D Y PATIL
COLLEGE of
ENGINEERING & TECHNOLOGY
(AN AUTONOMOUS INSTITUTE)
KASABA BAWADA, KOLHAPUR

D. Y. Patil College of Engineering and Technology,

Kasaba Bawada

(An Autonomous Institute)

NBA Accredited

NAAC Accredited with 'A' Grade

Structure & Syllabus of

Final Year B. Tech in Electronics & Telecommunication Engineering

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Department of Electronics & Telecommunication Engineering

2023-24

Final Year (B.Tech.) Electronics & Telecommunication

SEM-VII

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
1	201ETL401	PCC	Data Communication and Networks	3			3	100	ISE MSE ESE	20 30 50	20 20	40
2	201ETL402	PCC	Advanced Mobile Communication	3			3	100	ISE MSE ESE	20 30 50	20 20	40
3	201ETL403-05	PEC	Professional Elective – III	3			3	100	ISE MSE ESE	20 30 50	20 20	40
4	201ETL406-	PEC	Professional Elective – IV	3			3	100	ISE MSE ESE	20 30 50	20 20	40
5	201ETL409-10	OEC	Open Elective II	3	1		4	100	ISE MSE ESE	20 30 50	20 20	40
6	201ETP411	PCC -LC	Data Communication and Networks -Lab			2	1	50	ISE ESE OE	25 25	10 10	20
7	201ETP412	PCC-LC	Advanced Mobile Communication Lab.			2	1	50	ISE ESE OE	25 25	10 10	20
8	201ETP413	PROJ	Project Phase I			6*	3	100	ISE ESE POE	50 50	20 20	40
9	201ETP414	PROJ	Internship (4-6Weeks)			$1	4	100	ISE	100	40	40
TOTAL				15	1	10*	25	800		800		
Total Contact Hours				**26**								

*- For Project - I, consider the workload of 2 hours per week for each project group consisting of 5 students.

$ - Faculty workload of 1 hour for batch of 10 students per week will be considered for Internship to evaluate the work done during Internship after ESE of Sem.-IV/ Sem.-VI.

****Track-I**

Final Year (B.Tech.) Electronics & Telecommunication

SEM-VIII

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
10	201ETL415	PCC	5G: Technology and System	3	1		4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
11	201ETL416-18	PEC	Professional Elective-V	3			3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
12	201ETL419-21	PEC	Professional Elective - VI	3			3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
13	201ETP422	PROJ	Project Phase II			6*	3	300	ISE	150	60	120
									ESE POE	150	60	
TOTAL				9	1	6*	13	600		600		
Total Contact Hours				**16**								

*- For Project - II, consider the workload of 2 hours per week for each project group consisting of 5 students.

****Track-II**

Final Year (B.Tech.) Electronics & Telecommunication

SEM-VIII

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
10	201ETL415	PCC	5G: Technology and System (Online)	3	1		4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
11	201ETL416-18	PEC	Professional Elective-V (Online)	3			3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
12	201ETL419-21	PEC	Professional Elective - VI (Online)	3			3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
13	201ETP422	PROJ	Project Phase II			6*	3	300	ISE	150	60	120
									ESE POE	150	60	
TOTAL				9	1	6*	13	600		600		
Total Contact Hours				**16**								

*- For Project - II, consider the workload of 2 hours per week for each project group consisting of 3 to 5 students.

**** Note**-As per the industry requirement and present societal demand, we are offering two tracks for B. Tech. Autonomous semester VIII.

Track 1 will be conducted in physical mode and students has to complete the evaluation as per the structure

Track 2 will be for the students with Pre-placement offers or full time physical industrial internship. Students has to complete the courses in online mode as defined in structure for track 2.Evaluation of track 2 will be conducted by respective faculty members of the institute & Industry

1. **ISE: In Semester Evaluation, MSE: Mid Semester Examination, ESE: End Semester Examination**
2. **Note 1: Tutorials and practical shall be conducted in batches with batch strength not exceeding 25 students.**
3. **Note 2: ISE 1 and ISE 2 will be of 10 marks each (Out of these two one must be activity based)**
4. **Note 3 : MSE will be conducted for 30 marks**
5. **Note 4 : ESE will be conducted for 50 marks**

Summer Internship: The students are expected to undergo 4 to 6 weeks internship in the industry and work on the relevant areas assigned by the industry. The work done should be monitored and evaluated by the concerned industry expert based on the report prepared by the student. The department has to assign one faculty mentor, who has to communicate with the industry and monitor the entire internship related work periodically,

- The weightage of evaluation will be as under.
    - Industry Expert/ Supervisor: 70%
    - Department & Faculty Mentor: 30 % (includes presentation & submission of report to the department at the beginning of the subsequent semester)

- The Internship can be availed by the students during the summer vacations after completion of sem IV or VI.
- The credits of the internship will be considered in Sem VII.
- The industry expert/ Supervisor is excepted to assign the work worth minimum 100-200 hrs for 4 to 6 weeks duration & should monitor & evaluate periodically.
- At the completion of the internship work, the student is expected to prepare a report on the work done

  & get certificate from the industry expert.

Course Assessment:

The course assessment is to be done on the basis of ISE (In Semester Evaluation), MSE (Mid Semester Examination) and ESE (End Semester Examination). The weightage of components are as follows.

ISE	MSE	ESE
20%	30%	50%

1) ISE (Theory) 20 marks

ISE-1 and ISE-2 can be done by using following modes

1) Online test (on Moodle)
2) Surprise test
3) Open book exam
4) Active learning method as per OBE requirement
5) Self-learning topic
6) Case study
7) Demonstrations
8) Seminars
9) Assignments
10) Self Study

ISE (Lab) 20 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) MSE will be conducted for 30 marks.

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

*** Environment studies, Financial Management & Industrial Marketing (Non-Credit Mandatory Course):**

1. Self-study course

2. Course will be assessed by conducting objective type examination for 50 marks for which criteria for passing is 40% (20 marks).

3. Result of student will be declared only if student passes this course.

LIST OF ELECTIVES AS PER PROPOSED STRUCTURE

Professional Elective					
I	**II**	**III**	**IV**	**V**	**VI**
Digital Image Processing	Image Processing & Analysis	Computer Vision and Pattern	Speech Processing	Machine learning	Deep Learning
Fiber Optic Communication	Satellite Communication	Wireless Sensor Network	Micro-wave Theory	Cyber Security	Internet of Things
VLSI design	ASIC Design	System on Chip	MEMS Technology	Nano Electronics	Consumer Electronics

Open Elective (Offered by E & Tc department for students of other	
I	**II**
Sensor Technology	Biomedical Instrumentation
Electronics Instrumentation	Electronic Automation

Open elective courses are offered to gain the knowledge of multidisciplinary areas. Students must choose one open elective course from the list of courses offered by other departments (excluding open elective courses offered by their department). Following is the list of open elective-II courses. The detailed syllabus is available on to the college website under academic tab.

Open Elective-II (For students of E & TC branch)

Sr. No.	Department	Course Code	Subject Name
1	Computer Science & Engineering	201CSL409	Security and Privacy in Social Networks
		201CSL410	Web Applications Development
2	Civil	201CEL415	Smart Cities
		201CEL416	GPS & Remote Sensing
3	Mechanical	201MEL406	Industrial Management (IM)
		201MEL407	Computer Integrated Manufacturing System (CIMS)
4	Chemical	201CHL45.1	Fuel Cell Technology
		201CHL45.2	Industrial Behaviour and Practices
5	Computer Science & Engineering (Data Science)	201DSL406	Business Intelligence & Analytics.
		201DSL407	Data Visualization and Storytelling.
6	Computer Science & Engineering (Artificial Intelligent & Machine Learning)	201AIMLL405	AI For Everyone
		201AIMLL406	Machine Learning with Python
7	Architecture	201AR408-A	Affordable Housing
		201AR408-B	Sustainable Community Living

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Data Communication & Network	
Course Code: 201ETL401	**Semester : VII**
Teaching Scheme: L-T-P :3-0-0	**Credits:** 3
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks:** 50

Course Description:

Data communications and networking may be the fastest growing technologies in industry today. One of the ramifications of that growth is a dramatic increase in the number of professions where an understanding of these technologies is essential for success and a proportionate increase in the number and types of students taking courses to learn about them.

Course Objectives:

1	To understand the basic functionality of devices used in data communication.
2	To understand the protocols and their working as per the changing needs.
3	To study different addressing modes
4	To implement various algorithms on different layers in OSI and TCP/IP reference models.

Course Outcomes (COs):

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

401.1	Explain the basic concepts of components in data communication Networks and Transmission Media.
401.2	Understand the usability of different algorithms and Standards.
401.3	Implementation of different addressing modes & classes
401.4	Understand and apply the different protocols and routing mechanisms.

Prerequisites: Basic knowledge of Communication system.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
401.1	3	2	2	1	2	2						2	3	2	L2
401.2	3	2	3	3	2	3						2	3	3	L2
401.3	3	3	3	3	2	2						2	2	2	L3
401.4	2	3	2	3	2	3						2	2	3	L2

Content	**Hrs.**
UNIT 1.–Introduction To Data Communication Components, Data Representation, Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks, Internet, Protocols and Standards	7
UNIT. 2 - Network Models & Physical Layer Layered Tasks - Sender, Receiver, and Carrier, The OSI Model- Layered Architecture, Peer-to-Peer Processes, Encapsulation, Layers in the OSI Model, TCP/IP Protocol Suite, Addressing- Physical Addresses, Logical Addresses, Port Addresses, Specific Addresses, Physical Layer	7
UNIT. 3 – Data Link Layer Data Link Control, Piggybacking, HDLC, Multiple Access, Channelization, IEEE 802.3, IEEE 802.11, Bluetooth	7

UNIT. 4 – Network Layer IPv4 Adresses- Classful Addressing, Classless Addressing, IPv4 Datagram, IPv6 Addresses, IPv6 Advantages, IPv6 Packet Format, Address Mapping, Routing Protocols- Distance Vector Routing, Link State Routing,	7
UNIT 5.- Transport Layer Process-To-Process Delivery- Client/Server Paradigm, Multiplexing and De-multiplexing, Connectionless Versus Connection-Oriented Service, Reliable Versus Unreliable, UDP- Well-Known Ports for UDP, User Datagram, Checksum, UDP Operation, Use of UDP, TCP- TCP Services, TCP Features, Segment, Flow Control, Error Control, Congestion Control	7
UNIT. 6 – Application Layer Domain Name Space, DNS in the Internet, Remote Logging, Telnet, Electronic Mail, FTP, WWW and HTTP	7

Text Book:

1. B. A. Forouzan, "Data Communication and Networking" 4th edition, Tata Mc-Graw Hill, Publication.
2. Tanenbaum, "Computer Networks", 4th Edition, Pearson Education

Reference Books:

1. Wayne Tomasi, "Introduction to Data communications and Networking" Pearson.
2. Forouzan, "TCP/IP Protocol Suite", IIIrdEdition Tata Mc-Graw Hill publication.

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Advanced Mobile Communication	
Course Code: 201ETL402	**Semester** : VII
Teaching Scheme : L-T-P :3-0-0	**Credi**t: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of Advanced mobile communication. The course provides advanced knowledge in a number of transmission techniques and technologies in mobile communications. It covers the fundamentals communications in contemporary mobile communication standards.

Course Objectives:

1	Developments in the current and next generation mobile technologies.
2	Details of advanced mobile communication standards and their evolution.
3	Knowledge on mobility support in network layers
4	understand the technologies used in wireless and mobile communication
5	Understand the Smart Antennas

Course Outcomes (COs):

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

402.1	Understand Evolution of Mobile Communication
402.2	Evaluate the performance of mobile techniques
402.3	Understand the possible techniques to improve the performance of wireless systems using advanced mobile communication standards

402.4	Understand the working principle of HSPA and LTE.
402.5	Understand the mobile network, transport & application layers
402.6	Understand the Smart Antenna Configurations

Prerequisite:	Analog and digital communication ,cellular and Mobile communication

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
402.1	2	2	1	2	1								1	1	L2
402.2	2	1	1	2	1								1	1	L2
402.3	2	2	2	2	1								1	1	L3
402.4	2	2	2	2	2								1	1	L2
402.5	1	1	1	1	1								2	2	L2

Content	Hrs
Unit 1 : Evolution Of Modern Mobile Communication: History of wireless communication, Evolution of Mobile Communication Mobile and Wireless devices. A market for mobile communications. A simplified reference model for mobile communications, Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model. Wireless-transmission: A brief introduction of frequencies for radio transmission, signals propagation, Multiplexing, Modulation, spread spectrum, cellular system, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.	8
Unit 2 Mobile Network, Transport & Application Layers Mobile IP – Packet delivery process – Routing optimization – Mobile ad-hoc networks and routing protocols – Mobile TCP – Wireless Application Protocols	6
Unit 3: Advanced Mobile Communication Standards IEEE 802.11 WLAN standard and its variants – PHY layer technologies – MAC mechanism–Security, Qos and handover Issues – IEEE 802.15 WPAN standard – Bluetooth Architecture and Protocol stack – IEEE 802.16 Wireless broadband access standard – PHY and MAC layer overviews – WiMAX network architecture – Initialization and handover procedures.	8
Unit 4. Beyond 3G HSPA and LTE – Architecture – Radio interface and channels – Resource mapping – Session,mobility and security procedures – LTE Advanced – Heterogeneous Networks – Internetworking– IP based coupling Architecture - Multimode terminals and intersystem handover.	6
Unit 5: Overview and Channel Structure of LTE Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink SC-FDMA Radio	7

Resource. Downlink Transport Channel Processing: Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink	
Unit 6: Smart Antenna Configurations Fixed Side lobe Canceling, Retro directive Arrays, Beam forming, Adaptive Arrays, Butler Matrix, Spatial Filtering with Beam formers, Switched Beam Systems, Multiple Fixed Beam System. Uplink Processing, Diversity Techniques, Angle Diversity, Maximum Ratio Combining, Adaptive Beam forming, Fixed Multiple Beams versus Adaptive Beam forming, Downlink Processing	7

Text Books:

1. Andrea goldsmith, `Wireless Communication`, South Asia Edition 2015, Cambridge University Press
2. Theodore S. Rappaport, 'Wireless Communications Principles and Practice," Third Edition, Pearson Education. (Indian Edition is available)

Reference Books:

1. Ahmed El Zooghby, ‘Smart Antenna Engineering’, ARTECH HOUSE, INC, 2005.
2. Frank B. Gross, ‘Smart antenna with MATLAB’, 2nd Edition, McGraw-Hill, 2015
3. Iti Saha Misra, “Wireless Communication and Networks – 3G and Beyond”, Mc Graw Hill
   Education, Second Edition, 2013
4. Jochen Schiller, “Mobile Communications”, Pearson Education, Second Edition, 2012.
5. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press
6. Todd K Moon, Wynn C. Stirling" Mathematical Methods and Algorithms for Signal Processing, Prentice Hal
7. Lal Chand Godara , “SMART ANTENNAS” , CRC PR ESS, 2004

8. E.Dahlman et. al. “3G Evolution: HSPA and LTE for Mobile Broadband”, Elsevier, Second
Edition,
9. G.Sasibhushana Rao, "Mobile Cellular Communication", Pearson, 2013.
10. LTE for UMTS Evolution to LTE-Advanced’ HarriHolma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Computer Vision And Pattern Recognition (Professional Elective-III)	
Course Code: 201ETL403	**Semester :** VII
Teaching Scheme: L-T-P : 3-0-0	**Credits:** 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks:** 50

Course Description: To familiarize students with Pattern classification and methods, texture and motion analysis along with basics of artificial neural network.

Course Objectives:

1	Understand the concept of pattern classification
2	Learn different types of classification
3	Understand the content based image retrieval system.
4	Learn basics of artificial neural network.
5	Understand different types of texture analysis
6	Understand different types of motion analysis

Course Outcomes (COs):

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

403.1	Classify different patterns.
403.2	Identify methods of classification of an object for a given problem.
403.3	Understand the content based image retrieval system

403.4	Apply basic neuron model.
403.5	Compare types of texture analysis.
403.6	Identify methods of motion analysis for a given problem

Prerequisite:	Image Processing and analysis

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
403.1	2	2	2										2		L2
403.2	2	2	2										2		L2
403.3	2	2	2										2		L2
403.4	2	2	2										2		L2
403.5	2	2	2										2		L2
403.6	2	2	2										2		L2

Content	Hrs
Unit 1. Pattern Recognition Patterns and Pattern classes, Decision Theoretic Pattern Classification, Bayesian Decision Theory, Minimum Distance Classification.	7
Unit. 2 Classification Non Parametric Classification, Unsupervised Classification Strategies-clustering, K-means clustering Algorithm, Syntactic Pattern Classification.	7
Unit. 3 – Content based retrieval system Architecture of a content-based image retrieval system, Image features for retrieval, Content-Based Video Retrieval System.	7
Unit 4.- Artificial Neural Network Human Recognition system, Basic neuron, activation function, feed forward network, perceptron learning, AND, OR, XOR model.	7
Unit. 5 - Texture analysis Introduction to texture, Statistical texture description, Syntactic texture description	7
Unit.6- Motion Analysis Introduction, Differential motion analysis method, optical flow, Analysis based on correspondence of interest points, kalman filters	7

Text Books:

1. T. Acharya and A. K. Ray "Image Processing Principles and Applications" Wiley
2. Milan Sonka, " Image Processing Analysis and Machine vision", Thomson
3. M. K. Pakhira , "Digital Image Processing and Pattern Recognition",PHI

Reference Books:

1. S. Sridhar, "Digital Image Processing", (Oxford)
2. R.C. Gonzalez and R.E. Woods , "Digital Image Processing", Pearson

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Wireless Sensor Network	
Course Code: 201ETL404	**Semester** : VII
Teaching Scheme : L-T-P :3-0-0	**Credi**ts: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The aim of the course is to provide students to data transfer over wireless media. Digital signal modulation and coding schemes, electromagnetic waves propagation and data decoding are considered. IEEE 802.11 (Wi-Fi) is a wireless data link-layer protocol engineered specially for wireless media. Students will learn wireless network design, operation and testing; wireless network equipment configuration, wireless network security

Course Objectives:

1	To introduce cellular and wireless networks.
2	To introduce architecture of wireless networks.
3	Understand Networking concept
4	To introduce routing protocols in wireless networks..
5	Understand the need of security.
6	the use of network platform and tools

Course Outcomes (COs):

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

404.1	Understand the concept of Wireless sensor network
404.2	Explain the concepts, network architectures and applications of wireless sensor networks
404.3	Explain the network concept

404.4	Demonstrate the use of protocols in Network.
404.5	Apply the network security concepts to wireless sensor network
404.6	Use different tools and platforms in wireless sensor network

Prerequisite:	Basic Computer network concept

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
404.1	2					2				2		2			L2
404.2	3		3			3	3			3				3	L3
404.3	2				2					2					L2
404.4	2									2			2		L4
404.5		2			2			2		2			2		L4
404.6	3				3								2		L4

Content	Hrs
Unit 1: Introduction Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel - wireless sensor networks (WSNs)	7
Unit 2: Sensor Networks – Introduction & Architectures Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.	10
Unit 3: WSN Networking Concepts MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts -.	5
Unit 4: WSN Networking Protocols The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol.	6
Unit 5: Sensor Network Security Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack.	8
Unit 6: Sensor Network Platforms And Tools Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS,	6

Text Books:

Ad Hoc wireless Networks – Architecture and Protocols by C.S.R.Murthy& B.S. Manoj, Pearson Education

Reference Books:

1. Ad Hoc Wireless Networks – A communication Theoretic perspective by O.K.Tonguz & G.Ferrari, Wiley India
2. Ad Hoc Mobile Wireless Networks – Protocols and Systems by C. K. Toh (Pearson Education)
3. Ad Hoc Networking by Charles E. Perkins (Pearson Education)
4. Introduction to Wireless and Mobile Systems, 2nd Edition, by Dh

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: System on Chip (Professional Elective-III)	
Course Code: 201ETL405	**Semester** : VII
Teaching Scheme : L-T-P :3-0-0	**Credits**: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: With technological advances that allow us to integrate complete multi-processor systems on a single die . Systems-on-Chip (SoCs) are at the core of most embedded computing and consumer devices, such as cell phones, media players and automotive, aerospace or medical electronics. This course familiarizes students with SoC architecture features and shapes a complete set of skills in SoC-based design

Course Objectives:

1	To understand the concepts of System on Chip Design methodology for Logic and Analog Cores
2	To understand the concepts of System on Chip Design Validation.
3	To understand the concepts of SOC Testing.

Course Outcomes (COs):

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

405.1	Describe SoC Design Methodology.
405.2	Understand the design of different embedded memories
405.3	Apply digital logic, digital design & verification techniques to SoC design and verification.
405.4	Investigate new techniques for future systems

Prerequisite:	Microprocessor and Embedded Systems

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO 1	PSO 2	BTL
405.1	2	1	1												L2
405.2	2	2													L2
405.3	3	3	2	2										2	L3
405.4	2	2	2												L6

Content	**Hrs**
Unit 1: Introduction to SoC, SoB, SiP, Benefits of system-on-chip integration in terms of cost, power, and performance. Comparison on System-on-Board, System-on-Chip, and System-in-Package. Typical goals in SoC design – cost reduction, power reduction, design effort reduction, performance maximization. Productivity gap issues and the ways to improve the gap.	7
Unit 2: Design Methodological For Logic Cores- SoC Design Flow – On-chip buses –Design process for hard cores – Soft and firm cores – Core and SoC design examples.	7
Unit 3: Design Methodology for Memory and Analog Cores- Embedded memories –Simulation modes Specification of analog circuits – A to D converter –Phase locked loops –High I/O.	7

Unit 4: Design Validation- Core level validation –Test benches –SoC design validation – Co simulation – hardware/ Software co-verification. Case Study: Validation and test of systems on chip.	7
Unit 5: SoC Testing- SoC Test Issues –Cores with boundary scan –Test methodology for design reuse– Testing of microprocessor cores – Built in self-method –testing of embedded memories.	7
Unit 6: Interconnect architectures for SoC. Bus architecture and its limitations. Network on Chip (NOC) topologies. Mesh-based NoC. Routing in anNoC	7

Text Books:

1. Rochit Rajsunah, System-on-a-chip: Design and Test, ArtechHouse,2007.
2. PrakashRaslinkar, Peter Paterson &Leena Singh, System-on-a-chip verification: Methodology and Techniques, Kluwer Academic Publishers,2000.

Reference Books:

1. M.Keating, D.Flynn, R.Aitken, A, GibbonsShi, Low Power Methodology Manual for System-on- Chip Design Series: Integrated Circuits and Systems, Springer,2007
2. A.Manzone, P.Bernardi, M.Grosso, M. Rebaudengo, E. Sanchez, M.SReorda, Centro Ricerche Fiat, Integrating BIST techniques for on-line SoC testing, IEEE Symposium on On-Line testing, 2000
3. Pierre Bricaud,Reuse Methodology manual for System-On-A Chip, Michael Keating, Designs,Kluwer Academic Publishers,second edition,2001

Final Year Curriculum

w.e.f. 2023-2024

Course Title: Speech Processing	
Course Code: 406ETL406	**Semester** : VII
Teaching Scheme : L-T-P :3-0-0	**Credi**t: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The aim of the course is to introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression.

Course Objectives:

1	To introduce the models for speech production
2	To develop time and frequency domain techniques for estimating speech parameters.
3	To introduce a predictive technique for speech compression
4	To understand speech recognition, synthesis and speaker identification.

Course Outcomes (COs):

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

406.1	Understand the nature of speech, model and implementation.
406.2	Interpret the time domain and frequency domain methods to characterize the speech signal and to process the speech .
406.3	Apply Linear Predictive coding for Speech Analysis.
406.4	Analyse the speech recognition methods and pattern comparison techniques

Prerequisite:	Signals and Systems ,Digital Signal Processing

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
406.1	2	2	1	1	1								1	1	L2
406.2	1	1	1	1	1								1	1	L3
406.3	2	2	1	1	1								1	1	L2
406.4	2	2	2	2	2								1	1	L4
406.5	1	1	1	1	1								2	2	L4
406.6	1	1	1	1	1								1	1	L4

Content	Hrs
Unit 1: Nature Of Speech Signal Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production.Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance	9
Unit 2: Time Domain Methods For Speech Processing Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.	7
Unit 3: Frequency Domain Methods For Speech Processing Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format	7

extraction, pitch extraction, Analysis - synthesis systems.	
Unit 4: Linear Predictive Coding Of Speech Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.	7
Unit 5: Homomorphic Speech Analysis Central analysis of speech, format and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.	7
Unit 6: Applications Of Speech Processing Speech recognition, Speech coding, Speech synthesis and speaker verification.	5

Text Books:

1. L.R. Rabiner and R.E Schafer : Digital processing of speech signals, Prentice Hall, 1978.
2. L. Rabiner and B. H. Juang, Fundamentals of Speech Recognition, Prentice Hall, 1993.

Reference Books:

1. J.L Flanagan : Speech Analysis Synthesis and Perception - 2nd Edition - Sprenger Vertag, 1972.
2. I.H.Witten :Principles of Computer Speech , Academic press, 1983.
3. Frederick Jelinek, Statistical Methods of Speech Recognition, MIT Press, Cambridge, MA; London, England, 1997.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/117105145
2. https://ocw.mit.edu/courses/6-345-automatic-speech-recognition-spring-2003/
3. https://www.classcentral.com/course/youtube-digital-speech-processing-47859

Final Year B.Tech Curriculum

w.e.f. 2023-2024

Course Title: Microwave Engineering (Professional Elective IV)	
Course Code: 201ETL407	**Semester** : VII
Teaching Scheme : L-T-P :3-0-0	**Credi**ts: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: Microwave Engineering introduces the student to RF/microwave systems. Scattering parameters are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are elaborated.

Course Objectives:

1	Understand the basic concept of microwave engineering, and apply EM wave theory to understand the nature of microwave signal.
2	Understand the theoretical and experimental design and analysis of microwave tube devices and circuits
3	Learn the basics of Monolithic Microwave Integrated Circuits (MMIC).
4	Study Microwave semiconductor devices & applications
5	To understand various microwave measurement techniques
6	Expose students to different microwave antennas

Course Outcomes (COs):

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

407.1	Analyze the microwave waveguides and passive circuit components.
407.2	Identify and differentiate the state of art in microwave tubes and their uses in real life
407.3	Identify materials used in MMIC and microwave hazards
407.4	Differentiate solid state devices used in microwave based on their characteristics and operations
407.5	Measure the output power, VSWR, impedance, frequency and wavelength of microwave signal
407.6	Apply the microwave antenna knowledge for industrial and scientific purposes

Prerequisite:	Electromagnetic Engg.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
407.1	2	2	1	1									1	1	L2
407.1	1	1	1	1									1	1	L3

407.2	2	2	1	1									1	1	L2
407.3	2	2	2	2									1	1	L4
407.4	1	1	1	1									2	2	L4
407.5	1	1	2	2									1	1	L4

Content	Hrs
Unit 1: Wave Guides And Microwave Components Rectangular wave guides: TE and TM mode wave, power transmission in wave guide, power losses in wave guide, excitation of modes in wave guide. Microwave cavities, microwave hybrid circuits, directional coupler, Circulators and Isolators, microwave attenuators. (Numerical Expected).	8
Unit 2: Microwave Tubes Microwave linear beam Tubes: Klystrons, Re-entrant Cavities, Velocity-Modulation Process, Bunching Process in Klystrons, reflex klystron, slow wave structures, principle of operation of Helix Traveling-Wave Tubes (TWTs).Microwave Crossed field Tubes: Magnetron Oscillators, Cylindrical Magnetron, Forward and backward wave crossed field amplifier(CFA).	7
Unit 3: Monolithic Microwave Integrated Circuits And Hazards Materials: substrate, conductor dielectric & resistive MMIC growth, thin film formation, hybrid microwave I.C. fabrication, Electromagnetic compatibility, plane wave propagation in shielded rooms, anechoic chambers, microwave clean rooms, microwave hazards.	6
Unit 4: Microwave Solid State Devices Microwave bipolar transistor, microwave FETs, Microwave tunnel diodes, Gunn Effect diodes, RWH Theory, InP diodes, CdTe diodes, IMPATT diodes, PIN diodes, MESFETs and HEMT.	8

Unit 5: Microwave Measurements And Microwave Applications Measurement of microwave power, Measurement of wavelength, Measurement of VSWR, measurements of attenuation, Measurement of impedance, Measurement of S-Parameters.	7
Unit 6: Microwave Antennas Antenna parameters: antenna gain, directivity and beam width, Horn antenna, parabolic reflector with all types of feeding methods, slotted antenna, Lens antenna, Microstrip antennas, Corner reflector. Equations for antenna gain, directivity and beam width of all above antenna types.	6

Text Books:

1. Samuel Liao, “Microwave Devices and Circuit”, Prentice Hall of India
2. Annapurna Das & S K Das, “Microwave Engineering”, Tata Mc-Graw Hill.

Reference Books:

1. K. T. Matthew, “Microwave Engineering”, Wiley India, 2011
2. Shrushut Das, “Microwave Engineering”, Oxford Press.
3. M. Kulkarni, “Microwave and Radar Engineering”, Umesh Publications.
4. G.S.N. Raju, “Antennas and wave propagation”, Pearson Education

Final B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: MEMS Technology (Professional Elective-IV)	
Course Code: 201ETL408	**Semester** : VII
Teaching Scheme : L-T-P :3-0-0	**Credits**: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The aim of the course is to provide students with the knowledge of MEMS Technology. This course also gives emphasis on Micro manufacturing and design of microsystems.

Course Objectives:

408.1	To understand the technologies related to Micro Electro Mechanical Systems.
408.2	To understand design and fabrication processes involved with MEMS Devices.
408.3	To Analyze the MEMS devices and develop suitable mathematical models.
408.4	To identify various application areas for MEMS device.
408.5	To Describe the Micro manufacturing.
408.6	To Analyze the design of microsystems & its relevant constraints.

Course Outcomes (COs):

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

408.1	Describe the technologies related to Micro Electro Mechanical Systems.
408.2	Understand design and fabrication processes involved with MEMS Devices.
408.3	Analyze the MEMS devices and develop suitable mathematical models.
408.4	Identify various application areas for MEMS device.
408.5	Describe the Micro manufacturing.
408.6	Analyze the design of microsystems & its relevant constraints.

Prerequisite:	Sensor Technology

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
408.1	2	2	1	1									1	1	L2
408.2	2	1	2	2									1	2	L2
408.3	2	2	2	1									1	2	L4
408.4	1	1	1	2									1	1	L2
408.5	2	2	2	1											L2
408.6	1	2	2	1											L4

Contents	Hrs
Unit 1 Overview of MEMS and Microsystems: MEMS and Microsystem, Typical MEMS and Microsystem Products, Evolution of Micro fabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets.	6
Unit 2: Working Principles of Microsystems: Introduction, Micro sensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Microfluidics. Engineering Science for Microsystems Design and	11

Fabrication: Introduction, Molecular Theory of Matter and Inter-molecular Forces, doping of semiconductors, the diffusion process, Plasma Physics, Electrochemistry.	
Unit 3: Engineering Mechanics for Microsystems Design: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics, Overview on Finite Element Stress Analysis.	6
Unit 4: Scaling Laws in Miniaturization: Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Electromagnetic Forces, Scaling in Fluid Mechanics, Scaling in Heat Transfer.	5
Unit 5: Overview of Micro manufacturing: Introduction, Bulk Micro manufacturing, Surface Micromachining, The LIGA Process, Summary on Micro manufacturing.	6
Unit 6: Overview of Microsystem Design Introduction, Design considerations & design constraints, process design, design of a silicon die for a micro pressure sensor, general structure of CAD for microsystem product design, design case using CAD	8

Text Books:

1. Tai-Ran Hsu, MEMS and Micro systems: Design and Manufacture, Tata Mcgraw-Hill,Sixth Reprint 2007

Reference Books:

1. Hans H. Gatzen,Volker Saile, JurgLeuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.
2. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cengage Learning.
3. P Rai-Choudhary, MEMS and MOEMS Technology and Applications, PHI Learning Pvt.Ltd. 2012

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: 5G: Technology and System -Lab	
Course Code: 201ETP422	**Semester :** VIII
Teaching Scheme: L-T-P :0-0-2	**Credit:**1
Evaluation Scheme: ISE Marks : 25	**ESE (POE) Marks:** 25

Course Description:

In order to be ready for the 5G challenge, key mobile stakeholders are already preparing the 5G roadmap that encompasses a broad vision and envisages design targets the way towards Gigabit wireless. The research community at large has started to evolve the concept of 5G based on this clear set of widely accepted design targets. Early prominent scenarios are starting to emerge, where industrial stakeholders are proposing disruptive ideas towards shifting the market to their customer base and expertise. The scope of 5G is not only the mobile and wireless pieces, but also includes the wide area coverage network; or in other words, the Internet will also play a pivotal role in the fabric of the 5G technology ecosystem. Understanding the Internet today, its limitations and the way forward will assist us with our interdisciplinary design and place a fence around the 5G mobile system solution space based on the requirements and mechanics of the overlay networks.

Course Objectives:

1	To understand the basics of 5G implementation.
2	To study switch faults in 5G smart phones.
3	To study the spectrums for 5G in different modes.
4	To study the power management section in 5G smart phones

Course Outcomes (COs):

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

422.1	Explain the basic concepts, architecture of 5G enabled smart phones.
422.2	Investigate switch faults in 5G smart phones.
422.3	Compare the spectrums for 5G in different modes.
422.4	Test power management section in 5G smart phones

Prerequisites: Basic knowledge of Communication system.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
422.1	3	1	1	2	2	2						2	3	2	L2
422.2	3	3	3	3	3	3						2	3	3	L6
422.3	3	3	3	3	3	3						2	2	2	L4
422.4	2	3	2	3	2	3						2	2	3	L4

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	Operating 5G smart phone training platform in adaptor mode	S	2
2	Charging the mobile phone battery in battery mode	O	2

3	Operating 5G smart phone training platform in battery mode	O	2
4	Switch faults study in mobile battery and battery charging sections	O	2
5	Study of power management section and voltage measurements	S	2
6	Switch faults study in device control section	O	2
7	Switch faults study in dual SIM interface section	O	2
8	Switch faults study in user interface section	O	2
9	Observing the constellations of I/Q signals of trans-receiver sections	O	2
10	Observing the spectrum of trans-receiver RF carrier signal	O	2
11	Observing the spectrum of Bluetooth RF carrier signal	O	2
12	Observing the spectrum of RF carrier signal in Wi-Fi Mode	O	2
13	Observing the spectrum of RF carrier signal in Hotspot Mode	O	2
14	Switch faults study in RF spectrum analyser section	O	2

S: Study type and O: Operational type

Text Book:

1. Jonathan rodriguez, “Fundamentals of 5G Mobile networks”, Wiley Publication

Reference Books:

1. Afif Osseiran, Jose F. Monserrat, “5G Mobile and Wireless Communications Technology” Cambridge University Press.
2. Andreas Larsson, “5G Technology: Fundamentals of 5G Networks”, Wiley Publication.

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title**: Data Communication & Network -Lab**	
Course Code: 201ETP411	**Semester : VII**
Teaching Scheme : L-T-P :0-0-2	Credit:1
Evaluation Scheme : ISE Marks : **25**	ESE (Oral) Marks : **25**

Course Description:

Data communications and networking may be the fastest growing technologies in industry today. One of the ramifications of that growth is a dramatic increase in the number of professions where an understanding of these technologies is essential for success and a proportionate increase in the number and types of students taking courses to learn about them.

This course will provide hands on knowledge data communications and network implementation.

Course Objectives:

1	To understand the basic concept and devices used in data communication and network.
2	To understand the addressing modes and classes.
3	To implement various algorithms and protocols on different layers such as OSI and TCP/IP.
4	To analyze the different packets and structures.

Course Outcomes (COs):

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

411.1	Demonstrate the different devices and network elements.
411.2	Design & Implementation the addressing classes in networks.
411.3	Implementation of various algorithms and protocols in data communication.

411.4	Investigating various packets using packet analysers.

Prerequisites: Basic knowledge of Communication system.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
1	3	1	1	1	2	2						2	3	2	L3
2	3	2	3	3	3	3						2	3	3	L6
3	3	3	3	3	3	3						2	2	2	L3
4	2	3	2	3	3	3						2	2	3	L6

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	Study of various LAN topologies and implementation using network devices, cables and computers	S	2
2	PC to PC Communication : A) Socket Programming B) Chat Application	O	2
3	Implementation of bit stuffing and character stuffing using NS2	O	2
4	Study, design & implementation of Class A, B, C, D and E IP addressing.	O	2
5	Implementation of Leaky Bucket Algorithm	O	2

6	Implementation of Shortest Path Routing Algorithm	O	2
7	Implementation of Distance Vector Routing Algorithm	O	2
8	Design & Implementation of Sliding window protocol	O	2
9	Study & Implementation of the Address resolution protocol.	O	2
10	Investigating ICMP Packets Using Wireshark	O	2
11	Investigating TCP Packets Using Wireshark	O	2
12	Investigating DNS Packets Using Wireshark	O	2
13	Investigating ARP Packets Using Wireshark	O	2
14	Study & implement HTTP	O	2
15	Study & implement FTP	O	2

S: Study type and O: Operational type

Text Book:

1. B. A. Forouzan, “Data Communication and Networking” 4th edition, Tata Mc-Graw Hill, Publication.
2. Tanenbaum, “Computer Networks”, 4th Edition, Pearson Education

Reference Books:

1. Wayne Tomasi, “Introduction to Data communications and Networking” Pearson.
2. Forouzan, “TCP/IP Protocol Suite”, IIIrd Edition Tata Mc-Graw Hill publication.

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Advanced mobile communication Lab.	
Course Code: 201ETP412	**Semester** : VII
Teaching Scheme : L-T-P :0-0-2	**Credi**t: 1
Evaluation Scheme : ISE Marks : 25	ESE POE: 25

Course Description: The course includes experiments based on Advance mobile communication. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of Advanced mobile communication.

Course Objectives:

1	To introduce the concepts of wireless communication channel & models.
2	To Evaluate the performance of digital modulation techniques
3	Understand techniques to improve the performance of wireless systems using modern tools
4	Understand the working principle of smart antennas & their radiation patterns
5	Understand the MIMO Antennas

Course Outcomes (COs):

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

412.1	Determine Digital modulation Techniques
412.2	Apply the knowledge for wireless communication channels
412.3	Determine characteristics of micro strip devices and measurements of its parameters
412.4	Study of Antennas

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
412.1	2	2			1								2	2	L2
412.2	2	2			1								2	2	L3
412.3	2	2			1								2	2	L3
412.4	2	2			1								2	2	L3

List of Experiments			
Expt. No.	Name of Experiment	Type Hours	Type Hours
1	Study of basics of PSTN Network	S	2
2	Simulation of Loss Call system model of traffic engineering	S	2
3	Perform the process of call connection and call release of cellular Mobile system.	O	2
4	Establish seamless wireless connectivity using multiple access point	O	2
5	Use AT commands to understand working of 3G network using 3G mobile phone Trainer kit.	O	2
6	Simulate Bluetooth voice transmission to observe effect of AWGN and of interference of 802.11b on transmission using MATLAB and simulink	O	2
7	Develop a mobile application for wireless technology using any wizards such as available on www.appypie.com or any other	O	2
8	Study of mobile communication model	S	2
9	Study of mobile network and transport layer	S	2
10	Measurement of system capacity, improving coverage and capacity in cellular systems,	**O**	**2**
11	Study smarts antenna's and their configurations	S	2
12	Study of mimo antennas	S	2
13	Study of dipole antenna radiation pattern (simple dipole and folded dipole antenna)	S	2
14	Study of radiation pattern measurement of parabolic reflector antenna	S	2
15	Study of Diversity Techniques in antenna	S	2

S: indicates Study type

O: Operational type

Text Books:

1. Andrea goldsmith, `Wireless Communication`, South Asia Edition 2015, Cambridge University Press
2. Theodore S. Rappaport, 'Wireless Communications Principles and Practice," Third Edition, Pearson Education. (Indian Edition is available)
3. Ahmed El Zooghby, 'Smart Antenna Engineering', ARTECH HOUSE, INC, 2005.
4. Frank B. Gross, 'Smart antenna with MATLAB', 2nd Edition, McGraw-Hill, 2015

Reference Books:

1. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press
2. Todd K Moon, Wynn C. Stirling" Mathematical Methods and Algorithms for Signal Processing, Prentice Hal
3. Lal Chand Godara , "SMART ANTENNAS" , CRC PR ESS, 2004
4. Shahid Mumtaz, Jonathan Rodriguez, Linglong Dai mmWave Massive MIMO: A Paradigm for 5G

Final B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Project Phase-I	
Course Code: 201ETP413	**Semester** : VII
Teaching Scheme : L-T-P :0-0-6	**Credits**: 3
Evaluation Scheme : ISE Marks : 50	**ESE Marks** : 50

Course Description: The aim of this course is to provide a platform for design & development of a System as per the needs & requirement of a society/Industry. The project phase I work can be a design project / experimental project/ research based and or computer simulation project on Electronics & Telecommunication engineering or any of the topics relevant to the discipline.

Course Objectives:

413.1	To identify a problem related to society, industry, individual & provide a solution.
413.2	To analyse the problem by using basic engineering knowledge and modern Engineering tools.
413.3	To design & develop a system as per the needs of industry, society & individuals.
413.4	To understand professional and ethical responsibilities to work in a peer & multidisciplinary team.
413.5	To develop effective presentation and communication skills.

Course Outcomes (COs):

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

413.1	Identify a problem related to society, industry, individual & provide a solution.
413.2	Analyse the problem by using basic engineering knowledge and modern Engineering tools.

413.3	Design & develop a system as per the needs of industry, society & individuals.
413.4	Understand professional and ethical responsibilities to work in a peer & multidisciplinary team.
413.5	Develop effective presentation and communication skills.

Prerequisite:	Knowledge of Analog & Digital Electronics Design, Microcontrollers, Embedded Systems, Programming etc.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
413.1	3					2	1		1				3	2	L2
413.2	3	3		2	2								1	3	L4
413.3			3			1	1	3	3				2	2	L6
413.4								2	3						L2
413.5										3					L4

The Project work is to be carried by a group of students with a group size of maximum 5 students. The student's groups are required to undertake the Project Phase-I during the seventh semester and the same is continued in the eighth semester (Phase-II). Project Phase-I consists of reviews and implementation of the design work carried earlier, design methodology, circuit /schematic design/layout of a system and the submission of Project Phase-I report & Project diary. Report should highlight scope, objectives, methodology, approach and modern tools to be used like software and others, outline of project and expected results and outcome along with timeframe.

The project phase I work is to be extended for project phase II at B. Tech. (E & TC) Sem. VIII with same group working under guidance of same Faculty member assigned for project phase I.

Project Phase I documentation:

The work under Project Phase-I submitted by students shall include

1. Work Diary: Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project group for
    a. Searching suitable project work
    b. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring up the project.
    c. Day to day activities carried out related to project work for entire semester.
    d. Synopsis.

2. The group should submit the synopsis in the prescribed format containing the following.
    i. Title of Project
    ii. Names of Students
    iii. Name of Guide

iv. Relevance

v. Literature Review

vi. Proposed work

vii. Expenditure

viii. References

3. The synopsis shall be signed by each student in the group, approved by the guide and endorsed by the Head of the Department

4. Seminar/Presentation: The group has to deliver a Seminar/presentation in front of the DRC members of department during & at the end of each semester.

Important Notes:

1. Project group should continue maintaining a Project diary and should write about (a) Book referred (b) Company visited (c) Person contacted (d) Computer work done (e) Paper referred (f) Creative thinking.
2. The Diary along with Project Phase I Report shall be assessed at the time of ESE Oral examination.
3. One copy of the report should be submitted to Institute/ Department, One copy to Guide and one copy should be maintained by each student of the project group.

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: 5G: Technology and System	
Course Code: 201ETL415	**Semester :** VIII
Teaching Scheme: L-T-P :3-0-0	**Credits:** 3
Evaluation Scheme : ISE + MSE Marks: 20 + 30	ESE Marks : 50

Course Description:

In order to be ready for the 5G challenge, key mobile stakeholders are already preparing the 5G roadmap that encompasses a broad vision and envisages design targets the way towards Gigabit wireless. The research community at large has started to evolve the concept of 5G based on this clear set of widely accepted design targets. Early prominent scenarios are starting to emerge, where industrial stakeholders are proposing disruptive ideas towards shifting the market to their customer base and expertise. The scope of 5G is not only the mobile and wireless pieces, but also includes the wide area coverage network; or in other words, the Internet will also play a pivotal role in the fabric of the 5G technology ecosystem. Understanding the Internet today, its limitations and the way forward will assist us with our interdisciplinary design and place a fence around the 5G mobile system solution space based on the requirements and mechanics of the overlay networks.

Course Objectives:

1	To understand the basics of 5G technology.
2	To understand the various aspects of 5G small cells and clouds.
3	To study the concepts of Cognitive Radio for 5G.
4	To study the security and SON evolution in 5G.

Course Outcomes (COs):

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

415.1	Explain the basic concepts, architecture and quality of services of 5G.
415.2	Implement the 5G in Internet of Things.
415.3	Apply the concepts of Cognitive Radio for 5G.
415.4	Understand and apply the concepts of Security and SON in 5G.

Prerequisites: Basic knowledge of Communication system, 2G, 3G, & 4G.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	PSO1	PSO2	BTL
415.1	3	2	1	2		1						2	2	2	L2
415.2	3	2	3	2	1	2						2	3	3	L3
415.3	3	2	3	2	1	2						2	2	2	L3
415.4	2	2	2	2		2						2	2	2	L3

Content	Hrs.
UNIT 1.– Drivers For 5G Introduction, Historical Trend of Wireless Communications, 5G Architecture, Internet of Things and Context-Awareness, Mobility, Quality of Service Control.	7
UNIT 2. - Small Cells For 5g Mobile Networks Small Cells concept, Capacity Limits and Achievable Gains with Densification, Mobile Data Demand, Demand vs Capacity, Small-Cell Challenges.	7
UNIT 3. – Mobile Clouds Introduction, Mobile Cloud: User Resources, Software Resources, Hardware Resources, Networking Resources, Mobile Cloud Enablers: Mobile User Domain, Wireless Technologies, Software and Middleware, Network Coding	7
UNIT 4. – Cognitive Radio For 5g Wireless Networks Overview of Cognitive Radio Technology in 5G Wireless, Spectrum Optimization using Cognitive Radio, Cognitive Radio and Carrier Aggregation, Energy-Efficient Cognitive Radio Technology, Challenges for 5G Cognitive Terminals.	7
UNIT 5. - Security For 5g Communications Introduction, Overview of a Potential 5G Communications, System Architecture, Security Issues and Challenges in 5G Communications Systems, User Equipment, Access Networks, Mobile Operator's Core Network, External IP Networks	7
UNIT 6. – Son Evolution For 5g Mobile Networks Introduction, SON in UMTS and LTE, The Need for SON in 5G, Evolution towards Small-Cell Dominant HetNets, Towards a New SON Architecture for 5G.	7

Text Book:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile networks", Wiley Publication

Reference Books:

1. Afif Osseiran, Jose F. Monserrat, "5G Mobile and Wireless Communications Technology" Cambridge University Press.
2. Andreas Larsson, "5G Technology: Fundamentals of 5G Networks", Wiley Publication.

Final Year B.Tech Curriculum

w.e.f. 2023-2024

Course Title: Machine Learning (Professional Elective V)	
Course Code: 201ETL 416	**Semester** : VIII
Teaching Scheme : L-T-P :3-0-0	**Credi**t: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description:

This course is an introduction to the theoretical aspects of the design of algorithms that enable machines to "learn" from examples. This course will provide students an in-depth knowledge to the areas of Supervised and introduction of Unsupervised Machine Learning. The course will cover core Machine Learning algorithms for classification, regression and clustering.

Course Objectives:

Course Objectives:

1	Understand fundamentals Machine Learning.
2	To apply the knowledge of statatics & algebra
3	To analyse implementation of Machine Learning algorithms

Course Outcomes (COs):

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

416.1	Understand the paradigms of supervised and unsupervised machine learning
416.2	Identify the differences of multiple machine learning algorithms.
416.3	Understand a task as a machine learning problem.

416.4	Apply suitable algorithms to tackle different machine learning problems.

Prerequisite:	Linear Algebra, Statistics, Probability Theory

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
416.1	1	2	1										1	1	L2
416.2	1	2	2	2	1								1	1	L3
416.3	2	2	2	2	2								1	1	L3
416.4	2	2	2	2	2								1	1	L3

Content	Hrs
Unit 1: Introduction to Machine Learning What is machine learning (ML), Applications, Supervised ML, Unsupervised ML, Reinforcement Learning	6
Unit 2: Data Preprocessing Overview. Under fitting, Over fitting, Data Cleaning, Data Integration, Data Transformation, Dimensionality Reduction	6

Unit 3: Regression Hypothesis, cost function, parameter learning with gradient descent, learning rate, Gradient Descent for linear regression & Logistic Regression	9
Unit 4: Bayesian Learning Introduction Bayes theorem, Naïve Bayes Classifier, Bayesian belief Networks, Hidden Markov Model, Issues in Hidden Markov Model	7
Unit 5: Decision trees and SVM Definition, terminology, the need, advantages, and limitations. Constructing and understanding Decision trees, common problems with Decision trees, Decision tree algorithms, random forest, Introduction to Support Vector Machines, Linear Support Vector Machines	7
Unit 6: Clustering and Text Mining: Introduction to Clustering, Types of Clustering, Partitioning Methods of Clustering, Hierarchical Methods.	7

Text Books:

1. Machine Learning, Anuradha Srinivasaraghavan, and Vincy Joseph, Kindle Edition, 2020, WILEY.
2. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, 2010, Prentice Hall of India.
3. Practical Machine Learning Sunila Gollapudi Packt Publishing Ltd

Reference Books:

1. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw Hill Education

Online Resources:

1. https://www.coursera.org/learn/machine-learning
2. https://nptel.ac.in/courses/106106139

Final year. B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Cyber Security (Professional Elective V)	
Course Code: 201ETL417	**Semester** : VIII
Teaching Scheme : L-T-P :3-0-0	**Credi**t: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: Cyber security is the practice of protecting networks, systems, and programs from digital attacks. These attacks are usually aimed at accessing, changing, or destroying sensitive information, extorting money from users, or interrupting normal business processes. Cyber security technology is used to protect networks, systems, and programs from these digital attacks..

Course Objectives:

1	To gain knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks.
2	To examine secure software development practice.
3	To understand key terms and concepts in cyber laws and acts
4	To incorporate approaches for incident analysis and response

Course Outcomes (COs):

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

417.1	Explain the cyber security concepts
417.2	Describe the cyber security vulnerabilities and prevention techniques
417.3	Explain the different rules and regulations in cyber laws and acts
417.4	Explain the concepts of digital forensics & incident management

Prerequisite	Data Communication & Networking, Information Security

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
417.1	2	2	1	1									1	1	L2
417.2	1	1	1	1									1	1	L3
417.3	2	2	1	1							2		1	1	L2
417.4	2	2	2	2			2			2	-	2	1	1	L4

Content	Hrs
Unit 1 : Computer and Network Security Introduction to Computer Security - Introduction, How Seriously Should You Take Threats to Network Security?, Identifying Types of Threats, Basic Security Terminology, Concepts and Approaches, Online Security Resources Networks and the Internet : Introduction, Network Basics, How the Internet Works, Basic Network Utilities , Advanced Network Communications Topics	9
Unit 2 : Cyber Frauds, DoS, Viruses Cyber Stalking, Fraud, and Abuse: Introduction, How Internet Fraud Works, Identity Theft, Cyber Stalking, Protecting Yourself Against Cyber Crime. Denial of Service Attacks: Introduction, DoS, Illustrating an Attack, Malware: Introduction, Viruses, Trojan Horses, The Buffer-Overflow Attack.The Sasser Virus/Buffer Overflow, Spyware, Other Forms of Malware, Detecting and Eliminating Viruses and Spyware	8
Unit 3: Techniques Used by Hackers Introduction, Basic Terminology, The Reconnaissance Phase, Actual Attacks, Malware Creation, Penetration Testing	5
Unit 4 Computer Security Technology Introduction, Virus Scanners, Firewalls, Antispyware, IDS, Digital Certificates, SSL/TLS, Virtual Private Networks, Wi-Fi Security,	7
Unit 5 : cyber laws and acts Laws and Ethic ,digital Evidence controls ,Evidence handling procedures, Basics of indian Evidence ACT IPC and CrPC ,Electronics communication privacy ACT-Legal policies	6
Unit 6 : Introduction to Forensics Introduction, General Guidelines, Finding Evidence on the PC, Finding Evidence in System Logs , Getting Back Deleted Files, Operating System Utilities, Operating System Utilities, Mobile Forensics: Cell Phone Concepts	7

Text Books:

Computer Security Fundamentals - Chuck Easttom , Pearson ,third Edition

Reference Books:

1. Jason Luttgens, Matthew Pepe, Kevin Mandia, Incident Response & Computer Forensics, McGrawHill Osborne Media, 3 rd edition , 2014.
2. Keith J. Jones, Richard Bejtlich, Curtis W. Rose, Real Digital Forensics: Computer Security and Incident Response, Paperback – Import, 2005.
3. John Sammons, The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics Paperback, February 24, 2012.
4. Hacking Exposed: Network Security Secrets & Solutions, Stuart McClure, Joel Scambray and George Kurtz, McGraw-Hill, 2005.
5. Network intrusion alert: an ethical hacking guide to intrusion detection, Ankit Fadia, Manu Zacharia, Thomson Course Technology PTR, 2007.
6. Hacking Exposed: Network Security Secrets & Solutions, Stuart McClure, Joel Scambray and George Kurtz, McGraw-Hill, 2005.

Final B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Nanoelectronics (Professional Elective V)	
Course Code: 201ETL418	**Semester** : VIII
Teaching Scheme : L-T-P :3-0-0	**Credi**t: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of Nano electronics. The course includes Introduction to nanotechnology, development milestones in micro fabrication industry and the characterization of nanostructures in nanoelectonic devices.

Course Objectives:

1	To introduce the concepts of Nano electronics..
2	To apply the knowledge of Fabrication techniques
3	Understand characterization of nanostructures
4	Understand Inorganic semiconductor nanostructures.
5	Evaluate Nanostructures Transportation of charge.
6	Evaluate Nano electronic for various devices

Course Outcomes (COs):

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

418.1	Understand the quantum nanostructures, such as quantum dots, nanowires and quantum wells and their density of states.
418.2	Understand various deposition techniques at the atomic and molecular level.
418.3	Apply various techniques for characterization to Learn advanced optical and

	magnetic characterization techniques
418.4	Understand inorganic semiconductor nanostructures with MOSFET
418.5	Understand the concepts of Nano electronics such as ballistic transport and quantum confinement.
418.6	Analyze various nanostructures and its applications towards Quantum Electronic Devices.

Prerequisite:	Solid State Devices, Physics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
418.1	2	2	1	2	1								1	1	L2
418.2	2	1	1	2	1								1	1	L2
418.3	2	2	2	2	1								1	1	L3
418.4	2	2	2	2	2								1	1	L2
418.5	1	1	1	1	1								2	2	L2
418.6	1	1	1	1	1								1	1	L4

Content	Hrs
Unit 1: INTRODUCTION TO NANOTECHNOLOGY Introduction to nanotechnology, Impacts, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics. Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence, Schrodinger's Equation, wave function ,Low dimensional structures Quantum wells, wires and dots, Density of states and dimensionality , Basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, Quantum wires and quantum dots, carbon nano tube, graphene	8
Unit 2: FABRICATION TECHNIQUES Introduction to methods of fabrication of nano-layers, different approaches, physical vapour deposition, chemical vapour deposition Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide- dry and wet oxidation methods. Fabrication of nano particle- grinding with iron balls, laser ablation, reduction methods, sol gel, self assembly, precipitation of quantum dots.	8
Unit 3: characterization of nanostructures Introduction to characterization of nanostructures, tools used for of Nano materials characterization, microscope-optical, electron, and electron microscope. Principle of operation of Scanning Tunnelling Microscope, Atomic Force Microscope, Scanning Electron microscope, Specimen interaction. Transmission Electron Microscope X-Ray Diffraction analysis, PL & UV Spectroscopy, Particle size analyser	7
Unit 4: Inorganic semiconductor nanostructures MOSFET structures, Heterojunctions Quantum wells, modulation doped quantum wells, multiple quantum wells The concept of super lattices Kronig - Penney	5

model of super lattice	
Unit 5: Nanostructures Transportation of charge Transport of charge in Nanostructures under Electric field - parallel transport, hot electrons, perpendicular transport. 2 Quantum transport in nanostructures, Coulomb blockade 20 2 Transport of charge in magnetic field - Effect of magnetic field on a crystal. Aharonov-Bohm effect, the Shubnikov-de Hass effect, the quantum Hall effect..	7
Unit 6: Nanoelectonic devices Nanoelectonic devices - MODFETS, heterojunction bipolar transistors Resonant tunnel effect, RTD, RTT, Hot electron transistors , Coulomb blockade effect and single electron transistor, CNT transistors Heterostructure semiconductor laser Quantum well laser, quantum dot LED, quantum dot laser Quantum well optical modulator, quantum well sub band photo detectors, principle of NEMS	7

Text Books:

1. J.M. Martinez-Duart, R.J. Martin Palma, F. Agulle Rueda Nanotechnology for Microelectronics and optoelectronics , Elsevier, 2006
2. W.R. Fahrner, Nanotechnology and Nanoelctronics, Springer, 2005

Reference Books:

1. Nanoelectronics & Nanosystems: From Transistor to Molecular & Quantum Devices: Karl Goser, JanDienstuhl and others.
2. Nano Electronics and Information Technology: Rainer Waser
3. Chattopadhyay, Banerjee, Introduction to Nanoscience & Technology, PHI 2012
4. Poole, Introduction to Nanotechnology, John Wiley 2006.
5. George W. Hanson, Fundamentals of Nanoelectronics, Pearson Education, 2009.
6. K. Goser, P. Glosekotter, J. Dienstuhl, Nanoelectronics and nanosystems, Springer 2004.
7. Murty, Shankar, Text book of Nanoscience and Nanotechnology, Universities Press,2012.

Final Year B.Tech Curriculum

w.e.f. 2023-2024

Course Title: Deep Learning (Professional Elective VI)	
Course Code: 201ETL419	**Semester** : VIII
Teaching Scheme : L-T-P :3-0-0	**Credi**t: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: This course aims to present the core fundamentals behind the much talked about field of Deep Learning. This course elaborates the topics of deep learning such as, basics of neural networks, Artificial Neural Network, Convolutional Neural Network & Recurrent Neural Network etc.

Course Objectives:

1	To introduce the fundamentals of deep learning.
2	To analyse different models of deep learning to work with various types of inputs.
3	To learn architectures and optimization methods for deep neural network training

Course Outcomes (COs):

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

419.1	Understand the fundamentals of neural networks.
419.2	Apply optimization techniques for deep neural network training.
419.3	Apply attention mechanism to the neural network.
419.4	Critically evaluate the method's applicability in new contexts and construct new applications.

Prerequisite:	Statistics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
419.1	2	2	1	1	1								1	1	L2
419.2	2	1	1	1	1								1	1	L3
419.3	2	2	1	1	1								1	1	L2
419.4	2	2	2	2	2								1	1	L4

Content	Hours
Unit 1: Introduction Biological Neuron, Idea of computational units, McCulloch–Pitts unit History of Deep Learning, Deep learning workflow, Learning types McCulloch Pitts Neuron.	7
Unit 2: Activation functions and parameters Introduction to neural network and multilayer perceptrons (MLPs) , representation power of MLPs, sigmoid neurons, gradient descent, feed forward neural networks representation, Back propagation.	7
Unit 3: Convolutional Neural Networks Deep learning techniques, The convolutional operation, The max pooling operation, Training a convnet from scratch on a small dataset, Using pre-trained convnet, Visualizing what convnet learn.	7

Unit 4: Recurrent Neural Networks Introduction to RCNN, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs, Encoder Decoder Models, Attention Mechanism.	7
Unit 5: Optimization and Generalization Optimization in Deep Learning-Non –convex optimization for deep networks-stochastic optimization Generalization in neural networks -spatial transformer networks-recurrent networks, LSTM-recurrent neural network language models-world-level RNNs & deep Reinforcement learning-computational & artificial neuroscience.	7
Unit 6: Case Study Emotion Recognition using human face and body language, Natural Language Processing, Speech recognition.	7

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning, the MIT press, 2016.
2. Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now Publishers, 2009

Reference Books:

1. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi 2020.
2. Andrew Appel, Modern Compiler Implementation in C: Basic Techniques, Cambridge University Press, 1997.

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Internet of Things (Professional Elective-VI)	
Course Code: 201ETL420	**Semester** : VIII
Teaching Scheme : L-T-P :3-0-0	**Credit**: 3
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks** : 50

Course Description: The Internet is evolving to connect people to physical things and also physical things to other physical things all in real time. It‟s becoming the Internet of Things (IoT). The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied

Course Objectives:

1	To study fundamental concepts of IoT
2	To understand roles of sensors in IoT
3	To Learn different protocols used for IoT design
4	To be familiar with data handling and analytics tools in IoT

Course Outcomes (COs):

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

420.1	Understand the various concepts, terminologies and architecture of IoT systems
420.2	Use sensors and actuators for design of IoT.
420.3	Understand and apply various protocols for design of IoT systems
420.4	Use various techniques of data storage and analytics in IoT
420.5	Understand various applications of IoT

Prerequisite:	Microprocessor Hardware, Microcontroller

Content	Hrs
Unit 1: : FUNDAMENTALS OF IOT Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M	7
Unit 2: SENSORS NETWORKS Definition, Types of Sensors, Types of Actuators, Examples and Working, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	7
Unit 3: WIRELESS TECHNOLOGIES FOR IOT IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus	7
Unit 4: IP BASED PROTOCOLS FOR IOT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT	7
Unit 5: WEB OF THINGS Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.	7
Unit 6: APPLICATIONS OF IOT Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, IoT design Ethics, IoT in Environmental Protection.	7

Text Books:

1. 1.Hakima Chaouchi, ― The Internet of Things Connecting Objects to the Web‖ ISBN :978-1-84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, The Internet of Things: KeyApplications and Protocols‖, WileyPublications

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on-Approach)‖, 1st Edition,VPT, 2014.
2. Daniel Minoli, ―Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications‖, ISBN: 978-1-118-47347-4, Willy Publications
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

Final Year B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Consumer Electronics	
Course Code: 201ETL421	**Semester**: VIII
Teaching Scheme: L-T-P :3-0-0	**Credi**ts: 3
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks**: 50

Course Description: In developing nations demand of consumer electronic appliances is increasing day by day. This requires large number of technically trained man power in relevant industries. Looking towards the need of the country, in-depth knowledge for maintaining various electronics audio-video systems and home appliances is necessary for engineering students. This subject will introduce the students with working principles, block diagram and advance features of consumer electronics appliances like audio-video systems, microwave oven, washing machine, air-conditioner etc. which in-turn will develop skills to diagnosis fault and rectification of that in systematic way. Knowledge so gained would also help in working in production units of these consumer gadgets. Students may also start their own production units and may engage in fruitful self-employment.

Course Objectives:

1	To understand electronics engineering concepts used in consumer electronics systems
2	To identify the need of preventive maintenance in various electronic appliances
3	To use different product safety, compliance standards and techniques associated with electronic products
4	To evaluate and analyse different electronic products and systems based on

	specifications
5	To manage multi-faceted and multi-disciplinary projects with significant technical considerations using a broad systems perspective
6	To foster a desire to continue life-long learning.

Course Outcomes (COs):

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

421.1	Understand electronics engineering concepts used in consumer electronics systems
421.2	Identify the need of preventive maintenance in various electronic appliances
421.3	Use different product safety, compliance standards and techniques associated with electronicproducts
421.4	Evaluate and analyze different electronic products and systems based on specifications
421.5	Manage multi-faceted and multi-disciplinary projects with significant technical considerations using a broad systems perspective
421.6	Foster a desire to continue life-long learning.

Prerequisite:	Analog and Digital Electronics and programming subjects

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
421.1		2											2		L2
421.2						3							1		L2
421.3			1					2							L3
421.4		3													L4
421.5											2				L4
421.6												3			L5

Content	Hrs
Unit 1: Audio System Microphones, loudspeakers baffle and enclosure, Acoustics, mono, stereo, Quad, Amplifying System, Equalizers and Mixers Synthesizers, Commercial Sound, Theater Sound System.	8
Unit 2: Video Systems and Displays Video Systems and Displays: Monochrome, Colour TV standards, TFT, Plasma, HDTV, LCD, LED TV, Direct-To- Home (DTH- Set Top Box), Video Telephone and Video Conferencing	7
Unit 3: Domestic Appliances: Washing machines, Microwave ovens, Air-conditioners and Refrigerators, Telephone & Mobile Radio System.	7

Unit 4 :Consumer Appliances: Telephone & Mobile Radio System. Automated Teller Machines (ATMS), Bar codes, RFID.	7
Unit 5: Power supplies Power Supplies SMPS/UPS and Preventive Maintenance	6
Unit 6: Product Compliance Product safety and liability issues; standards related to electrical safety and fire hazards, EMI/EMC requirements, design techniques for ESD, RF interference and immunity, line current harmonics and mains voltage surge.	7

TEXT BOOKS:

1. Consumer Electronics; SP Bali; Pearson Education.

2. Consumer Electronics; J.S. Chitode; Technical Publications, Pune.

Final B. Tech. Curriculum

w.e.f. 2023-2024

Course Title: Project Phase-II	
Course Code: 201ETP422	**Semester** : VIII
Teaching Scheme : L-T-P :0-0-6	**Credi**t: 3
Evaluation Scheme : ISE Marks : 150	**ESE POE Marks**: 150

Course Description: The aim of this course is to provide a platform for design & development of a System as per the needs & requirement of a society/Industry. The project phase II work shall be based on hardware testing and software simulation/ testing of a module or a system designed.

Course Objectives:

1	Analyse a problem related to society, industry, individual & provide a solution.
2	Design & develop the system by using modern Engineering tools.
3	Design & develop a system as per the needs of industry, society & individuals.
4	Understand professional and ethical responsibilities to work in a peer & multidisciplinary team.
5	To develop effective presentation and communication skills.

Course Outcomes (COs):

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

422.1	Analyze a problem related to society, industry, individual & provide a solution.
422.2	Design & develop a system by using modern Engineering tools.
422.3	Design & develop a system as per the needs of industry, society & individuals.
422.4	Understand professional and ethical responsibilities to work in a peer & multidisciplinary team.

422.5	Develop effective presentation and communication skills.

Prerequisite:	Knowledge of Basic Engineering courses & relevant courses in Electronics & Telecommunication Engineering.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
422.1	3			2		2	1		1				3	2	L4
422.2	2	2	3	2	3								1	3	L6
422.3			3			2	1	3	3				2	2	L6
422.4								2	3						L2
422.5										3					L6

The project phase I work is to be extended for project phase II with same group working under guidance of same Faculty member assigned for project phase I. Each project group will complete the project in all respect (simulation, assembly, testing, fabrication, tabulation, Experimental/test results, and documentation etc). Hardcopy of project diary, maintained group wise in Sem-I to be continued in Sem-II, where the report of every weekly activity should be written & which should be presented at the time of ISE & ESE examination. The project work along with project report should be submitted as part of Semester II evaluation on or before the last day of the semester -II. The ISE evaluation of Project Phase -II work will be carried by a

group of DRC members as decided by DRC Coordinator and HoD. The Project guide will evaluate the Project work based on the Rubrics formulated and provided by the department. The Project Report should highlight abstract, scope, objectives, methodology, approach and modern hardware & software tools being used, outline of project and expected results and outcome.

Project Phase II documentation:

The work under Project Phase-II submitted by students shall include

1. Work Diary: Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project group for

a. Successful completion of project work

b. Brief report preferably on preparation of journal/or conference research papers.

c. Day to day activities carried out related to project work for entire semester.

2. Seminar/Presentation: The group must deliver a Seminar/presentation in front of the DRC members of department during & at the end of the semester as a part of ISE evaluation.

3. Final Project report by following all the guidelines provided by department.

Important Notes:

• Project group should continue maintaining a Project diary and should write about technical details about work done relevant to Project such as . (a) design work (b) Simulation work (c) hardware & software testing (d) Company visited and the details of work done, in case of industry sponsored projects (d) Computer work done (e) Paper referred (f) Creative thinking etc.

• The Diary along with Project Phase II Report shall be assessed at the time of ESE examination of Sem-VIII.

• One copy of the Project report should be submitted to Institute/ Department, One copy

to Guide and one copy should be maintained by each student of the project group.

• The project groups shall use the template of Project Report provided by the department and follow the necessary guidelines/ instructions given by guide/DRC.

• The students should refer the rubrics of project work prepared & circulated by department so as to understand the scoring/ marking methodology.