BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi)

Avalahalli, Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Electronics and Telecommunication Engineering

V and VI Semester Scheme and Syllabus

2021 Scheme - Autonomous

Approved in the BoS meeting held on 27.05.2023

Vision of the Department

To emerge as a premier department developing high quality Electronics and Telecommunication Engineering Professionals with ethics and eco-friendliness for betterment of the society.

Mission of the Department

Impart quality education in Electronics and Telecommunication Engineering by facilitating:

M1: Conducive learning environment and research activities

M2: Good communication skills, leadership qualities and ethics

M3: Strong Industry-Institute interaction

Program Educational Objectives (PEOs)

After three to four years of graduation our graduates will:

PEO 1: Excel as Professionals in Electronics, Telecommunication and IT related fields.

PEO 2: Engage in life-long learning.

PEO 3: Maintain ethical norms, exhibit good communication skills and leadership qualities.

Program Specific Outcomes (PSOs)

PSO 1: Analyze and design communication systems

PSO 2: Analyze and implement signal processing applications

PSO 3: Design and implement embedded systems

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(An Autonomous Institution affiliated to VTU, Belagavi)
Yelahanka, Bengaluru-560064

Date: 14.06.2023

CIE and SEE Pattern for 2021 Scheme
(Applicable from the AY 2021-22 onwards)

Important Note:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examinations (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 marks out of 50). The student is declared as a pass in the course if he / she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

4 CREDIT and 3 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs to be conducted for 40 Marks (90 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10 marks, total **20 marks**.
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (3 hours).

Question Paper Pattern:

Part - A: Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.

Part - B: There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question from each module.**

SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.

2 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks**.
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (2 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 100 questions each of 01 marks. The same is scale down to 50 marks.

1 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 50 Marks (1 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 50 questions each of 01marks. The same is scale down to 50 marks.

1 CREDIT LABORATORY COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Cumulative Assessment (CA) of each experiment is 20 Marks (Conduction 10 marks + Records 5 marks +Viva 5marks). The average of all the experiments to be taken for **20 marks.**
- Open Ended Experiments (OE) **10 marks.**
- 2 IAs Test to be conducted for 100 marks. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks. The average of 2 IA marks is scale down to **20 marks**.
- CIE marks =20 (CA) +10 (OE) + 20 (IA test) = 50 marks.
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks and scale down to 50 Marks.

Examinations to be conducted jointly by Two examiners. All the experiments are to be included for practical examination. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks.

CoE 16/06/2023 Dean AA 16/06/2023 Principal 19/6/23

Scheme of VI Semester

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021-22

Choice Based Credit System (CBCS)

UG PROGRAM: ELECTRONICS & TELECOMMUNICATION ENGINEERING (ETE) — **Semester: VI**

Sl. No	Course Category	Course Code	Course Title	Teaching Dept.	Teaching Hours /Week				Credits	Examination			
					L	T	P	PW		Duration Hrs.	CIE Marks	SEE Marks	Total Marks
1	HS	21HSS61	Project and Finance Management	ETE	2	0	0	0	2	2	50	50	100
2	AEC	21AEC62	Bio Informatics	ETE	1	0	0	0	1	1	50	50	100
3	AEC	21ET63	Computer Communication Networks	ETE	0	2	0	0	1	1	50	50	100
4	PE	21ET64X	Professional Elective - II	ETE	3	0	0	0	3	3	50	50	100
5	OE	21ET65X	Open Elective - I	ETE	3	0	0	0	3	3	50	50	100
6	PW	21ET66	Mini Project	ETE	0	0	0	4	2	3	50	50	100
7	PC	21EC67	Advanced Communication Theory	ETE	3	0	0	0	3	3	50	50	100
8	PC	21ET68	Wireless Communication	ETE	4	0	0	0	4	3	50	50	100
9	PC	21ECL69A	Advanced Communication Laboratory	ETE	0	0	2	0	1	3	50	50	100
10	PC	21ETL69B	Wireless Communication Laboratory	ETE	0	0	2	0	1	3	50	50	100
TOTAL					**15**	**4**	**4**	**4**	**21**		**500**	**500**	**1000**

Professional Elective - Group II	
Course Code	**Course Title**
21ET641	System on Chip
21ET642	DSP Algorithms & Architecture
21ET643	Robotics and Drone Technology
21ET644	Embedded system design
21ET645	Python Application Programming

Open Elective (OE) - Group I	
Course Code	**Course Title**
21ET651	Mobile Communication
21ET652	Sensors and Applications
21ET653	Signal Processing & Applications
21ET654	Embedded Controllers and Applications

Syllabus of VI Semester

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Project & Finance Management (2:0:0) 2

(Effective from the academic year 2020-21)

Course Code	21HSS61	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	01

Course Objectives:

This course will enable students to:

1. Define the fundamentals of Project Management.
2. Identify the strategies involved in selection, prioritization, planning & scheduling of a project.
3. Understand the time value of money & apply it for decision making.
4. Analyse project risk, progress & results.
5. Make awareness about various sources of finance.
6. Gain Knowledge on working capital & capital budgeting.

Preamble: Project Management:

Need for project management, management practices to meet the challenges of new economic environment, globalization process, rapid technological advancement, and quality concerns of the stakeholders.

Module – 1

Project Management:

Definition of project, characteristics of projects, types of projects, project roles.

Project Selection & Prioritization:

Strategic planning process, strategic objectives, identifying potential projects, feasibility study (environment, society), methods of selecting projects, prioritizing projects, securing and negotiating projects.

(5 Hours)

Module – 2

Project planning & scheduling:

Project scope & check list, work break down structure, project schedule, uncertainty in project schedules.

Project resourcing & risk planning:

Abilities needed when resourcing projects, estimate resource needs, cost planning & estimating, risk management planning, risk identification, risk analysis, project quality planning and project kick-off.

(5 Hours)

Module – 3

Project performing, progress & results:

Project supply chain management, project balanced score card approach, terminate project early, finish project, customer feedback & approval.

(5 Hours)

Module – 4

Financial Management: Evolution of financial management, key activities of finance manager, key decision areas in financial management, financial statement with balance sheet. Efficient utilization and generation of monetary resources and funds, a comparative study of finance and economics, Costs and revenue evaluation for various engineering operations.

Capital Budgeting:

Types of capital budgeting decisions, capital budgeting proposals, estimating cash flows for project appraisal, green capital budgeting.

(5 Hours)

Module – 5

Working capital management:

Factors affecting working capital requirement, operating cycle analysis, negative working capital, cash planning & managing cash flows.

Cost of capital and leverage Analysis:

Concept, significance, assumptions, factors affecting cost of capital, Leverage Analysis: operating leverage, financial leverage.

Recap: All the 5 modules.

(5 Hours)

Course outcomes:

The students will be able to:

CO1: Understand the selection, prioritization & initiation of individual projects.
CO2: Understand WBS, scheduling, uncertainty & risks associated in project.
CO3: Identify & Evaluate the progress and results of the project.
CO4: Understand time value of money & use it for decision making.
CO5: Outline capital requirements for starting a business & management of working capital.

Textbooks

1. Timothy J Kloppenborg, Project Management, Cengage Learning, 2nd Edition, 2009.
2. John J Hampton, Financial Management, PHI Publication, 4th edition.

References

1. Pennington Lawrence, Project Management, McGraw-Hill, 1st edition.
2. Joseph A Moder, Philips New Yark, Project Management with CPM & PRT, McGraw-Hill, 2nd edition, 1983.
3. Harold Kerzner, Project Management A system approach to Planning, Scheduling & Controlling, CBS Publication, 2nd Edition,2006.
4. S.D. Sharma, Operations Research, Kedar Nath Ramnath, Meerut, New Edition,2015.
5 M.Y. Khan, Financial Management, Tata Mc-Graw Hill, Fifth Edition,2007.
6 O.P. Khanna, Industrial Engineering & Management, Dhanpat Rai Publications, Second Edition, 1999.

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Bioinformatics (1:0:0) 1

(Effective from the academic year 2023-24)

Course Code	21AEC62	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15	Exam. Hours	3

Course Objectives:

1. Better understanding of dynamic biological processes and their understanding at molecular level enabled through and correlated using internet and Bioinformatics.
2. To relate the basic knowledge in Genetics & Molecular Biology and see how it can be applied through Bioinformatics perspective.
3. To utilize bioinformatics tools and databases for retrieving, analyzing, understanding and managing biological data.

Preamble: Bioinformatics is an interdisciplinary field mainly involving molecular biology and genetics, computer science, mathematics, and statistics. Data intensive, large-scale biological problems are addressed from a computational point of view.

Module – 1

Biological Data Acquisition:

The form of biological information. Retrieval methods for DNA sequence, protein sequence and protein structure information

(3 Hours)

Module – 2

Databases:

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases – primary sequence databases, protein sequence and structure databases, Organism specific databases.

(3 Hours)

Module – 3

Data Processing:

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local versus global. Distance metrics. Similarity and homology. Scoring matrices.

(3 Hours)

Module – 4

Methods Of Analysis:

Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, and PSI BLAST.

(3 Hours)

Module – 5

Applications:

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis: Comparative genomics, orthologs, paralogs.

(3 Hours)

Course Outcomes: The students will be able to:

CO1: Apply the basic methodology in Bioinformatics to retrieve data.

CO2: Analyse bioinformatics tools and databases for understanding and managing biological data.

CO3: Examine the applications of bioinformatics in allied areas.

Textbooks:

1. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press.
2. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin, S.Eddy, A.Krogh, G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O"Reilley Media.

References:

1. Bioinformatics The Machine Learning Approach by Pierre Baldi and Soren Brunak.

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Computer Communication Networks (0:1:0) 1

(Effective from the academic year 2020-21)

Course Code	21ET63	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:2:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	1

Course Objectives:

This course will enable students to:

1. Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
2. Understand the protocols associated with each layer.
3. Learn the different networking architectures and their representations.
4. Learn the functions and services associated with each layer.

Introduction: Computer Communication Networks, Significance and scope of Computer Communication Networks in current scenario, industry applications, research and innovations related to the course and impact of course on societal problems.

Module – 1

Introduction to Networks: Data communication: Components, Physical Structures, Network types: LAN, WAN, The Internet. Network The OSI Model: OSI Versus TCP/IP.

(2 Hours)

Module – 2

Data-Link Layer: Introduction: Services, Sublayers, types of addresses, ARP. Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol.

Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA

(3 Hours)

Module – 3

Network Layer: IPV4 Addresses: Classful Addressing, Classless Addressing, DHCP, Forwarding of IP Packets: Based on destination Address and Label.

Network Layer Protocols: Internet Protocol (IP): Datagram Format, IPv4 and IPv6 Datagrams.

(4 Hours)

Module – 4

Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: TCP, UDP

(3 Hours)

Module – 5

Application Layer: Introduction: providing services, Application- layer paradigms, Standard Client –Server Protocols: World wide web, Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection, Electronic Mail: Architecture, Web basedmail.

(03Hours)

Summary of the Course: The student will be able to understand the concepts of computer networks like network models, protocols and algorithms.

Note: A hands on Value Added Course/Workshop of about 10 hours has to be conducted.

Course outcomes: The students will be able to:

CO1: Understand the concepts of computer networks like network models, addresses, channels, nodes and topologies.

CO2: **Apply** the knowledge of communication channels, protocols, algorithms for data communication.

CO3: **Analyse** the characteristics of communication channels, protocols, algorithms for data communication.

CO4: **Interpret** the given case study material for network structure and protocols.

CO5: Perform in a **group** to **design** a data communication network using network simulator.

Textbooks

1. Forouzan, "Data Communications and Networking" , 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

References

1. James J Kurose, Keith W Ross, Computer Networks, , Pearson Education.
2. Wayarles Tomasi, Introduction to Data Communication and Networking, Pearson Education.
3. Andrew Tanenbaum, "Computer networks", Prentice Hall.
4. William Stallings, "Data and computer communications", Prentice Hall.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

System On Chip (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21ET641	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Understand the basic concepts of System-on-Chip design.
2. Learn the process of Processor, Memory and Bus Interface selection for System-on-Chip design.
3. Demonstrate the role of System-on-Chip design in applications of High-Performance Embedded Systems.

Introduction:

Significance and scope of SoC in current scenario, industry applications, research and innovations related to the course and impact of course on societal problems.

Module – 1

Introduction to the System Approach:

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

Chip Basics: Time, Area, Power, Reliability, and Configurability

(8 Hours)

Module – 2

Processors

Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

(8 Hours)

Module – 3

Memory Design

Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

(8 Hours)

Module – 4

Interconnect Customization and Configuration:

Inter-Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus

Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

(8 Hours)

Module – 5

Application Studies of System-on-Chip:
SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

(8 Hours)

Summary of the Course:
This course introduces students to the design flow of System-on-Chip for high performance embedded systems. The choice of Processors, Memories, Bus Protocol and trade of in performance at each iteration will provide insights into Area, Speed and Power trade off in design. Applications of System-on-Chip in area of communication and computer vision will enhance students skills for roles in Industry and Research.

Course outcomes:
The students will be able to:

CO1: **Understand** overview of process of System-on-Chip design as practised in industrial applications.

CO2: **Use** EDA tools provided by industrial vendors to understand Hardware-Software Co-design Process followed in System-on-Chip designs.

CO3: **Analyse** the role of different Processors cores, memory structures and bus protocols used as IP modules in high performance embedded systems.

CO4: **Design** Mult-Processor System-on-Chip solutions for high performance Embedded Systems.

CO5: **Evaluate** the performance metrics of System-on-Chip designs for Area, Timing and Power.

Textbooks

1. Michael J. Flynn and Wayne Luk, "Computer System Design System-on-Chip", Wiley India Pvt. Ltd.
2. Steve Furber, "ARM System on Chip Architecture ", 2nd Edition, 2000, Addison Wesley Professional.

References

1. Ricardo Reis, "Design of System on a Chip: Devices and Components", 1st Edition, 2004, Springer
2. Prakash Rashinkar, Peter Paterson and Leena Singh L, "System on Chip Verification – Methodologies and Techniques", 2001, Kluwer Academic Publishers.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

DSP Algorithms and Architecture (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21ET642	CIE Marks	50
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Understand the concepts of adaptive signal processing and basic building blocks of DSP processor.
2. Analyse properties and filter concepts on signals
3. Identify the addressing modes of TMS320C54XX
4. Write assembly codes for DSP algorithms

Introduction: Introduction to DSP system, significance and scope of DSP Kits in current scenario, industry applications, research and innovations related to DSP, impact on course on societal problems**.**

Module – 1

Basic DSP Operations: Introduction, A Digital Signal-Processing System, the Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation

(8 Hours)

Module – 2

Architectures for programmable digital signal processors: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External

(8 Hours)

Module – 3

Programmable Digital Signal Processors:

Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54XX, Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.

(8 Hours)

Module – 4

Implementation of Basic DSP Algorithms:

Introduction, The Q – notation, Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS32OC54xx**.** FIR Filters, IIR Filters, Interpolation and Decimation Filters

(8 Hours)

Module – 5

Interfacing memory and parallel i/o peripherals to DSP devices: Introduction, Memory Space Organization, And External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

Interfacing and applications of DSP processor: DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

Summary of the course: Course covers the importance and benefits of DSP systems, discuss architecture of TMS320C54XX, Instruction, assembly language programming, implementations of algorithms and interfacing of external peripherals.

(8 Hours)

Course outcomes: The students will be able to:

CO1 **Apply** the basics to compute pre-processing operations on digital signals

CO2: **Analyze** the assembly language code using TMS320C54XX instruction set for Digital filters, DSP computations

CO3: **Interpret** the given case study material related to implementation of applications on DSK

CO4: **Write an assembly / embedded C programs** and conduct the same using CCS for Implementing signal processing algorithms on the DSP Processor.

Textbooks

1. Avatar Singh and S. Srinivasa**, "**Digital Signal Processing" ,Thomson Learning, 2004.

Reference

1. Ifeachor E. C., Jervis B. W**, "**Digital Signal Processing: A practical approach", Pearson-Education, PHI 2002.
2. B Venkataramani and M Bhaskar**, "**Digital Signal Processors",TMH 2nd Edition, 2010.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Robotics and Drone Technology (3:0:0) 3

(Effective from the academic year 2020-21)

Course Code	21ET643	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Understand the basics of Robotics and Drone technologies.
2. Understand the different types of Drone systems
3. Analyze the performance of Robotics and UAV Drone based systems
4. Design embedded applications based on Robotics and UAV Drone Technologies.

Introduction: Introduction to Robotics and UAV Technologies; its significance and scope in the current scenario. Industrial applications, research and innovations related to Robotics and UAV Technologies. Impact of the course on society problems, sustainable solutions and national economy.

Module – 1

Specifications of Robots:

Introduction to Robots, Classifications of robots, Work envelope, Flexible automation versus Robotic technology, Applications of Robots.

(8 Hours)

Module – 2

Trajectory Planning:

Trajectory planning, Pick and place operations, Continuous path motion, Interpolated motion, Straight line motion.

(8 Hours)

Module – 3

Introduction to Drones:

Introduction to Unmanned Aircraft Systems, History of UAV drones, classification of drones, System Composition, Applications.

(8 Hours)

Module – 4

Design of UAV Drone Systems:

Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards and Regulatory Aspects- UK,USA and Europe- Design for Stealth–control surfaces specifications.

(8 Hours)

Module – 5

Avionics Hardware of Drones:

Autopilot – AGL-pressure sensors-servos-accelerometer –gyros actuators- power supply-processor, integration, installation, configuration, and testing.

Summary of the Course: The student will be able to explore the concepts, challenges and requirements of UAV and application of the same in Real time systems.

(8Hours)

Course Outcomes: The students will be able to:

CO1 : Acquire the knowledge of Working principles, characteristics of Robotics and Drone Technologies.

CO2 : **Apply** the knowledge gained in the design of Robotics and UAV Drone based systems

CO3 : **Analyze** the performance of Robotics and UAV Drone based systems

CO4 : **Design** different of embedded systems using Robotics and UAV Drone concepts

CO5 : Perform in a group to carry out a mini project based on robotics or UAV Drone technologies and submit the report on the same

Textbooks

1. Robert J. Schilling**, "**Fundamentals of Robotics Analysis and Control"**,** 1st Edition, PHI Learning 2009.
2. Niku S B, "Introduction to Robotics, Analysis, Systems, Applications", 1st Edition, Prentice Hall, 2001.
3. Robert C. Nelson, "Flight Stability and Automatic Control", 1st Edition, McGraw-Hill 1998.
4. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", 1st Edition, Springer 2007.

References

1. John J Craig**, "**Introduction to Robotics"**,** 1st Edition, Pearson 2009.
2. Deb S R and Deb S**, "**Robotics Technology and Flexible Automation", 1st Edition, Tata McGraw Hill Education Pvt. Ltd, 2010.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER - VI

Embedded System Design (3:0:0) 3
(Effective from the academic year 2021-22)

Course Code	21ET644	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course objectives:
This course will enable students to:
1. Understand the basics of memory, I/O systems and Architecture.
2. Learn the different system models and processors.
3. Study the functionality of multitasking
4. Design embedded applications.

Introduction: To Embedded System, significance and scope of Embedded System, in current scenario, industry applications, research and innovations related to Embedded System and impact of course on societal problems.

Module – 1

A System Engineering Approach to Embedded Systems Design:
Introduction to Embedded Systems Architecture, The Embedded Systems Models, Embedded Hardware building blocks, Reading a Schematic.

(9 Hours)

Module – 2

Embedded Processors & Memory:
ISA Architecture Models: Application specific, Internal Processor Design, Processor Performance, Reading Processors, Datasheet, ROM, RAM, Cache Memory, Cache mapping techniques, Memory Management of External Memory, Board Memory and Performance

(7 Hours)

Module – 3

Board I/O & Buses:
Managing Data: Serial vs. Parallel I/O, Interfacing the I/O Components, I/O and Performance, Bus Arbitration and Timing, I2C, SPI, USB, CAN & PCI protocols, integrating the Bus with Other Board Components, Bus Performance.

(7 Hours)

Module – 4

Embedded Software and RTOS
Device Drivers: Device Drivers for Interrupt-Handling, Memory Device Drivers, On-board Bus Device Drivers, Board I/O Driver.
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

8 Hours)

Module – 5

RTOS and IDE for Embedded System Design: Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques

Summary of the Course: The student will be able to understand the basics of memory, I/O systems and Architecture of an embedded system.

(9 Hours)

Course outcomes: The students will be able to

- CO1: Understand the basics of memory, I/O systems and Architecture.
- CO2: **Apply** the embedded system models, features of processors, memory and I/O systems in developing embedded System.
- CO3: **Analyze** the Real time OS functionality and device drivers used in multitasking embedded applications.
- CO4: **Design** embedded applications using given specifications and concepts of development process

Textbooks

1. Tammy Noergaard, Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, 2nd Edition, Newnes, 2012
2. Real–Time Systems Design and Analysis––3rd Edition, Phillip A. Laplante. Apr 2004. Wiley-IEEE Press.

References

1. Carl Hamacher and ZvonkoVranesic and SafwatZaky and NaraigManjikian, Computer Organization and Embedded Systems, 6th Edition.
2. Steve Heath, Embedded system Design , 2nd Edition.
3. James K Peckol, Embedded Systems– A contemporary Design Tool, John Weily.

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SEMESTER – VI

Python Application Programming (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21ET645	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Understand the syntax and semantics and create function in python
2. Understand the concepts of lists, tuples, dictionaries in python.
3. Handle strings and files in python
4. Implement object oriented programming concepts in python
5. Apply python packages for applications

Introduction: Introduction to python programming, , significance and scope of python programming in current scenario, industry applications, impact on course on societal problems**.**

Module – 1

Introduction: Why should you learn to write programs, Variables, operators and operands, expressions and statements, Conditional execution, Functions.

(8 Hours)

Module – 2

Iteration: Updating Variables, The while loops, infinite loops, infinite loops and break, finishing iteration with continue, loop patterns, debugging.

Strings: A String is a sequence, getting the length of a string using len, traversal through a string with a loop, string slices, strings are immutable, looping and counting, in operator, string comparison, string methods, parsing strings. Format operator, debugging.

Files : Persistence, opening files, text files and lines, reading files, searching through a file, letting the user choose the file name, using try, except and open, writing files, degugging.

(8 Hours)

Module – 3

Lists: A list is a sequence, lists are mutable, traversing a list, list operations, list slices, list methods, deleting elements, lists and functions, lists and strings, parsing line, objects and values, aliasing, list arguments, debugging.

Dictionaries: as set of counters, dictionaries and files, looping and dictionaries, advanced text parsing, debugging.

Tuples: immutable, comparing tuples, tuple assignment, dictionaries and tuples, multiple assignment with dictionaries, most common words, using tuples as keys, sequences, debugging.

Regular Expressions: Character matching, extracting data, combining searching and extracting, escape characters, debugging.

(8 Hours)

Module – 4

Classes and objects: user defined types, attributes, rectangles, instances as return values, objects are mutable, copying, debugging.
Classes and functions: Time**,** pure functions, modifiers, prototype vs planning, debugging
Classes and methods: object-oriented features, printing objects, examples, init method, __str_method, operator over loading, type-based dispatch, polymorphism, debugging.

(8 Hours)

Module – 5

Networked programs: HTTP, worlds simplest web browser, retrieving image and text using HTTP, Urlib, parsing concpepts, reading binary files using urlib

Using Web Services: XML, parsing XML, looping though nodes, JSON, Parsing JSON, API, google geocoding web service.

Python libraries suitable for Machine learning: Numerical analysis and data exploration with numpy Arrays, data visualization with Matplotlib.

Summary of the course: Course covers the importance and benefits of python programming.

(8 Hours)

Note: Students should implement basic programs using python and submit the report form the same as a part of the course.

Course outcomes: The students will be able to:

- CO1: Understand the various programming concepts of python language.
- CO2: Apply the various approaches to write code for a given a problem statement
- CO3: Analyze Python Programs using core data structures like functions, strings, Lists, Dictionaries.
- CO4: Interpret the given case study material related to concepts and approaches used for python programming.
- CO5: Perform in a group to Write and execute codes for real-time applications using modern tools

Text Books:

1. Charles R Severance, "Python for Everybody: Exploring Data Using Python 3", Edition, Create Space Independent Publishing Platform, 2016.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientists", 2nd Edition, Green Tea press, 2015.

References :

3. Marks Lutz, "Programming Python", 4th Edition, O'Reilly MEDIA, 2011. Isbn-13:9789350232873.
4. Wesley J Chun, "Core Python Applications programming", 3rd Edition, Pearson Education India, 2015. ISBN-13:9789332555365.
5. Reema Thareja, "Python programming using problem solving approach", Oxford Univesity press, 2017

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Choice Based Credit System (CBCS)

SEMESTER - VI

Mobile Communication (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21ET651	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand the requirements for Long term evolution
2. Explore the architectural view of LTE network.
3. Identify the requirements and challenges in establishing a 5G network
4. Categorize the applications of 5G network

Introduction: Significance and scope of wireless technologies, Importance in the economic growth of the nation. Career perspectives. Impact on national economy, state of art and future directions in mobile communication.

Module – 1

Introduction to LTE:

The Context for the Long Term Evolution of UMTS, Requirements and Targets for the Long Term Evolution, Technologies for the Long Term Evolution.

(8 Hours)

Module – 2

Network Architecture:

Introduction, Overall Architectural Overview, Protocol Architecture, Quality of Service and EPS Bearers, The E-UTRAN Network Interfaces: S1 Interface, The E-UTRAN Network Interfaces: X2 Interface.

(8 Hours)

Module – 3

Drivers for 5G: The 'Pervasive Connected World:

Introduction, Historical Trend of Wireless Communications, Historical Trend of Wireless Communications, 5G Roadmap, 10 Pillars of 5G, 5G Architecture.

(8 Hours)

Module – 4

The 5G Internet:

Introduction, Internet of Things and Context-Awareness, Networking Reconfiguration and Virtualisation Support, Mobility, Quality of Service Control, Emerging Approach for Resource Over-Provisioning.

(8 Hours)

Module – 5

Small Cells for 5G Mobile Networks:

Introduction, What are Small Cells, Capacity Limits and Achievable Gains with Densification, Mobile Data Demand, Demand vs Capacity, Small-Cell Challenges, Conclusions and Future Directions.

Cooperation for Next Generation Wireless Networks:

Cooperative Diversity and Relaying Strategies, PHY Layer Impact on MAC Protocol Analysis, Case Study: NCCARQ

Recap/Summary of all the modules.

(8 Hours)

Cour e outcomes: The students will be able to:

CO1: Apply the characteristics/protocols of wireless communication to establish the LTE/5G communication channel

CO2: Examine the requirements in establishing the LTE/5G communication network

CO3: Explore the challenges in establishing 5G network

CO4: Present in a team, the recent developments in LTE/5G technology

Textbooks:

1. Stefania Sesia, Issam Toufik, Matthew Baker, "LTE – The UMTS Long Term Evolution From Theory to Practice", 2nd Edition, Wiley
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", 2015, Wiley.

References:

1. Ramjee Prasad , "5G Outlook – Innovations and Applications", River Publishers,

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Choice Based Credit System (CBCS)

SEMESTER -VI

Sensors and Applications (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21ET652	CIE Marks	40
Teaching Hours/Week (L:T:P):	3:0:0	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Understand the working of different types of transducers and sensors.
2. Describe recent trends in sensor technology and their selection.
3. Undertake complex and unstructured problem-solving real time challenges using sensors.
4. Have a multidisciplinary experience, integrating knowledge of courses in Electronics and Telecommunication engineering.

Introduction: Introduction to sensors and Applications; its significance and scope in the current scenario. Industrial applications, research and innovations related to sensors. Impact of the course on society problems, sustainable solutions, and national economy.

Module – 1

Sensors and Transducers:

Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers.

(8 Hours)

Module – 2

Sensors and Transducers (continued):

Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems.

(8 Hours)

Module – 3

Data Acquisition Systems and Conversion:

Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion.

Data Transmission and Telemetry: Data/Signal Transmission, Telemetry. Measurement of Non – Electrical Quantities:Pressure Measurement

(8 Hours)

Module – 4

MCUs and DSPs for sensor:

Introduction, MCU control, MCUs for sensor interface, DSP control, Software, tools and support, sensor integration.

(8 Hours)

Module – 5

Sensor Communication and MEMS:

Wireless zone sensing, surface acoustical wave devices, intelligent transportation system, RF-ID, Micro optics, micro-grippers, micro-probes, micro- mirrors, FEDs, communications for smart sensors - sources and standards, automotive protocols, industrial networks, office and building automation, home automation, protocols in silicon, other aspects of network communications.

Summary of the Course: students will be acquire knowledge in different types of sensors and sensor communications along with MEMS.

(8 Hours)

Course outcomes: The course students will be able to:

CO1: Understand the understanding of working of various transducers and sensors, recent technologies.

CO2: **Apply** the knowledge gained in the developing different sensor applications.

CO3: **Analyze** the use of smart sensors in communication, MEMS and automation.

CO4: **Interpret** the given case study situation related to applications of sensors.

CO5: Perform in a **group** to **build** a small application and prepare the report for the same.

Textbooks

1. R.K Rajput, "Electrical and Electronic Measurements and instrumentation", 3rd Edition, S. Chand Publications, 2013.
2. Randy Frank, "Understanding Smart Sensors", 2nd Edition. Artech House Publications, 2013.

References

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre, "Micro and Smart Systems: Technology and modelling", Wiley Publications,2012.
2. J.B. Gupta, "A Course in Electronics and Electrical Measurements and Instruments", 13th Edition, Katson Books, 2008.

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SEMESTER - VI

Signal Processing and Applications (3:0:0)3

(Effective from the academic year 2021-22)

Course Code	21ET653	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Understand the fundamentals of signal processing.
2. Familiar with DSP techniques in frequency domain.
3. Use toolbox in the MATLAB software to write programs to perform various applications of signal processing.

Introduction: Introduction to Signal processing, significance and scope of signal processing in current scenario, industry applications, research and innovations related to signal processing, impact on course on societal problems**.**

Module – 1

Classification of signals: Classification of signals and operations of signals .

System Classification and properties: Linear-nonlinear, Time variant-invariant, causal-non causal, static-dynamic, stable- unstable, invertible

(9 Hours)

Module – 2

Analysis of LTI system in various domains: Convolution sum & Integral definition with basic problems, Z transform definition with basic problems, Introduction to Fourier Transform & DTFT, Definition and basic problems. Sampling Theorem- Statement and proof, converting the analog signal to a digital signal. Practical sampling.

Applications

(7 Hours)

Module – 3

Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, properties (no proof) and basic problems

Fast-Fourier-Transform (FFT) algorithms: Radix-2 FFT algorithms for the computation of DFT decimation-in-time algorithms. Application

(7 Hours)

Module – 4

Digital Filter Design:

Frequency response of ideal analog filters, Salient features of Butterworth filters, Design and implementation of Analog Butterworth filters to meet given specifications.

Design of FIR Filters using the Window technique: rectangular, hamming and the frequency sampling technique to meet given specifications. Applications

(8 Hours)

Module – 5

Applications of signal processing:
Introduction to image, bio medical signals. Case study on image, bio medical signal processing applications using MATLAB.

Summary of the Course: This course provides basic signal processing techniques in various domains and applications using MATLAB.

(9 Hours)

Course outcomes: The students will be able to:

CO1: **Apply** the knowledge of digital signal processing to find DFT's of various signals .

CO2: **Design** various digital filters.

CO3: **Interpret** the given case study material related to different operations and properties of signals and systems in various domains.

CO4: **Demonstrate** in team simple projects of Signal processing applications with ideas

Textbooks

1. Simon Haykins and Barry Van Veen, **"**Signals and Systems"**,** 2nd Edition, Wiley India, 2008.
2. Proakis & Monalakis, "Digital signal processing Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007.

References

1. Ayaraman, S.Esakkirajan, T.Veerakumar, Digital Image Processing, Tata Mc GrawHil
2. Kayvan Najarian , Robert Splinter, Biomedical Signal and Image Processing , CRC Press , Second edition, 2012 by Taylor & Francis Group, LLC.

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Choice Based Credit System (CBCS)

SEMESTER - VI

Embedded Controllers and Applications (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21ET654	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Understand, differentiate, classify, and identify different purposes of embedded systems in which they evolved.
2. Analyze the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
3. Discuss the hardware /software co-design approaches.
4. Demonstrate the applications of embedded controller systems as related to the industry trends.

Introduction: Introduction to embedded systems, significance and scope of embedded system in current scenario, industry applications, research and innovations related to embedded system, impact of course on societal problems.

Module – 1

Introduction to embedded controllers:

Introduction to embedded controller systems starting from definition of embedded system, embedded system vs general computing systems, history, classification, major application areas, and wearable devices-the innovative bonding of lifestyle with embedded technologies.

(8 Hours)

Module – 2

Typical embedded system:

Elements of embedded system, Analog and digital electronic components-Logic gates, Mux,De-Mux, Encoder, Decoder, Buffer ,Latch. Core of the embedded system, Sensors, Actuators, I/O Subsystem-Led,7-segment LED display, Optocoupler, Stepper motor, Relay, Piezo Buzzer, Push Button Switch, Keyboard. Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only), embedded firmware.

(8 Hours)

Module – 3

Embedded Systems-Application- and Domain Specific:

Application specific(Washing machine), Automotive domain examples, factors to be considered in selecting a controller.

Hardware Software Co-Design and Program Modelling: Fundamental issues in hardware software co-design, computational models in embedded design (excluding UML), hardware software trade-offs.

(8 Hours)

Module – 4

Embedded Product Development Life cycle (EDLC):

What and Why is EDLC, Objectives, Different Phases, EDLC approaches (Modelling the EDLC)

(8 Hours)

Module – 5

Industry Trends:

Processor trends in embedded system, Embedded OS trends, Development language trends-beyond embedded C, Open standards, Frameworks and Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet of Things(IoT) and Embedded Systems-The Next Big Thing

Summary of the Course: Course covers the basic concepts on embedded controller systems, applications and the trends in the embedded industry.

(8 Hours)

Course outcomes: The students will be able to:

CO1: Understand the basic concepts of embedded controller systems.

CO2: **Apply** the knowledge of embedded controller systems and be able to differentiate, classify and identify various embedded systems.

CO3: **Analyse** the role of sensors, actuators, and their interfacing with I/O subsystems of embedded system.

CO4: **Discuss** the different computational models used in embedded system design.

CO5: **Interpret** the given case study material related to the product development of embedded controller systems in various domains

CO6: **Perform an activity** as related to industrial applications of embedded controller systems.

Textbooks*:*

1. K V Shibu, "Introduction to Embedded Systems" 2nd Edition , McGraw Hill, 2016.

References:

1. Yifeng Zhu," Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd Edition, Man Press LLC ,2015.
2. Rajkamal, "Embedded Systems" 2nd Edition, McGraw Hill Publications, 2010.

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Choice Based Credit System (CBCS)

SEMESTER – VI

Mini Project (0:0:0:2) 2

(Effective from the academic year 2021-22)

Course Code	21ET66	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:0:4	SEE Marks	50
Total Number of Contact Hours		Exam Hours	03

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

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SEMESTER – VI

Advanced Communication Theory (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21EC67	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable the Students to:

1. Learn the characteristics of RF communication and Digital modulation.
2. Understand the basics of antennas and signalling over the channels.
3. Know the parameters required for antenna radiation and digital communication.
4. Acquire the knowledge of different antennas and digital modulation techniques.

Introduction: Importance of RF communication, digital communication, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

Module – 1

Antenna Basics:

Basic antenna parameters, patterns, beam area, Radiation intensity, Beam efficiency, directivity and gain, Radio communication link, Polarization.

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.

(8 Hours)

Module – 2

Electric dipole:

Fields of short dipole, Radiation resistance of short dipole, Thin linear antenna and Radiation resistance of $\lambda/2$ dipoles.

Types of Antennas:

Horn antenna, Parabolic antenna, Helical antenna, Yagi-Uda array, Log-periodic antennas.

(8 Hours)

Module – 3

Micro-strip antennas:

Basic characteristics, Feeding Methods, Rectangular patch, circular patch, Q- factor, Bandwidth and efficiency, coupling, circular polarization.

Self Study: Simulation of microstrip antennas for wireless communication.

Band-pass Signal to Equivalent Low-pass:

Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of band-pass signals, Complex low pass representation of band-pass systems, Complex representation of band pass signals and systems.

(8 Hours)

Module – 4

Signalling over AWGN Channels:

Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver.

(8 Hours)

Module – 5

Digital Modulation Techniques:

Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-ary PSK, M-ary QAM.

Frequency shift keying techniques using coherent detection: BFSK, DPSK symbol representation, Block diagram treatment of Transmitter and Receiver, probability of error(without derivation of probability of error equation)

Summary of the Course: The student will be able to explore the concepts of RF communication and digital communication.

(8 Hours)

Course outcomes: The students will be able to:

CO1: Understand the basic characteristics of antenna theory and digital communication

CO2: Apply various properties/laws /knowledge of microwave and digital communication to solve the problems related to communication system

CO3: Analyse the behaviour of antenna and modulation technique parameters required for wireless propagation

CO4: Design different antennas and digital modulation schemes

CO5: Interpret the given case study situation related to the wireless communication

CO6: Perform in a **group** to **design** different digital modulation techniques and microstrip antennas using **MATLAB/Simulink** and **HFSS tool.**

Textbooks*:*

1. John D. Kraus, "Antennas for all practical applications",4th Edition, McGraw Hill, 2011.
2. Simon Haykin**,** "Digital Communication Systems"**,** 1Edition, John Wiley & sons, 2014.

References :

1. Stutzman & Thiele , **"**Antenna Theory & Design" 2nd Edition**,** Wiley, 2010.
2. B.P.Lathi and Zhi Ding **, "**Modern Digital and Analog communication Systems"**,** 4th Edition, Oxford University Press, 2010.
3. Simon Haykin, "Digital Communication", John Wiley India Pvt. Ltd, 2009.

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Choice Based Credit System (CBCS)

SEMESTER – VI

Wireless Communication (4:0:0) 4

(Effective from the academic year 2021-22)

Course Code	21ET68	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Total Number of Contact Hours	50	Exam Hours	03

Course objectives:

This course will enable students to

1. Understand the basics of wireless communication and 4G standardization phases and specifications.
2. Explain the system architecture of 4G.
3. Analyse the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.
4. Analyse the main factors affecting LTE performance including mobile speed and transmission bandwidth.

Introduction: Evolution of wireless communication, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

Module – 1

The Cellular Concept – System Design Fundamentals:

Frequency reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity. Trunking and Grade of Service.

Basic Propagation Mechanism-Reflection (Ground Reflection), Diffraction, Scattering.

Small Scale Fading and Multipath: Small Scale Multipath Propagation, Impulse Response of Multipath Channel, Impulse Response of Multipath channel, Parameters of Mobile Multipath Channels, Types of Small scale Fading, Rayleigh and Rician Distributions.

(10 Hours)

Module – 2

Key Enablers for LTE features:

OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture.

Multicarrier Modulation: OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE.

OFDMA and SC-FDMA: OFDM with FDMA, TDMA, CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE.

Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive

Diversity, Transmit Diversity, Spatial Multiplexing, choice between Diversity.

(10 Hours)

Module – 3

Overview and Channel Structure of LTE:
Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink SC-FDMA Radio Resource.

Downlink Transport Channel Processing: Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink

(10 Hours)

Module – 4

Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink.

Physical Layer Procedures:
Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Pre-coder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink.

(10 Hours)

Module – 5

Radio Resource Management and Mobility Management:
PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination.

Summary of the Course: Course covers the fundamentals of wireless Communication, The concepts of LTE in detail is discussed.

(10 Hours)

Course outcomes: The students will be able to:

CO1: Understand the basics of wireless communication, system architecture and the functional standards specified in LTE 4G.

CO2: **Apply** the knowledge of radio interface protocols to LTE.

CO3: **Analyze** the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.

CO4: **Interpret** the given case study material related to the applications and types of mobile communication.

CO5: Perform in **group** to **demonstrate** 4G LTE network elements functionalities using **modern tools**.

Textbooks:

1. "Wireless Communications: Principles and Practice" Theodore Rappaport, 2nd edition, Prentice Hall Communications Engineering and Emerging Technologies series, 2002.
2. Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, "Fundamentals of LTE", Prentice Hall, 2018
3. Afif Osseiran, Jose.F. Monserrat, Patrick Marsha, "Fundamentals of 5G Mobile

Networks" Cambridge University Press, 2019

References:

1. HarriHolma and Antti Toskala, LTE for UMTS Evolution to LTE Advanced"Second Edition, John Wiley & Sons, Ltd. 2011.
2. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos "New Direction in Wireless Communication Systems from Mobile to 5G" CRC Press, 2019.
3. Jonathan Rodriguez "Fundamentals of 5G Mobile Networks" John & Wiley Sons, 2019

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Choice Based Credit System (CBCS)

SEMESTER – VI

Advanced Communication Laboratory (0:0:1:0) 1

(Effective from the academic year 2021-22)

Course Code	21ECL69A	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2:0	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

Course objectives:

This course will enable students to

1. Understand the circuits for the generation of digital Modulation and demodulation schemes viz; FSK, PSK, QPSK, DPSK.
2. Use modern tools to evaluate the performance of digital modulation techniques.

Experiments using Hardware

1. Generation and detection of BPSK, FSK
2. Generation and detection of QPSK, DPSK
3. Generation and detection of different Line codes.
4. Conduct an experiment to measure transmission loss, bending loss, NA of an optical fiber communication system.
5. Determination of the VSWR and Power loss of circulator and isolator
6. Measurement of VSWR and Power loss of directional coupler and E, Hplane tees
7. Measurement of impedance using slotted line assembly
8. Field intensity measurement of a Horn antenna

Experiments using Software (MAT LAB, SCI LAB, LAB VIEW etc)

1. Conduct an experiment to evaluate the performance (BER) of BPSK, FSK.
2. Conduct an experiment to evaluate the performance (BER) of QPSK, M-ary QAM

Open Ended Experiments

1. Demonstrate the application of different digital modulation techniques in various wireless communication systems, like GSM, LTE, WLAN, Wi – fi etc.
2. Field intensity measurement of a Parabolic antenna
3. Determination of the VSWR and Power loss of Magic tee
4. Prove Reciprocity Theorem of an Antenna
5. Determination of type of antenna as good Transmitter or Receiver

Course outcomes: The students will be able to

CO1:	**Conduct** experiments to measure different parameters related to microwave devices, components and antennas using microwave bench at RF range.
CO2:	**Write a report** for the conducted experiment.
CO3:	**Conduct** open ended experiments to measure/check the characteristics of RF devices/components

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Wireless Communication Laboratory (0:0:1:0) 1

(Effective from the academic year 2021-22)

Course Code	21ETL69B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2:0	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

Note: Conduct the following experiments to implement the indication communication process by simulation using MATLAB or any equivalent tool.

Laboratory Experiments

1. Develop a code to represent the different channel models for wireless networks
2. Develop a code to compute the Path loss, Link Budget and sketch relevant plot
3. Analysis of cellular concepts like cell-sectoring, splitting (using Quanlnet/NS3/ any other tool)
4. To consider 2 to 4 message signals, and obtain the Time Division-Multiplexed waveform and then perform de multiplexing and get back the original message signals (represent the signals in time domain and frequency domain at various stages)
5. Consider 24 message signals, and obtain the T1 carrier bit stream (represent the signal in time domain and frequency domain at various stages)
6. Consider the irreducible polynomial of order N (3 or 4) and obtain the 2^N-1 Codes, for the CDMA system. Build the Spread Spectrum modulating using any one of the valid codes.
7. To verify the correlation properties of the codes developed for the CDMA.
8. To build the BPSK-OFDM modulated waveform for binary input data stream and cover the message signals from the modulated waveform.
9. To build the QPSK-OFDM modulated waveform for binary input data stream and recover the message signals from the modulated waveform.
10. To build the GMSK modulated waveform for binary input data stream and recover the message signals from the modulated waveform.

Conduct of practical examination

- All laboratory experiments are to be included for practical examination
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- Change the experiment is allowed only once and marks allotted to the procedure part to be made zero.

Course outcomes: The students will be able to

CO1:	**Conduct** experiments to measure different parameters related to Wireless Communication
CO2:	**Write a report** for the conducted experiment.
CO3:	**Conduct** open ended experiments related to 4G LTE