DEPARTMENT OF TECHNOLOGY
FINAL YEAR B.TECH
Scheme of Teaching and Examination
Semester – VII (Electronics & Telecommunication Engineering)

Course code	Course	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credit	Scheme	Max. marks	Min. Passing$	Scheme	Max. marks	Min. Passing
ETE411	Digital Image Processing	3	-	-	3	CIE	30	40	--------	------	--------
						SEE	70		--------	------	--------
ETE412	ARM & Embedded systems	3	-	-	3	CIE	30	40	--------	------	--------
						SEE	70		--------	------	--------
ETE413	Microwave Engineering	3	-	-	3	CIE	30	40	--------	------	--------
						SEE	70		--------	------	--------
ETE414	Program Elective-I	3	-	-	3	CIE	30	40	--------	------	--------
						SEE	70		--------	------	--------
ETE415	Open Elective-I	3	-	-	3	CIE	30	40	--------	------	--------
						SEE	70		--------	------	--------
ETE416L	Major project (Phase-I)	-	-	2	4	--------	-------	--------	IPE	50	20
ETE411L	Digital Image Processing Laboratory	-	-	2	1	--------	-------	--------	EPE	50	20
ETE412L	ARM & Embedded systems Laboratory	-	-	2	1	--------	-------	--------	EPE	50	20
ETE413L	Microwave Engineering Laboratory	-	-	2	1	--------	-------	--------	EOE	50	20
ETE414L	Program Elective-I Laboratory	-	-	2	1	--------	-------	--------	IPE	50	20
ETE417	Internship-II	-	--	-	02	--------	-------	--------	IOE	50	20
	Total	**15**	**00**	**10**	**25**	--------	**500**	--------	--------	**300**	--------

Audit Course III

HS411	Professional Ethics	02	---	---	----	Evaluation at institute/ department level	Based on total marks obtained out of 50, the grade to be given by the course auditor (teacher)

Total contact hours per week: 25+02=27

$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE.

CIE: Continuous Internal Evaluation SEE : Semester End Examination

IPE : Internal Practical Evaluation IOE : Internal Oral Evaluation
EPE : External Practical Evaluation EOE : External Oral Evaluation
Note : Tutorials and Practical shall be conducted in batches with batch strength not exceeding 18 students.

DEPARTMENT OF TECHNOLOGY
FINAL YEAR B.TECH
Scheme of Teaching and Examination
Semester – VIII (Electronics & Telecommunication Engineering)

Course code	Course	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Total	Scheme	Max. marks	Min. Passing $	Scheme	Max. marks	Min. Passing
ETE421	Digital Television & Multimedia	3	-	-	3	CIE	30	40	--------	-------	--------
						SEE	70		--------	-------	--------
ETE422	Operating systems	3	-	-	3	CIE	30	40	--------	-------	--------
						SEE	70		--------	-------	--------
ETE423	Optical Fiber Communication	3	-	-	3	CIE	30	40	--------	-------	--------
						SEE	70		--------	-------	--------
ETE424	Program Elective-II	3	-	-	3	CIE	30	40	--------	-------	--------
						SEE	70		--------	-------	--------
ETE425	Open Elective-II	3	-	-	3	CIE	30	40	--------	-------	--------
						SEE	70		--------	-------	---------
ETE426	Major Project (Phase-II)	-	-	2	4	--------	-------	--------	EPE	50	20
ETE421L	Digital Television & Multimedia Laboratory	-	-	2	1	--------	-------	--------	EPE	50	20
ETE422L	Operating systems tutorial	-	1	-	1	--------	-------	--------	IOE	50	20
ETE423L	Optical Fiber Communication Laboratory	-	-	2	1	--------	-------	--------	EOE	50	20
ETE424L	Program Elective-II Laboratory	-	-	2	1	-------	-------	--------	IOE	50	20
ETE427	Financial Management	2	-	-	2	-------	-------	-------	IOE	50	20
	Total	**17**	**01**	**08**	**25**	--------	**500**	--------	--------	**300**	--------

Audit Course IV

HS421	Introduction to Indian Constitution	02	---	---	----	Evaluation at institute/ department level	Based on total marks obtained out of 50,the grade to be given by the course auditor

Total contact hours per week: 26+02=28

$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE.

CIE	: Continuous Internal Evaluation	SEE	: Semester End Examination
IPE	: Internal Practical Evaluation	IOE	: Internal Oral Evaluation
EPE	: External Practical Evaluation	EOE	: External Oral Evaluation

Note : Tutorials and Practical shall be conducted in batches with batch strength not exceeding 18 students.

Note: After semester VI, during vacation period, students will undergo Internship II for minimum 4 weeks in a reputed industry from standpoint of electronics engineering principles. The students will submit a report of the training. This particular activity is equivalent to one credit and it carries 50 marks as an Internal Oral Evaluation (IOE) which is included in Semester VII.

For submission of the activity report, all the students will follow one specific format recommended by the Program Advisory Board.

Equivalence of Final Year B.Tech (Electronics & Telecommunication Engineering) Semester VII and VIII

The above detailed syllabus is a revised version of the Final Year B.Tech (Electronics & Telecommunication Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2023. (Academic year 2023-24)

The Equivalence for the courses/courses of Electronics and Communication Technology at Final Year B Tech Semester VII and VIII pre-revised Program under the faculty of Engineering and Technology is as follows.

Final Year B.Tech Semester VII (Electronics and Communication Technology)

Sr.No	Final YearB.Tech(Electronics and Communication Technology) Semester VII Pre-revised syllabus	Final YearB.Tech (Electronics & Telecommunication Engineering) Semester VII Revised syllabus	Remark
1.	Audio and Video Engineering	No equivalence for semester 7	Course shifted to semester 8
2.	Industrial and Power Electronics	No equivalence for semester 7	Title changed and course shifted to semester 5
3.	Microwave Engineering	Microwave Engineering	Syllabus changed
4.			Course removed
5.	Elective-I (Internet of Things added)	No equivalence for semester 7	Changed to Program Elective-I
6.	Major Project (phase-I)	Major Project (phase-I)	Syllabus Changed
7.	Professional Ethics	Professional Ethics	No Change
8.	Internship-II	Internship-II	No Change
9.		Digital Image Processing	New compulsory course added
10.		Wireless Networks	New compulsory course added

11.		Program Elective-I	New course added
12.		Open Elective- I	New course added

Final Year B.Tech Semester VIII (Electronics & Telecommunication Engineering)

Sr.No	Final YearB. Tech(Electronics and Communication Technology) Semester VIII Pre-revised syllabus	Final Year B. Tech(Electronics & Telecommunication Engineering)Semester VIII Revised syllabus	Remark
1.	Broadband Communication	No equivalence for semester 8	Course removed
2.		Audio and video engineering	Course shifted from semester 7
3.		Operating systems	Course shifted from semester 6
4.	Elective-II	Program elective-II	New title program elective-II added and courses changed
5.	Major Project (Phase-II)		No Change
6.	Optical fiber communication	Optical Fiber Communication	Syllabus changed
7.	Wireless Networks	No equivalence	Course shifted to semester 7
8.	Satellite and Radar Communication	Satellite and Radar Communication	Course included in Program elective-II
9.	Constitution of India		No change
10.		Open elective-II	New course added
11.		Finance Management	New course added
12.			

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

LIST OF ELECTIVES

Sr. No.	Program Elective-I
1	Wireless Networks
2	PLC and automation
3	RF Circuit Design

Sr. No.	Open Elective-I
1	Internet of Things
2	Micro Electro Mechanical Systems
3	Remote Sensing & GIS
4	Software Defined Radio

Sr. No.	Program Elective-II
1	Satellite & Radar Engineering
2	Speech and Audio Processing

3	Wireless Sensor Networks

Sr. No.	**Open Elective-II**
1	Automotive Electronics
2	Robotics
3	Artificial Intelligence

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics and Telecommunication Engineering) Part IV, Semester VI**					
Course Title	**:**	**Digital Image Processing**			***Course Code*:**	**:**	**ETE411**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Practical :	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	Set and Information Theory, Signals and Transforms.					
Course Domain	**:**	Program Core					

Course Rationale: Digital image processing deals with the processing of Digitized images. In the image processing there are two major categories of processing, the first is enhancing the quality of the image so that the image will have a better visualized by human being. The other applications are associated with detecting and extracting information by machine may be to assist the human decisions. In this course we will introduce various image processing techniques, algorithms and their applications for improvement in visual quality of the image. Also curriculum includes introduction to the segmentation and object representation.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain the basics of image formation and acquisition.	**1.**	Elaborate Gray and color image representation techniques.
2.	Explain color and gray image representation technique with their inter-conversion.	**2.**	Apply image enhancement algorithms to digital image.
3.	Describe image enhancement algorithms	**3.**	Apply various morphological image processing algorithms on Digital Image
4.	Explain different morphological image processing algorithms.	**4.**	Apply image compression technique on digital image.
5.	Explain different image compression Algorithms	**5.**	Apply different segmentation algorithms on digital Image.
6.	Explain image representation and segmentation algorithms.	**6.**	Obtain representation of objects in given image using boundary and surface-based methods.

Curriculum Content	**Hours**
UNI I-Digital Image Fundamentals Introduction, Image acquisition, Fundamental steps in digital image processing, pixels. Image sampling and quantization, Two-dimensional sampling theory,	04

reconstruction of images from its samples, Practical limits in sampling reconstruction. Image quantization.	
UNIT II-Image Enhancement Image enhancement: Point operations, contrast stretching, clipping and thresholding, negative image, intensity level slicing, bit plane Slicing. Histogram modeling, histogram equalization, modification. Spatial operations, sharpening and smoothing techniques. Frequency domain image enhancement.	08
UNIT III- Color Image Color Image representation, Chromaticity, RGB color model, HIS color model, CYM Color Model, CYMK Color Model. Inter-conversion of color models. Color image enhancement.	04
Unit IV-Morphological Image Processing Introduction, Dilation and erosion**,** opening and closing, hit or miss transformation, morphological algorithms, Region filling, boundary extraction, skeletonization, convex Hall.	05
Unit V-Image Compression Image Compression Fundamentals, Image compression models, Elements of Information Theory, Error free Compression Techniques, variable length coding, Arithmetic coding, LZW coding, Lossy Compression Techniques, Transform based coding, Image compression standards, JPEG.	07
UNIT VI-Image Segmentation and Representation Point, line, Edge detection, Discontinuity based and similarity-based segmentation algorithms. Representation: Boundary and shape-based representation and descriptors, Texture and Texture based Descriptors.	08
Assignments: Based on the following activity - Solving questions based on said curriculum.	
Suggested Text Books:	
1.	Gonzalez, Rafel C. and Woods, Richard E., "Digital Image Processing", Second Edition, Prentice Hall.
2.	Pratt, William K., "Digital Image Processing", John Wiley & Sons, New York.
Suggested Reference Books:	
1.	Jain, Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi.
2.	M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**ARM and Embedded systems**			***Course Code*:**	**:**	**ETE412**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Practical:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE313					
Course Domain	**:**	Program Core					

Course Rationale:
This course deals with study of 32-bit ARM 7 architecture and understanding the fundamentals of Embedded systems.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Study and understand the architecture of ARM7TDMI family.	**1.**	Discuss the architecture of ARM7TDMI microcontroller.
2.	Study assembly language instructions of ARM microcontroller.	**2.**	Explain the instruction set of ARM microcontroller
3.	Write programs for ARM microcontroller in assembly language and c language.	**3.**	Write programs in assembly and C language for ARM microcontroller family.
4.	Understand the memory management techniques.	**4.**	Discuss the memory management scheme of ARM microcontroller.
5.	To be familiar with embedded systems	**5.**	Compare the features of 8-bit, 16-bit and 32-bit microcontrollers.
6.	Understand applications of embedded systems	**6.**	Illustrate the features and applications of embedded systems.

Curriculum Content	**Hours**
Unit I- INTRODUCTION TO ARM ARCHITECTURE ARM7TDMI architecture, registers, interrupts, exception process, status registers processor modes, memory, memory mapped I/O, endianness	06
Unit II- ARM INSTRUCTION SET ARM instruction set: Data processing instruction, Load, store, Branch, interrupt instruction, program status register instruction, loading constants, conditional execution	06
Unit III- THE THUMB INSTRUCTION SET Entering thumb state, Thumb instruction set: Thumb register usage, ARM Thumb Interworking, branch instructions, Data processing, single register load-store, multiple register load-stores, stack instructions, software interrupt instruction.	06

Unit IV- INTERRUPTS , MEMORY MANAGEMENT UNIT Interrupts and exception-handling schemes; Memory architecture, Memory access sequence, translation process, access permissions, domains, Aborts.	06
Unit V- ARM APPLICATIONS AND PLATFORMS ARM applications – IoT, Machine Learning, Automotive, mobile , graphics, embedded systems applications; ARM development platforms	06
Unit VI- EMBEDDED SYSTEMS Introduction, CISC and RISC architectures, features of 16/32 bit microcontrollers, device drivers, Interrupt servicing mechanisms, programming concepts in embedded c and c++, Prototype development phases, software design and implementation, Hardware software co design, Case study: Adaptive cruise control system in car.	09

Suggested list of Tutorials and Assignments:

Based on the syllabus content students have to complete any one of the following activities:

1. Simulation-based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments

General Instructions: Assembly language programs, C language programs should be taught to students.

Suggested Text Books:

1.	ARM architecture reference manual
2.	Sloss, Symes, Wright, "ARM system developers guide" Morgan Kaufman, Elsevier, publication
3.	Raj Kamal, "Embedded Systems: Architecture, Programming and Design", TMH, 2003.
4.	Wolf, Wayne, "Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001

Suggested Reference Books:

1.	Vahid, Frank and Givargi, Tony, "Embedded System Design: A Unified Hardware/Software Introduction", John Wiley & Sons, New York, 2000.
2.	Deshmukh, Ajay V., "Microcontroller Theory and Applications", Tata McGraw-Hill.
3.	ARM7TDMI manual
4.	Philips LPC 2148 manual

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Microwave Engineering**			***Course Code*:**	**:**	**ETE413**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs./week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 312					
Course Domain	**:**	Program Core					

Course Rationale: Electromagnetic Spectrum is a natural resource. Each band of frequency is having certain advantages. Microwave is the range of frequency ranging from 1GHz to 300 GHz. Due to typical characteristics the use of microwave is inevitable in certain applications. This course aims to make students familiar to characteristics, operation of components and devices, measurements of microwaves and explore various applications.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Inculcate fundamental concepts of microwave engineering and its applications	**1.**	Understand microwave frequency bands, characteristics of microwaves and its applications
2.	Analyze the rectangular waveguides and field equations in rectangular Waveguide.	**2.**	Describe the types of waveguides, rectangular waveguides and field equations.
3.	Categorize different types of microwave components based on their applications.	**3.**	Describe waveguide components for various applications
4.	Share the knowledge to use microwave oscillators & amplifiers in microwave communication and compare their characteristics.	**4.**	Explore and analyze various microwave tubes.
5.	Introduce the students to various microwave solid state devices used in microwave amplifiers and oscillators.	**5.**	Understand and analyze the various microwave solid state devices.
6.	Demonstrate the ability to measure different microwave parameters using microwave bench setup.	**6.**	Perform measurements on microwave devices and networks.

Curriculum Content	**Hours**
Unit I-Introduction to Microwave Definition, Microwave Frequency Bands, Microwave Characteristics, Microwave System, Microwave Applications.	04

Unit II-Microwave Waveguides Types of Waveguides, Rectangular Waveguides, Wave Equations, Solutions of Wave Equations in Rectangular Coordinates, TE and TM Modes in Rectangular Waveguide, Impossibility of TEM Waves, Cut Off Frequency, Wave Impedance for TE and TM Wave, Dominant Mode and Degenerate Modes, Mode Characteristics of Phase Velocity, Group Velocity, Wavelength and Impedance Relations; Power Transmission in Rectangular Waveguide, Excitations of Modes, Resonant Cavity, Illustrative Problems.	08
Unit III-Waveguide Components Introduction of S-Parameters, E and H Plane Tee, Hybrid Junctions, Applications of Magic Tee, Hybrid Ring, Directional Coupler, Waveguide Terminations, Attenuators, Ferrites: Faraday Rotation Principle, Gyrator, Phase-Shifter, Circulator, Isolator.	07
Unit IV-Microwave tubes Limitations of Conventional Tubes at Microwave Frequencies, Types of Microwave Tubes, **Two cavity Klystron:** Velocity Modulation Process, Bunching Process, Output Power and Beam Loading; **Reflex Klystron:** Velocity modulation, Power Output and Efficiency, **Helix Traveling Wave Tube:** Slow Wave Structures, Amplification Process, Conventional Current; **Microwave cross field tubes (M type):** Introduction, cross-field effects; Magnetrons.	08
Unit V-Microwave Semiconductor Devices **Microwave Solid-State Devices:** Microwave Tunnel Diode; PIN Diode, Varactor Diode. **Transferred Electron Devices:** Gunn-Effect Diodes, RWH Theory, Modes of Operations; **Avalanche Transit Time Devices:** IMPATT Diode, TRAPATT Diode.	05
Unit VI-Microwave Measurements **Description of Microwave Bench:** Different Blocks and their Features, Precautions; **Microwave Measurements:** Power, Attenuation, Frequency, Low and High VSWR, Impedance Measurements.	04

Suggested list of Tutorials and Assignments:

Based on the syllabus content students have to complete any one of the following activities

1. Simulation-based work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments

Suggested Text Books:	
1.	Samuel Y. Liao, Microwave Devices and Circuits, Pearson, 3rd Edition, 2003.
2.	Pozar, David M. Microwave Engineering. John Wiley & Sons, 2011.
3.	Peter A. Rizzi, Microwave Engineering Passive Circuits, PHI, 3rd Edition, 1999.
Suggested Reference Books:	
1.	M.L. Sisodia, G.S. Raghuvanshi, Microwave Circuits and Passive Devices Wiley Eastern Ltd., New Age International Publishers Ltd, 1stEdition, 1995.
2.	R.E. Collin, Foundations for Microwave Engineering, IEEE Press, John Wiley.

3.	Srivastava, Ganesh Prasad and Vijay Laxmi Gupta. Microwave Devices and Circuit Design. PHI Learning Pvt. Ltd., 2006.
4.	Sharma, K. K. Fundamentals of Microwave & Radar Engineering. S. Chand Publishing, 2011.
5.	Kulkarni, Muralidhar. Microwave and Radar Engineering. Umesh Publications, New Delhi, 5th Edition.
6.	Gottapu Sasi Bhushana Rao, Microwave and Radar Engineering, Dorling Kindersley (India), New Delhi, India, 2014 (Licensees of Pearson Education)
Web References:	
1.	http://nptel.ac.in/courses/117101119/1
2.	http://www-group.slac.stanford.edu/kly/Lecture_Series/slac_klystron_lecture_series.htm

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Wireless Networks**			***Course Code*:**	**:**	**ETE414**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE312, ETE 315					
Course Domain	**:**	Program Elective -I					

Course Rationale: Wireless Networks utilizes electromagnetic waves for transmission and reception of information. As an alternative to guided media such as copper cables, fiber optics and waveguides wireless networks have become crucial for enabling flexibility and mobility. The course aims to discuss different aspects of wireless networks.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Describe frequency reuse and other concepts of cellular communication technology.	**1.**	Apply fundamental concepts in the design of mobile cellular system
2.	Characterize and analyze the radio propagation mechanisms of mobile and wireless environments	**2.**	Understand basic propagation mechanisms and models
3.	Explain the concept of multipath and fading	**3.**	Understand effects of fading.
4.	Explain concept of wireless networking and signaling	**4.**	Compare wired and wireless communication and understand use of signaling systems
5.	Demonstrate the multicarrier and multi-antenna systems in wireless communication	**5.**	Understand use of Multicarrier and MIMO systems
6.	To learn about mobile generations evolution and architecture and applications of 5G	**6.**	Differentiate among the different generations of mobile standards.

Curriculum Content	**Hours**
Unit I- Cellular Concepts Wireless communication system, Types of wireless communication, Cellular system, Hexagonal Geometry of Cell, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Distance to Frequency Reuse Ratio, Interference & System Capacity, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems - Cell Splitting, Cell Sectorization, Repeaters, Micro Cell Zone Concept, Basics of Mobile Handset & SIM	08

Unit II- Mobile Radio Propagation: Large Scale Path Loss Free Space propagation model, Relating Power to Electric Field, The three Basic Propagation Mechanisms, Reflection, Ground Reflection (Two Ray) Model, Diffraction, Scattering, Overview of Outdoor and Indoor Propagation Models.	06
Unit III- Mobile Radio Propagation: Small Scale Fading and Multipath Small-Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of small-Scale Fading.	05
Unit IV- Wireless Networking Introduction To Wireless Networks, Difference Between Wireless and Fixed Telephone Networks, Development of Wireless Networks, Fixed Network Transmission Hierarchy, Traffic Routing in Wireless Networks, Common Channel Signaling (CCS), Signaling System No. 7, Architecture of B-ISDN & Services	06
Unit V- Transmission Techniques Single carrier vs Multicarrier Transmission, Multicarrier Modulation, SISO & MIMO Transmission, OFDM, MIMO-OFDM	05
Unit VI- Evolution of Mobile Technologies Overview of 1G, 2G, 3G, 4G -LTE and 5G Features, Frequency Bands, Architecture, Introduction to 6G.	06

Suggested list of Tutorials and Assignments:
Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work.
2. Case study work.
3. Site visit.
4. Solve technical quiz.
5. Solve home assignments.

Suggested Text Books:

1.	Wireless Communications Principals & Practice - Theodore S. Rappaport, Pearson
2.	Mobile Communications - Jochen Schiller, Pearson

Suggested Reference Books:

1.	Wireless Communications & Networks - William Stallings, Pearson
2.	Wireless Telecommunications Systems and Networks – Mullett, Cengage
3.	Wireless Communication - Goldsmith Andrea, Cambridge University Press
4.	Fundamentals of Wireless Communication - David Tse and Pramod Viswanath, Cambridge University Press
5.	Wireless Digital Communications Modulation and Spread Spectrum Applications Kamilo Feher, PHI
6.	Wireless Communications, P. Muthu Chidambra Nathan, PHI

7.	Wireless Communication Systems: From RF Subsystems to 4G Enabling Technologies by Ke-Lin Du and M. N. S. Swamy, Cambridge University Press
8.	William C.Y.Lee, "Mobile Communications Engineering Theory & Applications", TMH.
9.	V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education.
10.	V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**PLC and Automation**			***Course Code*:**	**:**	**ETE414**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Practical:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE313					
Course Domain	**:**	Program Elective-I					

Course Rationale:
This course deals with the study of PLC architecture, ladder diagram and programming.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Understand the evolution and need of automation	**1.**	Explain the need of automation for industry and society
2.	Study the PLC and their types	**2.**	Describe the PLC types and architecture
3.	Study the programming concept in PLC	**3.**	Write program for PLC to control the application
4.	Understand the need of PLC in automation	**4.**	Explain the role of PLC in manufacturing automation.
5.	Study the commissioning and maintenance of PLCs	**5.**	Explain the role of PLC in process automation.
6.	Study of the SCADA	**6.**	Discuss the installation and commissioning issues in PLCs

Curriculum Content	**Hours**
Unit 1-Introduction to Automation Introduction to Automation, Evolution of Industrial Automation. Controllers, Role of PLC in automation, PLC Types, PLC programming, Standard Hierarchical Automation Systems Levels, Functional Levels & Database Organization. Automation in manufacturing and process control. Automation options with merits and demerits – PC, DCS, PLC, Fieldbus & hybrid architectures- selection criteria and comparative study.	06
Unit 2-Fundamentals of PLC Families, Processors, operation, Programming tools, memory structure, access & programming modes. PLC Hardware- Physical components, racks, slot, Power, CPU, Discrete & Analog Input/Output modules, RTUs & HMI panels Programming-	06

Numbering systems, Ladder Logic Symbols, Instructions, Program Logic Development, testing & debugging.	
Unit 3- PLC programming Programming Language Standards IEC 61131-3: IL, ST, SFC, FBD, L L Programming, Multi Rung Ladders, Sequence, Logic, transfer of control timers & counters. Process Interfacing elements- analog sensors, digital sensors, actuators, Linear & Rotary Encoders.	06
Unit 4- PLC in manufacturing and process automation Logic Development steps for programming, Fail safe Programming, Emergency shutdown, Safety Interlocks **Case Studies-** AC/ DC Motor Controls, Variable speed AC motor drives, conveyer belt, robots, CNCs, Computer integrated manufacturing. Control strategies in process automation- Auto/Manual control, Open loop, closed loop, on-off. **Case Studies-** Temperature control system, Level control system, Pressure & flow control, Continuous & Batch processing.	06
Unit 5-Commissioning & Maintenance Project Planning, installation and verification, Project & Program Documentation. PLC Fault Handling & Diagnosis, Redundant configurations, networking.	06
Unit 6-SCADA Plant monitoring & control based on SCADA. Functions of SCADA, PLC/SCADA Communication, Graphics & HMI, animation, database configuration, Real-Time & historical trends, wireless controls.	09

Suggested list of Tutorials and Assignments: Based on the syllabus content students have to complete any one of the following activities:

1. Simulation based small project work
2. Case study work
3. Site visit
4. Solve technical quiz
5. Solve home assignments

General Instructions: Focus should be given on PLC based design and programming

Suggested Text Books:	
1.	Programmable Logic Controllers, John & Fredric Hackworth, Pearson
2.	Programmable Logic Controllers, Webb & Reis, PHI
3.	Distributed computer control for Industrial Automation, Popovic & Bhatkar
4.	Introduction to Programmable Logic Controllers, Gary Dunning, Thomson
5.	SCADA: Supervisory Control And Data Acquisition By : Stuart Boyer ISA
Suggested Reference Books:	
1.	Nathan Clerk, “PLC Programming: A practical guide to ladder logic and the RSLogix 500 environment”,

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**RF Circuit Design**			***Course Code*:**	**:**	**ETE414**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Practical :	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	ETE212, ETE214, ETE312					
Course Domain	**:**	Program Elective- I					

Course Rationale: This course deals with study of RF design issues, study of RF components, design of RF filters, coupled filters, amplifiers, mixers and oscillators.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce students about RF design issues.	**1.**	Discuss RF design issues and analyze electronic components considering RF issues.
2.	Make students able to analyze and design different types of RF filter.	**2.**	Analyze and design different types of RF filters.
3.	Explain to students how to analyze and design RF Coupled filters.	**3.**	Analyze and design RF-coupled filters.
4.	Make students aware of the Study of RF components and their applications	**4.**	Discuss different RF components and their applications.
5.	Make students able to design RF amplifiers.	**5.**	Design RF amplifiers.
6.	Make students able to design RF mixers and oscillators.	**6.**	Design RF mixers and oscillators.

Curriculum Content	**Hours**
Unit I: RF ISSUES Importance of RF design, Electromagnetic Spectrum, RF behavior of passive components, Chip components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications.	04
Unit II: RF FILTER DESIGN	06

Filter types and parameters, Low pass filter, High pass filter, Bandpass and Bandstop filter, Insertion Loss. Special Filter Realizations: Butterworth type filter, Chebyshev type filters, Denormalization of standard low pass design.	
Unit III: COUPLED FILTERS Odd and Even Mode Excitation, Bandpass Filter Design, Cascading band pass filter elements, Design examples.	06
Unit IV: ACTIVE RF COMPONENTS & APPLICATIONS RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks –Impedance matching using discrete components, Microstrip line matching networks, Amplifier classes of operation and biasing networks.	06
Unit V: RF AMPLIFIER Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, high power and multistage amplifiers.	07
Unit VI: OSCILLATORS AND MIXERS Basic Oscillator model, High frequency oscillator configuration, Balanced modulators, Basic characteristics of Mixers, Phase Locked Loops, RF directional couplers and hybrid couplers, Detector and demodulator circuits.	07

Assignments: Based on the following activity

1. The Report on Industrial Visit
2. The simulation of the RF circuits using Simulation Tools like Altium, Microwave Office, PADS,
L-EDIT, S-EDIT, HFSS or any other.
3. Hardware Implementation of the application-oriented circuit with the help of circuits from said curriculum.
4. Solving miscellaneous questions based on said curriculum**.**

Suggested Text Books:

1.	Reinhold Ludwig and Powel Bretchko, RF Circuit Design, Theory and Applications, Pearson Education Asia, First Edition, 2001.
2.	James Hardy, "High Frequency Circuit Design ", Resto Publishing Co., NewYork,

Suggested Reference Books:

1.	Joseph. J. Carr, Secrets of RF Circuit Design, McGraw Hill Publishers, Third Edition, 2000.
2.	Mathew M. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.
3.	Ulrich L. Rohde and David P. NewKirk, RF / Microwave Circuit Design, John Wiley & Sons USA 2000.
4.	Roland E. Best, Phase - Locked Loops : Design, simulation and applications, McGraw Hill Publishers 5TH edition 2003.
5.	Ian Hickman, " RF HandBook ", Butter Worth Heinemann Ltd., Oxford, 1993.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part VIII**					
Course Title	**:**	**Internet of Things**			***Course Code*:**	**:**	**ETE 415**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	**03**
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 222, ETE 214, EC 313					
Course Domain	**:**	Open Elective-I					

Course Rationale: This course deals with basic concepts of sensing and actuating technology, identifiers, and identification technology, RFID Technology, wireless protocols used for internetworking, Power line communication, protocols for networking, and utility metering.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Study of wireless protocols used for internetworking	**1.**	Explain the Internet of Things and the entities involved therein.
2.	Study of different topologies	**2.**	Explain the wireless protocols involved in IoT
3.	Study of RFID Technology	**3.**	Illustrate the working principle of RFID technology
4.	Understanding power line communication	**4.**	Describe the issues in power line communication
5.	Study of protocols for networking	**5.**	Explain the protocols involved in networking and automation
6.	Study of protocols for utility metering	**6.**	Explain the M2M protocols involved in utility metering

Curriculum Content	**Hours**
Unit I - Introduction to IoT Introduction, history, objects in IoT, identifiers, identification technology, sensing and actuating technology, connection and network of objects,	04
Unit II - IEEE 802.15.4 IEEE 802 family protocols, physical layer, Media access control layer, Use of 802.15.4 protocol, IEEE 802.15.4e, IEEE 802.15.4g, challenges and requirements in WSN, issues in nodes and communications	07
Unit III - RFID technology and issues Introduction, RFID principle, RFID system components, concepts and terminology-RF identification, transponder classes, standards, system architecture. RFID applications and research issues.	07
Unit IV - Power line communication	

Introduction, existing PLC technologies, types of technologies, security, performance issues, standards and normalization, home network application architecture, PLC role in IoT, ideal PLC system for M2M and its issues.	07
Unit V - M2M protocols for networking and automation Introduction to BACnet protocol, LonWorks platform, Modbus, KNA, ZigBee, Z-wave protocols	07
Unit VI - M2M protocols for utility metering Introduction to M-bus, wireless M-bis, ANSI C 12 suite, DLMS/COSEM	07
The suggested list of Tutorials and Assignments: Minimum 5 Assignments should be conducted on basis of the above-mentioned Theory Syllabus of this subject.	

Suggested Text Books:	
1.	Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things- Key applications and protocols" Wiley
2.	Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things" Wiley
Suggested Reference Books:	
1.	Sudeep Mishra, Anandarupmukherjee and Arijit Roy, Introduction to IoT, New Delhi: University Cambridge Press, 2021.
2.	Arsheep Bahga, Vijay Madisetti "Internet of Things- A hands on approach" Orient Blackswan Private Limited - New Delhi

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Micro Electro Mechanical Systems**			***Course Code*:**	**:**	**ETE415**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	BS-11A2, Engineering Physics, ETE212-ECAD-I					
Course Domain	**:**	Open Elective- I					

Course Rationale: This course deals with fundamentals of MEMS, study of MEMS device materials, modelling of MEMS, MEMS switches, transducers, sensors and actuators, MEMS packaging.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce students the fundamentals of MEMS technology.	**1.**	Explain fundamentals of MEMS technology and its applications.
2.	Give knowledge to students about MEMS materials and fabrication processing	**2.**	Discuss material used for MEMS devices and fabrication processes.
3.	Enable students to prepare mechanical models of MEMS devices.	**3.**	Estimate performance parameters by mechanical modelling of MEMS device.
4.	Give ideas to students about types and models of MEMS switches.	**4.**	Illustrate types and models of MEMS switches
5.	Make students aware of MEMS transducers, sensors and actuators.	**5.**	Classify MEMS Transducers, Sensors and actuators.
6.	Teach students about how to make MEMS packaging.	**6.**	Explain MEMS packaging.

Curriculum Content	**Hours**
Unit I-Introduction Introduction to MEMS technology, MEMS fabrication, Power Handling and Reliability of MEMS devices, MEMS applications.	06
Unit II-MEMS materials Semiconductors and their processing, silicon micromachining techniques, Thermo responsive Materials, Piezoelectric Materials, Electro strictive/Management Materials, Rheological Materials Ceramics, Polymers and their synthesis.	06
Unit III-Modeling of MEMS Introduction, Mechanical Modeling of MEMS Devices, Spring Constant of Fixed – Fixed Beams, Spring Constant of Cantilever Beams, Forces on MEMS Beams.	06

Unit IV-MEMS Switches Introduction to MEMS switches, Electrostatic Actuation, Capacitive shunt and series switches: Physical description, circuit model and electromagnetic modelling; Techniques of MEMS switch fabrication.	06
Unit V-Transducers, Sensors and Actuators Introduction, Principles of sensing and actuation, Microplates, Capacitive effects, Flow measurement using Integrated paddle-cantilever structure, MEMS Gyroscopes. Chemical and Biological Transducers: basic concepts of cellular biology, chemical sensors, molecule-based biosensors, cell-based biosensors.	06
Unit VI-Integration and Packaging Role of MEMS packages, types of MEMS packages, module packaging, packaging materials and reliability issues.	06
Assignments: Based on the following activity 1. The Report on Industrial Visit 2. The Design and simulation of microscale range devices with MEMS components using Simulation Softwares/Tools like COMSOL, SUGAR. 3. Solving miscellaneous questions based on said curriculum.	
Suggested Text Books:	
1.	MEMS: Theory Design and Technology - Rebeiz, G.M. John Wiley & Sons
2.	RF MEMS and their Applications- Varadan, V.K., Vinoy, K.J. and Jose, K.J., John Wiley & Sons
Suggested Reference Books:	
1.	Physics of Semiconductor Devices-Sze, S.M, John Wiley & Sons. 1994
2.	RF MEMS Circuit Design for Wireless Communications - De Los Santos, H.J, Artech House.
3.	Micromechanics & MEMS - Trimmer, W., IEEE Press

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Remote Sensing and GIS**			***Course Code*:**	**:**	**ETE415**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	ETE 315, Data Communication, Image Processing					
Course Domain	**:**	Open Elective-I					

Course Rationale: This course deals with basic fundamental concepts of remote sensing and GIS, GIS data sources, its types, analysis and planning of GIS, implementation of GIS, working and segments of GPS, and integration of GIS-RS.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce students about remote sensing basic concepts and types, terminology and nomenclature of the discipline**.**	**1.**	Describe Remote Sensing concepts, physical fundaments and components and adequately use vocabulary, terminology and nomenclature of the discipline
2.	Give knowledge to students about GIS basic concepts.	**2.**	Understand main concepts that define Geographic Information Systems.
3.	Make students aware of the classification of GIS data structure, types and standards.	**3.**	Classify & interpret GIS data sources, types & data standards.
4.	Enable students to analyze, plan and implement GIS.	**4.**	Understand the analysis, planning & implementation of GIS
5.	Make students aware of working and segments of GPS.	**5.**	Understand the working and segments of GPS
6.	Make students able to integrate GIS and RS to solve real-world problems.	**6.**	Understand the integration of GIS - RS & use of them to solve real-world problems

Curriculum Content	**Hours**
Unit I: Remote Sensing Fundamentals & Development Definition, Types, Chronological Development, International Remote Sensing Centers, Indian Remote Sensing Centers & their Activities, Satellite Programs of India, Elements of EMR - Wavelength Regions, Energy Interaction in Atmosphere – Absorption, Scattering, Atmospheric Windows, Terrestrial Interaction, Spectral Reflectance Curves, Active & Passive Remote Sensing, Classification of Remotely Sensed Data	06

Unit II: GIS (Geographic Information System) Introduction Definition of GIS, The Origins of GIS, What Is CADD? What Is AM/FM? What Is GIS? Applications, GIS Industry & GIS Software: GIS Software Vendors, GIS Products, GIS Users, GIS Services, Benefits of GIS, Map Data Security, Elimination of Redundancy, Map Revisions, Search & Analysis of Map Data, Productivity of Employees, Integration of Map Data	06
Unit III: GIS Data Sources, Collection & Entry, Digitizing, GPS Surveying, Digital Ortho Photography, Satellite Imagery, GIS Data Formats & Standards, Vector Data, Raster Data, Raster Images, DOD Spatial Data Standards (SDS), Spatial Data Transfer Standard (SDTS), Open GeoData Interoperability Specification (OGIS).	06
Unit IV: GIS Analysis, Planning and Implementation Network Analysis, Digital Terrain Modeling & Analysis, Grid Cell GIS Modeling &Analysis, GIS Plan, Components of GIS Plan, Phases – Planning, Analysis, Implementation, Successful Implementation of GIS, Management Support, Leadership & Vision, Data Conversion & Maintenance, Hardware and Software, User Training, Data Communication, Software Customization, User Support, Funding	06
Unit V: Introduction to Global positioning system GPS Satellite Constellations, GPS Segments: Space, Control, User, Signals & Codes, GPS Receivers. Operating Principle & Sources Of Errors in GPS, Modes of Measurements & Post Processing of Data, Accuracy of GPS Observation. GPS Applications in Various Fields, Indian Regional Navigation Satellite System (IRNSS) – NAVIC	06
Unit VI: Integration of Remote sensing and GIS Remote Sensing and GIS Synergy, Need For Integration, Facilities for Integration, General View on Applications, Case Studies- Land Record, Utility Management, Oil And Gas, Global Change.	06
Assignments: Based on the following activity 1. The Report on Industrial Visit 2. GIS analysis using software tools like ERDAS IMAGINE, ENVI, PCI Geomatica, GRASS GIS, SAGA GIS or any other. 3. Solving miscellaneous questions based on said curriculum.	
Suggested Text Books:	
1.	The GIS Handbook – By G.B. Korte 5th Edn. Oxford press
2.	An Introduction to Geological Information System – By Ian wood, Sarah Cornelius, Steve Carver, Pearson Education
3.	Remote Sensing and Geographical Information Systems – By M.Anji Reddy, B S Publications
Suggested Reference Books:	
1.	Remote Sensing Application and Geographic Information Systems Recent Trends – By Muralikrishna I.V. ,TMH
2.	Principles of Geographical Information Systems (Spatial Information Systems) - by Peter A. Burrough (Author), Rachael A. McDonnell , Oxford University Press

3.	Remote Sensing & Image Interpretation – By Thomas M.Linnesand, R.W.Kiefer,Jonathan W. Chipman, Wiley Publications.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Software Defined Radio**			***Course Code*:**	**:**	**ETE 415**
Teaching Scheme (Hours)	**:**	Lecture :	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial :	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE321, ETE322, ETE323					
Course Domain	**:**	Open Elective-I					

Course Rationale: A **Software Defined Radio (SDR)** is a radio communication system that employs reconfigurable software-based components for processing and conversion of digital signals. Unlike traditional radio communication systems, these radio devices are highly flexible and versatile. This is an emerging technology used to connect our ever increasing wireless world.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Provide knowledge of fundamentals and state-of the art concepts in software defined radio.	**1.**	Study Needs, Characteristics, Benefits and Design Principles of a Software Radio.
2.	Explain the various components of software-defined-radios with the understanding of their limitation and application of software-defined-solutions to overcome such limitations.	**2.**	Study design aspects of software radios
3.	Explain about the interplay of analog and digital signal processing for power as well as spectrum efficient transmission and reception of signal.	**3.**	Understand concept of Smart Antennas
4.	Explain the applications of Software Defined Radios.	**4.**	Study key hardware elements and related Trade-Offs

Curriculum Content	**Hours**
Unit I- Fundamentals of SDR Software Radios, Needs, Characteristics, Benefits, Design Principles of a Software Radio, Radio frequency implementation issues, Principal Challenge of Receiver Design.	06
Unit II- RF and SDR RF Receiver Front-End Topologies, Enhanced Flexibility of the RF Chain with Software Radios, Transmitter Architectures and their issues, Noise and Distortion in the RF Chain,	06

Timing Recovery in Digital Receivers Using Multirate Digital Filters.	
Unit III- Signals in SDR Approaches to Direct Digital Synthesis, Analysis of Spurious Signals, Spurious Components due to Periodic Jitter, Band-pass Signal Generation, Hybrid DDS-PLL Systems, Generation of Random Sequences, Parameters of data converters**.**	06
Unit IV- Smart Antennas Concept of Smart Antennas, Structures for Beam-forming Systems, Smart Antenna Algorithms, Digital hardware choices, Key Hardware Elements, DSP Processors, Field Programmable Gate Arrays, Trade-Offs in Using DSPs, FPGAs and ASICs.	06
Unit V- Case studies in Radio System Power Management Issues, Object-oriented representation of radios and network resources, Mobile Application Environments, Joint Tactical Radio System, Case studies in software radio design.	06
Unit VI- Applications of SDR Applications of SDR in advance communication systems, challenges and issues, Implementation, Parameter Estimation- Environment, location, other factors, vertical handoff, network interpretability.	06
Suggested list of Tutorials and Assignments: Minimum 8 Assignments based on syllabus contents.	

Suggested Text Books:	
1.	Jeffrey H. Reed, "Software Radio: A Modern Approach to Radio Engineering", Prentice Hall PTR; May 2002 ISBN: 0130811580
2.	Dillinger, Madani, Alonistioti (Eds.), "Software Defined Radio, Architectures, Systems and Functions", Wiley 2003
3.	Bard, Kovarik, "Software Defined Radio, The Software Communications Architecture", Wiley 2007
4.	Bard, John and Kovarik, Vincent, "Software Defined Radio: The Software Communications Architecture", Wiley Series in Software Radio, 2007.

Suggested Reference Books:	
1.	Johnson, C.R. and W.A. Sethares, "Telecommunication Breakdown: Concepts of Communication Transmitted via Software-Defined Radio, Pearson Prentice Hall, 2004
2.	Bard, John and Kovarik, Vincent, "Software Defined Radio: The Software Communications Architecture", Wiley Series in Software Radio, 2007.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Sem VII**					
Course Title	**:**	**Major Project (Phase -1)**			***Course Code*:**	**:**	**ETE416L**
Teaching Scheme (Hours)	**:**	Practical:	02 Hrs. /week= 2 X 13 = 26 hrs.		***Total Credits***	**:**	04
Evaluation Scheme (Marks)	**:**	IPE = 50	EPE= NIL	Total= 50	***Duration of EPE***	**:**	03 Hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE212, ETE215, ETE313, ETE316L, ETE317, RM 311, ETE324, ETE326L					
Course Domain	**:**	Program Core					

Course Rationale:

This course deals with identifying, classifying and formulating the problem and finding technological solution to correct the problem. The students are encouraged to find the technological solution on societal, environmental related problems.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Understand basic stages in electronic system design	**1.**	Identify social, environmental, market needs and solutions.
2.	Surveying the problem and finding technological solution.	**2.**	Explain design and development stages in electronics engineering projects.
3.	Designing electronics systems.	**3.**	Apply engineering knowledge for solving real world problems.
4.	Learning and using circuit simulation and development tools	**4.**	Manage project and finance.
5	Working in team to accomplish task	**5.**	Provide technological solutions on recent problems and lifelong learning.
6.	Project management and life-long learning	**6.**	Work in team, follow ethical practices, and prepare documentation and presentation.

Sr. No.	***Course curriculum***
1.	The project work is to be carried out in two semesters of final year B. Tech. (E & TC), semester VII & VIII. Each major project group will consists of maximum 3 students. In semester – VII, group will select a project with the approval of the guide and submit the synopsis of project in the month of August. The group is expected to complete detailed system design, layout etc. and at least 50% project work should be completed

	in semester – VII, as a part of term work. In addition all students of project group will deliver the seminar on the proposed project only. Team of faculty members and guide will assess the term work. **If a group of student select a project under sponsored category from industry, it is essential that they should take prior written permission & approval at the beginning of semester-VII from Head of Institution through Head of Department & Concerned Guide.**

General Instructions:

Students have to submit the synopsis up to 30th August. They have to submit monthly progress reports. Work in laboratory under supervision of guide. At the time of semester end assessment demonstrate the project. They have to bring model, convey technical details using PPT.

Suggested Text Books/ Reference Books/Manual	
1.	Articles from reputed journals, magazines, websites, real world problems, case studies, Survey reports
2.	Institute's Laboratory Course Manual and equipment-wise Standard Operating Procedure to follow.

Class, Part& Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Digital Image Processing Laboratory**			***Course Code*:**	**:**	**ETE411L**
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs./week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE= NA	EPE=50 EOE=NA	Total= 50	***Duration of EPE***	**:**	03 Hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE316L- Advanced programming techniques					
Course Domain	**:**	Program Core					

Course Rationale: In this laboratory course students can do hands-on programming using MATLAB/SCILAB/PYTHON.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain the basics of image formation and acquisition.	**1.**	Demonstrate basic operations on digital image.
2.	Explain describe color and gray image conversion processing and their inter-conversion.	**2.**	Demonstrate Gray image representation techniques.
3.	Describe image enhancement algorithms	**3.**	Demonstrate application of image enhancement algorithms to digital image.
4.	Explain different morphological image processing algorithms.	**4.**	Demonstrate color image representation techniques.
5	Explain different image compression Algorithms	**5.**	Demonstrate application of morphological image processing algorithms on Digital Image.
6.	Explain image representation and segmentation algorithms.	**6.**	Demonstrate image segmentation algorithms on digital Image.

Sr. No.	***List of Experiments***
1.	Brightness Enhancement
2.	Contrast Manipulation
3.	Histogram Equalization
4.	Determination of Image Negative
5.	Threshold Operation

6.	Gray level slicing without preserving background
7.	Gray level slicing with preservation of background
8.	Logarithmic Transformation
9.	Power Law Transformation
10.	Spatial domain Filtering: Smoothing and Sharpening image
11.	Noise minimization using median Filter
12.	Addition, Subtraction, Multiplication, Division of image
13.	Extraction of Red Green and Blue Components of color
14.	Erosion and Dilation of image

General Instructions: NA

Suggested Text Books/ Reference Books/Manual

1.	Gonzalez, Rafel C. and Woods, Richard E., "Digital Image Processing", Second Edition, Prentice Hall.
2.	M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**ARM and Embedded systems Laboratory**			***Course Code*:**	**:**	**ETE412L**
Teaching Scheme (Hours)	**:**	Practical:	02 Hrs./week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE = Nil	EPE=50 EOE= NIL	Total= 50	***Duration of EPE***	**:**	03 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE313					
Course Domain	**:**	Program Core					

Course Rationale:

This course deals with study of 32-bit ARM 7 architecture and understanding the fundamentals of Embedded systems. Students should learn interfacing and programming aspects.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Study and understand the architecture of ARM7TDMI family.	**1.**	Discuss the architecture of ARM7TDMI microcontroller.
2.	Study assembly language instructions of ARM microcontroller.	**2.**	Explain the instruction set of ARM microcontroller
3.	Write programs for ARM microcontroller in assembly language and c language.	**3.**	Write programs in assembly and C language for ARM microcontroller family.
4.	Understand the memory management techniques.	**4.**	Discuss the memory management scheme of ARM microcontroller.
5	To be familiar with embedded systems	**5.**	Compare the features of 8 bit, 16 bit and 32 bit microcontrollers.
6.	Understand applications of embedded systems	**6.**	Illustrate the features and applications of embedded systems.

List of Experiments

Sr. No.	**Minimum eight experiments should be performed from following list based on syllabus.**
1.	Blinking LEDs interfaced with ARM microcontroller.
2.	Switch interfacing and programming
3.	Relay interfacing and programming
4.	Seven segment interfacing and programming
5.	DC motor clockwise and anticlockwise programming
6.	ADC/DAC interfacing and programming
7.	LCD interfacing and programming
8.	Buzzer interfacing and programming
9.	Stepper motor interfacing and programming
10.	RTOS programming
11.	ARM based simulation
12.	Use and handling Integrated Development Environments for ARM controller

General Instructions: Simulation and hardware-based experiments should be conducted.

Suggested Text Books/ Reference Books/Manual

1.	ARM architecture reference manual

2.	Sloss, Symes, Wright, “ARM system developers guide” Morgan Kaufman, Elsevier, publication
3.	Raj Kamal, "Embedded Systems: Architecture, Programming and Design", TMH, 2003.
4.	Wolf, Wayne, "Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Microwave Engineering Laboratory**			***Course Code*:**	**:**	**ETE413L**
Teaching Scheme (Hours)	**:**	Practical:	O2Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE= NIL	EOE=50	Total=50	***Duration of EOE***	**:**	03 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 312					
Course Domain	**:**	Program Core					

Course Rationale: The lab course will give a practical exposure to students to learn the characteristics of Microwave components and devices. To gain the practical hands on experience by exposing the students to various microwave components.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Inculcate fundamental concepts of microwave engineering and its applications	**1.**	Understand microwave frequency bands, characteristics of microwaves and its applications
2.	Analyze the rectangular waveguides and field equations in rectangular Waveguide.	**2.**	Describe the types of waveguides, rectangular waveguides and field equations.
3.	Categorize different types of microwave components based on their applications.	**3.**	Describe waveguide components for various applications
4.	Share the knowledge to use microwave oscillators & amplifiers in microwave communication and Compare their characteristics.	**4.**	Explore and analyze various microwave tubes.
5	Introduce the students to various microwave solid state devices used in microwave amplifiers and oscillators.	**5.**	Understand and analyze the various microwave solid state devices.
6.	Demonstrate the ability to measure different microwave parameters using microwave bench setup.	**6.**	Perform measurements on microwave devices and networks.

List of Experiments

Sr. No.	Experiment Name
1.	Study of field patterns of various modes inside a rectangular waveguide using Virtual lab.
2.	Study of field pattern of various modes inside a rectangular waveguide cavity using Virtual lab.
3.	Measurement of Unknown frequency using direct and indirect method.
4.	Measurement of wavelength by slotted line method.
5.	Measurement of VSWR of unknown load.
6.	Concept of generalized n-port scattering parameters, and formulation of these parameters into 2-port reflection and transmission coefficients.
7.	Measurement of attenuation.
8.	Measurement of impedance of unknown load.
9.	Determination of VI characteristics of Gunn diode using microwave test bench.
10.	Study of characteristics of E-Plane Tee and H-Plane Tee.
11.	Study of characteristics of directional coupler.
12.	Measurement of insertion loss of the waveguide
13.	Measurement of phase constant of the waveguide
14.	S- Parameter measurement of the magic tee
15.	Measurement of Microwave Parameters such as Return loss, Bandwidth, Smith Chart using Vector Network Analyzer.
General Instructions: Any 8 experiments based on above syllabus but not limited to this list should be conducted.	
Suggested Text Books/ Reference Books/Manual	
1.	Samuel Y. Liao,Microwave Devices and Circuits, Pearson, 3rd Edition, 2003.
2.	Pozar, David M. *Microwave Engineering*. John Wiley & Sons, 2011.
3.	Peter A. Rizzi, Microwave Engineering Passive Circuits, PHI, 3rd Edition, 1999.
4.	M.L. Sisodia, G.S.Raghuvanshi, Microwave Circuits and Passive Devices Wiley Eastern Ltd., New Age International Publishers Ltd, 1stEdition, 1995.
5.	R.E. Collin, Foundations for Microwave Engineering, IEEE Press, John Wiley.

6.	Srivastava, Ganesh Prasad and Vijay Laxmi Gupta. Microwave Devices and Circuit Design. PHI Learning Pvt. Ltd., 2006.
7.	Sharma, K. K. Fundamentals of Microwave & Radar Engineering. S. Chand Publishing, 2011.
8.	Kulkarni, Muralidhar. Microwave and Radar Engineering. Umesh Publications, New Delhi, 5th Edition.
9.	Gottapu Sasi Bhushana Rao, Microwave and Radar Engineering, Dorling Kindersley (India), New Delhi, India, 2014 (Licensees of Pearson Education)

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Wireless Networks Laboratory**			***Course Code*:**	**:**	**ETE414L**
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs./week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE=50 IOE= Nil	EPE/EOE= Nil	Total=50	***Duration of IPE***	**:**	03 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE222L, ETE322T,					
Course Domain	**:**	Program Elective-I					

Course Rationale: Wireless Networks utilizes electromagnetic waves for transmission and reception of information. As an alternative to guided media such as copper cables, fiber optics and waveguides wireless networks have become crucial for enabling flexibility and mobility. The course aims to discuss different aspects of wireless networks.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Describe frequency reuse and other concepts of cellular communication technology.	**1.**	Apply fundamental concepts in the design of mobile cellular system
2.	Characterize and analyze the radio propagation mechanisms of mobile and wireless environments	**2.**	Understand basic propagation mechanisms and models
3.	Explain the concept of multipath and fading	**3.**	Understand effects of fading.
4.	Explain concept of wireless networking and signaling	**4.**	Compare wired and wireless communication and understand use of signaling systems
5	Demonstrate the multicarrier and multi-antenna systems in wireless communication	**5.**	Understand use of Multicarrier and MIMO systems
6.	To learn about mobile generations evolution and architecture and applications of 5G	**6.**	Differentiate among the different generations of mobile standards.

List of Experiments

Sr. No.	Name of Experiment
1.	Study of sections of 3G mobile phone trainer.

2.	Study of 3G network AT commands.
3.	Study and starting 4G VoLTE Smart Phone.
4.	Study and analyze the Power Management Unit in 4G LTE Smart Phone.
5.	Study and analyze of SIM Interface section in 4G LTE Smart Phone.
6.	Study and analyze that a mobile is powered ON at the alarm Set Time (Function of RTC system) in 4G LTE Smart Phone.
7.	Study and understand 4G AT Commands
8.	Study of real-time operation of 5G VoLTE Smart Phone.
9.	Study of Dual SIM interface section of 5G VoLTE Smartphone.
10.	Study of Battery charging circuit of 5G VoLTE Smartphone.
11.	Study of Power management unit 5G VoLTE Smartphone.
12.	Study of Buzzer, Vibrator and Mic Speaker units of 5G VoLTE Smart phone.
13.	Study of RF signals using RF Spectrum Analyzer module
14.	Visit to Mobile Base station or Wireless station (Optional)
15.	Any 8 experiments based on above syllabus but not limited to this list should be conducted using hardware/software/simulator/virtual lab etc.
General Instructions: Any 8 experiments based on a syllabus but not limited to this list should be conducted.	
Suggested Text Books/ Reference Books/Manual	
1.	Wireless Communications Principals & Practice - Theodore S. Rappaport, Pearson
2.	Mobile Communications - Jochen Schiller, Pearson
3.	Wireless Communication - Goldsmith Andrea, Cambridge University Press
4.	Fundamentals of Wireless Communication - David Tse and Pramod Viswanath, Cambridge University Press
5.	Wireless Digital Communications Modulation and Spread Spectrum Applications Kamilo Feher, PHI
6.	Wireless Communications, P. Muthu Chidambra Nathan, PHI
7.	Wireless Communication Systems: From RF Subsystems to 4G Enabling Technologies by Ke-Lin Du and M. N. S. Swamy, Cambridge University Press
8.	William C.Y.Lee, “Mobile Communications Engineering Theory & Applications”, TMH.
9.	V.K.Garg, J.E.Wilkes, “Principle and Application of GSM”, Pearson Education.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**PLC and Automation Laboratory**			***Course Code*:**	**:**	**ETE414L**
Teaching Scheme (Hours)	**:**	Practical:	02 Hrs./week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE = 50	EPE/EOE= NIL	Total= 50	***Duration of IPE***	**:**	03 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE313					
Course Domain	**:**	Program Elective-I					

Course Rationale:
This course deals with the study of PLC architecture, ladder diagram and programming.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Understand the evolution and need of automation	**1.**	Explain the need of automation for industry and society
2.	Study the PLC and their types	**2.**	Describe the PLC types and architecture
3.	Study the programming concept in PLC	**3.**	Write program for PLC to control the application
4.	Understand the need of PLC in automation	**4.**	Explain the role of PLC in manufacturing automation.
5	Study the commissioning and maintenance of PLCs	**5.**	Explain the role of PLC in process automation.
6.	Study of the SCADA	**6.**	Discuss the installation and commissioning issues in PLCs

List of Experiments

Sr. No.	**Minimum eight experiments should be performed from following list based on syllabus.**
1.	Demonstration of PLC architecture
2.	PLC Ladder logic programming
3.	Analog signal interfacing and sensing

4.	Digital signal interfacing and sensing
5.	DC motor control
6.	Stepper motor control
7.	AC motor control
8.	Switch interfacing and sensing
9.	Relay interfacing and controlling
10.	Delay generation for event control
11.	Pulse counter application
12.	SCADA based system simulation

General Instructions:

Simulation and hardware-based experiments should be conducted.

Suggested Text Books/ Reference Books/Manual	
1.	Programmable Logic Controllers, John & Fredric Hackworth, Pearson
2.	Programmable Logic Controllers, Webb & Reis, PHI
3.	Distributed computer control for Industrial Automation, Popovic & Bhatkar
4.	Introduction to Programmable Logic Controllers, Gary Dunning, Thomson
5	SCADA: Supervisory Control And Data Acquisition By : Stuart Boyer ISA

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**RF Circuit Design Laboratory**			***Course Code*:**	**:**	**ETE414L**
Teaching Scheme (Hours)	**:**	Practical:	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE=50 IOE= NA	EPE= NA EOE= NA	Total=50	***Duration of IPE***	**:**	03 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	ETE212L, ETE214L					
Course Domain	**:**	Program Elective-I					

Course Rationale: This course deals with the experimental study of different RF filters, mixers and oscillators.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Make students aware of RF design issues	**1.**	Discuss RF design issues
2.	Make students able to analyze and design different types of RF filter.	**2.**	Analyze electronic components considering RF issues.
3.	Explain to students how to analyze and design RF Coupled filters.	**3.**	Analyze and design different types of RF filters
4.	Make students aware of the Study of RF components and their applications	**4.**	Discuss different RF components
5	Make students able to design RF amplifiers.	**5.**	Describe RF amplifiers, mixers and oscillators
6.	Make students able to design RF mixers and oscillators.	**6.**	Design RF circuits

List of Experiments

Sr. No.	**Title**
1.	Study of scattering parameters of RF components
2.	Study of the application of Smith Chart
3.	Design and Characteristic assessment of different filters
4.	Study of characteristics of RF diodes, BJTs, FETs
5.	Design and characteristic study of RF Amplifiers

6.	Design and characteristic study of RF Multistage Amplifier
7.	Study of characteristics of RF Oscillators
8.	Study of characteristics of RF Mixers
9.	Study of characteristics of RF Modulator and Demodulator circuits
10.	Study of characteristics of RF Directional Couplers
11.	Study of Voltage Standing Wave Ratio (VSWR)
12.	Study of RF design issues and PCB designing
General Instructions: 1. Minimum 8 Experiments from above list should be conducted. 2. Two experiments out of above list should be based on Simulation Tool.	
Suggested Text Books/ Reference Books/Manual	
1.	Joseph. J. Carr, Secrets of RF Circuit Design, McGraw Hill Publishers, Third Edition, 2000.
2.	Ian Hickman, " RF HandBook ", Butter Worth Heinemann Ltd., Oxford, 1993.
3.	Reinhold Ludwig and Powel Bretchko, RF Circuit Design, Theory and Applications, Pearson Education Asia, First Edition, 2001.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VII**					
Course Title	**:**	**Internship-II**			***Course Code*:**	**:**	**ETE417**
Teaching Scheme (Hours)	**:**	Practical:	4-week industrial training after 6th semester		***Total Credits***	**:**	02
Evaluation Scheme (Marks)	**:**	IOE = 50	EPE= NIL	Total= 50	***Duration of IOE***	**:**	03 Hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE212, ETE215, ETE313, ETE316L, ETE317, RM 311, ETE324, ETE326L, ETE416L					
Course Domain	**:**	Program Core					

Course Rationale:

This course deals with understanding the working culture of industry for students. The students undergoe industrial training for 4 weeks after completion of 6th semester. Students have to understand all technical, managerial, administrative, financial aspects of industry.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To expose students to real working environment and get acquainted with the organization structure, business operations and administrative functions.	**1.**	Know the industrial working environment.
2.	To have hands on experience in the related field to get exposure with the industrial trend.	**2.**	Utilize the technical resources.
3.	To promote cooperation and to develop synergetic collaboration between industry and the university.	**3.**	Write technical documents and appear for interview / power point presentations/ technical discussions.
4.	To set the step for future recruitment.	**4.**	Develop attitude of a team player and ability of life-long learning.
5	Get familiarity with professional skills	**5.**	Adapt and develop professional skills required for employability.
6.	Understand the information required for entrepreneurship.	**6.**	Motivation for entrepreneurship.

Sr. No.	***Course curriculum***

1.	Four-week industrial training in a reputed industry from stand point view of electronics engineering, entrepreneurship is mandatory. Students should learn and understand the concepts of industrial organization and management. They should get familiarity with different departments like R & D, production, quality, purchase, sales & marketing and other. Students should submit detail report in the given format to the B.Tech Electronics & Telecommunication Engineering program in which all details of internship must be included. Panel of faculty members appointed by the program coordinator will assess the individual student.
General Instructions: Students have to submit certificate to department. They have to submit the internship 2 report to department in given format. They have to present their information in PPT format in front of panel of teachers. The internship 2 must be completed after 6th semester in vacation.	
Suggested Text Books/ Reference Books/Manual	
1.	Articles from reputed journals, magazines, websites, real world problems, case studies, Survey reports
2.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class &Semester	:	**Final Year B.Tech (Electronics & Telecommunication Engineering) Part IV, Semester VII**									
Course Title	:	**Professional Ethics**						***Course Code*:**	:	**HS411**	
Teaching Scheme (Hours)	:	Lecture= 2 hrs. /Week						***Credits***	:	--	
Evaluation Scheme (Marks)	:	**Assignments** **Viva voce**	: :	50 25	**Written Test** **Grand Total**	: :	25 100	***Duration of Exam***	:	03 Hrs.	
Revision	:	Third						***Month***	:	June 2023	
Pre-requisites	**:**	It does not require any pre-requisite as such but eager to know about our profession's connectivity, role and responsibility towards society and environment.									
Course Domain	**:**	Audit Course at institute level, Humanities & Social Science									
Course Rationale:											
Course Objectives: The Course Teacher will					***Course Outcomes:*** Students will be able to						

1.	Explain importance of engineers' connectivity with society and environment.	**1.**	Realize the role of engineers towards society and environment.
2.	Make students aware of ethics and responsibility of engineers as professionals.	**2.**	Demonstrate ethical practices and responsibility as a professional.
3.	Make them able to undergo ethical judgments and solve problems.	**3.**	Make ethical judgments and solve problems.
4.	Develop attitudes required of engineers and values shared by engineers	**4.**	Get developed for engineers' attitude with sharing of values.
5.	Help them practice decision making & team players.	**5.**	Practice decision making and team culture.
6.	Describe importance of lifelong learning.	**6**	Follow lifelong learning attitude.

Curriculum Content	**Hours**
Unit I: Engineer, Society and Environment 1. Understanding of the relation between engineering and society/Environment. 1.1 Understanding of the effects and impacts of science and technology on human society. 1.2 Understanding the effects and impacts of science and technology on the natural environment. 1.3 Understanding the characteristics of the modern globalized world.	**07**
Unit II: Ethics and engineering Profession 2 Understanding of ethics and responsibilities of engineers as Professionals. 2.2 Understanding of the roles and responsibilities of engineers in Society. 2.3 Understanding of the basic concepts and theories of ethics. 2.4 Understanding the relation between law and ethics and having basic legal literacy. 2.5 Understanding of the nature of professional ethics.2.6 Understanding of the purposes and roles of codes of ethics and those of conduct set by engineering societies and associations. 2.7 Understanding of the social responsibility (SR) of organizations (companies in particular). 2.8 Understanding of ethics in specific areas (and knowledge of concrete cases) 2.9 Understanding the nature of ethics in research and development.	**07**
Unit III: Ethical Perception and Problem solving 3 Ability to make ethical judgments and solve problems. 3.2 Understanding and application of methods to identify related factors in ethical issues and to make a structural analysis of them. 3.3 Understanding and application of methods to analyze technical factors in ethical issues and make structural analysis of them. 3.4 Understanding and application of methods to analyze organizational factors and provide organizational solutions. 3.5 Ability to design one's conduct to solve ethical problems Based on the abilities to analyze factors gained through 3.2–3.4, 3.6 Comprehensive problem-solving capability	**06**
Unit IV: Engineer's attitude and Social Responsibility	**06**

4 Attitude required of engineers and values shared by engineers. 4.1 Attitude to think autonomously and independently based on an understanding of the responsibility of an engineer. 4.2 Attitude to accept a diversity of values (recognizing the existence of the various value systems different from their own as well as the multiplicity of values). 4.3 Attitude to share values (such as safety emphasized in the codes of ethics) to which engineers should assign paramount importance. 4.4 Attitude and willpower to act on ethical judgments of their own.	

Reference Books:

1. Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. Seth, M. L., "Principles of Economics", Lakshmi Narain Agarwal, Agra.
3. Agarwal, A. N., "Indian Economy", Vikas Publishing House Pvt. Ltd., New Delhi.
4. Datta R. and Sundharam, "Indian Economy", K. P. M., S. Chand & Co. Ltd., New Delhi
5. Prof. M P Raghavan, "Professional Ethics in Engineering", SCITECH Publication(India) Pvt.Ltd, Second Edition

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Digital Television & Multimedia**			***Course Code*:**	**:**	**ETE421**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 Hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	ETE322, ETE323					
Course Domain	**:**	Program Core					

Course Rationale: In the last thirty three years, there have been many changes since Satellite Communications was changed lot. There has been a complete transition from analog to digital communication systems. The analog techniques are replaced by digital modulation and digital signal processing, while distribution of television programming remains the largest sector of commercial satellite communications, low earth orbit constellations.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Study concept of digital & high definition TV system.	**1.**	Understand concept of digital & high definition TV system.
2.	Study advanced TV systems like LCD, plasma, LED, CCTV, etc.	**2.**	Illustrate advanced TV systems like LCD, plasma, LED, CCTV, etc.
3.	Study the broadcast standards of Multimedia.	**3.**	Compare the broadcast standards of Multimedia.
4.	Study compression techniques for efficient utilization of bandwidth.	**4.**	Analyze compression techniques for efficient utilization of bandwidth.

Curriculum Content	**Hours**
Unit I- Digital TV Transmission and Reception Digital system hardware, Signal quantization and encoding, Digital signals and parameters, Digital Satellite Television, Digital T.V. Receiver system, Merits of Digital TV receiver.	06
Unit II- High-Definition TV Component coding, MAC signals, MAC encoding format ,scanning frequencies D2-MAC Packet Signal , Duo binary Coding ,HDTV Standards & compatibility, colorimetric characteristics & parameters of HDTV systems.	06
Unit III- Advanced TV systems LCD TV System :LCD Technology , LCD Matrix types & operations , Plasma TV System : Plasma & conduction of charge ,Plasma TV screen ,Signal processing in Plasma TV,	06

Plasma color Receiver, LED TV, DTH Receiver System ,CCTV, working of block converter,: IR Remote control.	
Unit IV- Introduction to Multimedia What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media.	06
Unit V- Audio & Image Representation Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware. Image Processing, Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.	06
Unit VI- Video Representation Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21,	06
Suggested list of Tutorials and Assignments: Minimum 5 assignments based on syllabus content.	
Suggested Text Books:	
1.	Monochrome and Color TV – R.R. Gulati, 2nd revised edition, New Age International Publication
2.	A.M. Dhake, "Television and Video Engineering", 2 nd Edition, Tata Mc-Graw Hill Publication.
3.	Digital Video Processing-A. Murat Tekalp, Prentice Hall Signal Processing Series, BS publications
4	Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2008. 2. Rajneesh Aggarwal & B. B Tiwari, "Multimedia Systems", Excel Publication, New Delhi, 2007.
5.	"Multimedia Systems" by Lovely Professional University.
Suggested Reference Books:	
1.	Television and Video Engineering - A.M. Dhake, 2nd Edition
2.	Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007
3.	Li & Drew, "Fundamentals of Multimedia", Pearson Education, 2009.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Operating Systems**			***Course Code*:**	**:**	**ETE422**
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE225					
Course Domain	**:**	Program Core					

Course Rationale: The course provides fundamental concepts of operating system. The presence of operating system in between user and computer hardware. This course includes CPU scheduling, memory management, and device management.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain how Operating System is Important for Computer System	**1.**	Explain basic concepts of operating systems and compare different operating systems.
2.	Expose the students to various functions of the Operating system and their usage.	**2.**	Explain Processes & Threading environment in operating systems.
3.	Provide exposure to Linux and windows 7 operating systems.	**3.**	Discuss issues related to the memory & I/O in Operating systems.
4.	Provide knowledge of real time operating system.	**4.**	Describe various process management concepts like scheduling, synchronization, deadlocks.
5.	Explain architecture of different operating system	**5.**	Explain concepts of memory management.
6.	Expose the students to various functions of the Operating system and their usage.	**6.**	Explain concepts of real time operating system

Curriculum Content	**Hours**
Unit I- Overview of Operating Systems Abstract view of an operating system, Fundamental principles of OS operations, OS interaction with the computer and user programs, Efficiency, system performance and user service, Multiprogramming System, The Time Sharing System, The Real Time Operating System, Distributed operating system, Operation of OS, Operating	06

system with monolithic structure, Virtual machine operating system, Kernel based operating system, Microkernel based operating system	
Unit II- Processes, Threads and Synchronization Processes and programs, Implementing processes, Threads, Process synchronization, Race condition, Critical Section, Synchronization approaches, Classic process, synchronization problems, Semaphores, Monitors. Process Scheduling: Scheduling terminology and concepts, Non preemptive scheduling policies, Preemptive scheduling policies, Long, Medium and short term scheduling.	06
Unit III- Memory Management and Deadlock What is deadlock, Deadlock in resource allocation, Handling Deadlocks: Deadlock, Detection and Resolution, Deadlock prevention, Deadlock avoidance, managing the memory hierarchy, Memory allocation to a process, Heap Management, Contiguous Memory Allocation and Non Contiguous Allocation, Segmentation and Segmentation with paging, Virtual memory basics, Demand paging, and Page replacement policies, controlling memory allocation to a process.	06
Unit IV- File systems and I/O systems Overview of file processing, Files and file operations, Fundamental file organizations and access methods, Overview of I/O system, I/O hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O request to h/w operation.	06
Unit V- Case Study Linux: Linux History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output, Interposes Communication, Network Structure, Security. Windows 7: History, Design Principles, System Components, Terminal Services and Fast User, Switching, File System, Networking, Programmer Interface.	06
Unit VI- Real Time Operating Systems RTOS, scheduler, objects, scheduler, services, RTOS characteristics. Tasks: Tasks states and scheduling, synchronization, communication, concurrency, deadlocks, Semaphores: definition, operations, Queue: queue states, queue content, use of message queue in communication. Exceptions and interrupts, processing of general exceptions. Memory: Dynamic memory allocation, fixed size memory management, hardware memory management.	06
Suggested list of Tutorials and Assignments: 1. case study work 2. solve technical quiz 3. Solve home assignments	
Suggested Text Books:	

1.	Operating System Concepts - Abraham Silberschatz, Peter B. Galvin & Grege Gagne (Wiley)
2.	Operating Systems - A Concept Based approach - Dhananjay M Dhamdhere (TMGH).
Suggested Reference Books:	
1.	Unix Concepts and Applications – Sumtabha Das (TMGH).
2.	Operating System : Concepts and Design - Milan Milenkovic (TMGH)
3.	Operating System with case studies in Unix, Netware and Windows NT - Achyut S. Godbole (TMGH).

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Optical Fiber Communication**			***Course Code*:**	**:**	**ETE423**
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE314, ETE322					
Course Domain	**:**	Program Core					

Course Rationale: *The course introduces fundamentals of optical communication system. The course covers Optical fiber material properties and fabrication methods and signal distortion and degradation in optical fiber. The working principles of optical sources and detectors.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain fundamental concept of Optical communication system.	**1.**	Interpret functions of different blocks of optical communication
2.	Explain basic elements of optical fiber transmission link, fiber modes configurations and structures.	**2.**	Understand the properties of optical fiber that affect the performance of a communication link.
3.	Calculate different types of loss	**3.**	Explain types of dispersion and able to measure attenuation and scattering losses of optical fiber.
4.	Explain optical sources, materials and fiber splicing	**4.**	Discuss fiber splicing, connectors and calculate intrinsic and extrinsic losses in fiber
5.	Explain working of optical receivers and noise performance in photo detector.	**5.**	Explain working principles of optical sources and detectors.
6.	Explain WDM, solitons and SONET/SDH network.	**6.**	Understand working of different optical networks and operational principles of WDM.

Curriculum Content	**Hours**
UNIT I-Introduction to Optical Fiber communications Overview of optical fiber communication system, advantages of optical fiber communications, ray theory transmission, total internal reflection, acceptance angle, numerical aperture, skew rays. V number, Single mode fibers, step index fibers, graded index fibers.	06

UNIT II-Optical fiber material and fabrication methods Single mode fibers,cut off wavelength, mode field diameter, effective refractive index. Fiber materials:Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers, Fiber fabrication methods: Outside vapor phase oxidation, Vapor axial deposition, Chemical vapor deposition and Plasma activated vapor deposition method.	06
UNIT III-Signal Degradation, distortion and Fiber splicing Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity determination, group delay, types of dispersion, material dispersion, wave guide dispersion, polarization mode dispersion, intermodal dispersion. pulse broadening.Fiber Splicing- Splicing techniques, Splicing single mode fibers. Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints,. optical fiber connectors connector types.	06
UNIT IV-Optical Sources Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies. Reliability of LED&ILD. light emitting diodes (LEDs), laser diodes, light source linearity, modal, partition and Reflection Noise, source to fiber power launching , output patterns, power coupling, power launching, equilibrium numerical aperture, laser diode to fiber coupling.	06
UNIT V-Optical Detectors and Receivers physical principles of PIN and APD, detector response time, temperature effect on avalanche gain, comparison of photo detectors, optical receiver operation, fundamental receiver operation, digital signal transmission, error sources, receiver configuration, digital receiver performance, probability of error, quantum limit, analog receivers.	06
UNIT VI-Optical Networks Basic Networks, SONET/SDH, Broadcast-and –Select WDM Networks,Wavelength Routed Networks, Nonlinear Effects on Network Performance, Performance of WDM + EDFA Systems, Solitons, optical CDMA.	06
Suggested list of Tutorials and Assignments: 1. case study work 2. site visit 3. solve technical quiz 4. Solve home assignments	
Suggested Text Books:	
1.	Gerd Keiser ,"Optical Fiber Communications", 5th Edition Mc Graw-Hill International edition, 2000.

2.	John M. Senior, "Optical Fiber Communications", PHI, 3rd Edition, 2020
Suggested Reference Books:	
1.	D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, "Fiber Optic Communications" Pearson Education, 2005.
2.	S.C .Gupta, Text Book on Optical Fibre Communication and its Applications", PHI
3.	Govind P. Agarwal, John Wiley, " Fiber Optic Communication Systems",3rd Edition
4.	Joseph C. Palais , "Fiber Optic Communications", 4th Edition, Pearson Education

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	:	**Satellite & Radar Engineering**			Course Code:	:	**ETE424**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	03 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	BS-11A2, ETE312					
Course Domain	**:**	Program Elective-II					

Course Rationale: The goal of this course is to make students familiar with how satellites and radars work and applications of these technologies.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce student to the fundamental concepts of satellite communication, satellite subsystems and their operation.	**1.**	Explain basic satellite system with its subsystems.
2.	Enable the student to locate satellite and determine antenna angles for establishment of link.	**2.**	Define orbital parameters and determine antenna look angles.
3.	Enable student to analyze, design satellite link and evaluate performance of satellite link.	**3.**	Classify types of losses and formulate power link budget for satellite.
4.	Make students aware about different satellite applications	**4.**	Illustrate applications of satellite communication such as DBS, VSAT and GPS.
5.	To study the principles of operation of various blocks of Radar systems and Radar Range equation.	**5.**	Determine range, power and other performance parameters required for radar.
6.	Make students aware about different types of radars and their applications.	**6.**	Differentiate between different types of radars with their application.

Curriculum Content	**Hours**
Unit I- Introduction to Satellite Systems Introduction, Frequency Allocations, Satellite services, Satellite Subsystem : Attitude and Control System(AOCS), Telemetry, Tracking, Command and Monitoring, Power	06

Systems, Communication Subsystem, Satellite Antennas, Equipment Reliability and Space Qualification.	
Unit II- Orbital Mechanics and Geostationary Satellite Introduction, Kepler's Laws, Orbital Elements, Orbit Perturbations, Inclined Orbits, Local Mean Solar Time and Sun-Synchronous Orbits, Antenna Look Angles Determinations, Limits of Visibility, Earth Eclipse of Satellite, Sun Transit Outage, Polar Orbiting Satellites.	06
Unit III- Satellite Link Design Introduction, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Transmission Losses, Link Power Budget Equation, System Noise, Carrier to Noise Ratio for Uplink and Downlink, Combined Uplink and Downlink Carrier to Noise Ratio, Inter Modulation Noise.	06
Unit IV- Satellite communication applications Introduction to DBS system: Orbital Spacing, Power Rating and Number of Transpo nders, Frequencies and Polarization, Transponder Capacity; Home DBS system : Home Receiver Outdoor Unit (ODU), Home Receiver Indoor Unit (IDU), Satellite Mobile Services, VSATs, Global Positioning Satellite System (GPS), Prominent space agencies of the world, ISRO – Activities & Services, ISRO- Satellite Navigation Services.	06
Unit V-RADAR Fundamentals Basic RADAR, Radar range equation, Radar Block Diagram, Radar Frequencies, Applications of radar, Detection of signals in Noise, Receiver Noise and the signal to noise ratio, Radar Cross Section of Targets, Transmitter Power, PRF, Antenna Parameters ,System Losses, Display methods.	06
Unit VI- RADAR Systems Types of Radar, CW Doppler Radar, Moving Target Indication radar, Pulsed Radar System, Frequency modulated CW Radar, Phased Array Radar: Principles, Operation, Performance, Limitations and Applications**.** Overview of Indian Radars.	06

Suggested list of Tutorials and Assignments:

Based on the syllabus content students have to complete any one of the following activity

1. simulation-based work
2. case study work
3. site visit
4. solve technical quiz
5. Solve home assignments

Suggested Text Books:

1.	Satellite Communications - Dennis Roddy - Mc-Graw Hill Publication
2.	Introduction to Radar System - M. I. Skolnik ,Mc-Graw Hill publication

Suggested Reference Books:	
1.	Satellite Communications systems - M. Richharia - Mc Millan publication
2.	Introduction to Satellite Communication - Bruce R. Elbert, Third Edition , Artech House London
3.	Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance - Louis J. Ippolito, Jr. -John Wiley and Sons, Ltd, Publication
4.	Satellite Communications Systems: Systems, Techniques and Technology, Michel Bousquet Gerard Maral, Wiley.
5.	Satellite Communications, Robert M. Gagliardi, CBS Publishers
6.	Principles of Radar, Toomay J.C, PHI Publications

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Speech and audio processing**			***Course Code*:**	**:**	**ETE424**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	**03**
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 213, EC 314					
Course Domain	**:**	Program Elective-II					

Course Rationale: This course deals with basic concepts of speech signals and their attributes, the human auditory system, speech processing in the time domain and in the frequency domain, coding techniques, challenges, and solutions for speech signals.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce to students the human auditory system.	**1.**	Understand the human auditory system.
2.	Develop a Basic understanding of speech signal attributes.	**2.**	Understand the theory of speech signal and speech production.
3.	Introduce time domain processing techniques for speech signals.	**3.**	Understand time domain speech processing.
4.	Introduce Frequency domain processing techniques for speech signals and Develop a Basic understanding of LPC	**4.**	Understand Frequency domain speech processing. Explain LPC its challenges and solutions.
5.	Introduce Speech signal coding techniques and challenges.	**5.**	Explain audio signal coding techniques and standards.
6.	Introduce classification of Audio quality analysis methods	**6.**	Classify Audio quality analysis methods

Curriculum Content	**Hours**
Unit I - Digital models for the speech signal Process of speech production, Acoustic theory of speech production, Lossless tube models, and Digital models for speech signals.	06
Unit II - Time domain models for speech processing Time-dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Short time autocorrelation function, Pitch period estimation using autocorrelation function, Median smoothing.	06

Unit III - Short time Fourier analysis Linear Filtering interpretation, Filter bank summation method, Gamma tone filter, other considerations in filter bank design, speech spectrum analysis using FFT.	06
Unit IV - Linear predictive coding of speech Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications.	06
Unit V - Audio Processing Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio, Audio Coding - High quality, low-bit-rate audio coding standards, Multichannel audio - Stereo, Multichannel surround sound.	06
Unit VI - Audio quality analysis: Objective analysis methods- PEAQ, Subjective analysis methods - MOS score, MUSHRA score. Spatial audio standards.	06
The suggested list of Tutorials and Assignments: Minimum 5 Assignments should be conducted on basis of the above-mentioned Theory Syllabus of this subject.	

Suggested Text Books:	
1.	Ben gold and N Morgan, “Speech and audio signal processing”, John Wiley and sons
2.	. L. R. Rabiner and R. W. Schafer**,** “Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.
Suggested Reference Books:	
1.	D. O’Shaughnessy, “Speech Communications: Human and Machine,”Universities Press.
2.	. L. R. Rabiner and B. Juang,“Fundamentals of Speech Recognition,” Pearson Education (Asia) Pte. Ltd., 2004.
3.	Z. Li and M.S. Drew**,** “Fundamentals of Multimedia,” Pearson Education (Asia)

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Wireless Sensor Networks**			***Course Code*:**	**:**	**ETE 424**
Teaching Scheme (Hours)	**:**	Lecture: 03 Hrs./week Tutorial: --			***Total Credits***	**:**	03
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	03 hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 315, ETE 412					
Course Domain	**:**	Program Elective-II					

Course Rationale: The course aims to give students an understanding of the sensor network concepts and practical aspects of wireless sensor networks and an appreciation of their wide application area.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To understand terminology, issues, challenges and emerging technologies for wireless sensor networks	**1.**	Describe & adequately use vocabulary, terminology and nomenclature of wireless sensor networks.
2.	To introduce the need and challenges in case of mobile Ad-hoc Networks.	**2.**	Understand main concepts of mobile ad hoc networks.
3.	To learn about various routing protocols	**3.**	Compare routing protocols for sensor networks.
4.	To discuss the medium access control protocols and their issues.	**4.**	Understand key MAC protocols for sensor networks
5.	To familiarize students to Underwater Wireless Sensor Networks.	**5.**	Differentiate the concepts of terrestrial sensor networks and underwater wireless sensor networks.
6.	To study the design considerations of wireless sensor networks.	**6.**	Give solution to the various problems encountering in the design of wireless sensor networks.

Curriculum Content	**Hours**
Unit I- Introduction to Wireless Sensor Networks Introduction to Sensor Networks Constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Introduction of Wireless Sensor Networks Coverage (Type, Coverage, Topology management), Wireless Sensor Networks Issues and challenges, Mobile Sensor Networks	06

Unit II- Mobile Ad-hoc Networks Mobile Ad-Hoc Networking with a View of Wireless: Imperatives and Challenges, Off-the-Shelf Enables of Ad Hoc Networks, IEEE 802.11 in Ad Hoc Networks: Protocols, Performance and Open Issues, Mobile Ad Hoc Networks Routing Technology for Dynamic, Wireless Networking, Routing Approaches in Mobile Ad Hoc Networks, Mobile Ad Hoc Network Security.	06
Unit III- Wireless Sensor Networks- Routing Protocols Introduction, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks: WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation, Low-Energy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems, Directed Diffusion, Geographical Routing.	06
Unit IV- Wireless Sensor Networks- MAC Protocols Wireless Transmission Technology and Systems: Radio Technology Primer, Available Wireless Technologies. Medium Access Control Protocols for Wireless Sensor Networks: Fundamentals of MAC Protocols, MAC Protocols for WSNs, MAC performance issues Sensor-MAC Case Study	06
Unit V- Underwater Wireless Sensor Networks Introduction of underwater Wireless Sensor Networks (Need, Differences with terrestrial sensor networks), Potential application- Ocean environment monitoring, Ocean mapping, oil/mineral exploration , Disaster prevention, assisted navigation and tracking, Research challenges, Physical effects -properties of sea water , Physical properties, Network topology and localization, UWSN Deployment- Static and self-adjusted, UWSN Architecture- static, hybrid and mobile, Energy issues, Localization, Mobility.	06
Unit VI- Wireless Sensor Networks- Design Principles Design Principles, approach for Wireless Sensor Networks, IoT Gateway Concepts, Need of gateway, Wireless Sensor Networks sensor nodes Structure, Hardware design of sensor node, Application Protocols MQTT, REST/HTTP, CoAP. Wireless Sensor Networks Security- requirements, attack type, protocol.	06
Suggested list of Tutorials and Assignments: **Based on the syllabus content students have to complete any one of the following activity** 1. simulation-based work 2. case study work 3. site visit 4. solve technical quiz 5. Solve home assignments	

Suggested Text Books:	
1.	Ad Hoc Wireless Networks: Architectures and Protocols by C. Siva Ram Murthy, B. S. Manoj Prentice Hall PTR, 2007
2.	Protocols & Architectures for Wireless Sensor Networks by Holger Karl, Andreas Willig Wiley.
3.	Guide to Wireless Sensor Networks by Sudip Misra, springer.
Suggested Reference Books:	
1.	Wireless Sensor Networks An Information Processing Approch by Feng Zhao, Leonidas J Guibas, Morgan Kaufmann Publishers.
2.	AD HOC Wireless Network A Communication-Theoretic Perspective by Ozan K. Tonguz, Gianluigi Ferrari by Wiley Publications.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Automotive Electronics**			***Course Code*:**	**:**	**ETE425**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	03 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	ETE224, ETE313					
Course Domain	**:**	Open Elective-II					

Course Rationale: This course deals with basic concepts of Automotive system, automotive Sensory and actuators system, Automotive intra processor protocols and grade microcontrollers.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Make student aware of fundamentals of Automotive vehicle system	**1.**	Comprehend the roles and implementations of various systems used in automotive.
2.	Make student aware of Automotive Sensory System	**2.**	Understand the automotive sensory systems.
3.	Make students aware of Automotive Actuators	**3.**	Discuss the various actuators for automotive systems.
4.	Make students aware of intra processor communication protocol	**4.**	Understand need for protocol & intra processor communication protocol
5.	Make students aware of Electronic Communication Protocols	**5.**	Understand working various automotive protocols and compare them.
6.	Make students able to compare Automotive Grade Microcontrollers	**6.**	Compare Automotive Grade Microcontrollers

Curriculum Content	**Hours**
Unit I. Automotive Systems Overview Automotive Vehicle Technology, Overview of Vehicle Categories, Various Vehicle Sub Systems like Chassis, Body, Driveline, Engine, Fuel, Emission, Brakes, Suspension, Doors, Safety & Security, Comfort & Multimedia, Communication & Lighting, Future Trends in Automotive Embedded Systems: Drive by Wire, Autopilot, Robotics.	06
Unit II. Automotive Sensory System Concept to Market	05

Understanding Automotive Product Design Cycle, Building Blocks of Automotive Electronic Product -Automotive Sensors and Transducers: Types, Force, Humidity, Carbon Dioxide (CO2), Carbon Monoxide (CO), Oxygen (O2) Sensor, LAMBDA Sensor, Proximity Distance Sensors, Speed, Engine Knock Sensor, Flow Sensor, New developments in sensor technology.	
Unit III. Automotive Actuators Introduction, Function & Operating principle, Construction & working of solenoid actuators, Relays, Motorized actuators, Thermal Actuators, Electro-hydraulic & Electrochemical Valve actuators, Application & New Developments in the Actuators Technology.	05
Unit IV. Automotive Protocols I The need for Protocol, Intra processor Communication Protocols: UART, I2C & I2S, SPI, RS485 MODBUS & USB.	06
Unit V. Automotive Protocols II LIN, CAN, Overview of - KWP2000 , J1850 & J1939 FlexRay.	08
Unit VI. Automotive Grade Microcontrollers Overview of Automotive Grade Microcontrollers, Microcontrollers with Built in CAN Interface ATMega164P, AT32UC3C2512C, Safety Critical Microcontrollers like Hercules TMS470M ARM Cortex-M3 Series, Case study- cruise control of car, Artificial Intelligence and engine management.	06

Assignments: Based on the following activity

1. The Report on Industrial Visit.
2. The simulation of the Models using Simulation Tool like AUTOSAR.
3. Implementation of a model using Automotive Sensors, Actuators and Protocols and microcontrollers as given in the curriculum.
4. Solving miscellaneous questions based on said curriculum.

Suggested Text Books:

1.	Understanding Automotive Electronics by William B. Ribbens
2.	Automobile Electrical and Electronic Systems by Tom Denton
3.	Automobile Engineering Vol 1 &Vol 2 by Kripal Singh

Suggested Reference Books:

1.	Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive
2.	Automobile Mechanics by W.H. Crouse, Tata McGraw Hill

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Robotics**			***Course Code*:**	**:**	**ETE425**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	**03**
		Tutorial:	--				
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70	Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 211, ETE 212, ETE 214, EC 325, EC 313					
Course Domain	**:**	Open Elective- II					

Course Rationale: This course deals with basic concepts of robotics, the mechanism of a robot, the preparation of the control system of the robot, different sensors, and machine vision system for robot

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce students to the fundamental of robotics and its applications.	**1.**	Classify robots and explain applications of robotics.
2.	Develop a basic understanding of robot operation and implementation of sense and control in robots.	**2.**	Illustrate the fundamental mechanism of robots.
3.	Enable students to apply kinematics equations to the model robot for performing tasks.	**3.**	Formulate the position and motion of the robot using kinematic equations.
4.	Enable students to apply basic design mechanism	**4.**	Select the drive and control to be used for the robot.
5.	Introduce students the classification of end effectors, and Gripper mechanisms	**5.**	classify end effectors, and types of Gripper mechanisms
6.	Introduce students the classification of sensors	**6.**	Classify sensors and design robot end effectors for a specific application

Curriculum Content	**Hours**
Unit I - Introduction History of Robotics, Classification of Robots, Laws of Robotics, Robot Components, Advantages and Disadvantages of Robots, Applications of Robotics, Social and labor issues.	06
Unit II - Mechanism of Robot	05

Robot Degrees of Freedom, Robot Joints, Robot Coordinates, Robot Reference Frames, Robot Workspace, Robot Characteristics, Programming Modes, Robot Mechanism	
Unit III - Kinematics of Robot Matrix Representation: point, vector, frame, rigid body; Homogeneous Transformation Matrices, Representation of Transformations: pure translation, pure rotation and combined transformation; Transformations Relative to the Rotating Frame (with Numerical); Inverse of Transformation Matrices, Forward and Inverse Kinematics of Robots, Forward and Inverse Kinematic Equations: Position, orientation.	05
Unit IV - Drives and Control system Hydraulics systems, Pneumatic drive, Electric drives: DC motor, Stepper motor, Servo motors; Gear Power transmission systems: Rotary to linear motion conversion Types of gears, Gear drive, Belt drives; Types of Controllers, characteristics of control system.	06
Unit V - End Effectors Types of end effectors, Types of Gripper mechanisms: Mechanical grippers, Grippers force analysis, Vacuum cups, Magnetic Grippers, Adhesive Grippers; Tools as end effector, Robot end effector interface, considerations in gripper selection and design	08
Unit VI - Sensors and machine vision Position sensors, Velocity sensors, Accelerometers, Proximity sensors, Force and Pressure Sensors, Range Finders, Remote Center Compliance (RCC) Device; Machine vision system.	06
The suggested list of Tutorials and Assignments: Minimum 5 Assignments should be conducted on basis of the above-mentioned Theory Syllabus of this subject.	
Suggested Text Books:	
1.	Introduction to robotics analysis, control and applications Saeed B. Niku: willey publication
2.	Industrial Robotics: Technology, programming and applications. Mikell P. Groover, TMH
Suggested Reference Books:	
1.	Yoremkoren, Robotics for Engineers, McGraw- Hill,USA,1987
2.	Robotic Engineering: An integrated approach Richard D. kalfter, PHI

Class, Part & Semester	**:**	**Final Year B.Tech (Electronics and Telecommunication Engineering) Part IV, Semester VIII**				
Course Title	**:**	**Artificial Intelligence**		***Course Code*:**	**:**	**ETE425**
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week	***Total Credits***	**:**	03
		Practical : :	---			
Evaluation Scheme (Marks)	**:**	CIE=30 (20+10)	SEE = 70 Grand Total=100	***Duration of SEE***	**:**	3 hrs
Revision:	**:**	Fourth		***Month***	**:**	June 2023
Pre-requisites	**:**					
Course Domain	**:**	Open Elective-II				

Course Rationale: In this course of students will learn basics of Soft computing, Artificial Intelligence, Machine Learning and also Deep learning.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain the basics of AI, ML and DL.	**1.**	Elaborate basic concepts of AI, ML and DL.
2.	Explain different Supervised learning networks.	**2.**	Compare different Supervised learning networks.
3.	Describe different unsupervised learning algorithms	**3.**	Identify different unsupervised learning algorithms for the related real world problems
4.	Explain different morphological image processing algorithms.	**4.**	Describe various regression techniques.
5.	Explain different types of classification models	**5.**	Compare different types of classification models
6.	Explain fundamentals of deep learning.	**6.**	Apply fundamental concepts of ANN.

Curriculum Content	**Hours**
UNIT I- Introduction Artificial Intelligence and Neural Network, Biological Neural Network, Brain vs. Computer, Evolution of Neural Networks, Basic Models of Artificial Neural Network, Machine Learning, Types of Learning, Important Terminologies of ANN, McCulloch-Pitrs Neuron.	04
UNIT II- Supervised Learning Network Introduction, Learning rule, Architecture, training and testing of Prerceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neurons, Back-Propagation Network, Radial Basis Function Network.	08
UNIT III- Unsupervised Learning Networks	04

Introduction, Clustering, K Means clustering, Hierarchical Clustering, Principal Component Analysis (PCA).	
Unit IV- Regression Univariate Regression – Model Representation, Least-Square Method for finding values of the regression coefficients. Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Optimizing Simple Linear Regression with Gradient Descent Algorithm. Multivariate Regression –Model Representation, Polynomial Regression. Generalization Issues- Overfitting Vs. Underfitting, Bias Vs. Variance.	05
Unit V- Classification Binary Classification: Linear Classification model, Performance Evaluation- Confusion Matrix, Accuracy and ROC curves. Logistic Regression – Model, Cost Function. Linear Support Vector Machines (SVM) – Introduction, Soft Margin SVM, Introduction to various SVM Kernel to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid. Multiclass Classification techniques -One vs One, One vs Rest. Enhancing Performance of classification: Cross-Validation, Sub-Sampling, Hyper Parameter Tuning Techniques.	07
UNIT VI-Introduction to Deep Learning Introduction, Vanishing gradient problem, Convolution neural network (CNN), RNN, Autoencoders.	08
Assignments: Based on the following activity 1. Solving questions based on said curriculum. 2. Implementation of Algorithms using python.	

Suggested Text Books:	
1.	Dr. S. N. Sivanandam, Dr. S. N. Deepa, “Principles of S.oft Computing”, John Wiley & Sons Publication.
2.	Siman Hyken, “Neural Network-a comprehensive foundation”, Pearson Education.
Suggested Reference Books:	
1.	C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2.	Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Major Project (Phase -2)**			***Course Code*:**	**:**	**ETE426**
Teaching Scheme (Hours)	**:**	Practical:	02 Hrs/week= 2 X 13 = 26hrs		***Total Credits***	**:**	04
Evaluation Scheme (Marks)	**:**	IPE = NIL	EPE= 50	Total= 50	***Duration of EPE***	**:**	03 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE212, ETE215, ETE313, ETE316L, ETE317, RM 311, ETE324, ETE326L, ETE416L					
Course Domain	**:**	Program Core					

Course Rationale:

This course deals with identifying, classifying and formulating the problem and finding technological solution to correct the problem. The students are encouraged to find the technological solution on societal, environmental related problems. Design and development of a system to achieve the desired objective.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Understand basic stages in electronic system design	**1.**	Identify social, environmental, market needs and solutions.
2.	Surveying the problem and finding technological solution.	**2.**	Illustrate design and development stages in electronics engineering projects.
3.	Designing electronics systems.	**3.**	Apply engineering knowledge for solving real world problems.
4.	Learning and using circuit simulation and development tools	**4.**	Manage project and finance.
5	Working in team to accomplish task	**5.**	Provide technological solutions on recent problems and lifelong learning.
6.	Project management and life-long learning	**6.**	Work in team, follow ethical practices, and prepare documentation and presentation.

Sr. No.	***Course curriculum***
1.	The project selected and approved in semester VII has to be continued in semester VIII. Students have to complete the project in all aspects and submit the written project report of the same. External examiner from Industry or faculty member from out of the University has to be called for project assessment.

General Instructions:

Students have to submit monthly progress reports. Work in laboratory under supervision of guide. At the time of semester end assessment demonstrate the project. They have to bring model, convey technical details using PPT. Students have to face viva voce. At the end students have to submit the hard copy of project report to department.

Suggested Text Books/ Reference Books/Manual	
1.	Articles from reputed journals, magazines, websites, real world problems, case studies, Survey reports
2.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Digital Television & Multimedia Laboratory**			***Course Code*:**	**:**	**ETE421L**
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE= NIL	EPE =50	Total=50	***Duration of EPE***	**:**	03 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**	ETE322, ETE323					
Course Domain	**:**	Program Core					

Course Rationale: Digital TV lab course introduces the practical on color composite video signal, DTH, fault finding of LCD/LED, demonstration of satellite receiver, installation of CCTV etc.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Study concept of digital & high definition TV system.	**1.**	Understand fundamentals of Digital Television.
2.	Study advanced TV systems like LCD, plasma, LED, CCTV, etc.	**2.**	Apply the fundamental knowledge to understand how to troubleshoot LCD TV.
3.	Study the fundamentals of Multimedia.	**3.**	Apply the fundamental knowledge to understand how to troubleshoot LED TV.
4.	Study compression techniques in Multimedia.	**4.**	Demonstrate how to connect satellite receiver with Television to receive various programs

List of Experiments

Sr. No.	Title of **Experiments**
1.	Study of Pattern Generator / CCVS
2.	Demonstration of DTH
3.	Demonstration of CCTV
4.	Installation of LCD TV
5.	Installation of LED TV
6.	Trouble shooting of LCD/LED Television receiver: No picture on the screen
7.	Trouble shooting of LED Television receiver: The screen is too dark
8.	Trouble shooting of LCD/LED Television receiver: Horizontal Lines appear during start-up

9.	Trouble shooting of LCD/LED Television receiver: LED TV has no sound
10.	Trouble shooting of LCD/LED Television receiver: The image on the screen is stretched or distorted
11.	Video Compression using MATLAB Simulink
12.	Read and write audio file using MATLAB
Suggested Text Books/ Reference Books/Manual	
1.	Television Engineering -Audio and Video Systems, D. S. Bormane, P.B. Mane, Wiley publication.
2.	R. R. Gulati, —Monochrome and colour television
3.	Fundamentals of Electronics-LCD/LED TV Practical version 1.0 by Funfirst Funtronic Pvt.Ltd
4.	"Audio Video Engineering" by Dr. R. C. Jaiswal, Nirali Prakashan; First edition (2019)

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, VIII**					
Course Title	**:**	**Operating Systems Tutorial**			***Course Code*:**	**:**	**ETE422L**
Teaching Scheme (Hours)	**:**	Tutorial:	1Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE=50	EOE = Nil	Total=50	***Duration of IOE***	**:**	3 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE225					
Course Domain	**:**	Program Core					

Course Rationale: The course provide fundamental concepts of operating system. The presence of operating system in between user and computer hardware. It This course includes CPU scheduling, memory management, and device management

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain how Operating System is Important for Computer System	**1.**	Explain basic concepts of operating systems and compare different operating systems.
2.	Expose the students to various functions of the Operating system and their usage.	**2.**	Explain Processes & Threading environment in operating systems.
3.	Provide exposure to Linux and windows 7 operating systems.	**3.**	Discuss issues related to the memory & I/O in Operating systems.
4.	Provide knowledge of real time operating system.	**4.**	Describe various process management concepts like scheduling, synchronization, deadlocks.
5	Explain architecture of different operating system	**5.**	Explain concepts of memory management.
6.	Expose the students to various functions of the Operating system and their usage.	**6.**	Explain concepts of real time operating system

Sr. No.	***List of Tutorials***
1.	Compare different types of operating system.
2.	Problems based on scheduling policies.

3.	Kernel based operating system
4.	Multiprogramming operating system
5.	Discuss the following terminology related to process a) Race condition b) Synchronization c) Critical section
6.	Explain Deadlock condition , deadlock detection and avoidance
7.	Draw Resource allocation graph for given condition
8.	Discuss different page replacement polices
9.	Explain file operation and access methods.
10.	Case study on Windows operating system
11.	Case study on Linux operating system
12.	Case study on real time operating system
General Instructions: Minimum eight tutorials should be conducted from above list but not limited to this list.	
Suggested Text Books/ Reference Books/Manual	
1.	Operating System Concepts - Abraham Silberschatz, Peter B. Galvin & Grege Gagne (Wiley)
2.	Operating Systems - A Concept Based approach - Dhananjay M Dhamdhere (TMGH).
3.	Unix Concepts and Applications – Sumtabha Das (TMGH).
4.	Operating System : Concepts and Design - Milan Milenkovic (TMGH)
5.	Operating System with case studies in Unix, Netware and Windows NT - Achyut S. Godbole (TMGH).

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, VIII**					
Course Title	**:**	**Optical Fiber Communication Laboratory**			***Course Code*:**	**:**	**ETE423L**
Teaching Scheme (Hours)	**:**	Practical :	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE/IOE=	EOE=50	Total=	***Duration of EOE***	**:**	3 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE323					
Course Domain	**:**	Program Core					

Course Rationale: *The course deals with fundamentals of optical communication system. The course covers Optical fiber material properties and fabrication methods. The working principles of optical source and detectors.*

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain fundamental concept of Optical communication system.	**1.**	Interpret functions of different blocks of optical communication
2.	Explain basic elements of optical fiber transmission link, fiber modes configurations and structures.	**2.**	Understand the properties of optical fiber that affect the performance of a communication link.
3.	Calculate different types of loss	**3.**	Explain types of dispersion and able to measure attenuation and scattering losses of optical fiber.
4.	Explain optical sources, materials and fiber splicing	**4.**	Discuss fiber splicing, connectors and calculate intrinsic and extrinsic losses in fiber
5	Explain working of optical receivers and noise performance in photo detector.	**5.**	Explain working principles of optical sources and detectors.
6.	Explain WDM, solitons and SONET/SDH network.	**6.**	Understand working of different optical networks and operational principles of WDM.

Sr. No.	***List of Experiments***
1.	Setting up Fiber optic analog link
2.	Setting up Fiber optic digital link

3.	Intensity Modulation system using analog input signal
4.	Intensity Modulation system using digital input signal
5.	Frequency modulation system
6.	Pulse width modulation system
7.	Study of propagation loss in optical fiber
8.	Measurement of Bending loss in optical fiber
9.	Measurement of Numerical Aperture
10.	Setting up Fiber optic voice link using Frequency modulation
11.	Setting up Fiber optic voice link using PWM
12.	

General Instructions: Minimum Eight experiments should be conducted from above list but not limited to this list.

Suggested Text Books/ Reference Books/Manual

1.	Gerd Keiser ,"Optical Fiber Communications", 5th Edition Mc Graw-Hill International edition, 2000.
2.	John M. Senior, "Optical Fiber Communications", PHI, 3rd Edition, 2020
3.	D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, "Fiber Optic Communications" Pearson Education, 2005.
4.	S.C .Gupta, Text Book on Optical Fibre Communication and its Applications", PHI
5.	Govind P. Agarwal, John Wiley, " Fiber Optic Communication Systems",3rd Edition
6.	Joseph C. Palais , "Fiber Optic Communications", 4th Edition, Pearson Education

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Satellite & Radar Engineering Laboratory**			***Course Code*:**	**:**	**ETE424L**
Teaching Scheme (Hours)	**:**	Practical:	02 Hrs./week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE=50	EPE/EOE= Nil	Total=50	***Duration of IOE***	**:**	03 Hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	BS-11A2, ETE312					
Course Domain	**:**	Program Elective-II					

Course Rationale: The goal of this course is to make students familiar about how satellites and radars work and applications of these technologies.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce student to the fundamental concepts of satellite communication, satellite subsystems and their operation.	**1.**	Explain basic satellite system with its subsystems.
2.	Enable the student to locate satellite and determine antenna angles for establishment of link.	**2.**	Define orbital parameters and determine antenna look angles.
3.	Enable student to analyze, design satellite link and evaluate performance of satellite link.	**3.**	Classify types of losses and formulate power link budget for satellite.
4.	Make students aware about different satellite applications	**4.**	Illustrate applications of satellite communication such as DBS, VSAT and GPS.
5	To study the principles of operation of various blocks of Radar systems and Radar Range equation.	**5.**	Determine range, power and other performance parameters required for radar.
6.	Make students aware about different types of radars and their applications.	**6.**	Differentiate between different types of radars with their application.

List of Experiments

Sr. No.	Experiment Name

1.	Study of Satellite communication System
2.	Establishment of a Direct Communication Link.
3.	Verification of Direct Communication Link.
4.	Demonstration of transmission & reception of Function Generator Waveforms through Direct Link
5.	Demonstration of transmission & reception of multiple Signals simultaneously through Direct Link.
6.	Establishment of an Active Satellite Link.
7.	Verification of Satellite Communication Link.
8.	Demonstration of transmission & reception of Function Generator Waveforms through Satellite Link.
9.	Demonstration of transmission & reception of multiple Signals simultaneously through Satellite Link.
10.	Study of Global Positioning System & IRNSS.
11.	Study of Doppler Radar
12.	Measurement of Velocity and Vibrations using RADAR
13.	Study of Radar based alarm system and object detection
General Instructions: Any 8 experiments based on above syllabus but not limited to this list should be conducted using hardware/software/simulator.	
Suggested Text Books/ Reference Books/Manual	
1.	Satellite Communications - Dennis Roddy - Mc-Graw Hill Publication
2.	Introduction to Radar System - M. I. Skolnik ,Mc-Graw Hill publication
3.	Satellite Communications systems - M. Richharia - Mc Millan publication
4.	Introduction to Satellite Communication - Bruce R. Elbert, Third Edition , Artech House London
5.	Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance - Louis J. Ippolito, Jr. -John Wiley and Sons, Ltd, Publication
6.	Satellite Communications Systems: Systems, Techniques and Technology, Michel Bousquet Gerard Maral, Wiley.
7.	Satellite Communications, Robert M. Gagliardi, CBS Publishers
8.	Principles of Radar, Toomay J.C, PHI Publications

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Speech and audio processing Laboratory**			***Course Code*:**	**:**	**ETE424L**
Teaching Scheme (Hours)	**:**	Practical:	02 Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IOE= 50	EPE/EOE= NA	Total=50	***Duration of IOE***	**:**	03 Hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 213, EC 314					
Course Domain	**:**	Program Elective-II					

Course Rationale: This course deals with basic concepts of speech signals and their attributes, the human auditory system, speech processing in the time domain and in the frequency domain, coding techniques, challenges, and solutions for speech signals.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce to students the human auditory system.	**1.**	Understand the human auditory system.
2.	Develop a Basic understanding of speech signal attributes.	**2.**	Understand the theory of speech signal and speech production.
3.	Introduce time domain processing techniques for speech signals.	**3.**	Understand time domain speech processing.
4.	Introduce Frequency domain processing techniques for speech signals.	**4.**	Understand Frequency domain speech processing.
5	Introduce Speech signal coding techniques and challenges.	**5.**	Explain audio signal coding techniques and standards.
6.	Develop a Basic understanding of LPC its challenges and solutions.	**6.**	Explain LPC its challenges and solutions.

Sr. No.	***List of Experiments***
1.	To study the properties of the speech signal
2.	To study time domain processing of speech signal
3.	To study the median smoothing of the speech signal

4.	To study the speech signal filtering technique
5.	To study the speech spectrum analysis using FFT
6.	To study the frequency domain analysis of speech signal
7.	To study the digital processing of speech signal
8.	To study the noise removal of the speech signal
General Instructions: Minimum of 8 experiments should be conducted on the basis of the above-mentioned Syllabus of this subject using MATLAB software.	
Suggested Text Books/ Reference Books/Manual	
1.	Ben gold and N Morgan, "Speech and audio signal processing", John Wiley and sons
2.	. L. R. Rabiner and R. W. Schafer**,** "Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.
3.	D. O'Shaughnessy, "Speech Communications: Human and Machine,"Universities Press.
4.	. L. R. Rabiner and B. Juang,"Fundamentals of Speech Recognition," Pearson Education (Asia) Pte. Ltd., 2004.
5.	Z. Li and M.S. Drew**,** "Fundamentals of Multimedia," Pearson Education (Asia)

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics & Telecommunication Engineering), Part IV, Semester VIII**					
Course Title	**:**	**Wireless Sensor Network Laboratory**			***Course Code*:**	**:**	**ETE424L**
Teaching Scheme (Hours)	**:**	Practical:	02Hrs/week		***Total Credits***	**:**	01
Evaluation Scheme (Marks)	**:**	IPE= Nil, IOE= 50	EPE/EOE= Nil	Total= 50	***Duration of IOE***	**:**	03 Hrs
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites *(if any)*	**:**	ETE 315, ETE 412					
Course Domain	**:**	Program Elective-II Laboratory					

Course Rationale: The course aims to give students an understanding of the sensor network concepts and practical aspects of wireless sensor networks and an appreciation of their wide application area.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To understand terminology, issues, challenges and emerging technologies for wireless sensor networks	**1.**	Describe & adequately use vocabulary, terminology and nomenclature of wireless sensor networks.
2.	To introduce the need and challenges in case of mobile Ad-hoc Networks.	**2.**	Understand main concepts of mobile ad hoc networks.
3.	To learn about various routing protocols	**3.**	Compare routing protocols for sensor networks.
4.	To discuss the medium access control protocols and their issues.	**4.**	Understand key MAC protocols for sensor networks
5	To familiarize students to Underwater Wireless Sensor Networks.	**5.**	Differentiate the concepts of terrestrial sensor networks and underwater wireless sensor networks.
6.	To study the design considerations of wireless sensor networks.	**6.**	Give solution to the various problems encountering in the design of wireless sensor networks.

List of Experiments

Sr. No.	Experiment
1.	To study and understand the concept of Wireless Sensor Network.

2.	To study different network topologies like - Point to Point, Star ,Mesh etc.
3.	To study different wireless sensor networks.
4.	To study Interfacing of analog / digital signaling of Sensors.
5.	To study Graphical analysis of analog / digital Sensors.
6.	To study Routing algorithms
7.	To study how to configure End Device and Router.
8.	To Study End Device parameters like Sleep period, Sensor scan time, PAN ID, Baud Rate
9.	To study Interfacing using Arduino, Python, and C programing etc.
10.	To study Basics of Network Simulation
11.	Simulating a Local Area Network
12.	Measuring Network Performance
13.	Simulating a Wi-Fi Network
14.	Simulating a Mobile Adhoc Network
15.	Simulating a Wireless Sensor Network
General Instructions: Any 8 experiments based on above syllabus but not limited to this list should be conducted using hardware/software/simulator/virtual lab etc.	
Suggested Text Books/ Reference Books/Manual	
1.	Ad Hoc Wireless Networks: Architectures and Protocols by C. Siva Ram Murthy, B. S. Manoj Prentice Hall PTR, 2007.
2.	Protocols & Architectures for Wireless Sensor Networks by Holger Karl, Andreas Willig Wiley. Guide to Wireless Sensor Networks by Sudip Misra, springer.
3.	Wireless Sensor Networks An Information Processing Approch by Feng Zhao, Leonidas J Guibas, Morgan Kaufmann Publishers.
4.	AD HOC Wireless Network A Communication-Theoretic Perspective by Ozan K. Tonguz, Gianluigi Ferrari by Wiley Publications.
Web References:	
1.	Virtual Labs - https://www.vlab.co.in

Class, Part & Semester	**:**	**Final Year B. Tech (Electronics and Telecommunication Engineering) Part IV, Semester VIII**					
Course Title	**:**	**Financial Management**			***Course Code*:**	**:**	**ETE427**
Teaching Scheme (Hours)	**:**	Lecture:	02 Hrs/week		***Total Credits***	**:**	02
		Practical :	--				
Evaluation Scheme (Marks)	**:**	IOE = 50	EPE/EOE= Nil	Grand Total=50	***Duration of IOE***	**:**	03 Hrs.
Revision:	**:**	Fourth			***Month***	**:**	June 2023
Pre-requisites	**:**						
Course Domain	**:**	Finance and Humanity					

Course Rationale: In this course of students will learn basics of personal financial planning and management.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
7.	Explain the basics of Financial Planning.	**7.**	Elaborate basic concepts Financial Planning.
8.	Explain the importance and methods of financial management.	**8.**	Describe the importance and methods of financial management.
9.	Explain the different purchasing strategies.	**9.**	Describe the different purchasing strategies purchasing strategies.
10	Explain different insurance and their importance.	**10.**	Elaborate different insurance and their importance.
11	Explain different types investment options and their comparison.	**11.**	Compare different type of investment options.
12	Explain retirement financial planning.	**12.**	Describe the making of retirement financial planning.

Curriculum Content	**Hours**
UNIT I- Financial Planning What is Financial Literacy and financial planning, Need of financial planning, The Financial Planning Process, Opportunity Costs and the Time Value of Money, *Financial Aspects of Career Planning*: Employment Search Strategies, Financial and Legal Aspects of Employment. *Money Management Strategy*: Personal Financial Statements, Budgeting for Skilled Money Management, *Planning Your Tax Strategy*: Income Tax Fundamentals, Filing Your Federal Income Tax Return, Tax Planning Strategies.	04
UNIT II- Financial Management Financial Services for Financial Planning: Managing Daily Money Needs, Types of Financial Services, Savings Plans, Evaluating Savings Plans, Payment Methods. Introduction to Consumer Credit: Measuring Your Credit Capacity, Applying for Credit, Complaining about Consumer Credit, The Cost of Credit.	05

UNIT III- Purchasing Decisions Consumer Purchasing Strategies, Financial Implications of Consumer Decisions, Major Consumer Purchases: case study-vehical, Legal Options for Consumers. The Housing Decision: Housing Alternatives, The Home-Buying Process, The Finances of Home Buying, Selling Your Home.	03
Unit IV- Insuring the assets and Resources Insurance and Risk Management: An Introduction, Property and Liability Insurance, Home and Property Insurance, Home Insurance Cost Factors, Automobile Insurance Coverage and cost. Health insurance: Health Care Costs, Health Insurance and Financial Planning, Private Sources of Health Insurance and Health Care, Government Health Care Programs, Life Insurance: Determining Your Life Insurance Needs, Important Provisions in a Life Insurance Contract, Buying Life Insurance, Life Insurance Proceeds.	05
Unit V- Investing Your Financial Resources Preparing for an Investment Plan, Factors Affecting the Choice of Investments, Factors That Reduce Investment Risk, Investing in Stocks: Evaluating a Stock Issue, Numerical Measures That Influence Investment Decisions, Buying and Selling Stocks. Investing in Bonds and Mutual funds: Types of Bonds, Government Bonds and Debt Securities, factors Deciding to Buy or Sell Bonds, Classifications of Mutual Funds, Deciding factors to Buy or Sell Mutual Funds. Investing in Real Estate, Advantages and disadvantage of Real Estate Investments, Investing in Precious Metals, Gems, and Collectibles.	05
UNIT VI- Controlling financial future Why Retirement Planning, Retirement Living Expenses, Conducting a Financial Analysis, Planning Your Retirement Income, Living on Your Retirement Income.	02

Assignments: Based on the following activity

- Solving questions based on said curriculum.

Suggested Text Books:

1.	Jack R. Kapoor, Les R. Dlabay, Robert j. Hughes, Melissa m. Hart, "Personal Finance", The McGraw-Hill Education Publication.

Suggested Reference Books:

1.	Madura , Casey, Roberts , "Personal Financial Literacy", Pearson Education.

Class & Semester	:	**Final Year B.Tech (Electronics & Telecommunication Engineering) Part IV, Semester VIII**

Course Title	:	**Introduction to Indian Constitution**						***Course Code*:**	:	**HS421**	
Teaching Scheme (Hours)	:	Lectures= 2 hrs. /Week						***Credits***	:	--	
Evaluation Scheme (Marks)	:	Assignments Viva voce	: :	50 25	Written Test Grand Total	: :	25 100	***Duration of Exam***	**:**	03 Hrs.	
Revision	:	Third						***Month***	:	June 2023	
Pre-requisites	**:**	It has no any pre-requisites. Every citizen of the country ought to study the course content.									
Course Domain	**:**	Audit Course at institute level, Humanities & Social Science									

Course Rationale: As a citizen of India, every student should have basic knowledge about Indian constitution. Every student should know the importance of Fundamental rights, Fundamental duties as well as Directive Principles. This course fulfills all these requirements. This course also includes knowledge about state as well as union legislature, judiciary and executive. It helps to understand emergency provisions, electoral process and amendment procedures. This course is helpful for the students to be legally updated.

Course Objectives: The Course Teacher will		***Course Outcomes:*** Students will be able to	
1.	Familiarize students with the preamble	**1.**	Get associated with Indian Constitution
2.	Describe fundamental rights & duties of citizens.	**2.**	Understand their fundamental duties and rights.
3.	Explain union and state executives.	**3.**	Recognize union and state executives.
4.	Discuss constitutional provisions.	**4.**	Interpret about constitutional provisions.
5.	Illustrate electoral process.	**5.**	Understand and follow the electoral process
6.	Summarize role of democracy in social welfare.	**6.**	Realize importance of democracy in social welfare.

Curriculum Content	**Hours**
Unit I- Introduction to Preamble and Fundamental Rights Preamble to the constitution of India. Fundamental rights under Part – III – details of Exercise of rights, Limitations & Important cases.	04
Unit II- Fundamental Duties and Directive Principles. Relevance of Directive principles of State Policy under Part – IV. Fundamental duties & their significance.	05
Unit III- Union Legislature, Judiciary & Executive.	04

President, Prime Minister, Parliament & the Supreme Court of India.	
Unit IV- State Legislature, Judiciary & Executive. Governors, Chief Minister, State Legislator and High Courts.	05
Unit V: Constitutional Provisions. Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes. Emergency Provisions.	05
Unit VI- Electoral process & Amendment procedures: Constitution of election commission, system of adult suffrage, procedure for amendment. 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments.	05

Text Books:

1. Durga Das Basu: "Introduction to the Constitution of India" (Students Edn.) Prentice – Hall EEE, 19th/20th Edn. 2001.
2. R.C.Agarwal, "Indian Political System", (1997) S.Chand and Company, New Delhi. Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi.
3. K.L.Sharma, "Social Stratification in India: Issues and Themes", (1997), Jawaharlal Nehru University, New Delhi.

Reference Books:

1. An Introduction to Constitution of India" by M.V. Pylee, Vikas Publishing, 2002. Sharma, Brij Kishore, "Introduction to the Constitution of India: Prentice Hall of India, New Delhi.
2. U.R.Gahai, "(1998) Indian Political System ", New Academic Publishing House, Jalandhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, "(1997) Social Stratification and Charge in India ", Manohar, New Delhi.