2. Arogyaswami.,Paulraj, Gore, Dhananjay and Nabar, Rohit., Introduction to Space- Time Wireless Communications, Cambridge University Press (2008).
3. David, Tse and Viswanath, Pramod, Fundamentals of Wireless Communication, Cambridge University Press (2006).
4. Fitzek, Frank H.P., Katz and Marcos D., Cooperation in Wireless Networks: Principles and Applications, Springer(2007).

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Course Title : **VLSI System Design Lab**	
Course Code : **202ETP605**	**Semester : II**
Teaching Scheme : L-T-P : **0-0-2**	Credits : **1**
Evaluation Scheme : ISE Marks : **25**	

Course Objectives:

1. The student will learn to design Various Combinational circuits using CMOS Logic.
2. The student will learn design Various Sequential circuits using CMOS Logic.

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Understand Digital Circuit design using CMOS.
2	Build blocks of a system to solve engineering problems.
3	Use EDA tools like Cadence, Mentor Graphics and other open source software tools like NGSPICE through lab exercises

Note: Any 8 of the following circuits are to be designed and implemented using NGSPICE, Cadence EDA Tools or Equivalent CAD tools.

List of Experiments:

List of Experiments	
Expt. No.	**Name of Experiment**
1	DC and Transient analysis of NMOS and PMOS Transistor using NGSPICE.
2	DC, Transient analysis of CMOS Inverter using NGSPICE.
3	DC, Transient analysis of CMOS Inverter using Cadence EDA Tool.
4	Schematic to Symbol generation using Cadence EDA Tool.
5	Schematic to Layout of CMOS Inverter using Cadence EDA Tool
6	Post Layout simulation of CMOS Inverter and Parasitic Extraction
7	Design and Simulation of CMOS/NMOS Inverter.
8	Design and Simulation of CMOS Universal Gates.
9	Design of all basic gates using Cadence EDA Tool.
10	Design of combinatorial circuits using Cadence EDA Tool.

* Minimum eight experiments should be performed to cover the entire curriculum of course.

References:

1. Jan M Rabaey, Anantha Chadrakasan, Borivoje Nikolic, “Digital integrated circuits a design perspective”, Pearson education.
2. Sung Mo Kang, Yusuf Leblebici, “CMOS digital integrated circuits”, TataMcGraw Hill Publication.
3. Neil E Weste, Kamran Eshraghian, “Principle of CMOS VLSI Design”, Pearsoneducation.
4. Baker Li Boyce, “CMOS Circuit Design, Layout, and Simulation”, Wiley, 2nd Edition.
5. Pucknell, D.A. and Eshraghian, K., “Basic VLSI Design”, PHI, 3rd Edition.

Course Title : **Patten recognition and Machine Learning**	
Course Code : **202ETP606**	**Semester : II**
Teaching Scheme : L-T-P : **0-0-2**	Credits : **1**
Evaluation Scheme : ISE: **25**	ISE Marks : **25**

Course Description: Course consists of methods for the classification of different patterns, objects, signals, and processes. It also includes machined learning techniques.

Course Objectives:

1. To study the concepts parametric and linear models for classification
2. To study the neural network and SVM for classification.
3. To study machine independent and unsupervised learning techniques.

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Describe parametric and linear models for classification
2	Design neural network and SVM for classification
3.	Develop machine independent and unsupervised learning techniques.

Expt. No.	**Name of Experiment**
1	Bays rule
2	Discriminate functions
3	linear regression
4	logistic regression
5	Perceptron
6	Multi-layer Perceptron
7	back propagation algorithm
8	linear programming algorithms
9	Support vector machine
10	K-means clustering, fuzzy k-means clustering
11	hierarchical clustering

*Note:- Minimum eight experiments should be performed.

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Course Title : **Stress Management by Yoga**	
Course Code : **202ETP614**	**Semester : II**
Teaching Scheme : L-T-P : **2-0-0**	Credits : **(Non-credit Mandatory course)**
Evaluation Scheme: This Course will be assessed by conducting objective type examination for 50 marks for which criteria for passing is 40% (20 marks).Result of student will be declared only if student passes this course.	

Course Description:

This course aims to make the students aware of the skills to develop heath & cope up with stress. A few minutes each day are enough to practice the self-help techniques.

Course Objectives: At the end of this course, students will be able

1. To achieve overall health of body and mind
2. To overcome stress

Course Outcomes (COs):

At the end of the course the student should be able to:

1	Develop healthy mind in a healthy body thus improving social health.
2	Improve efficiency

Content	Hours
Unit 1–: Definitions of Eight parts of yog. (Ashtanga yog)	6
Unit 2–: Yam and Niyam. Do‘s and Don’t’s in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	5
Unit 3–: Asan and Pranayam **i)** Various yoga poses and their benefits for mind &body **ii)**Regularization of breathing techniques and its effects- Types ofpranayama and meditation	5

Note: This course is self-study course

References:

1. “Yogic Asanas for Group Training-Part-I” : Janardan Swami Yoga bhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata