GOVERNMENT OF INDIA
MINISTRY OF
PARLIAMENTARY AFFAIRS

आजादी का अमृत महोत्सव

mygov मेरी सरकार

PREAMBLE TO THE CONSTITUTION

PREAMBLE

WE, THE PEOPLE OF INDIA.

having solemnly resolved to constitute India into a SOVEREIGN SOCIALIST SECULAR DEMOCRATIC **REPUBLIC** and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship:

EQUALITY of status and of opportunity;

and to promote among them all

FRATERNITY assuring the dignity of the individual and the unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this 26th day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

I have read the Preamble

23-01-2026

Signature

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

("Deemed to be University u/s 3 of the UGC Act, 1956")
Accredited 'A+' Grade by NAAC(2nd Cycle)
Agalakote, B.H.Road, Tumkur – 572 107.KARNATAKA, INDIA.

No. SSAHE/ACA-S&C/88/UG (BE)/2026 **Date: 23/09/2026**

NOTIFICATION

Sub:- Ordinance pertaining to Curriculum of Undergraduate Programme in Bachelor Engineering (4th year Electronics and Communication Engineering)

Ref: Proceedings of the 32nd Academic Council meeting held on 28/07/2026 vide agenda no. SSAHE/AC/XXXII-52/2026 .

In exercise of the powers vested under section 6 of 6.05 of MoA / Rules of SSAHE, the Revised Ordinance pertaining to Curriculum of Undergraduate Programme in Bachelor of Engineering disciplines (4th year Electronics and Communication Engineering) is notified herewith as per Annexure.

By Order,

REGISTRAR

REGISTRAR
Sri Siddhartha Academy of Higher Education
Agalakote, B.H. Road, Tumkur - 572 107.

To,

Dean / Principal, Sri Siddhartha Institute of Technology,

Copy to:

1) **Office of the Chancellor, SSAHE, for kind information,**
2) **PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE**
3) **All Officers of the Academy Examination Branch / Academic Section / Guard File / Office copy.**

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(DEEMED TO BE UNIVERSITY), Accredited A+ Grade by NAAC

SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY

(A constituent College of Siddhartha Academy of Higher Education, Tumakuru)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR BE DEGREE COURSE

Academic Year 2026-27

Vision

Mould quality technocrats in the field of Electronics and Communication with human values to cater the societal needs

Mission

- To impart high-quality academic environment.
- To provide training in new tools and technologies.
- To facilitate continuous learning and research environment.
- To inculcate professionalism with ethical values, with little impact on environment.

Program Educational Objectives:

PEO-1: Proficient to apply the knowledge gained in mathematics, science and engineering to the field of electronics and communication engineering for the synthesis and analysis of systems

PEO-2: Competent to pursue higher studies and research, with effective communication

PEO-3: Aware of new technologies in the domain field, apply the same for the societal requirement minimizing the impact on environment and ethical practices in their domain

Knowledge and Attitude Profile (WK):

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data

analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability, etc., with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an

engineering specialization as specified in WK1 to WK4 respectively to develop solutions to complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8)

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling, recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team Work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for: i) Independent and life-long learning ii) Adaptability to new and emerging technologies iii) Critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

PSO1: The ability to identify, analyze and design systems related to modern engineering hardware and software tools, in Electronics and Communication Engineering in the areas of electronics, communication, image processing, VLSI, signal processing and embedded systems for solving day to day problems.

PSO2: Impact the awareness about the impact of professional engineering solutions in societal and environmental context, professional ethics and be able to communicate effectively.

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(Deemed To Be University Accredited A+ Grade by NAAC)

SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY

(A constituent College of SSAHE, Accredited by NBA)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR BE DEGREE COURSE-2022 (160 Credits Scheme, NEP Batch)

FOURTH YEAR B.E. 7th Semester Academic Year: 2026-27

Sl No.	Course Code		Course Title	Teaching Dept.	Teaching Hours					Credits	Examination			
					L	T	P	S	Total		CIE	SEE	Total Marks	Exam Hrs.
1	PC	22EC701	Mobile and Wireless Communications	ECE	42	-	28	50	120	4	50	50	100	3
2	PC	22EC702	IOT and its Applications	ECE	42	-	28	50	120	4	50	50	100	3
3	PE	22EC7PE3X	Professional Elective III	ECE	42	-	-	48	90	3	50	50	100	3
4	PE	22EC7PE4X	Professional Elective IV	ECE	42	-	-	48	90	3	50	50	100	3
5	PE	22EC7PE5X	Professional Elective V	ECE	42	-	-	48	90	3	50	50	100	3
6	PE	22EC7PE6X	Professional Elective VI	ECE	42	-	-	48	90	3	50	50	100	3
7	PW	22ECPW706	Project Phase-I	ECE	-		28	32	60	2	50	-	50	-
				Total	**252**		**84**	**324**	**660**	**22**	**350**	**300**	**650**	-

Elective III 22EC7PE31 – Digital Signal Compression 22EC7PE32 – Advanced Digital Signal Processing 22EC7PE33 – Multimedia Communication	**Elective IV** 22EC7PE41 – MEMS and Nanoelectronics 22EC7PE42 – VLSI Testing and Testability 22EC7PE43 – Submicron Devices
Elective V 22EC7PE51 – RF IC Design 22EC7PE52 – Natural Language Processing 22EC7PE53 – Optimization Methods in Machine Learning	**Elective VI** 22EC7PE61 – Applied Embedded Systems 22EC7PE62 – Wireless Sensor Networks 22EC7PE63 – Digital Signal Processing for Wireless Communication

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: Mobile and Wireless Communications				
Subject Code:	**22EC701**	**L – T – P - S:**	**42-0-28-50 (In Hrs)**	
			Credits	**4**

Sl. No.	Course Objectives
1	**Understand** the basics of cellular system concepts.
2	**Learn** various signal propagation mechanisms including large scale and small-scale effects.
3	**Study** multiple access techniques and modulation schemes for mobile communication.
4	**Acquire** the knowledge of wireless standards.

Module	Description	Hrs
I	**Cellular concepts:** Introduction, Cellular Telephone systems and call initiation, Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control, Wireless Standards: Overview of 2G to 5G cellular standards. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA. (Text 1: 1.1,1.3 to 1.4.4, 2.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 3.1 to 3.7.4)	**9**
II	**Signal propagation:** Introduction, Propagation mechanism- reflection, refraction, diffraction and scattering. Large scale signal propagation, Practical link budget design using path loss models, Outdoor and indoor Propagation models. (Text 1: 4.1 to 4.10.1, 4.10.3 to 4.10.4, 4.11 to 4.11.4)	**9**
III	**Fading channels:** Introduction, Multipath and small-scale fading- Doppler shift, power delay profile, average and RMS delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate, statistical multipath channel models, Capacity of flat and frequency selective channels. (Text 1: 5.1 to 5.1.2, 5.4 to 5.5.2, 5.7.3, 5.7.4)	**8**
IV	**Antennas and multiple access schemes:** Introduction, Antennas at Cell site and mobile terminal- Smart antennas, Types and applications, Handset considerations, RF antenna characterization and types of handsets, monopole antennas,	**8**

	PIFA, base station antennas and arrays, SDMA Modulation scheme, QAM, MSK and GMSK, M-ary and OFDM. (Text 2: 8.13, 8.15, 8.16 to 8.17.4 Text 1: 9.5, 6.9.2. 6.9.3, 6.10.2 , 6.10.3)	
V	**Receiver structure:** Introduction, Diversity techniques, Practical space diversity considerations -selection and MRC receivers RAKE receiver. Equalization techniques, Maximum Likelihood Sequence Estimation (MLSE) equalizer, multiple antenna communications, MIMO. (Text 1: 7.5, 7.7.2, 7.10,7.10.3, 7.11 Text 2: 8.15.4)	**8**

LAB CONTENT

Sl. No.	Experiment Description
1	Determine power received using Free space propagation – Path loss model
2	Determine power received using Outdoor propagation model - Okumura model
3	Determine power received using Outdoor propagation model - Hata model
4	Generate orthogonal codes in Code Division Multiple Access (CDMA)
5	Comparison of Bit Error Rate between Coherent and Non-coherent modulation techniques
6	Simulate Rayleigh Fading channel.
7	Simulate wireless channel Equalizer.
8	Study Constellation diagram of Quadrature Amplitude Modulation (QAM) technique using MATLAB SIMULINK.
9	To study radiation pattern of Dipole antenna using 4NEC2 simulator
10	To study radiation pattern of Yagi-Uda Antenna (3, 5 and 7 – element) using 4NEC2 simulator

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Wireless Communications, Principles and Practice	Theodore S. Rappaport	Prentice Hall, 2nd Edition, 2010
2	Wireless and Cellular Telecommunications	WCY Lee	McGraw Hill, 3rd Edition, 2006

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Mobile communications Design Fundamentals	WCY Lee	Prentice Hall, 2ndEdition, 1993.
2	Wireless communications and Networks	William Stallings	Pearson, 2ndEdition, 2009.
3	Wireless communications	P.Muthu Chidambara Nathan	PHI Publications, 2008.
4	Mobile Radio Communications	Aymond Steele	IEEE Press, 2nd Edition, 1992.

Course Outcomes:

Course outcome	Descriptions
CO1	**Interpret** wireless standards for telecommunication applications.
CO2	**Demonstrate** the effects of fading channels.
CO3	**Identify** and simulate different models for path loss measurement under different environment.
CO4	**Apply** various methodologies to improve cellular capacity.
CO5	**Analyze** multiple access techniques and handoff strategies used in cellular networks.

Course Articulation Matrix:

PO/RSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3											
CO2	3	2	2		1								
CO3	2	1	2		1								
CO4		1	1		2	1							
CO5		2	2	2	2								

Course Assessment and Evaluation: Integrated Courses

Continuous Internal Evaluation (CIE): 50 Marks

Components		Duration(min)	Marks Conducted for	Marks reduced to	40% Min Marks in each component to write SEE
Theory- Internal Assessment	IA-1	90	50	15	12
	IA-2	90	50	15	
Periodic Lab Assessment		-	30	10	4
Lab CIE		-	20	5	2
One Open Ended Experiment/ Project		-	10	5	2
Total CIE			**150**	**50**	**20**

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10 M), Conduction of Experiments(10M) and Viva(5M)-**Total 30M**
Lab CIE: Write-up(5M), Conduction/Execution/Demonstration(10M) and Viva(5M)-**Total 20M**
One Open Ended Experiment/ Project: Experimental / project Design (4 marks), Execution/demonstration (3 marks) and Analysis/Viva (3 marks)- **Total 10M**

Semester End Examination (SEE): **Max 100 Marks,** Duration: 3 Hrs
The question paper shall contain 10 full questions (20 marks each)**,** with 2 questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice**.** Each question may have a maximum of 4 sub-divisions**.**
Minimum passing Marks: 40% of Max Marks

Department: Electronics and Communication Engineering	**Semester:**	**7**

Subject: IoT and its Applications				
Subject Code:	**22EC702**	**L – T – P - S:**	**42-0-28-50 (In Hrs)**	
			Credits	**4**

Sl. No.	Course Objectives
1	**Understand** the basic concepts, evolution, and architecture of the Internet of Things (IoT).
2	**Learn** design principles, network protocols, and communication technologies for IoT systems.
3	**Study** skills in prototyping and programming for IoT applications using hardware and software tools.
4	**Identify** the roles of sensors, actuat1ors, and associated cloud technologies in IoT environments.

Module	Description	Hrs
I	**Overview of Internet of Things:** Introduction, IOT definitions, Characteristic and History, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, web communication protocols used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT, XMPP) for IoT/M2M devices. (Text 1:1.1 to 1.6 and Text 2: 2.1-2.3)	**9**
II	**Architecture and Design Principles for IoT:** Introduction, Internet connectivity, Internet-based communication, IPv4, IPv6, 6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports, Data Collection, (Text 1: 4.1 to 4.6)	**9**
III	**Prototyping and Designing Software for IoT Applications:** Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development. (Text 1: 9.1,9.2,9.3)	**8**
IV	**IOT Sensing and actuation:** Introduction, Sensors, Sensor Characteristics, Sensourial deviations, Sensing types, sensing considerations, actuators, actuator types, actuator characteristics. (Text 2: 5.1 - 5.9)	**8**
V	**Associated IOT Technologies:** Cloud Computing, Introduction	**8**

	to Cloud models, Service level agreement in cloud computing ,cloud implementation, Sensor Cloud Sensors as a service. (Text 2: 10.1 to 10.6, 12.1 to 12.2).	

LAB CONTENT

Sl. No.	Experiment Description
1	On/off an LED, Buzzer, Relay using Arduino/raspberry pi.
2	program for displaying "SMART CITY TUMKUR" in 16×2 LCD display using Arduino/raspberry pi.
3	Write a program to interface a Stepper motor using Arduino/raspberry pi.
4	Write a program for measuring Temperature & Humidity using Arduino/raspberry pi.
5	Write a program to detect Light Intensity using LDR ,obstacle using Ultrasonic sensor and moisture content using moisture sensor with Arduino/raspberry pi.
6	Write a program for Up-counter/ Down-Counter with 7-segment display using Arduino.
7	Send sensor data to Google Sheets using Arduino + USB + PC + Python bridge
8	Publish and subscribe sensor data using MQTT on Raspberry Pi (e.g., temperature sensor)
9	Remote logging of sensor data to a text file on Raspberry Pi using Python and local network
10	Control an Bulb via HTTP request using Raspberry Pi as a web server

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Internet of Things Architecture and design principles	Raj Kamal	McGraw Hill Education, 1st 2017
2	Introduction to IOT	Sudip Mishra, Anandarup Mukherjee, Arijit Roy	Cambridge University Press 2021

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Introduction to Industrial Internet of Things and Industry 4.0	S Mishra, A Mukherjee, C Roy	Cambridge University Press 2020
2	Rethinking the IOT : A scalable approach to connect everything	Francis DaCosta	Apress Publication, 2013,First Edition

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the fundamental concepts and communication protocols of IoT.
CO2	**Apply** IoT system architecture and related cloud-based technologies.
CO3	**Analyze** networking concepts and address schemes in IoT-based applications.
CO4	**Interpret** IoT prototypes using sensors, actuators, and Arduino.
CO5	**Design** and implement secure and scalable IoT systems using modern tools and frameworks.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2											
CO2		3		3	2								
CO3	2	1											
CO4			3	2	3						2		
CO5	2			3	2						2		

Course Assessment and Evaluation: Integrated Courses

Continuous Internal Evaluation (CIE): 50 Marks						
Sl.No	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	15	12
		IA-2	90	50	15	
2	Periodic Lab Assessment		-	30	10	4
3	Lab CIE		-	20	5	2
4	One Open Ended Experiment/ Project		-	10	5	2
	Total CIE			**150**	**50**	**20**

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module
Rubrics for Periodic Lab Assessment: Attendance (5M), Lab record (10 M), Conduction of Experiments(10M) and Viva(5M)-**Total 30M**
Lab CIE: Write-up(5M), Conduction/Execution/Demonstration(10M) and Viva(5M)-**Total 20M**
One Open Ended Experiment/ Project: Experimental / project Design (4 marks), Execution/demonstration (3 marks) and Analysis/Viva (3 marks)- **Total 10M**

Semester End Examination(SEE) : **Max 100 Marks,** Duration: 3 Hrs
The question paper shall contain 10 full questions (20 marks each)**,** with 2 questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice**.** Each question may have a maximum of 4 sub-divisions**.**
Minimum passing Marks : 40% of Max Marks

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: Digital Signal Compression				
Subject Code:	**22EC7PE31**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No.	Course Objectives
1	**Understand** source coding techniques for signal compression.
2	**Summarize** various quantization techniques in digital signal compression.
3	**Outline** the different applications of digital signal compression.
4	**learn** the concepts of audio, image and video compression standards.

Module	Description	Hrs
I	**Introduction to compression techniques**: Introduction, Compression techniques, probability model, markov model, The Kraft-McMillan Inequality, The Huffman Coding Algorithm, Applications of Huffman Coding, Static Dictionary, Adaptive Dictionary, Applications of Adaptive Dictionary. (Text 1:1.1, 2.3.2, 2.3.3, 2.4.3, 3.2, 3.8 ,5.3 to 5.5)	**9**
II	**Quantization**: Introduction ,Uniform Quantizer , Adaptive Quantization, Entropy-Coded Quantization, Advantages of Vector Quantization over Scalar Quantization, LBG algorithm, Tree-Structured Vector Quantizers, Trellis-Coded Quantization.(Text 1:9.4,9.5,9.7,10.3,10.4,10.8)	**8**
III	**Transform coding**: Introduction, Coding: Transforms – DCT, DST, DWHT, Quantization and Coding of Transform Coefficients, Application to Image Compression—JPEG. **Sub-band Coding:** Sub-band Coding, Application to Speech Coding—G.722, Application to Audio Coding—MPEG Audio, Application to Image Compression. (Text 1:13.4 to 13.6,14.4,14.10 to 14.12)	**9**
IV	**Wavelet Based Compression**: Introduction, Wavelets, Multi resolution analysis & scaling function, Implementation using filters, Image compression, JPEG 2000. (Text 1:15.3 to 15.6 and 15.9)	**8**
V	**Video Compression**: Introduction, Motion compensation, Video signal representation, ITU-T Recommendation H.261, The MPEG-1 Video Standard, MPEG-2 Video Standard—H.262 Algorithms, ITU-T Recommendation H.263. (Text 1:18.3 to 18.5 and 18.8 to 18.10)	**8**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Introduction to Data Compression	Khalid Sayood	2013, Third Edition, Morgan Kaufmann Publishers

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Fundamentals of Multimedia	Z. Li and M.S. Drew.	2014, Second Edition, Pearson Education (Asia) Pte. Ltd.,
2	Data Compression: The Complete Reference	D. Salomon	2007, Fourth Edition, Springer

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the principles of various compression techniques applied in digital signal compression.
CO2	**Interpret** the concepts of different filters for application of speech compression.
CO3	**Apply** the concepts of transform coding techniques and wavelet techniques for image compression.
CO4	**Optimize** quantization algorithms for effective data representation.
CO5	**Analyze** the different algorithms for video compression.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2	3	1											
CO3		3	2										
CO4		2	2										
CO5		3	3	2							2		

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.
Activity Based Learning (ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hack ranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination (SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			Semester:	7
Subject: Advanced Digital Signal Processing				
Subject Code:	22EC7PE32	L – T – P - S:	42-0-0-48 (In Hrs)	
			Credits:	3

Sl. No.	Course Objectives
1	**Understand** the fundamentals of discrete-time signal processing and analyze multirate signal processing techniques such as decimation and interpolation.
2	**Study** the modern digital signal processing algorithms and applications.
3	**Acquire** the knowledge of use of digital systems in real time application
4	**Learn** the algorithms for wide area of recent applications.

Module	Description	Hrs
I	**Introduction to Digital Signal Processing:** Review of Discrete time signals and systems and frequency analysis of discrete time linear time invariant systems, implementation of discrete time systems, correlation of discrete time systems Sampling, decimation by a factor 'D', Interpolation by a factor 'I', sampling rate conversion by a factor 'I/D', Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion. (Text 1- 11.2, 11.3, 11.4, 11.5, 11.6)	**9**
II	**Multirate Digital Signal Processing:** Multirate signal processing and its applications, Design of Digital filters, Design of FIR filters, Design of IIR filters, frequency transformations, Digital filter banks, two channel quadrature mirror filter banks, Mchannel QMF bank. (Text 1- 11.9, 10.2, 10.3, 10.4,11.10,11.11, 11.12)	**8**
III	**Linear prediction and Optimum Linear Filters:** Random signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process. Forward and Backward Linear Prediction. Solution of the Normal Equations. The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters. (Text 1-12.1, 12.2,12.3,12.4,12.5)	**8**
IV	**Adaptive filters:** Applications of Adaptive Filters-Adaptive Channel Equalization, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm, Properties of LMS algorithm. Adaptive direct form filters- RLS algorithm.	**8**

	(Text 1- 13.1.2, 13.1.6,13.1.7, 13.2.2,13.2.4, 13.3))	
V	**Power Spectrum Estimation:** Non parametric Methods for Power Spectrum Estimation - Bartlett Method, Welch Method, Blackman &Tukey Methods.Parametric Methods for Power Spectrum Estimation: Relationship between the auto correlation and themodel parameters, Yule and Walker methods for the AR Model Parameters, Burg Method for the AR Model parameters, Unconstrained least-squares method for the AR Model parameters, Sequential estimation methods for the AR Model parameters, ARMA Model for Power Spectrum Estimation. (Text 1-14.2, 14.2.1,14.2.2, 14.2.3, 14.3.1,14.3.2, 14.3.3, 14.3.4, 14.3.5, 14.3.8)	**9**

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Digital Signal Processing Principles, Algorithms, and Applications	John G. Proakis,	Prentice-Hall International Inc., 4th Edition, 2012.

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Discrete-time signal processing.	Oppenheim, Alan V.	Pearson Education India, 1999.
2	Digital signal processing: a computer-based approach.	Mitra, Sanjit Kumar, and Yonghong KuoVolume	Volume 2. New York: McGraw-Hill Higher Education, 2006.

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the principles of sampling, decimation, and interpolation.
CO2	**Implement** digital filter banks for multiband signal processing.
CO3	**Analyse** forward and backward linear prediction of a stationary random process using Levinson-Durbin Algorithm
CO4	**Apply** LMS algorithm & RLS algorithm to analyze adaptive filters and its application.
CO5	**Compute** power spectrum using parametric & non-parametric methods.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2		2	2										
CO3		3											
CO4		3	2										
CO5		3											

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module .

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.

The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: Multimedia Communication				
Subject Code:	**22EC7PE33**	**L –T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No.	Course Objectives
1	**Study** different information representations of Multimedia.
2	**Understand** the concept of Multimedia Transport in Wireless Networks.
3	**Learn** the Security issues in multimedia networks and multimedia standardization.
4	**Acquire** the knowledge of real-time multimedia network applications.

Module	Description	Hrs
I	**Multimedia Communications:** Introduction, Multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, Information representation, text and Images. (Text 1: 1.1 to 1.5, 2.2, 2.3)	**9**
II	**Information Representation:** Introduction, Audio and Video, Distributed multimedia systems, main Features of a DMS, Resource management of DMS, Networking and Multimedia operating systems. (Text 1: 2.4, 2.5 and Text-2: 4.1 to 4.5)	**9**
III	**Multimedia Processing in Communication:** Introduction, Perceptual coding of digital Audio signals, Transform Audio Coders, Audio Sub Band Coders. (Text 2: 3.1, 3.2, 3.6, 3.7)	**8**
IV	**Multimedia Communication Standards:** Introduction, MPEG approach to multimedia standardization, MPEG-1, MPEG-2, Overview of MPEG-4.(Text 2: 5.1 to 5.4, 5.5.1)	**8**
V	**Multimedia Communication Across Networks:** Introduction, Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks. (Text 2: 6.1 to 6.3)	**8**

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Multimedia Communications	Fred Halsall, K.	Pearson education, 2001.
2	Multimedia Communication Systems	R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic	Pearson education, 2004.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Multimedia: Computing, Communications and Applications	Ralf Steinmetz, Klara Nahrstedt,	Pearson education, 2002

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** basic methodologies of design and development of multimedia communication and management systems.
CO2	**Analyse** the stages of creating and editing multimedia content such as digitization, editing, coding, compression, transmission, analysis and retrieval of multimedia information.
CO3	**Choose** the best Internet, streaming technologies for multimedia systems.
CO4	**Interpret** problems across different application areas and select the right mechanisms for managing multimedia content.
CO5	**Evaluate** the performance, quality of service (QoS), and efficiency of multimedia communication systems under different network conditions.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	2										
CO2	2	2									1		
CO3		1	2			1							
CO4		1	3										
CO5	2			2		1							

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.

The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: MEMS and Nano Electronics				
Subject Code:	**22EC7PE41**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No	Course Objectives
1	**Understand** the physical scaling laws influence the behavior of MEMS devices and assess the operational principles of commonly used MEMS components such as sensors and actuators.
2	**Gain** knowledge of various microfabrication processes and techniques used in MEMS manufacturing.
3	**Study** the packaging approaches essential for device protection and functionality.
4	**Learn** the principles of nanoelectronics, focusing on fabrication approaches (top-down and bottom-up), and exploring the quantum behavior of light and electrons compared to classical systems at the nanoscale.

Module	Description	Hrs
I	**Overview of MEMS and Microsystems:** Microsystems and microelectronics, Microsystems and miniaturization, Working principle of micro system - Micro sensors, Micro actuators, MEMS with Micro actuators. **Scaling Laws in Miniaturization**-Scaling in Geometry, scaling in Electrostatic Forces, scaling in Electromagnetic Forces, scaling in Fluid Mechanics. **Materials for MEMS** - Substrate & wafer, Si as a substrate material, Si compound, Si Piezo-resistors. (Text 1: 1.4,1.6, 2.2,2.3,2.4, 6.2,6.4,6.5,6.7, 7.2,7.4,7.5,7.6.)	10
II	**Microsystems Fabrication Process:** Photolithography, Ion implantation, Diffusion, Oxidation, Chemical vapor deposition (CVD), Physical vapor deposition, Deposition by Epitaxy, Etching. (Text 1: 8.2,to 8.9)	8
III	**Manufacturing Process:** Introduction, Bulk Micromachining, Surface Micromachining and LIGA Process, Summery of Micromachining. **Microsystems Design:** Design consideration, Process design.	8

	(Text1:9.1,to 9.5, 10.2,10.3)	
IV	**Microsystems Design and Packaging:** Mechanical design using MEMS. Microsystems packaging, interfacings in Microsystems packaging, packaging technology, selection of packaging materials. (Text 1: 10.4,11.3,11.4,11.5,11.8)	8
V	**Introduction to Nano electronics:** Top-Down approach, Bottom-Up approach, nanotechnology potential, comparison of classical and quantum systems, light as a wave, light as a particle, electrons as particles, electrons as waves. (Text 2: 1.1,1.2,1.3,2.1,2.3,2.4)	8

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	"MEMS and Microsystems Design and Manufacturing"	Tai-Ran Hsu, John Wiley and Sons,	2ndEdition, Tata McGraw Hill, 2008.
2	"Fundamentals of Nano Electronics"	George W. Hanson,	Pearson Education India, 2009

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	"Micro and Smart Systems"	G.K. Ananthasuresh, K.J. Vinoy, S. Gopala Krishnan, K.N. Bhat, V.K. Aatre,	1st Edition, Wiley India, 2010.
2	"Introduction to Nanotechnology"	Charles P. Poole, Jr, Frank J. Owens,	John Wiley & Sons, Inc. 2003.

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the structure and operation of MEMS and Microsystems, including sensors, actuators, and the effects of scaling laws and material properties.
CO2	**Interpret** various micro system fabrication processes such as lithography, ion implantation, and deposition techniques.

CO3	**Compare** and apply different MEMS manufacturing methods including bulk micromachining, surface micromachining, and the LIGA process.
CO4	**Design** simple MEMS-based systems with appropriate packaging and interfacing techniques by considering mechanical and material constraints.
CO5	**Analyze** Nano electronic principles, including quantum effects and nanoscale fabrication approaches, to differentiate classical and quantum systems.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2											
CO2					2								
CO3	1		1	3									
CO4		1	3		2								
CO5			3	2									

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: VLSI Testing and Testability				
Subject Code:	**22EC7PE42**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No.	Course Objectives
1	**Learn** the concepts of testing and verification.
2	**Understand** the test generation techniques.
3	**Explore** design-for-testability (DFT) techniques.
4	**Study** memory testing methods.

Module	Description	Hrs
I	**Introduction to VLSI Testing:** Introduction to Testing, Role of Testing in VLSI, Faults in Digital Circuits, Functional and Structural Models, Levels of Modeling, Logical Fault Models, Types of Testing, Fault Detection and Fault Location. (Text 1: 1.1 to 1.4, 2.1 to 2.5,4.1, 4.2)	**8**
II	**Fault modeling:** Defects, Errors, and Faults, Functional v/s Structural testing, Levels of Fault models, Single stuck-at fault: Fault equivalence, Equivalence of single stuck-at faults, Fault collapsing, Fault Dominance and checkpoint theorem. (Text 2: 4.1, 4.2, 4.3, 4.5)	**8**
III	**Logic and fault simulation:** Simulation for design verification, Simulation for test evaluation, Modeling circuits for simulation: Modeling levels and types of simulators, Hierarchical connectivity description, Gate level modeling of MOS Networks, modeling signal states, timing. (Text 2: 5.1 to 5.3)	**9**
IV	**Design for testability:** Ad-Hoc DFT methods, Scan design, scan design rules, Tests for scan circuits, multiple scan register, overheads of scan design, Built-in-self-test: the economic case for BIST, Random logic BIST: Definitions, BIST process, BIST pattern generation, BIST response compaction, built-in logic block observers. (Text 2: 14.1, 14.2, 14.2.1 to 14.2.4, 15.1, 15.2.1 to 15.2.5.)	**9**

V	**Test-per-clock BIST systems:** Test-per-scan BIST systems, circular self-test path system, circuit initialization, device level BIST, test point insertion. Memory BIST: Definition, march tests SRAM BIST, SRAM BIST with MISR. (Text 2: 15.2.6 to 15.2.11, 15.3, 15.3.1 to 15.3.3)	**8**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Digital System Testing and Testable Design	M. Abramovici, M. A. Breuer, and A. D. Friedman	IEEE Press,1994.
2	Essentials of Electronic Testing	M.L. Bushnell and V. D. Agarwal	Kluwer Academic Publishers,2000

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Learning Module for the course – VLSI Testing and Testability	Ajai Jain	IIT, Kanpur,2001

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the role of test generation and test application in VLSI design flow.
CO2	**Analyze** different fault models and test generation techniques.
CO3	**Demonstrate** fault list and test pattern generation for a given gate-level enlist.
CO4	**Evaluate** test strategies for sequential circuits using Design-for-Testability (DFT) techniques.
CO5	**Design** logic subsystem conforming to testability requirements.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1	1									
CO2		1	3	2									
CO3		2	2	3									
CO4		2	3	2									
CO5	2	2	1	1									

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: Submicron Devices				
Subject Code:	**22EC7PE43**	**L – T – P - S:**	**42-0-0-48**	**(In Hrs)**
			Credits:	**3**

Sl. No.	Course Objectives
1	**Understand** the basics of device physics and MOS transistor theory relevant to submicron devices.
2	**Learn** the effects of scaling, short channel effects, and the associated reliability issues in advanced MOS technologies.
3	**Study** the performance metrics, trade-offs, and design considerations of modern submicron transistors.
4	**Acquire** the knowledge of emerging technologies like SOI and ITRS roadmap applicable to submicron and nanoscale device design.

Module	Description	Hrs
I	**Review of Device Physics and MOS Capacitor:** Basics of semiconductor device physics, MOS capacitor theory and characteristics, threshold voltage. Transistor Theory: Basic operation of MOSFETs, characteristics, threshold behavior. Scaling Trends: Moore's Law, evolution of submicron technology. MOS Device Scaling Theory. (Text 1: 1.1 to1.4, 2.1 to 2.6, 4.1 to 4.5)	9
II	**Short Channel Effects and Leakage:** Short channel effects, sub-threshold conduction, punch through, DIBL. High Field Effects: Carrier velocity saturation, mobility degradation, velocity overshoot. Reliability Issues in Scaled Devices. (Text 1: 5.1 to 5.6, 6.1 to 6.4)	9
III	**Advanced Concepts:** Definitions of channel length, impact of scaling on performance, performance metrics of digital technologies. Transistor Design Trade-offs: Power vs. performance, threshold voltage engineering. Technology Case Studies.(Text 1: 6.5 to 6.9, 7.1 to 7.3 and Text 2: Ch. 7, 8)	8
IV	**SOI Technology:** Introduction to Silicon on Insulator (SOI) devices, partially and fully depleted SOI, floating body effects. SOI for Low Power Applications. (Text 1: 8.1 to 8.4 and Text 2: 9.1 to 9.3)	8
V	**Interconnect and Foundry Technology:** Interconnect	8

	limitations in submicron regime, impact on circuit performance, technology integration. Semiconductor Roadmap: ITRS, future trends. (Text 1: 9.1 to 9.5)	

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Integrated Microelectronic Devices: Physics and Modeling	J. A. del Alamo	Pearson, 2017
2	Fundamentals of Modern VLSI Devices	Yuan Taur, Tak H. Ning	Cambridge University Press, 1998

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Solid State Electronic Devices	B. G. Streetman & S. Banerjee	Prentice Hall, 1999
2	Fundamentals of Semiconductor Devices	M. K. Achuthan and K. N. Bhat	McGraw Hill, 2006
3	Semiconductor Devices: Modelling and Technology	Nandita Dasgupta, Amitava Dasgupta	PHI, 2009

Course Outcomes:

Course outcome	Descriptions
CO1	**State** the fundamental device physics concepts and MOS operation in submicron regimes.
CO2	**Identify** the effects of device scaling and performance reliability analysis trade-offs.
CO3	**Analyze** emerging device structures such as SOI and their advantages for modern circuits.
CO4	**Interpret** trends and projections from ITRS for technology planning and design.
CO5	**Evaluate** the limitations of interconnects and their impact on circuit design in scaled technologies.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1											
CO2	1	3	2										
CO3		2	3										
CO4	2	2	2	1									
CO5			3	2	1								

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: RF IC Design				
Subject Code:	**22EC7PE51**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No.	Course Objectives
1	**Introduce** the concept of Radio Frequency Integrated system.
2	**Study** different types of key RF circuits.
3	**Learn** the design trade-off of radio frequency communication systems.
4	**Understand** the concepts of High frequency amplifiers, Low Noise amplifiers and RF amplifiers.

Module	Description	Hrs
I	**Wireless Principles:** Introduction, A brief history of wireless systems, Non-cellular wireless applications, Shannon, Modulations & Alphabet Soup, Propagation. Passive RLC Networks: Parallel RLC Tank, Series RLC Networks, Other RLC networks, RLC Networks as impedance Transformers. (Text 1: 2.1–2.6, 3.1–3.4)	**9**
II	**Distributed Systems:** Introduction, Link between lumped and distributed regimes, Driving-point Impedance of Iterated structures, Transmission lines in more detail, Behavior of Finite – length transmission lines. (Text 1: 6.1–6.7)	**9**
III	**High frequency amplifier design:** Introduction, Zeros as bandwidth Enhancers, The shunt –series amplifier, Bandwidth Enhancement with fT-Doublers, Tuned amplifiers, Neutralization and unilateralization, Cascaded amplifiers, AM – PM conversion. (Text 1: 9.1–9.9)	**8**
IV	**Voltage references and biasing:** Introduction, Review of diode behavior, Diodes and bipolar transistors in CMOS technology, Supply –independent bias circuits, Bandgap voltage reference, Constant gm bias. Noise: Thermal noise, Shot noise, Flicker noise, Popcorn noise, Classical two- port noise theory, Examples of noise calculations, A handy rule of thumb, Typical noise performance. (Text 1: 10.1–10.6, 10.8–10.12)	**8**

V	**RF Power Amplifiers:** Introduction, General considerations, Class A, AB, B and C power amplifier. Low noise Amplifier: Introduction, amplifiers with feedback, Noise, linearity , stability, Broad band linear amplifier design example. (Text 1:12.1–12.6 and Text-2: 7.1–7.5)	**8**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	The Design of CMOS Radio Frequency Integrated Circuit	Thomas H. Lee	Cambridge, 2004, 2nd edition.
2	Radio Frequency Integrated Circuits Design	John Rogers	Artech House, 2003.

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Design of Analog CMOS Integrated Circuits,	Behzad Razavi	Tata McGraw Hill, 2005
2	RF circuit design, theory and applications	Reinhold Ludwig, Pavel Bretchko	Pearson Asia Education edition, 2001

Course Outcomes:

Course outcome	Descriptions
CO1	**Conceptualize** the Wireless systems, RLC networks, Transmission lines, Amplifiers and Mixer.
CO2	**Describe** the characteristics of RLC Networks.
CO3	**Compute** the parameters for designing circuit networks of High frequency amplifiers, and RF amplifiers.
CO4	**Analyze** the operating principles, performance parameters, and application-specific characteristics of different types of RF amplifiers.
CO5	**Evaluate** the noise characteristics, biasing techniques, and performance trade-offs in RF power amplifiers and low-noise amplifiers for wireless applications.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1										
CO2		3	2	1									
CO3		2	3	2									
CO4		3	3	2									
CO5		3	2	1							1		

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: Natural Language Processing				
Subject Code:	**22EC7PE52**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
		Credits:	**3**	

Sl. No.	Course Objectives
1	**Outline** the foundational problems and scope of Natural Language Processing (NLP).
2	**Classify** linguistic features using formal grammar rules and morphological structures.
3	**Explain** the procedures for training and evaluating NLP systems using experimental methods.
4	**Summarize** various NLP techniques used for syntax, semantics, and language modeling.

Module	Description	Hrs
I	**Natural Language processing (NLP):** Introduction, Applications or Use cases of NLP, Components of NLP, Steps in NLP, Finding the Structure of Words: Words and Their Components, Lexemes, Morphemes, Morphology, Problems in morphological processing, Typology, Morphological Typology, Natural Language Processing with python NLTK package (Text Preprocessing Tasks): Word Tokenization, Sentence Tokenization, Filtering Stop words, Stemming, Tagging. Parts of Speech, Lemmatization, Chunking, Chinking, Named Entity Recognition, Term Frequency and Inverse Document Frequency (TF-IDF). (Text 1: 1.1–1.4 and Text 2: 1.1–1.5, 2.1–2.4, 3.1–3.5, 6.1–6.4, 23.1–23.3)	**9**
II	**Syntax Analysis:** Parsing Natural Language, Tree banks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure: Syntax Analysis using Dependency Graph, Syntax Analysis using Phrase Structure Trees, Parsing Algorithms: Shift Reduce Parsing, Hyper Graphs and Chart Parsing (CYK Parsing), Models for ambiguity Resolution in Parsing: Probabilistic Context Free Grammar, Generative Models, Discriminative models for Parsing. (Text 1: 2.1–2.6 Text 2: 12.1–12.6, 13.1–13.5, 14.1–14.3, 15.1–15.4, 16.1–16.3)	**9**

III	**Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems. (Text 1: 3.1–3.4 Text 2: 4.1–4.5, 5.1–5.3, 6.1–6.2, 7.1–7.3)	**8**
IV	**Semantic Parsing:** Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software. (Text 1: 4.1–4.3 Text 2: 17.1–17.4, 18.1–18.3, 20.1–20.2)	**8**
V	**Predicate-Argument Structure:** Meaning Representation Systems, Software. Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure. (Text 1: 5.1–5.3 Text 2: 19.1–19.4, 21.1–21.3, 22.1–22.3)	**8**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Multilingual natural Language Processing Applications: From Theory to Practice	Daniel M.Bikel and Imed Zitouni,	Pearson Publication.
2	Speech and Natural Language Processing-	Daniel Jurafsky & James H Martin,	Pearson Publications.

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Natural Language Processing and Information Retrieval:	Tanvier Siddiqui, U.S.Tiwary.	1st Edition , Oxford University Press

Course Outcomes:

Course outcome	Descriptions
CO1	**Identify** language patterns using formal grammar rules.
CO2	**Apply** suitable methods for training and evaluating NLP systems.
CO3	**Build** simple statistical models using probability techniques.
CO4	**Analyze** different NLP methods using supervised and unsupervised learning techniques.
CO5	**Interpret** the concept of text using semantic and discourse analysis techniques.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2		2			2								
CO3		2	2		2								
CO4		2											
CO5	2												

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module .
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			Semester:	7
Subject: Optimization Methods in Machine Learning				
Subject Code:	22EC7PE53	L – T – P - S:	42-0-28-50 (In Hrs)	
		Credits:	3	

Sl. No.	Course Objectives
1	**Learn** the basic concepts of machine learning and the need of optimization.
2	**Understand** the various optimization methods that underlie machine learning methods
3	**Outline** various gradient methods for optimization
4	**Study** convex and cutting plane methods for optimization in machine learning.

Module	Description	Hrs
I	**Optimization and Machine Learning**: Introduction, Support vector machine, Regularized optimization, algorithms, Vector spaces (Text1: 1.1- 1.10, text 2: 1.1- 1.3)	**8**
II	**Gradient Methods**: Introduction, Definitions and First Examples, Properties of the Sub differential Set, Directional, Derivatives, Incremental Sub gradient, Proximal Methods, Convergence for Methods with Cyclic Order Convergence for Methods with Randomized Order, Some Applications (Text1 : 3.1-3.3, Text 2:4.1-.4.5)	**9**
III	**Convex Optimization methods in machine learning**: Introduction, Basic properties, Convexity, black box model, structured optimization (Text 3: 1.1-1.5)	**8**
IV	**Convex Optimization methods in finite dimension:** Introduction, the center of gravity method, ellipsoid method, Vaidya's cutting plane method (Text 3: 2.1-2.3)	**8**
V	**Cutting plane methods in machine learning**: Primal and Dual Projected Sub Gradient Methods Introduction, Regularized Risk Minimization, Multiple Kernel Learning, MAP Inference in Graphical Models (Text 1: 8.1-8.3, Text 2: 7.1-7.4)	**9**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	First-Order Methods in Optimization	Amir Beck	Kivmars Bowling publisher, II vol, 2018
2	Optimization for Machine Learning	Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright	MIT Press,vol 1, 2021
3.	Convex Optimization: Algorithms and Complexity	Sébastien Bubeck	Bubeck , Vol 8, 2015

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	The LION Way: Machine Learning plus Intelligent Optimization	Roberto Battiti, Mauro Brunato.	Lionsolver, Inc. 2013.
2	Learning with Submodular Functions: A Convex Optimization Perspective”	F. Bach,	Foundations and Trends in Machine Learning, Now Publishers Inc, vol 2, 2018

Course Outcomes:

Course outcome	Descriptions
CO1	**Comprehend** the various techniques and applications for optimization.
CO2	A**nalyze** characteristics of gradient methods and various methods for convergence.
CO3	**Summarize** cutting plane methods and convex optimization methods.
CO4	**Apply** basic concepts of mathematics to formulate an optimization problem.
CO5	**Describe** cutting plane methods in machine learning.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2												
CO2		2											
CO3		3	2										
CO4	1												
CO5	1												

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.

The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: Applied Embedded Systems				
Subject Code:	**22EC7PE61**	**L – T – P - S:**	**42-0-0-48**	**(In Hrs)**
			Credits:	**3**

Sl. No.	Course Objectives
1	**Understand** the implementation and applications of the embedded system.
2	**Learn** the historical background of real-time systems and its classifications.
3	**Study** the various software development approaches and a operating system services required.
4	**Acquire** the knowledge of languages to develop software for real- time Applications

Module	Description	Hrs
I	**Real-Time Systems:** Introduction, Historical background, Elements of a Computer Control System, RTS-Definition, Classification- time Systems, Time Constraints, Classification of Programs. Concepts of Computer Control: Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text 1: 1.1 to 1.6 and 2.1 to 2.6)	**9**
II	**Embedded controller (PIC) CPU architecture and instruction sets:** Introduction, Hardware architecture and pipelining, program memory consideration, Register file structure and Addressing modes, CPU register, Instruction set, Loop time subroutine, Timer2 and Interrupts: Timer2 use interrupt logic, Timer2 Scalar Initialization. External interrupts and Timers: Timer0 Compare/capture mode, Timer1/CCP programmable period scalar. Timer1 and sleep mode, PWM O/P Port B change interrupts. (Text 2: 2.1 to 2.6, 2.9 to 2.10, 2.12)	**9**
III	**Computer Hardware Requirements for Real-Time Applications:** Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.	**8**

	(Text 1 : 3.1 to 3.8)	
IV	**Operating Systems:** Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion. (Text 1: 6.1 to 6.11)	**8**
V	**Embedded RTOS Inter process communication:** Introduction, Process Management, Timer Functions , Event Functions, Memory management, Device, File, and IO Subsystems Management, Interrupt Routines in RTOS environment and handling of interrupt source calls by RTOS, Introduction to Real Time Operating System, Basic Design Using a Real Time Operating System, RTOS Task Scheduling Models, Latency, Response Times, Deadline as Performance Metric, Latency and Deadlines as Performance Metric in Scheduling Models For Periodic, Sporadic and Aperiodic Tasks, CPU Load as Performance Metric, Sporadic Task Model Performance Metric. OS security issues.(Text 3 : 8.1 to 8.11)	**8**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Real-Time Computer Control	Stuart Bennet	Pearson Education, 2nd Edition, 2008.
2	Design with PIC Microcontrollers	John BPitman	Pearson Education, 1st Edition, 1996.
3	Embedded Systems: Architecture and Programming	Raj Kamal	Mcgraw Hill, 2nd Edition, 2008.

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Real-Time Systems Analysis	Phillip. A. Laplante	Prentice Hall, 2nd Edition, 2005.
2	Real –Time Systems	C.M. Krishna, Kang G. Shin	McGraw –Hill, , 3rd Edition, 1997.

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the fundamentals of real-time systems, computer control systems, and time constraints.
CO2	**Classify** different types of real-time programs and control models such as sequence, loop, and supervisory control.
CO3	**Interpret** the architecture, instruction set, and timer functionalities of PIC microcontroller.
CO4	**Analyze** various hardware components, data transfer techniques, and standard interfaces for real-time embedded systems.
CO5	**Evaluate** task scheduling, memory management, and communication strategies in real-time operating systems.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2											
CO2	2	2	1										
CO3	3	3	2										
CO4		3	2	2	2								
CO5	2	3	3	2	2								

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering			**Semester:**	**7**
Subject: Wireless Sensor Networks				
Subject Code:	**22EC7PE62**	**L – T – P - S:**	**42-0-0-48 (In Hrs)**	
			Credits:	**3**

Sl. No.	Course Objectives
1	**Acquire** the knowledge of the fundamentals of wireless sensor networks including its critical real time applications.
2	**Study** the different protocols related to different layers and its difference with conventional protocols.
3	**Understand** the issues in relevant to the sensor networks and the challenges demanded in managing and maintaining sensor networks.
4	**Explore** quality of service (QoS) and energy management strategies essential for efficient sensor network performance and sustainability.

Module	Description	Hrs
I	**Introduction:** Fundamentals of Wireless communication technology; The Electromagnetic spectrum; radio propagation; characteristics of wireless channels; modulation techniques; multiple access techniques; wireless LANs, PANs, WANs, and MANs; wireless internet. (Text 1: 1.1 to 1.6, 2.1, 2.2, 2.5, 2.5.1, 3.1, 3.2, 3.2.1, 4.1, 4.2)	**10**
II	**Adhoc/ sensor networks:** Key definitions of Adhoc/ sensor networks, unique constraints and challenges, advantages of Adhoc/sensor networks, driving application, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.(Text 1: 5.1 to 5.3)	**8**
III	**MAC protocols:** Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocol for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.(Text 1: 6.2 to 6.8)	**8**
IV	**Routing Protocols:** Issues in designing a routing protocol, classification of routing protocols, table driven, on demand, hybrid, flooding, hierarchical, and power aware routing protocols.(Text 1: 7.1 to 7.9)	**8**
V	**QoS and Energy management:** Issues and challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classifications, Battery, transmission power and system power management schemes.(Text 1: 10.1 to 10.5, 10.57, 11.2 to 11.6)	**8**

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Ad Hoc Wireless Networks	C. Siva Ram Murthy and B. S. Manoj	Pearson Education,2nd edition, 2008.

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Wireless Sensor Networks	Feng Zhao and Leonidas J. Guibas	.Elsevier, 2004.
2	Mobile Communications	Jochen Schiller	Pearson Education, 2nd Edition, 2003.
3	Wireless Communications and Networks	William Stallings,	Pearson Education, 2004.
4	Wireless Sensor networks, Technology Protocols & Architectures	Kazem Sohraby, Daniel Minoli, Taieb Znayi	John Wiley & Sons, Inc1st Edition 2007.

Course Outcomes:

Course outcome	Descriptions
CO1	**Describe** the significance of wireless channel and wireless network standards.
CO2	**Illustrate** the characteristics of MAC protocols, QoS and Energy management techniques in wireless Adhoc Networks.
CO3	**Summarize** different MAC routing protocols of adhoc/ sensor networks.
CO4	**Analyze** various critical parameters of node deployment, location discovery, QoS and Energy management issues.
CO5	**Classify** different routing protocols and multiple access techniques.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2											
CO2		2	2										
CO3		2	2	2									
CO4		2	2	3			1						
CO5	1	1											

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.
Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.
The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.
Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering		**Semester:**	**7**
Subject: DSP for Wireless Communication			
Subject Code:	**22EC7PE63**	**L – T – P - S:**	**42 – 0 – 0 – 48(Hrs)**
		Credits	**3**

Sl. No.	Course Objectives
1	**Understand** the physical and statistical models of wireless channels.
2	**Study** DSP techniques to mitigate multipath fading and optimize link performance.
3	**Learn** multiple access (TDMA/FDMA/CDMA/OFDM) and MIMO signal-processing techniques in modern wireless systems.
4	**Acquire** the knowledge of DSP techniques used across various wireless standards (GSM, WCDMA, LTE, IS-95, 5G).

Module	Description	Hrs.
I	**Physical Wireless Channel Modeling:** Covers input/output models for wireless channels, impulse response of LTV systems, and baseband equivalents. Discusses delay and Doppler spreads, coherence time and bandwidth, and introduces Jakes model for simulating fading. (Text 1 :1.1–2.3)	9
II	**Statistical Channel Models:** Introduces statistical models including Rayleigh and Rician fading, non-coherent detection, and channel measurement using probing signals. Covers Rake receiver, Jakes spectrum, and large-scale fading models like Okumura, Hata, and log-normal shadowing. (Text 1: 3.1 – 4.5)	9
III	**Statistical Channel Models:** Introduces statistical models including Rayleigh and Rician fading, non-coherent detection, and channel measurement using probing signals. Covers Rake receiver, Jakes spectrum, and large-scale fading models like Okumura, Hata, and log-normal shadowing. (Text 1: 5.1 – 6.4)	8
IV	**Multiple Access and OFDM:** Explains TDMA, FDMA, CDMA (with PN sequences), Rake receiver, and multicarrier modulation. Focuses on OFDM structure, cyclic prefix, frequency offset, and PAPR problems. (Text 1: 7.1 – 8.3)	8
V	**MIMO and Wireless Standards:** IMO capacity, diversity, spatial multiplexing, and beamforming. Reviews standards: GSM, IS-95, WCDMA, LTE, 5G NR, and video over wireless. (Text 1: 9.1 – 10.2; Text 2: 7)	8

Text Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Wireless Communications	Andrea Goldsmith	Cambridge University Press, 1st Edition, 2005
2	Fundamentals of Wireless Communication	David Tse and Pramod Viswanath	Cambridge University Press, 2005

Reference Books:

Sl. No.	Text Book title	Author	Volume and Year of Edition
1	Wireless Communication Principles	T.S. Rappaport	Pearson, 2002
3	5G NR: The Next Generation Wireless Access Technology	Erik Dahlman, Stefan Parkvall, Johan Sköld	ISBN-10: 0128143231 August 17/31, 2018
4	Wireless Communication (MIT Open Courseware)	Robert Gallager	MIT OCW, 2006
5	MIMO-OFDM Wireless Communications with MATLAB	Yong Soo Cho, Jaekwon Kim, Won Young Yang and Chung G. Kang	Wiley, 2010

Course Outcomes:

Course outcome	Descriptions
CO1	**Interpret** characterize of wireless channels using physical and statistical parameters.
CO2	**Analyze** link budgets, including path-loss, fading margins, and traffic engineering aspects.
CO3	**Design** multipath diversity receivers (RAKE) and multi-carrier (OFDM) systems, considering PAPR and ICI.
CO4	**Compare** different DSP techniques used in various multiple access schemes.
CO5	**Summarize** different MIMO parameters and wireless standards.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2	2	2											
CO3	2		3										
CO4		1		2									
CO5		2			2								

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks						
Sl. No.	**Components**		**Duration (min)**	**Marks Conducted for**	**Marks reduced to**	**40% Min Marks in each component to write SEE**
1	Theory- Internal Assessment	IA-1	90	50	20	16
		IA-2	90	50	20	
2	Activity Based Learning	ABL1	-	25	5	4
		ABL2	-	25	5	
Total CIE				150	50	20

IA-1 Syllabus: 2 ½ Module, IA-2 Syllabus: 2 ½ Module.

Activity Based Learning(ABL): Online course with certification, Hobby project, Simulations, Industrial Visits, Community-Based Learning, Case-study, Problem-Based Learning, Peer Teaching, web page design, student publications, Hackathons, Quiz (Leetcode, GitHub, Hackaranks and company specific quiz), Student Development program(1 week/online or offline), ……Etc.

Semester End Examination(SEE) : Max 100 Marks, Duration: 3 Hrs.

The question paper shall contain 10 full questions (20 marks each), with **2** questions from each of the 5 Modules, ensuring 100% syllabus coverage. Students shall answer any 5 full questions with 1:1 choice. Each question may have a maximum of 4 sub-divisions.

Minimum passing Marks : 40% of Max Marks.

Department: Electronics and Communication Engineering		**Semester:**	**7**
Subject: Project Phase-I			
Subject Code:	**22ECPW706**	**L – T – P - S:**	**0-0-28-32**
		Credits:	**2**

Description

1. Students (maximum-4) shall carry out a detailed survey on the area and the topic on which they are interested to do the Project work.
2. Students are instructed to prepare synopsis of three different topics with title of the project work and submit to class teachers.
3. Project Evaluation Committee will review the synopsis and suggest suitable title in relevance to the recent trends in Electronics and Communication Engineering domain.
4. Students are instructed to give a detailed presentation and justify the tittle of the project with problem definition.
5. Get the observations and recommendations in the dairy from the respective Guide with signature and submit the project dairy to HoD.
6. Project work Seminar consists of overview of the Project work: Introduction, Literature Survey (minimum-10 papers related to the topic), problem statement, motivation, objectives, proposed methodology for solving societal problems.
7. Evaluation Scheme: Continuous evaluation will be done by respective Project Guides and PEC members based on the Regularity, Technical Knowledge and Competence, Programming Skills, Communication Skills, Demonstration skills, Collaborative Learning and Documentation Skills of the students.

NOTE: **Maintain project work dairy**: Frequently monitored (every 15 days) by the respective guide.

Course Outcomes:

Course Outcome	Descriptions
CO1	**Formulate** the given engineering problem and review literature.
CO2	**Design** a methodology using engineering knowledge and analytical abilities.
CO3	**Implement** the methodology and propose a meaningful solution by using problem solving skills considering health and safety issues.
CO4	**Effectively** communicate the solution through report and oral presentation.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3						3			3		
CO2	2	3	2	2		2							
CO3			3	1	2	2	2		2	3	2	2	
CO4					2			2	3	3	3		

Phase-1 CIE Evaluation (50 Marks) (During 7th Semester)

Evaluation Parameters	Marks
Synopsis evaluation by DPEC (Relevance of the topic, Novelty, societal need, Industry based)	10
Meeting regularity	10
Presentation Evaluation by DPEC	15
Viva-voce	5
Report writing	10
Total	50

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

(Deemed To Be University Accredited A+ Grade by NAAC)

SRI SIDDHARTHA INSTITUTE OF TECHNOLOGY

(A constituent College of SSAHE, Accredited by NBA)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION FOR BE DEGREE COURSE-2022 (160 Credits Scheme, NEP Batch)

FOURTH YEAR B.E

8th Semester B E **Academic Year: 2026-27**

Sl No.	Course Code		Course Title	Teaching Dept.	Teaching Hours				Total	Credits	Examination			
					L	T	P	S			CIE	SEE	Total Marks	Exam Hrs.
1	PC	22ECTS801	Technical seminar	EC	-	-	-	30	30	1	50	-	50	-
2	PC	22ECIN802	Internship	EC	-	-	30	30	60	2	50	-	100	3
3	PW	22ECPW803	Project work Phase-2	EC	-	-	140	130	270	9	50	50	100	3
				Total	-	-	**170**	**190**	**360**	**12**	**150**	**50**	**250**	-

L: Lecture., T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination, S: Self Learning.

Credit Distribution: PW: Project Work-09, Technical Seminar-1, Internship-2, Total-12 Credits.

Department: Electronics and Communication Engineering		**Semester:**	**8**
Subject: Technical seminar			
Subject Code:	**22ECTS801**	**L – T – P - S:**	**0-0-0-30**
		Credits:	**1**

Description

1. Selection of topic/area:

- Each Student shall carry out a detailed survey on the area and the topic on which they are interested to present the Technical seminar.
- Student is instructed to prepare the abstract of three different topics with title of the Technical seminar and submit to class teachers.
    - Evaluation Committee members will review the abstract of the topic and suggest suitable title in relevance to recent trends in Electronics and Communication Engineering domain.
    - Student is instructed to give a detailed presentation and justify the title of the paper with recent trends and applications.
    - Presentation consists of Overview of the topic: Introduction, Literature Survey (minimum-06 papers related to the topic), recent trends and applications.

2. **Evaluation Scheme:** Continuous evaluation will be done by respective Guide and Evaluation Committee members based on Technical Knowledge and Competence, Communication Skills, Presentation skills (Slide preparation) and report submission.

Course Outcomes:

Course Outcome	Descriptions
CO1	**Outline** the recent technologies relevant to the topic selected.
CO2	**Interpret** the impact of the technology on the society, environment and domain.
CO3	**Compile** and present the report of the study made.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3		1			2					1		
CO2	3	2		2	2						2	2	
CO3							1	2	3	2			

Technical Seminar:

Break-up of CIE marks for Technical Seminar

Evaluation Parameter	Marks
Relevance of the topic	10
Report	10
Presentation	20
Viva-Voce	10
Total	50

Department: Electronics and Communication Engineering			**Semester:**	**8**
Subject: Internship				
Subject Code:	**22ECIN802**		**Credit:2**	

Description
1) Each student must undergo a full-time internship at an industry/research organization/institute approved by the department, during the prescribed period in the final semester. 2) Students are required to maintain a detailed internship diary/logbook with regular entries on activities, tasks, tools learned, and observations during the internship. 3) Students must regularly communicate with the internal guide and obtain periodic reviews of their progress. 4) The logbook must include observations and recommendations from the industry supervisor, duly signed and verified by the concerned authority. 5) On completion of the internship, the student should prepare a comprehensive report containing: company profile, internship objectives, work carried out, skills acquired, challenges faced, tools/technologies used, outcomes achieved, and conclusion. 6) The student shall make a final presentation of their internship experience to a department evaluation committee. 7) The internship report must be submitted to the department as per the specified format and guidelines. Note: All internship-related activities must strictly adhere to the department's calendar of events. Late submissions or failure to comply with requirements will not be permitted.

Course Outcomes:

Course outcome	Descriptions
CO1	**Apply** engineering knowledge and professional skills to solve real-world problems in industry or research environments.
CO2	**Analyze** the structure, workflow, and project management practices of the host organization to identify areas for innovation or improvement.
CO3	**Develop** technical documentation and reports that reflect practical experiences and learning outcomes.

Course Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1		2	3		3				2		3	3	2
CO2		2	3	2				3	3				2
CO3		2		2		3	2			2	3		2

Internship Evaluation

Break-up of CIE marks for Internship evaluation

Evaluation Parameter	Marks
Assessing the relevancy of the topic by the Dept. internship Evaluation Committee (Faculty supervisor and One senior professor)	10
Company/ Industry assessment	10
Report writing	10
Presentation	15
Viva- Voce	05
Total	50

Break-up of SEE marks for Internship evaluation

Evaluation Parameter	Marks
Report	08
Presentation	35
Viva-voce	07
Total	50

Department: Electronics and Communication Engineering		**Semester:**	**8**
Subject: Project Work Phase-2			
Subject Code:	**22ECPW803**	**L – T – P - S:**	**0-0-140-130**
		Credits:	**9**

Description
1. Each project group is instructed to demonstrate the partial outcome of the project during beginning of the final semester. 2. Each project group is instructed to meet the guide for reviewing the progress with dairy. 3. Get the observations and recommendations in the dairy from the respective Guide with signature and submit the project dairy to HoD. 4. After completion of the project work, each group need to make an arrangement for final demonstration at Department/Institution/Industry. 5. Final presentation includes: Introduction, Literature Survey, problem statement, motivation, objectives, proposed methodology, implementation details, Software/Hardware tools used and experimental results for fulfilling the defined objectives and conclusion of the project work. 6. Final report submission as per guidelines of Department. Note: All the above activities in adherence with calendar of events of the department (Late submission will not be permitted).

Course Outcomes:

Course outcome	Descriptions
CO1	**Design** and implement the work using appropriate Hardware and Software tools.
CO2	**Test** the performance of the system with suitable data.
CO3	**Analyze** and compare earlier results with obtained results.
CO4	**Work** effectively as an individual and team member to manage tasks, documentation, and project milestones.
CO5	**Present** and defend project outcomes effectively through oral and written communication.

Course Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1			3	3	2		2					3	
CO2		2				2			2				
CO3		2		2						2			
CO4						2	2	3	2	2	1		
CO5								2	3	2			

Major Project Evaluation
Major Project work done by students is evaluated in two phases
a) Phase 1 evaluation (CIE: 50 marks) No SEE
b) Phase 2 evaluation (CIE: 50 marks + SEE: 50 marks)

b) Phase-2 CIE Evaluation (50 Marks) (During 8th Semester)

Evaluation Parameters	Marks
Midterm Presentation Evaluation by DPEC+ Viva- Voce	10
Weekly Meetings with Guide recording all the remarks in diary	10
Final Presentation & demonstration Evaluation by DPEC	10
Project related activities (Mandatory): (Publication in National/ International Journals, Technodea, KSCST project submission, Plagiarism report)	10
Report writing	10
Total	50

c) Phase-2 SEE Evaluation (50 Marks)

Evaluation parameters	Marks
Writing the abstract and technical details of Project	08
Project demonstration / Presentation of project	25
viva voce	07
Project Report	10
Total	50