Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

Aided By Govt. of Karnataka

Approved
Scheme and Syllabus of
VII & VIII Semester
For
2020 Batch

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

VII Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing / Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	MC	18HS71	Cost Management of Engg Projects	HS	03	--	--	03	050	050	100	02
2	PC	18EC71	Wireless Communication	EC	04	--	--	03	050	050	100	04
3	PC	18EC72	Microwave and Antenna	EC	04	--	--	03	050	050	100	04
4	PE	18EC73X	Professional Elective-3	EC	03	--	--	03	050	050	100	03
5	PE	18EC74X	Professional Elective-4	EC	03	--	--	03	050	050	100	03
6	OE	18EC75X	Open Elective-C	EC	03	--	--	03	050	050	100	03
7	PC	18ECL76	Advance Communication Lab	EC	--	--	02	02	050	050	100	01
8	PC	18ECL77	Computer Communication Network Lab	EC	--	--	02	02	050	050	100	01
9	Project	18ECP78	Project work phase-1	EC	--	--	02	02	050	050	100	02
10	INT	18ECI79	Internship	--	--	--	--	---	---	---	--	--
			Total		**20**	**--**	**06**	**24**	**400**	**400**	**800**	**23**

Internship: All the students admitted to III year of BE have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. A University examination will be conducted during VIII semester and prescribed credit are added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the internship will be declared as failed and have to complete during subsequent University examination after satisfy the internship requirements

Note: : PC: Professional Core. PE: Professional Elective, OE: Open Elective. MC: Mandatory Course, PRJ: Project work, INT: Internship

Select **ANY ONE** of the Professional Elective. Open Elective-A: Students can select any one of the open electives (Please refer to consolidated list of Dr AIT for open electives) offered by any Department

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Professional Elective-3(PE-3)		
Sl. No.	**Course Code**	**Course Title**
1	18EC731	5G Technology
2	18EC732	Virtual Reality
3	18EC733	Real Time Operating systems
4	18EC734	DSP Algorithm and architecture
5	18EC735	Network and Cyber Security
6	18EC736	Optical Fibre Communication

Professional Elective-4(PE-4)		
Sl. No.	**Course Code**	**Course Title**
1	18EC741	Analog and Mixed Mode VLSI
2	18EC742	Operating systems
3	18EC743	Satellite Communication
4	18EC744	Real Time Embedded Systems
5	18EC745	Operations Research
6	18EC746	Adaptive Signal Processing

Open Elective-C (OE-C)		
Sl. No	**Course Code**	**Course Title**
1	18EC751	Internet of Things (CS, IS, EI, TE, ML, ME, IEM, EEE, CV)
2	18EC752	Cryptography (CS, IS, ML,TE, EI,EEE)
3	18EC753	Mobile Communication (EI, EE, ML)
4	18EC754	Bio Mechatronics (CS, IS, EI, TE, ML, ME, IEM, EEE, CV)
5	18EC755	Introduction to Unmanned Aerial Vehicle (UAV) (CS,IS, EI, TE,ML, ME, IEM, EEE,CV)

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VIII Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing/ Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	MC	18HS81	Occupational and Safety and Health administration	CV	03	--	--	03	050	050	100	02
2	Project	18ECP81	Project Work Phase-2	EC	--	--	03	03	050	050	100	10
3	Seminar	18ECS82	Technical Seminar	EC	--	--	03	03	050	050	100	01
4	INT	18ECI83	Internship	EC	--	--	03	03	050	050	100	02
Total					**03**	**--**	**09**	**12**	**250**	**250**	**500**	**15**

Internship: Those, who have not pursued /completed the internship will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

Note: : PC: Professional Core. PE: Professional Elective, OE: Open Elective. MC: Mandatory Course, PRJ: Project work, INT: Internship

Select **ANY ONE** of the Professional Elective and Open Elective subject

Students can select any one of the open electives (Please refer to consolidated list of Dr. AIT open electives) offered by any Department.
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives. Registration to electives shall be documented under the guidance of Programme Coordinator/ Mentor.

VII Semester

WIRELESS COMMUNICATION			
Course Code:	18EC71	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	4:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52 hours theory	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

1.To understand the basics of wireless Communication used for mobile telephony.

2.To apply the basic methodologies of cellular system designing

3.To describe 3G network architecture and cellular network

4.To understand GSM and TDMA technologies

5.To distinguish between CDMA technology, wireless LAN and PAN technologies

Module-1	**10 hrs**
Introduction to wireless telecommunication systems and Networks, History and Evolution of wireless radio system, Development of modern telecommunication infrastructure, overview of existing Network infrastructure, Wireless Network applications, Future Wireless Network. Different generations of wireless cellular networks 1G, 2G,2.5G ,3G and 4G Cellular system and beyond, Wireless standard organizations. **TEXT 1**	
Teaching Learning Method:	Chalk and Board /PPT
RBT Level:	L1, L2
Module-2	**10 hrs**
Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components. Cellular component identification, Call establishment. **TEXT 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-3	**10 hrs**
Wireless network architecture and operation: The cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backhaul networks, Mobility management, Radio resources and power management, Wireless network security.**TEXT1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-4	**11 hrs**
GSM and TDMA Technology: GSM system overview-introduction to GSM and TDMA,GSM Network and System Architecture, GSM channel concept, GSM system operations-GSM identities, GSM system operations (Traffic cases). **TEXT1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-5	**11 hrs**
CDMA Technology: CDMA system overview, introduction to CDMA,CDMA network and system architecture **CDMA basics:** CDMA Channel concept, CDMA operations(Layer 3) 3g CDMA,IS95B,CDMA 2000 and WCDMA	

Wireless LANs/IEEE 802.11X: Introduction and Evolution of Wireless LANs, Design issues. Wireless PAN/IEEE 802.15x: Introduction, Wireless Pan application and Architecture. **TEXT1**

Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Understand the history and evolution of wireless communication system and overview of the Existing network infrastructures

CO2.Describe 3G cellular system components

CO3. Understand the cellular concepts, Mobility management, power management and wireless Network security.

CO4. Analyse and differentiate GSM and TDMA technologies.

CO5. Understand design issues in CDMA, Wireless LAN and PAN networks.

Suggested Learning Resources:

Text Books:

1. Garry J Mullet, "Introduction to Telecommunication Systems and Networks: , India Edition, Delmar Cengage Learning,2007

Reference Books

1: T. L. Singal, "Wireless Communications" Tata McGraw -Hill Education,2010

2: Vijay K Garg, "IS-95 CDMA and cdma2000: Cellular/PCS Systems Implementation", Pearson Education, reprint 2006

Web Links:

http://www.nptel.ac.in/courses/ /117102062/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Topics on wireless communication applications for presentation

2: Mini projects on wireless communication applications

3: Group discussion on various wireless communication applications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO2	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO3	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO4	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO5	✓	✓				✓	✓	✓				✓	✓	✓	✓

High-3, Medium-2, Low-1

VII Semester

MICROWAVE AND ANTENNA			
Course Code:	18EC72	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understanding the basics of microwave and waveguides.
2. Understanding the concepts of microwave networks, microwave passive devices and semiconductor devices.
3. Understanding microwave tubes, microwave design principles and antenna basics.
4. Understanding the importance of point sources, arrays and radiations from wires.
5. To understand different types of antennas like aperture, reflector, broadband and Microstrip antennas.

Module-1	**09 hrs**

Introduction to Microwaves -History of Microwaves, Microwave Frequency bands, applications of Microwaves, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Waveguides- Rectangular waveguide, Circular waveguide, Strip line, Micro strip line. **TEXT 1,2**

Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1, L2

Module-2	**09 hrs**

Microwave Network Analysis - Network parameters for microwave circuits, Scattering Parameters. **Microwave Passive devices and semiconductor Devices** - Microwave passive devices - Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave Semiconductor Devices - Gunn Diodes, IMPATT diodes, PIN diodes**.**

TEXT 1,2

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2

Module-3	**11 hrs**

Microwave Tubes: Klystron- two cavity klystron amplifier and reflex klystron (klystron oscillator)
Microwave Design Principles - Microwave
Filter Design, RF and Microwave Amplifier Design

Antenna Basics - Physical concept of radiation, near and far field regions, basic antenna parameters: radiation patterns, beam area, radiation Intensity, beam efficiency, reciprocity, directivity and gain, antenna apertures, effective height, bandwidth, radiation efficiency, radio communication Link, antenna temperature and antenna field zones. **TEXT 1,2,3.4**

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2

Module-4	**11 hrs**

Radiations from wires: Short electric dipole, fields of a short dipole, radiation resistance of dipole, Half wave dipole antenna, folded dipole
antennas.

Point Sources & their arrays - Arrays, Point source, Power theorem and its application, Examples of

power patterns, Field patterns, Phase patterns, Array of isotropic point sources different cases, non-isotropic sources, principle of pattern multiplication, linear arrays of n elements of equal amplitude & spacing, broad side, end fire arrays.

TEXT 3,4

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2, L3

Module-5	**12 hrs**

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

TEXT 3.4

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2, L4

Course outcomes:

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

CO1. Identify the microwave frequency band, its applications and different types of waveguides

CO2. Analyse microwave networks, microwave passive devices and semiconductor devices.

CO3. Apply microwave design principle, microwave tubes and antenna basics.

CO4. Be able to analyse the radiation patterns from different types of wires, point sources and their arrays.

CO5. Illustrate and design antennas like aperture, reflector, and broadband. Microstrip antenna.

Suggested Learning Resources:

Text Books:

1. Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.
2. Annapurna Das, Sisir K Das, Microwave Engineering, TMH Publication, 2001
3. J.D. Kraus, Antennas, McGraw Hill, 1988.
4. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.

Reference Books

1. Microwave Devices and circuits- Liao / Pearson Education. 1992
2. M. Kulkarni., "Microwave devices and Radar Engg." Umesh Publications, 2011
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.

Web Links:

1. www.nptel.in
2. https://www.academia.edu/12559664/Collin_Foundations_for_Microwave_Engineering
3. https://www.academia.edu/13759443/Basic_Antennas_Understanding_Practical_Antennas_and_Design_Joel_R_Hallas_2009

4. www.youtube/microwave , www.youtube/antennas

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Creating physical modules

2: Exploring new technologies and presenting

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1												2	
CO2	3	3	2											2	
CO3	3	2	3	2			1					1	2	2	
CO4	3	3	2	2			1					1	2	2	
CO5	3	3	2	2			1					1	2	2	

High-3, Medium-2, Low-1

VII Semester

5G TECHNOLOGY			
Course Code:	18EC731	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Assess the genesis and impact of 5G and use case requirement in real world.
2. Understanding the 5G architecture and its deployment.
3 Understanding the security features in 5G technology.
4. Understanding the wireless spectrum crunch 5G technologies.
5. Analysing and understanding SON and Green flexible RF in 5G technology.

Module-1	**08 hrs**
Drivers for 5G: The 'Pervasive Connected World' Introduction, Historical Trend of Wireless Communications, Evolution of LTE Technology to Beyond 4G, 5G Roadmap, 10 Pillars of 5G, 5G in Europe, 5G in North America, 5G in Asia, 5G Architecture**Text1**	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-2	**08 hrs**
The 5G Internet Introduction, Internet of Things and Context-Awareness, Internet of Things, Context-Awareness, Networking Reconfiguration and Virtualization Support, Software Defined Networking, Network Function Virtualization, Mobility, An Evolutionary Approach from the Current Internet, A Clean-Slate Approach, Quality of Service Control, Emerging Approach for Resource Over-Provisioning**. Text1**	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-3	**08 hrs**
Security for 5G Communications: Introduction, Overview of a Potential 5G Communications, System Architecture, Security Issues and Challenges in 5G Communications Systems, User Equipment, Access Networks, Mobile Operator's Core Network, External IP Networks **Text1**	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-4	**07 hrs**
The Wireless Spectrum Crunch: White Spaces for 5G. Introduction, Background, Early Spectrum Management, History of TV White Spaces, History of Radar White Spaces, TV White Space Technology, Standards, Approaches to White Space, White Space Spectrum Opportunities and Challenges, TV White Space Applications, International Efforts, Role of WS in 5G Text1	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-5	**08 hrs**
SON Evolution for 5G Mobile Networks, Introduction, SON in UMTS and LTE, The Need for SON in 5G, Evolution towards Small-Cell Dominant HetNets, Towards a New SON Architecture for 5G, **Green Flexible RF for 5G:** Introduction, Radio System Design, Nonlinear Crosstalk in MIMO Systems **Text1**	

Teaching Learning Method:	Chalk & Board
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Introduction to drivers in 5G technology.

CO2. Analyse the 5G architecture and its deployment.

CO3. Elaborate security features in 5G technology.

CO4. Analyse the role of wireless spectrum crunch 5G technologies.

CO5. Elaborate the SON and Green flexible RF in 5G technology.

Suggested Learning Resources:

Text Books:

1. **Jonathan Rodriguez**, "Fundamentals of 5G Mobile", Wiley Publications, 2015.

Reference Books:

1. **Afif Osseran, Jose F.Monserrat, Patrick Marsch,** " 5G Mobile and Wireless Communications Technology" Cambridge University Press, 2016
2. **Harri Holma, Antti Toskala, Takehiro Nakamura**, " 5G Technology: 3GPP New Radio", John Wiley & Sons Ltd. 2020

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

VIRTUAL REALITY			
Course Code:	18EC732	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	03:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To become familiar with the basic concepts of virtual reality Technology and input devices
2. To understand the output devices.
3. To study the concepts of Modeling in virtual
4. To understand the human factors in VR
5. To become familiar with the applications of VR

Module-1	**09 hrs**
INTRODUCTION: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Text book1: 1.1, 1.3, 1.5, 2.1, 2.2 and 2.3**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-2	**07 hrs**
OUTPUT DEVICES: Graphics displays, sound displays & haptic feedback. **Text book1: 3.1,3.2 and 3.3**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-3	**08 hrs**
MODELING: Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management. **Text book1: 5.1, 5.2 and 5.3, 5.4 and 5.5**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-4	**07 hrs**
HUMAN FACTORS: Methodology and terminology, user performance studies, VR health and safety issues. **Text book1: 7.1, 7.2 and 7.3**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-5	**08 hrs**
APPLICATIONS: Medical applications, military applications, robotics applications. **Text book1: 8.1, 8.3 and 9.2**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2

Course outcomes:

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

CO1 Describe the basic concepts of virtual reality and input devices.

CO2 Compare the input and output devices

CO3 Use the virtual reality modeling techniques

CO4 Illustrate the human factors in virtual reality

CO5 Understanding and identifying the applications of virtual reality

Suggested Learning Resources:

Text Books:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons. 2003
2. Introduction to Virtual Reality, John Vince, Springer, London, Springer-Verlag London Limited 2004

Reference Books (if required)

1. Virtual Reality Systems. John Vince, Pearson Education, 2007

Web Links:

1. https://doi.org/10.1007/978-0-85729-386-2, 978-1-85233-739-1
2. www.nptelcoursematerial
3. www.youtube/virtual
4. Introduction - Learning Virtual Reality [Book] (oreilly.com)
5. https://www.geeksforgeeks.org/virtual reality-introduction

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Creating VR environment using Unity 3D tool

2: Creating VR environment using Unreal engine tool

3: Creating VR environment using Mycraft or Cospace tool

4: Creating VR environment using Blender tool

5: Creating VR environment using A-Frame tool

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3						1							1	
CO2	3						1							1	
CO3	3		2		2		1					1	2	1	1
CO4	3						1							1	
CO5	3		2			3	1							2	

High-3, Medium-2, Low-1

VII Semester

REAL TIME OPERATING SYSTEM			
Course Code:	18EC733	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Impart the fundamental concepts of the OS and real time systems.
2. Expose to the concepts such as scheduling techniques, dynamic priority policies.
3. Describe the concepts such as blocking, deadlock, live lock & soft real-time services.
4. Impart the firmware components, debugging and reliability system design.
5. Expose to different available RTOS's through their analysis.

Module-1	**08 hrs**

Introduction to real-time embedded systems: Brief history of real time systems, a brief history of embedded systems.
System Resources: resource analysis, real-time service utility, scheduling classes, the cyclic executive, scheduler concepts, pre-emptive fixed priority scheduling policies, Real-Time OS, thread safe re-entrant functions. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-2	**08 hrs**

Processing: pre-emptive fixed-priority policy, feasibility, rate monotonic least upper bound, necessary and sufficient feasibility, deadline – monotonic policy, dynamic priority policies.
I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture. Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-3	**08 hrs**

Multi-resource Services: Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion. Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, Mixed hard and soft real-time services. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

Embedded system components: firmware components, RTOS system software mechanisms, software application components.
Debugging components: exceptions assert, checking return codes, single-step debugging, kernel scheduler traces, test access ports, trace ports, power-on self-test and diagnostics, external test equipment, application-level debugging. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-5	**07 hrs**

High availability and reliability design: reliability and availability, similarities and differences, reliability, reliable software, available software, design trade- offs, hierarchical applications for fail-safe design. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1: Understand the basics of Real Time Embedded System and System Resources

CO2: Analyse the concepts Processing and IO Resources

CO3: Analyse Various multi-resource services

CO4: Analyse different Embedded System Components and Debug components.

CO5: Analyze and Categorize the design trade-offs

Suggested Learning Resources:

Text Books:

1: Real-time Embedded Components and Systems", Sam Siewert, Cengage Learning.

Reference Books

1: Raj Kamal, "Embedded Systems", Tata McGraw Hill, New Delhi, *2008*.

2: Phillip. A. Laplante, "Real-Time Systems Design and Analysis", Prentice Hall India,2nd Edition, *2005*.

3: Jane. W. S. Liu, "Real Time Systems", Pearson Education, *2005*

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Programming Assignments / Mini Projects can be given.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2				2						1			
CO2	2	2		2	2							1			
CO3	2	2				2						1			
CO4	2	2			2	2						1			
CO5	2	2		2	2	2						1			

High-3, Medium-2, Low-1

VII Semester

DSP Algorithms & Architecture			
Course Code:	18EC734	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:1	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To gain the knowledge of basics of DSP like DFT, FFT, LTI systems, Digital Filters.
2. To understand the architectures of DSP processors.
3. To study the implementation of DSP algorithms.
4. To understand the interfacing of DSP processors with memory and I/O devices.
5. To study the applications of DSP processor.

Module-1	**09 hrs**

Introduction to Digital Signal Processing: 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.

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 Interfacing.

TEXT 1

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	**RBT Level:** L1, L2, L3

Module-2	**06 hrs**

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, On-Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.

TEXT 1

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	**RBT Level:** L1, L2, L3

Module-3	**06 hrs**

Implementation of Basic DSP Algorithms: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

TEXT 1

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	**RBT Level:** L1, L2, L3

Module-4	**10 hrs**

Implementation of FFT Algorithms: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS32OC54xx.

Interfacing Memory and Parallel I/O Peripherals to DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).
TEXT 1

Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-5	**06 hrs**

Interfacing and Applications of DSP Processor: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.
TEXT 1

Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes:

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

CO1: Define the fundamentals of DSP and the general architecture of DSP

CO2: Understand the general architecture of DSP processor and in particular TMS320C54xx DSP to run algorithms.

CO3: Applying the concept of DSP algorithms.

CO4: Analyse the implementation of FFT algorithms and interfacing memory to DSP processor.

CO5: Creating new designs based on existing algorithms targeted to DSP processor.

Suggested Learning Resources:

Text Books:

1. Avatar Singh and S. Srinivasan, "Digital Signal Processing", Third Edition, Thomsoc Learning, 2004

Reference Books (if required)

1: Ifeachor E. C., Jervis B. W Pearson-Education, "Digital Signal Processing: A Practical Approach", edition, Pearson Education, 2002

2: B Venkataramani and M Bhaskar, "Digital Signal Processors", 2nd edition, TMH, 2010

3: Peter Pirsch, "Architectures for Digital Signal Processing", 4th edition, John Wiley, 2007

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Simulation: Assembly language programs to implement FIR, IIR filters and FFT algorithms

2: Interface: TMS320C54xx processor

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2	2	2						1	1	2	2	1
CO2		2	2	2	2						1	1	2	2	1
CO3		2	2	2	2						1	1	2	2	1
CO4		2	2	2	2						1	1	2	2	1
CO5															

High-3,Medium-2, Low-1

VII Semester

NETWORK AND CYBER SECURITY			
Course Code:	18EC735	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Know about security concerns in Email and Internet Protocol. ·
2. Understand cyber security concepts. ·
3. List the problems that can arise in cyber security. ·
4. Discuss the various cyber security frame work.
5. Will be in a position to apply the concepts of cyber security framework in computer system administration

Module-1	**08 hrs**
Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH) **Text 1**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2
Module-2	**08 hrs**
E-mail Security: Pretty Good Privacy, S/MIME, Domain keys identified mail. **Text1**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2
Module-3	**08 hrs**
IP Security: IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Combining security Associations Internet Key Exchange. Cryptographic Suites. **Text 1**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2, L3
Module-4	**07 hrs**
Cyber network security concepts: Security Architecture antipattern: signature-based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, behavioural and entropy-based malware detection. The problems: cyber antipatterns concept, forces in cyber antipatterns, cyber anti pattern templates, cyber security antipattern catalog. **Text-2**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2, L3
Module-5	**08 hrs**
Cyber network security concepts: Enterprise security using Zachman framework Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem-solving patterns, enterprise workshop, matrix mining, mini patterns for problem solving meetings. **Text-2: Chapter 3 & 4**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2, L3

Course outcomes:

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

CO1. Explain network security protocols ·

CO2. Understand the basic concepts of cyber security ·

CO3. Discuss the cyber security problems ·

CO4. Explain Enterprise Security Framework ·

CO5. Apply concept of cyber security framework in computer system administration.

Suggested Learning Resources:

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325- 1877-3.

2. Thomas J. Mowbray, "Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions", Wiley.

Reference Books (if required)

1.Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.

2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

OPTICAL FIBER COMMUNICATION			
Course Code:	18EC736	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To become familiar with the basic concepts of propagation of optical energy in single and multimode optical fibers
2. To understand the fiber losses and its measurements to provide background for optical fiber communications.
3. To understand the the optical sources and detectors.
4. To understand Optical amplifiers and Networks

Module-1	**07 hours**

OVERVIEW OF OPTICAL FIBER COMMUNICATION:

Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory transmission: total internal reflection, acceptance angle, numerical aperture, skew rays, Cylindrical fiber: modes, mode coupling, step index fibers and graded index fibers, single mode fibers: cutoff wave length and mode filed diameter. **TEXT 1**

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-2	**07 hours**

TRANSMISSION CHARACTERISTICS OF OPTICAL

FIBERS: Introduction, Attenuation, Material absorption: Intrinsic and extrinsic absorption, linear scattering losses: Rayleigh scattering and Mie scattering, Dispersion: Chromatic dispersion: Material and Waveguide dispersion, bending loss. . **TEXT 1**

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-3	**09 hours**

OPTICAL FIBERS AND CABLES: Cable design: Fiber buffering, cable structural and strength members, cable sheath and water barrier, examples of fiber cables.

OPTICAL SOURCES AND DETECTORS: Laser: Introduction, basic concepts: absorption and emission of radiation, population inversion. Optical emission from semiconductors: The p-n junction, spontaneous emission, carrier recombination, stimulated emission and lasing, heterojunctions, semiconductor materials. **LED:** Introduction, power & efficiency: double heterojuncation LED **Detectors:** Introduction, quantum efficiency, responsivity. Semiconductor photodiodes: p-i-n and Avalanche photodiode, Phototransistors, photoconductive detectors.

TEXT 1

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3

Module-4	**07 hours**

DIGITAL TRANSMISSION SYSTEMS: Point –to-point links: System considerations, Link power Budget, Rise Time Budget, First window transmission distance, Transmission distance for single mode Links

TEXT 2

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3

Module-5	**09hours**

OPTICAL NETWORKS: Introduction, Optical networks concepts: Optical networking terminology, Optical network node and switching elements, Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, internet protocol, Optical network deployment: Long haul networks, Metropolitan area networks, Access networks, Local area networks. Optical Ethernet, Network protection, restoration and survivability. TEXT 1

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1 Describe the basic concepts of propagation of optical energy in single and multimode optical fibers.

CO2 Compare the fiber losses and its measurements to provide background for optical fiber communications.

CO3 Use the cable design and identify the optical sources and detectors.

CO4 Illustrate the digital transmission system of optical fiber communication

CO5 Understanding and Identifying the different optical Networks and its communication.

Suggested Learning Resources:

Text Books:

1: John M. Senior, "**Optical Fiber Communications**", 3rd Impression Reprint v, Pearson Education, 2012

2: Gerd Keiser, "**Optical Fiber Communication**", 3rd Ed., MGH, Reprint, 2012

Reference Books:

1: Joseph C Palais, "**Fiber Optic Communication**", 4th Edition, Pearson Education, 2012

2: GowerJohn , "Optical Communication System", second edition, Prentice, *2013*

Web Links: www.google.com, Optical Fiber Communications", John M. Senior pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Seminar presentation on Optical Fiber Communication

2: Group discussion on applications of Optical Fiber in modern world of technology

3: Encouraging students to know optical Fiber working and applications by visiting Optoelectronic industry

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1								1	2	1
CO2	3	2	2		1								1	2	1
CO3	3	2	2		1								1	2	1
CO4	3	2	1		1								1	2	1
CO5	3	2	1		1								1	2	1

High-3, Medium-2, Low-1

VII Semester

ANALOG AND MIXED MODE VLSI			
Course Code:	18EC741	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the concept of Analog Design.
2. Analysis of Single stage amplifiers in VLSI perspective.
3. Analysis of Current sources and sinks in VLSI perspective.
4. Understand the concept of Data Converter Fundamentals.
5. Design and Mismatch Error Analysis of DAC and ADC Architectures.

Module-1	**09 hrs**
Basic MOS Device Physics: General considerations: MOSFET as a Switch, MOSFET Structure, MOS symbols, MOS I/V Characteristics: Threshold Voltage, Derivation of I/V Characteristics, Second Order Effects, MOS Device Models: MOS Device Layout, capacitances, MOS Small-signal Model, NMOS versus PMOS devices, Long channel vs Short-channel devices. **(Text 1)**	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3
Module-2	**07 hrs**
Single Stage Amplifiers: Basic Concepts, Common source stage, Common Source stage with resistive load, Common Source stage with Diode connected load, Common Source Stage with Current Source load, Common Source stage with Triode load, Common Source stage with source degeneration. **(Text 1)**	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3
Module-3	**07 hrs**
Current Sources and Sinks: The current mirror, The Cascade Connection, Sensitivity Analysis, Transient response, other current sources & sinks. **(Text 1, 2)**	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3
Module-4	**07 hrs**
Data Converter Fundamentals: Analog versus Digital discrete time signals, Converting Analog signals to Digital signals, Sample and Hold Characteristics, DAC specifications, ADC specifications, Mixed signal layout issues. **(Text 2)**	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3
Module-5	**09 hrs**
Data Converter Architectures: DAC architecture, Digital input code, Resistors string, R-2R ladder networks, Current steering, Charge scaling DACs, Cyclic DAC, Pipeline DAC. **ADC Architecture:** Flash, 2-step flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC. **(Text 2)**	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3

Course outcomes:

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

CO1. Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.

CO2. Analyse and Design of Single Stage Amplifiers.

CO3. Analyse and Design of Current sources and sinks.

CO4. Understand concepts of ADC and DAC

CO5. Analysis of ADC, DAC Architectures and Mismatch errors.

Suggested Learning Resources:

Text Books:

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Twenty Fifth Reprint, TATA McGraw Hill, 2013.
2. R Jacob Baker, "CMOS Circuit Design, Layout and Simulation", PHI, 2005

Reference Books:

1. Philip E Allen and Douglas R Holberg, "CMOS Analog Circuit Design", Second edition, Oxford University Press, 2004.
2. Adel Sedra and K C Smith, "Microelectronics Circuits", Fifth edition, Oxford University Press, 2009.

Weblink;

1. http://nptel.ac.in

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Design of CMOS amplifier using CAD tools

2: Design of Memory circuits using the MOS transistors

3: Design of OP AMP for particular specifications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2						2	2	3	
CO2	3	3	3	3	3	2						3	2	3	1
CO3	2	3	2	2	2	2						3	1	3	1
CO4	3	3	3	3	3	3						3	2	3	2
CO5	3	3	3	3	3	3						3	3	3	3

High-3, Medium-2, Low-1

VII Semester

OPERATING SYSTEM			
Course Code:	18EC742	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the history and types of operating systems.
2. Understand the design issues associated with operating systems development.
3. Understand the process management and scheduling.
4. Understand the concepts of memory management.
5. Understand the file and I/O operation.

Module-1	**08 hrs**

INTRODUCTION: Goals of an OS, Operation of an OS

OVERVIEW OF OPERATING SYSTEMS: OS and computer system, Efficiency, system performance and user convenience, Classes of operating systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems. **TEXT 1**.

Teaching Learning Method:	Chalk and talk method, Youtube Videos, Programming examples
RBT Level:	L1, L2

Module-2	**08 hrs**

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of an operating system, Operating systems with monolithic structure, Layered design of an operating system, Virtual machine operating systems, Kernel based operating systems. **TEXT1**

Teaching Learning Method:	PowerPoint Presentation, YouTube videos
RBT Level:	**RBT Level:** L1, L2, L3

Module-3	**08 hrs**

PROCESS MANAGEMENT: Process and programs, Programmer view of processes, OS view of processes, Threads.

SHEDULING: Preliminaries, Non pre-emptive scheduling policies, pre-emptive scheduling policies, scheduling in practice. **TEXT 1**

Teaching Learning Method:	Chalk and talk method, Power Point Presentations and supporting YouTube Videos
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

MEMORY MANAGEMENT: Managing the memory hierarchy, static and dynamic memory allocations, memory allocation to a process, reuse of memory, contiguous and non-contiguous memory allocation, paging, segmentation, segmentation with paging.

VIRTUAL MEMORY: Virtual memory Basics, Demand paging, page replacement policies. **TEXT 1**

Teaching Learning Method:	Chalk and Talk Method, You Tube Videos
RBT Level:	**RBT Level:** L1, L2

Module-5	08 hrs

FILE SYSTEMS: File system and IOCS, Files and file organization, Fundamentals of file organizations, Directory structures, File protection, Interface between file system and IOCS, Allocation of disk space. implementation of file access. **TEXT 1**

Teaching Learning Method:	Power Point Presentation, YouTube videos
RBT Level:	**RBT Level:** L1, L2

Course outcomes

CO1: Understand the evolution of operating systems and various types of operating systems in practice
CO2: Analyze the structure of operating system.
CO3: Analyze the concepts of process management and different scheduling management.
CO4: Understand the design issues in memory management and virtual memory.
CO5: Understand the file and I/O management techniques

Suggested Learning Resources:

Text Book:

1. D.M.Dhamdhare, "Operating Systems", Second Edition, TMH, 2008

Reference Books:

1. Stalling William, "Operating Systems", Sixth edition, Pearson Education,

2. Avi Silberchatz, Peter Baer Galvin, Greg Gagne, "Operating system Concepts", Ninth edition, John wiley & Sons

Web Links.

1. faculty.salina.k-state.edu/tim/ossg/Introduction/OSrole.html
2. https://users.dimi.uniud.it/~antonio.dangelo/OpSys/.../Operating_System_Concepts.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
Activity 1:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		2								1			
CO2		2	2	2						2		2			
CO3	2	2	2			1	1					1			
CO4	2	2		2							1	1			
CO5	2	2									1	1			

High-3, Medium-2, Low-1

VII Semester

SATELLITE COMMUNICATION			
Course Code:	18EC743	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To be able to familiar with satellite systems and laws governing satellite orbit
2. To understand concept of geostationary orbit and various losses on signal transmission in satellite system
3. To evaluate link power budget estimation, System noise and various space segment subsystems
4. To study earth segment, interference between satellite circuits and multiple access systems
5. To understand Direct Broadcast System, Satellite mobile and specialized services

Module-1	**10 hrs**
OVER VIEW OF SATELLITE SYSTEMS: Introduction, frequency allocation, INTELSAT, Orbits and launching methods: Kepler's laws, definitions of terms for earth orbiting satellites. Orbital element, apogee and perigee heights, orbit perturbations, inclined orbits, calendars, universal time, sidereal time, orbital plane, local mean time and sun synchronous orbits. Numerical problems.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module-2	**06 hrs**
GEOSTATIONARY ORBIT: Introduction, antenna, look angles, polar mount antenna, Limits of visibility, earth eclipse of satellite, sun transit outage, launching orbits. Numerical problems.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module-3	**08 hrs**
SPACE SEGMENT: Introduction, power supply unit, attitude control: spinning satellite stabilization, momentum wheel stabilization. Station keeping, thermal control, TT&C subsystem, transponders. **SPACE LINK**: Introduction, EIRP, transmission losses: free space transmission, feeder losses, and antenna misalignment losses. Link power budget equation, System noise: antenna noise, amplifier noise temperature, overall system noise temperature.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module-4	**10 hrs**
EARTH SEGEMENT: Introduction, receive only home TV system: out-door unit, indoor unit, MATV, CATV, Tx – Rx earth station. **INTERFERENCE AND SATELLITE ACCESS**: Introduction, interference between satellite circuits. Satellite access: single access, Pre-assigned FDMA, demand assigned FDMA, spade system, TDMA: pre-assigned TDMA.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module -5	**05 hrs**

SATELLITE SERVICES: satellite mobile services, VSAT, RadarSat, Global positioning satellite system, orbcomm.

Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1,L2,L3

Course outcomes:

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

CO1. Identify the characteristics of satellite communication Orbits, Launching Methods and channels.

CO2. Explain the concept of geostationary orbit and mathematical model for various losses on signal transmission in satellite system.

CO3. Apply analytical and empirical models in the design of satellite networks and space segments. Able to compute link power budget estimation, System noise.

CO4. Illustrate the multiple access schemes for satellite access.

CO5. Compile the Direct Broadcast System, satellite mobile and specialized services

Suggested Learning Resources:

Text Books:

1: Dennis Roddy, "Satellite Communications",4th Edition, McGraw- Hill International edition, 2006,

Reference Books:

1: Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", 2nd Edition, John Wiley Pvt. Ltd & Sons, 2008.Pearson Education Asia / PHI, Indian Reprint, 1997.

2: W. L. Pitchand, H. L. Suyderhoud, R. A. Nelson. , "'Communication Systems"", 2nd Edition, Pearson Education , 2007

Web Links:

1. https://www.amazon.com/Satellite-Communications-2nd-DennisRoddy/.../00705337...
2. https://www.flipkart.com/satellite-communications-2nd/p/itme9z9vfzvc9gea

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3													
CO2	3	2				3									
CO3		1				2						2			
CO4		1				2						3			
CO5		3				1						2			

High-3, Medium-2, Low-1

VII Semester

REAL TIME EMBEDDED SYSTEMS			
Course Code:	18EC744	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Introduce the fundamental concepts of the Real time Embedded systems.
2. Study concepts relating to Real time Embedded systems such as Scheduling techniques, Dynamic priority policies.
3. Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real time services.
4. Understand the basic hardware and software components of Real time embedded systems.
5. Expose to Real time embedded system applications through different case studies.

Module-1	**07 hrs**
Real-Time Embedded Systems: Introduction, Brief history of Real Time Systems, A brief history of Embedded Systems. **System Resources:** Introduction, Resource analysis, Real-Time Service Utility, scheduling classes, Scheduler concepts, Real-Time OS. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3
Module-2	**08 hrs**
Processing with Real Time Scheduling: Introduction, Pre-emptive Fixed Priority Scheduling Policies with timing diagrams, Problems and issues, Feasibility, Rate Monotonic least upper bound (No derivation), Necessary and Sufficient feasibility, Dynamic priority policies. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3
Module-3	**08 hrs**
I/O Resources: Execution efficiency, I/O Architecture. **Memory:** Physical hierarchy, ECC Memory, **Multi-resource Services:** Blocking, Deadlock and livelock. **Soft real-time services:** Missed deadline, QoS. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3
Module-4	**08 hrs**
Embedded System Components: **Hardware Components:** Sensors, Actuators, IO Interfaces, Processor Complex or SoC, Processor and IO Interconnection, Bus Interconnection, High-Speed Serial Interconnection, Low-Speed Serial Interconnection, Interconnection Systems, Memory Subsystems. **Firmware Components:** Boot Code, Device Drivers, Operating System Services. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3

Module-5	08 hrs

Case Studies:

Robotic Applications: Robotic Arm, Actuation, End Effector Path, Sensing, Tasking, Automation and Autonomy.

Computer Vision Applications: Object Tracking, Image Processing for Object Recognition, Characterizing Cameras, Pixel and Servo Coordinates, Stereo-Vision. (Text 1)

Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1: Discuss the fundamentals of various real time services, real time service utilities, and Real time embedded system.

CO2: Apply priority based static and dynamic Real time scheduling techniques for the given real time embedded system specifications.

CO3: Analyse deadlock conditions, shared memory problem, priority inversion, missed deadlines and QoS of Real time embedded systems.

CO4: Choose the appropriate real time embedded system components to improve the performance.

CO5: Conduct Case Studies about simple real time embedded systems.

Suggested Learning Resources:

Text Books:

1: "**Real-Time Embedded Components and Systems",** Sam Siewert, John Pratt, Mercury Learning and Information, 2016.

Reference Books:

1: James W S Liu, "**Real Time System**", Pearson education, 2008.

Web Links: nptel.ac.in/courses

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Seminar on different Real Time Embedded Systems we come across in daily life.

2: Analysis of different applications of Real Time Embedded Systems.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1				1						1			
CO2	1	1		1	1							1			
CO3	1	1				1						1			
CO4	1	1			1	1						1			
CO5	1	1				1						1			

High-3, Medium-2, Low-1

VII Semester

OPERATIONS RESEARCH			
Course Code:	18EC745	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3 : 0 : 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives: This course will enable students to:

1. Understand the Scope of Operations Research and TP Formulation.
2 Understand the Assignment Problem.
3. Understand the Network Construction.
4. Understand the competitive real-world phenomena using concepts from game theory.
5. Formulate Queuing models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Queuing problems.

Module-1	**08 hrs**
Introduction to Operations Research: Basics definition, Scope, Objectives, Phases, Models and Limitations of Operations Research. **Transportation Problem:** Formulation, Solution, Unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test.Text1	
Teaching Learning Method: **RBT Level:**	
Module-2	**08 hrs**
Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem and assignment problem. **Text1**	
Teaching Learning Method: **RBT Level:**	
Module-3	**08 hrs**
PERT-CPM Techniques: Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks. **Text1**	
Teaching Learning Method: **RBT Level:**	
Module-4	**08 hrs**
Game Theory: Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game). **Text1**	
Teaching Learning Method: **RBT Level:**	
Module-5	**07 hrs**
Queuing Theory: Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/ 1 and M/M/C queuing model. **Text1**	
Teaching Learning Method: **RBT Level:**	

Course outcomes:

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

CO1. Determine the optimal solution for Transportation problems.

CO2. Ability to interpret and explain the Assignment Problem.
CO3. Formulate and solve problems as networks and graphs.
CO4. Determine the best strategy and value of the given game model.
CO5. Design the Queuing system, Game Theory and their characteristics.

Suggested Learning Resources:

Text Books:

1: P. Sankara Iyer, "**Operations Research**", First Edition, Tata McGraw-Hill, ***2008***

2: A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "**Operations Research**", First Edition, Pearson Education, ***2005***

Reference Books (if required)

1: P. K. Gupta and D. S. Hira, "**Operations Research**", Second Edition, S. Chand & co, ***2007***

2: S D Sharma, "**Operations Research, Problems and Solutions**", Paperback 1, kedar Nath Publisher, India Ltd, ***2012***

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
Activity 1:
Activity 2:
Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2						1	1			3	1	
CO2	3	2	2						1	1			3	1	
CO3	3	2	2						1	1			3	1	
CO4	3	2	2						1	1			3	1	
CO5	3	2	2						1	1			3	1	

High-3, Medium-2, Low-1

VII Semester

ADAPTIVE SIGNAL PROCESSING			
Course Code:	18EC746	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To understand the basic concept of adaptive filter and adaptive system.
2. To be able to identify the geometrical significance of Eigenvectors and values
3. To analyze the Simple, Newton's and Steepest descent Gradient search method to search performance surface
4. To study estimation of gradient component using Newton's, Steepest-descent methods and LMS algorithm
5. To be familiar with design of adaptive communication system, adaptive noise canceller and adaptive modelling in FIR digital filter synthesis

Module-1	**06 hrs**
ADAPTIVE SYSTEMS: Definition and characteristics, Areas of application, General properties, Open- and closed loop adaptation, Applications of closed-loop adaptation, Example of an adaptive system. (Text1)	
Teaching Learning Method:	Chalk board/PPT/Classroom Discussion/Group activity
RBT Level:	L1, L2
Module-2	**10 hrs**
THE ADAPTIVE LINEAR COMBINER: General description, Input signal and weight vectors, Desired response and error, the performance function, gradient and minimum mean-square error, Example of a performance surface **PROPERTIES OF THE QUADRATIC PERFORMANCE SURFACE**: Normal of the input correlation matrix, Eigen values and Eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigenvectors and Eigen values.(Text1)	
Teaching Learning Method:	Chalk board/PPT/Classroom Discussion/Group activity
RBT Level:	L1, L2, L3
Module-3	**10 hrs**
SEARCHING THE PERFORMANCE SURFACE: Methods of searching the performance surface, Basic ideal of gradient search methods, a simple gradient search algorithm and its solution, Stability and rate of convergence, The learning curve, and Gradient search by Newton's method in multidimensional space, Gradient search by the method of steepest descent, Comparison of learning curves. (Text1)	
Teaching Learning Method:	Chalk board/PPT/Classroom Discussion/Group activity
RBT Level:	L1, L2, L3
Module-4	**07 hrs**
THE LMS ALGORITHM: Derivation of the LMS algorithm, convergence of the weight vector, an example of convergence, learning curve, noise in the weight-vector solution (Text1)	
Teaching Learning Method:	Chalk board/PPT/Classroom Discussion/Group activity
RBT Level:	L1, L2, L3
Module-5	**06 hrs**

ADAPTIVE MODELING AND SYSTEM IDENTIFICATION: Multipath communication channel, geophysical exploration, FIR digital filter synthesis. (Text1)

Teaching Learning Method:	Chalk board/PPT/Classroom Discussion/Group activity
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1: Understand the basic concept of adaptive filter and adaptive system

CO2: Understand the design of adaptive linear combiner and identify the geometrical significance of Eigenvectors and values

CO3: Analyse the Simple, Newton's and Steepest descent Gradient search method to search performance surface.

CO4: Estimate the gradient component using Newton's, Steepest-descent methods and LMS algorithm

CO5: Design of adaptive communication system, adaptive noise canceller and adaptive modelling in FIR digital filter synthesis.

Suggested Learning Resources:

Text Books:

1, Bernard Widrow and Samuel D. Stearns, "Adaptive Signal Processing", Edition, Pearson Education, Asia, 2009

2. Simon Haykin, "Adaptive filter Theory", 4th edition, Pearson Education Asia, 2008

Reference Books (if required)

1: T. Adali and Simon Haykin, "Adaptive Signal Processing: Next Generation Solutions,"Wiley India, 2012.

2: Jophn R. Treichler C. Richard Johnson, Jr. and Michael G. Larimore, "Theory and Design of Adaptive Filters", Pearson Education / PHI 2002.

Web Link: https://archive.nptel.ac.in/courses/117/105/117105075/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Group activity through implementation of circuit using MATLAB

2: Discussion of concepts in classroom through real time processing of model using MATLAB

3: Quiz

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2											3	2	
CO2	3	3	3										3	2	
CO3	3	3	3										3	3	
CO4	3	3	3										3	3	
CO5	3	2	2	2									3	2	

High-3, Medium-2, Low-1

VII Semester

INTERNET OF THINGS			
Course Code:	18EC751	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Assess the genesis and impact of IoT applications, architectures in real world
2. Illustrate diverse methods of deploying smart objects and connect them to network.
3. Compare different Application protocols for IoT
4. Infer the role of Data Analytics and Security in IoT.
5. Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

Module-1	**09 hrs**
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Computer Stack. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	

Module-2	**10 hrs**
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, **Connecting Smart Objects:** Technologies for connecting smart objects, Communication criteria, Topologies, IoT Access Technologies: Protocol Stack utilizing IEEE 802.15.4, LoRaWAN, NB-IOT and other LTE variations. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	

Module-3	**06 hrs**
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Optimizing IP for IoT, Profiles and Compliances. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos, assignments **RBT Level:** L1, L2, L3	

Module-4	**06 hrs**
Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos, assignments **RBT Level:** L1, L2, L3	

Module-5	**08 hrs**
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, **TEXT 1**	

Teaching Learning Method:	Chalk and Talk, YouTube videos, assignments
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.

CO2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.

CO3. Appraise the role of IoT protocols for efficient network communication.

CO4. Analyze higher layer IoT Protocols.

CO5. Elaborate the need for Data Analytics and identify the applications of IoT in Industry.

Suggested Learning Resources:

Text Books:

1: David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education (Cisco Press Indian Reprint).

2: Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017

Video link: IoT Projects for Beginners To Master The Technology - Great Learning (mygreatlearning.com)

Reference Books:

1: Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014. (ISBN: 978-8173719547)

2: Raj Kamal, "Internet of Things: Architecture and Design Principles", 1 st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Model based implementation of IOT applications

2: Case studies on smart city

3: Case studies on smart health care

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	2	2			1				2	
CO2	3					2	1							2	
CO3	3		2			2	2						2	2	
CO4	3		1			2	1					1	2	2	
CO5	3		1		1	2	1					3	2	2	

High-3, Medium-2, Low-1

VII Semester

CRYPTOGRAPHY			
Course Code:	18EC752	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To impart the basic concepts of network security and classical encryption, number theory, stream ciphers, block ciphers and authentication
2. To interpret the cryptographic algorithms like stream ciphers and block ciphers using classical encryption techniques
3. To apply the concept of classical encryption techniques to stream ciphers and block ciphers
4. To analyse the stream ciphers, block ciphers and authentication functions
5. To design the stream ciphers, block ciphers and authentication functions

Module-1	**08 hrs**
Introduction: Services, mechanisms and attacks, OSI security architecture, Model for network security. **Symmetric ciphers:** Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Mono Alphabetic Cipher, Playfair Cipher, Hill Cipher, polyalphabetic Cipher and One-Time Pad (OTP). Transposition Techniques, Rotor Machines, Steganography. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L1, L2

Module-2	**08 hrs**
Finite Fields: Groups, Rings, Fields. Modular Arithmetic: Divisors, properties of modulo operator, modular arithmetic operations and properties. Euclid's Algorithm, Greatest Common Divisor (GCD), finding GCD. Finite Fields of the form GF (p): Finite fields of order p, polynomial arithmetic. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L1, L2

Module-3	**08 hrs**
Private Key Encryption: Simplified DES, Block Cipher Principles, Data encryption standard (DES), Strength of DES, Block Cipher Design Principles and Block Cipher Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L2, L3, L4

Module-4	**07 hrs**
Public Key Encryption: Principles of Public-Key Cryptosystems, The RSA algorithm. Key Management, Diffie - Hellman Key Exchange. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L2, L3, L4

Module-5	**08 hrs**
Authentication Functions and Hash Functions: Authentication functions, message authentication codes, hash functions, security of Hash functions and MACs. **TEXT 1**	
Teaching Learning Method:	

RBT Level:	L2, L3, L4

Course outcomes:

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

CO1: Define the basic concepts of network security, classical encryption, number theory, Private key, public key, authentication

CO2: Understand the structure of cryptographic algorithms and their applications.

CO3: Apply the concept of classical encryption techniques to existing standard algorithms.

CO4: Illustrate the significance of cryptographic algorithms and their applications.

CO5: Design the private key and public key, authentication functions for applications.

Suggested Learning Resources:

Text Books:

1. **Text book 1:** William Stallings, "Cryptography and Network Security: Principles and Practice", Fifth Edition, Pearson, 2010

Reference Books:

1. Behrouz Forouzan, "Cryptography and Network Security", edition, TMH, 2007
2. Alfred J. Menezes, Paul C. Van Oorschot and Scott A. Vanstone, "Handbook of Applied Cryptography", edition, CRC Press, Reprint 2001
3. Bruce Scheiner, "Applied cryptography: protocols, algorithms, and source code in C", 2nd edition, Wley India, 2008
4. Atul Kahate , "Cryptography and Network Security", 2nd edition, TMH, 2006

Web Links: http://www.nptel.ac.in/courses/106105031/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

MOBILE COMMUNICATION			
Course Code:	18EC753	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Able to understand the basics of wireless communication used for mobile telephony.
2. Able to understand basic methodologies of cellular system design ·
3. Able to remember components and characteristics of 2.5G network, 3G network architecture. Discuss the various cyber security frame work.
4. Able to understand Spread Spectrum communication and CDMA technology.
5. Able to remember characteristics of emerging wireless technologies.

Module-1	**08 hrs**
Evolution of wireless communication system: History of wireless communication, advantages and disadvantages of wireless communications, wireless network generations, comparison of wireless systems, evolution to next generation networks, application of wireless communications, potential market areas. **TEXT 1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-2	**08 hrs**
Principles of cellular Communication: Cellular terminologies, cell structure and cluster, frequency reuse concept, cluster size and system capacity method of locating co channel cells, frequency reuse distance, co- channel interference and reduction methods, A Basic Cellular system: Limitations of conventional mobile telephone system, **TEXT 1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-3	**07 hrs**
Global System for Mobile (GSM): GSM Network architecture, Signalling protocol Architecture, identifies in GSM system, GSM channels, frame structure, speech coding, authentication and security in GSM, services. **TEXT1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-4	**08 hrs**
CDMA digital cellular standards (IS 95): General model of Spread spectrum digital communication system, Direct sequence Spread Spectrum, Frequency hopping Spread Spectrum, Architecture of CDMA system. **3G Digital cellular Technology:** 2.5G TDMA evolution, GPRS Technology, EDGE Technology, UMTS Technology-CDMA: Comparison of W-CDMA and IS 95.**TEXT1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-5	**08 hrs**
Emerging wireless Network Technologies: IEEE.802.11 technology, ETSI Hyper LAN Technology, IEEE.802.15 WPAN technology, IEEE.802.16 WMAN technology, Mobile AD-HOC network	

(MANETS), Wireless Sensor Networks (WSNs), Security requirements of wireless Networks, IEEE.802.21 standard-An overview, Interoperability of Wireless Networks.**TEXT1**

Teaching Learning Method:	Chalk & Talk, PowerPoint presentation
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Identify the telecommunication system and networks system, 3G cellular system components; list the components of wireless cellular network and different frequency band used in GSM and CDMA

CO2. Explain cellular systems, list the characteristics of 3G wireless mobile systems and network security

CO3. Explain the architecture of 3G and network Systems and the operation needed for call setup and call release in GSM and TDMA system and concept of CDMA,

CO4. Illustrate the cellular concept, cell sectoring and cell splitting, mobility management, CDMA channel concept, GSM frame concept

CO5. Discuss characteristics of Emerging wireless Network Technologies

Suggested Learning Resources:

Text Books:

1. T L Singal, "Wireless Communications: Tata McGraw-Hill Education, Delmar Cengage Learning,2010.

Reference Books:

1. Garry J Mullet, "Introduction to Telecommunication Systems and Networks", India Edition, Delmar Cengage Learning, 2007
2. Upena Dalal, "Wireless communication", Oxford Higher Education, 6th impression,2013**Web Links:** http://www.nptel.ac.in/courses/106105031/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

BIO-MECHATRONICS			
Course Code:	18EC754	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Learn basic knowledge about Bio mechanics, Bio sensors and actuators, and bio- mechatronics devices.
2. Impart the bio assist devices.
3. Know the different types, bio imaging and processing.
4. Understand about bio mechatronics devices and their functions.

Module-1	**08 hrs**
Bio Mechanics: Cardiovascular biomechanics, Musculoskeletal and orthopedic biomechanics, human ergonomic, Rehabilitation. **Text1**	
Teaching Learning Method:	Chalk and Board /PPT
RBT Level:	L1, L2
Module-2	**08 hrs**
Bio Sensors and Actuators: Introduction to Bio mechatronics, Electrodes - Types, - Measurement of blood pressure - Blood Gas analyzers: pH of blood, Smart actuators for biological applications **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-3	**08 hrs**
Medical Measurements: Heart rate - Heart sound -Pulmonary function measurements -spirometer -finger-tip oximeter - ESR, GSR measurements **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-4	**07 hrs**
Wearable mechatronics devices: Wearable Artificial Kidney, Wireless capsule endoscope, Wearable Exoskeletal rehabilitation system, Wearable hand rehabilitation. **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-5	**08 hrs**
Sensory Assist Devices: Hearing aids – Implants, Optical Prosthetics, Visual Neuroprostheses – Sonar based systems, Respiratory aids, Tactile devices for visually challenged. **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Demonstrate the basic knowledge about the Bio mechanics, Bio sensors and actuators, and bio-mechatronics devices.

CO2. Acquire the different bio imaging and processing.

CO3. Analyse the Signal processing with bio sensors and actuators.

CO4. Analyse modern medical measurement devices.

CO5. Understand the properties of bio assist devices.

Suggested Learning Resources:

Text Books:

1. Graham M. Brooker, "Introduction to Bio-Mechatronics", Sci Tech Publishing, 2012.

Reference Books

1.Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "Bio-Medical Instrumentation and Measurements", II edition, Pearson Education, 2009.

2. Raymond Tong Kaiyu. "Bio-mechatronics in Medicine and Healthcare" Pan Stanford Publishing, CRC Press, 2011

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Seminar, Mini projects, Group discussion

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

INTRODUCTION TO UNMANNED AERIAL VEHICLE (UAV)			
Course Code:	18EC755	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the basic aviation history and UAV systems
2. Acquire the knowledge of basic aerodynamics, performance, stability and control.
3. Understand the mission and control of UAVs.
4. Understand the launch and recovery of UAVs.

Module-1	**07 hrs**
Introduction: Aviation History and Overview of UAV systems. Classes and Missions of UAVs: Examples of UAV systems-very small, small, Medium and Large UAVs, Classes of UAV systems. Missions of UAV systems. **Text 1**	
Teaching Learning Method:	Chalk and Board /PPT
RBT Level:	L1, L2
Module-2	**08 hrs**
The Air Vehicle: Basic Aerodynamics: Basic Aerodynamics equations, Aircraft polar, the real wing and Airplane, Induced drag, the boundary layer, Flapping wings. Total Air-Vehicle Drag Performance: Overview, Climbing flight, Range and Endurance – for propeller driven aircraft, range- a jet-propelled aircraft, Guiding Flight. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-3	**08 hrs**
Stability and Control: Overview, Stability, longitudinal stability, lateral stability, dynamic stability, Aerodynamics control, pitch control, lateral control, Autopilots, sensor, controller, actuator, airframe control, inner and outer loops, Flight-Control Classification, Overall Modes of Operation, Sensors Supporting the Autopilot. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-4	**08 hrs**
Mission Planning and Control: Overview, Physical configuration. Air Vehicle and Payload Control: Overview, Modes of control, Piloting the Air vehicle, Controlling the Payloads. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-5	**08 hrs**
Launch and Recovery: UAV Launch Methods for Fixed-Wing Vehicles: Rail Launchers, Pneumatic Launchers, Hydraulic/Pneumatic Launchers. Recovery Systems: Conventional Landings, Vertical Net Systems, Parachute Recovery, Mid-Air Retrieval, Shipboard Recovery. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Able to understand the UAV systems.

CO2. Able to interpret the mission planning and control of UAV.

CO3. Gain the knowledge of the basic aerodynamics and performance of UAVs

CO4. Capable of analysing the stability and control required for UAV.

CO5. Able to apply the knowledge for launch and recovery of UAVs.

Suggested Learning Resources:

Text Books:

1. Paul Gerin Fahlstrom , Thomas James Gleason, "Introduction To UAV Systems", 4th Edition, Wiley Publication, 2012 John Wiley & Sons, Ltd.

Reference Books

1. Landen Rosen, "Unmanned Aerial Vehicle", Alpha Editions, 2015.

2. Valavanis**,** K., Vachtsevanos, George J., Handbook of Unmanned Aerial Vehicles, Springer, 2015.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Seminar, Mini projects, Group discussion

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

ADVANCED COMMUNICATION LAB			
Course Code:18ECL76	18ECL76	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:1:0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	12	**Total Marks:**	100
Credits:	01	**Exam Hours:**	03

Course objectives:

This course will enable students to:

1. Understand the circuit schematic and its working of ASK, FSK, PSK, DPSK and QPSK circuits.
2. Design and test of ASK, FSK, PSK, DPSK and QPSK circuits.
3. Analyzing various losses using OFC kit
4. Measurement of parameters like frequency, guide wavelength, power, VSWR and Attenuation.
5. Learn to measure directivity and gain of different antennas.
6. Demonstrate sampling theorem under different sampling conditions.

Syllabus Contents

1	ASK generation and detection using discrete components.
2	FSK generation and detection using discrete components.
3	PSK generation and detection using discrete components.
4	To prove sampling theorem, to study the effects of under sampling and oversampling.
5	DPSK generation and detection using kit.
6	QPSK generation and detection using kit
7	Establish Analog and Digital communication link using optical fiber and Measure the losses (coupling loss, bending loss, attenuation loss numerical aperture.)
8	Measurement of frequency, guide wavelength, power, VSWR and Attenuation in a microwave test bench.
9	Measurement of directivity and gain of micro strip patch antenna using printed dipole.
10	Measurement of directivity and gain of Yagi antenna (printed) using printed dipole.

Course outcomes:

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

CO1. Understand the working of ASK, FSK, PSK, DPSK and QPSK circuits.
CO2. Design ASK, FSK, PSK, DPSK and QPSK circuits.
CO3. Analyse various losses using OFC kit and parameters like frequency, guide wavelength, power, VSWR and Attenuation.
CO4. Demonstrate the sampling theorem and measurement of antenna parameters.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															

High-3, Medium-2, Low-1

VII Semester

COMPUTER COMMUNICATION NETWORKS LAB			
Course Code:18ECL76	18ECL77	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:1:0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	12	**Total Marks:**	100
Credits:	01	**Exam Hours:**	03

Course objectives:

This course will enable students to:

1. Demonstrate the simulation of few protocols of data link layer and network layer.
2. Demonstrate the network communication between source and destination.
3. Demonstrate the detection and correction of error in data communication.
4. Simulate the configuration and verification of networking devices.

	Syllabus Contents
1	Write a C program to implement Bit Stuffing and deStuffing
2	Write a C program to simulate a character stuffing and destuffing for a given message.
3	Write a C program to compute a polynomial checksum for a given binary data frame
4	Write a C program to simulate a shortest path Algorithm.
5	Using TCP/IP Sockets, write a client-server program to make client to communicate with Server using socket programming techniques in python.
	Part B
6	**SERIAL COMMUNICATION USING** (i) RS232 (ii) MODEM COMMUNICATION (iii) FIBER OPTIC COMMUNICATION
7	**Configuring and Verifying LAYER 2 Switches:** Establish a communication between the HOSTS by connecting the Network Devices as given below, configure them and verify the same. Configuration includes HOSTNAME, BANNER, PASSWORD (CONSOLE, TELNET and ENABLE),MANAGEMENT IPand DEFAULT GATEWAY.
8	**Configuring and Verifying VLAN:**Establish a communication between the hosts by connecting the network Devices as given below, configure them and verify the same. Configuration includes Switch port configuration and encapsulation methods.
9	**Configuring and Verifying IP Routing:**Establish a communication between the hosts by connecting the network Devices as given below, configure them and verify the same. Configuration includes: 1. Static Routing 2. Dynamic Routing (RIP/OSPF/EIGRP)
10	**Configuring DHCP Server on a Router:** Configure DHCP server on a router to assign IP address dynamically to the hosts and verify the same **a. For One Broadcast Domain**

	b. For Many Broadcast Domain
12	**PART-C [Simulation Case-Study]** Dr. AIT is granted a block of addresses starting from **192.168.100.0/24**. The Dr. AIT College committee decided to distribute these blocks of addresses to **THREE** Departments with each department receiving just **FOUR** Addresses. **1. Design the sub blocks and give the slash notation to each sub block.**
13	**2. Simulate the above case using Cisco-packet Tracer.** Note: while simulating Consider the following Constraints: a. Establish a communication within the Departments. b. Only HOD's of each Department can communicate (Single user from each Department) with each other.

Course outcomes:

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

CO1 conduct an experiment to simulate various protocols of data link and network layer.

CO2. Configure and verify VLAN and switches.

CO3.write the program to verify the detection and correction of error.

CO4.Demonstrate the data communication between two systems using the communication kit.

Co5. write the program to transfer file and establish connection between two devices.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO2		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO3		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO4		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO5		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**

High-3, Medium-2, Low-1

VII Semester

MAJOR PROJECT PHASE-1			
Course Code:	18ECP78	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	26	**Total Marks:**	100
Credits:	02	**Exam Hours:**	03

Course objectives: The student will be able to learn,

1. How to originate, develop, and analyse ideas and information, as well as how to link knowledge from other fields together, in order to apply these abilities to the project's job.
2. How to effectively connect with others and to convey ideas to a specific audience both orally and in writing.
3. How to work as a team to accomplish a common goal to develop collaboration abilities.
4. To evaluate what they've learned and take the appropriate action to improve it.

Major Project Guidelines:

The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester. The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the 1st week after the commencement of 8th semester.

Formation of Groups:

Students are free to choose their project partners from within the programme or any other programme. The project work is to be carried out by a team of two to four students. Each student in the team must contribute towards the successful completion of the project.

The project may be carried out In-house / Industry / R & D Institution.

Selection of Project Topic:

The topics of the project work must be in the field of respective program. The projects as far as possible should have societal relevance with focus on sustainability.

Course outcomes:

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

CO1. Apply their knowledge of science, math, and engineering to the challenges in the relevant engineering domains.

CO2 Create, develop, and showcase novel or multidisciplinary modules.

CO3. Use contemporary engineering tools, software, and equipment to solve problems and continue learning throughout their life to stay with technological advancements.

CO4. Utilize their knowledge of professional ethics and obligations to work effectively as an individual or as a leader in varied teams.

Assessment Details (both CIE and SEE):

CIE Assessment:

The following are the weightings given for the various stages of the project.

1. Identification of Problem and Introduction 20%
2. Literature Survey and Identifying Research Gap 20%
3. Methodology, H/W & S/W Specifications 20%
4. Design requirements and Specifications 20%
5. Presentation and Viva voce 20%

SEE Assessment:

The following are the weightages given during Viva Examination.

1. Written presentation of synopsis 10%
2. Presentation/Demonstration of the project 30%
3. Methodology and Experimental Results & Discussion 30%
4. Report 10%
5. Viva Voce 20%

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1		2				2	1	
CO2	3		3	3	3	1	1		2	2			1	1	
CO3	3	2		1	3							1	1	1	
CO4								3	3	2			1	1	

High-3, Medium-2, Low-1

VIII Semester

MAJOR PROJECT PHASE-2			
Course Code:	18ECP81	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:3:0	**SEE Marks:**	50
Total Hours of Pedagogy:		**Total Marks:**	100
Credits:	10	**Exam Hours:**	03

Course objectives: The student will be able to learn,

1. How to originate, develop, and analyse ideas and information, as well as how to link knowledge from other fields together, in order to apply these abilities to the project's job.
2. How to effectively connect with others and to convey ideas to a specific audience both orally and in writing.
3. How to work as a team to accomplish a common goal to develop collaboration abilities.
4. To evaluate what they've learned and take the appropriate action to improve it.

Major Project Guidelines:

The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester. The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the 1st week after the commencement of 8th semester.

Formation of Groups:

Students are free to choose their project partners from within the programme or any other programme. The project work is to be carried out by a team of two to four students. Each student in the team must contribute towards the successful completion of the project.

The project may be carried out In-house / Industry / R & D Institution.

Selection of Project Topic:

The topics of the project work must be in the field of respective program. The projects as far as possible should have societal relevance with focus on sustainability.

Course outcomes:

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

CO1. Apply their knowledge of science, math, and engineering to the challenges in the relevant engineering domains.

CO2 Create, develop, and showcase novel or multidisciplinary modules.

CO3. Use contemporary engineering tools, software, and equipment to solve problems and continue learning throughout their life to stay with technological advancements.

CO4. Utilize their knowledge of professional ethics and obligations to work effectively as an individual or as a leader in varied teams.

Assessment Details (both CIE and SEE):

CIE Assessment:

The following are the weightings given for the various stages of the project.

1. Identification of Problem and Introduction 20%
2. Literature Survey and Identifying Research Gap 20%
3. Methodology, H/W & S/W Specifications 20%
4. Design requirements and Specifications 20%
5. Presentation and Viva voce 20%

SEE Assessment:

The following are the weightages given during Viva Examination.

1. Written presentation of synopsis 10%
2. Presentation/Demonstration of the project 30%
3. Methodology and Experimental Results & Discussion 30%
4. Report 10%
5. Viva Voce 20%

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1		2				2	1	
CO2	3		3	3	3	1	1		2	2			1	1	
CO3	3	2		1	3							1	1	1	
CO4								3	3	2			1	1	

High-3, Medium-2, Low-1

VIII Semester

Course Name: Technical Seminar			
Course Code:	18ECS82	**SEE Marks:**	50
Credits:	01		

Course objectives:

1. Identify and compare technical and practical issues related to the area of course specialization.
2. Outline annotated bibliography of research demonstrating scholarly skills.
3. Prepare a well-organized report employing elements of technical writing and critical thinking.
4. Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

Course outcomes:

CO1. Identify recent technical topics from interested domains related to the program.

CO2. Organize a detailed literature survey and build a document with respect to technical publications.

CO3. Analysis and comprehension of proof-of-concept and related data.

CO4. Develop **e**ffective presentation and improve communication skills.

CO5. Make use of new and recent technology for creating technical reports.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	2	-	1	-	2	1	-	
CO2	1	2	-	-	-	-	-		-	-	-	2	-	-	
CO3	1	-	-	1	-	-	-	-	-	-	-	2	-	-	2
CO4	1	-	-		-	-	-	-	-	3	-	2	-	-	2
CO5	1	-	-	-	-	-	-	-	-	-	-	2	-	-	2

High-3, Medium-2, Low-1

Semester VIII

INDUSTRY INTERNSHIP			
Course Code:	**18ECI83**	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):		**SEE Marks:**	50
Total Hours of Pedagogy:		**Total Marks:**	100
Credits:	2	**Exam Hours:**	3

Course objectives:

1. Understand the process of applying engineering knowledge to industrial products & processes
2. Explain the importance of skilling, training and resource management.
3. Comprehend the importance of team work, communication and sustainable solutions.
4. Imbibe values, professional ethics for lifelong learning.

Guidelines

Research/Industrial Internship - At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University) Research/Industrial Internship shall be carried out – Based on industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of 24 weeks during the vacation of VI/VII semesters. A University Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. Research internship Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavour of current research going on on a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: This is an extended period of work experience undertaken by university/Institute students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with "unexpected contingencies" helps students recognize, appreciate, and adapt to organization realities by tempering knowledge with practical constraints.

Those, who have not pursued /completed the internship will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

Course outcomes:

At the end of the industrial training the student will be able to:

CO1. Understand the process of applying engineering knowledge to solve industrial problems

CO2. Develop skills through training relevant to industrial requirement

CO3. Communicate effectively and work in teams

CO4. Imbibe the practice of professional ethics and need for lifelong learning.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	3	2		2				1			3		2
CO2				3	2	2		1					1	1	2
CO3					1		2	3	3					2	2
CO4					1		3			2	3		2	3	2
CO5															

High-3,Medium-2, Low-1

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

Ref. No: AIT /EC /BOS / 467 /2023-24 **Date:** 12-08-2023
3

To
Dean (Academic)
Dr Ambedkar Institute of Technology
Bengaluru-56

Sir,

Sub: Regarding the details of the BOS meeting held on 12-08-2023

The External BOS 2023-24 meeting was held in blended mode in the department of the Electronics and communication Engineering and through Google meet link: https://meet.google.com/iun-vhbc-tfs on Saturday, 12-08-2023 10:30 am.

The BOS committee has approved the following:

1. NEP based Scheme and I & II semester syllabus of UG Courses of the 2023 Batch Students.
2. NEP based Scheme and III & IV semester syllabus of UG Courses of the 2022 Batch Students.
3. NEP Based Scheme and V & VI semester Syllabus of UG Courses of the 2021 Batch Students.
4. VII & VIII semester Syllabus of UG Courses of the 2020 Batch Students.
5. Skill Lab for 2023 batch students.
6. Scheme and Syllabus of I and II-year PG course.
7. The List of BOE members.
8. The list of Valuers / Examiners.

Thanking you

Tarulipa V Nandy
CHAIRMAN BOS
Dept. of ECE

HOD
Dept. of Electronics and Communication Engg.
Dr. Ambedkar Institute of Technology
Bengaluru - 560056

Enclosures:

1. List of Members of BOS.
2. Curriculum Design –UG
3. Minutes of the BOS Meeting.
4. Scheme & Syllabus of I/II Semester Basic Electronics and Communication Engineering for the academic year 2023-24.
5. Scheme & Syllabus of 3rd and 4th Semesters for the academic year 2023-24.
6. Scheme & Syllabus of 5th and 6th Semesters for the academic year 2023-24.
7. Scheme & Syllabus of 7th and 8th Semesters for the academic year 2023-24.
8. List of BOE Members.
9. List of valuers / Examiners.

Members of BOS:

Sl No.	*CATEGORY*	*Nomination of the Committee*	*Name of the Person with Designation*
1	Head of the Department	**Chairperson**	Dr. Mahalinga V Mandi, Dean (P&D), Professor & Head, Department of ECE, Dr. AIT, Bengaluru-56
2	Faculty Members at Different Levels Bearing Different Specializations	**Member 1.**	Dr. Umadevi H. Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 2.	Dr. Ramesh S, Dean (Exam), Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 3.	Smt. Sudha B S. Associate Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 4.	Dr. Shivaputra Assistant Professor Department of ECE, Dr. AIT, Bengaluru-56
		Member 5.	Dr. Meenakshi.L.R. Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 6.	Mr. Mohan Kumar V Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 7.	Dr. Jambunath S Baligar Associate Professor Department of ECE, Dr. AIT, Bengaluru-56
		Member 8.	Dr. Chetan. S Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
3	Subject Experts from outside the College Nominated by Academic Council	**Member 1.**	Dr. Devendra Jalihal Professor, EEE department IIT Madras, Chennai-600 036

		Member 2.	Prof. Santanu Mahapatra Professor, Department of Electronic Systems Engineering, Indian Institute of Science Bangalore, Bengaluru- 560012
		Member 3.	Dr. Mandeep Singh Professor, Department of ECE, NITK, Surathkal
		Member 4.	Prof. P.Nagaraju Associate Professor, Dept. of TCE, RVCE, Bengaluru-560 059
4	Expert from outside College, Nominated by Vice Chancellor (VTU)	**VTU Nominee**	Dr. Manajanaik N Professor, Department of ECE, UBDT, Davangere, Karnataka
5	Representative from Industry /Corporate Sector/Allied area related to Placement Nominated by Academic council	**Member 1.**	Mr. Kubendra.K Senior Design Engineer VLSI Group, Samsung India,Outer ring Road, Near Marathahalli, Bengaluru
		Member 2.	Mr. Somshekar H Mobileum India Pvt ltd., Director of Engineering.
		Member 3.	Mr. Sampath Kumar Srinivas Mitel, Senior Staff Software Engineer Manyata Tech Park, Bangalore
6	Post Graduate Meritorious alumnus nominated by Principal	**Member**	Mr. Premkumar M N Senior Manager, Intel, India Bengaluru

Tarakeshwar V. Nandi

CHAIRMAN

BOS Dept. of ECE

HOD

Dept. of Electronics and Communication Engg.,
Dr. Ambedkar Institute of Technology
Bengaluru - 560056

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

MINUTES OF THE MEETING OF THE BOARD OF STUDIES 2023-24

DATED: Saturday, 12th August 2023

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

BOS Meeting Notice

Sub: Board of Studies Meeting is convened on 12-08-2023

With reference to the above subject, External Board of Studies Meeting of the department is convened on Saturday, the 12th August 2023 at 10:30 a.m. in Department of ECE for finalizing the scheme and syllabus of UG in B.E. (E & C) and PG, M.Tech in VLSI Design and Embedded Systems for the academic year 2023-24 with the following agenda.

Agenda:

1. Approval of the NEP Scheme and Syllabus of 1st to 8th Semesters B.E (E &C) for the Batch-2023
2. Approval of the NEP Scheme and Syllabus of 3rd to 8th Semester B.E(E & C) for the Batch -2022
3. Approval of the NEP Scheme and Syllabus of 5th to 8th Semester B.E(E & C) for the Batch-2021
4. Approval of the Scheme and Syllabus of 7th to 8th Semester B.E(E & C) for the Batch-2020
5. Approval of Basic IoT Skill Lab for the Batch-2023 students.
6. Approval of the Scheme and Syllabus for the 1st and 2nd Semester PG for the Batch-2023
7. Approval of the Scheme and Syllabus for the 3rd and 4th Semester PG for the Batch-2022.
8. Approval of the courses for the Major, Minor Degree
9. Approval of List of Examiners

Minutes of Board of Studies (BOS) Meeting:

The Meeting of Board of Studies (BOS) for Department of Electronics and Communication Engineering was held on 12-08-2023 at 10:30 a.m. under the Chairmanship of the Dr. Mahalinga V. Mandi, Dean (P&D), Professor and Head, Department of Electronics and Communication Engineering in the department of Electronics and Communication engineering and through Google meet link: https://meet.google.com/iun-vhbc-tfs.

At the very outset, the Chairman welcomed all the Internal and External members of BOS to the meeting and gave a preliminary presentation on the agenda items with reference to the scheme and syllabus of UG and PG for the academic year 2023-24

The chairman along with BOS coordinators gave a detailed presentation of the courses to be offered to the students in both Core and Elective subjects in semester wise at the Under Graduate level and Post Graduate level, also briefed the members about the Curriculum Design of the Department for the UG and PG Courses.

PROCEEDINGS/RESOLUTIONS:

The following are the Suggestions of the members of BOS with reference to the presentations:

I and II semester for 2023 batch:

- Subject Expert Devendra Jalihal Suggested to reduce the syllabus for "Basic electronics" (Module 1) for ECE
  Sol. Internal BOS members clarified that most of the topics will be dealt up to Remembering & Understand level (L1, L2)

- Subject Expert Mandeep Singh suggested to include recent edition text books for the course Introduction to Electronics Engineering (22EST104C/204C).
  Sol. Recent edition text books prescribed for subject Introduction to Electronics Engineering (22EST104C/204C).

III and IV Semesters for 2022 batch:

- Subject Expert Devendra Jalihal suggested to rearrange the contents of the topic Fourier Transforms in the subject "Signals and Systems".
  Sol. Topic Fourier Transforms in the subject "Signals and Systems" is rearranged as per the suggestions.

- Subject Expert Dr. Nagaraju P remarked regarding the IPCC subject Analog Electronic Circuits (21ECT303) that JFET experiment was added in practical component while only concepts of MOSFET were dealt in theory.
  Sol. JFET experiments in practical component is replaced by MOSFET experiments.

- Subject Expert Dr. Nagaraju P suggested to reduce the contents of 7th and 8th experiments in Analog and Digital Electronics Lab (22ECL305).
  Sol. Redundant experiments are removed as per suggestions.

- Subject Expert Dr. Nagaraju P suggested to include Proportional controller concept in module 3 in the IPCC subject Modern Control Systems as these concepts were included in practical component.
  Sol. Proportional Controller Concepts included in module 3.

V and VI Semesters for 2021 batch:

- Industry Expert Sampath Kumar Srinivas seek clarification regarding the duration for mini project.
- Industry Expert Sampath Kumar Srinivas suggested to include IPV6 concept in **Computer Communication Networks (21ECT503).**
  Sol. IPV6 concept included as per suggestion.

- Subject Expert Dr. Nagaraju P suggested to include recent edition books for the subject Microwave and Antenna.
  Sol. Prescribed Textbooks updated to recent editions.

- Industry Expert Kubendra suggested to include RISC V concepts in Microprocessor and Microcontroller subject.
  Sol. RISCV concepts included as Module 4 and Module 5 in Microprocessor and Microcontroller subject.

- Subject Expert Dr. Nagaraju P suggested to include Embedded C experiments instead of Assembly Programs in the subject CO & ARM Processor.
  Sol. Assembly Programs replaced with embedded C programs.

- Subject Expert Dr. Nagaraju P suggested to update prescribed text books for the subject ANN
  Sol. Prescribed text books updated to recent editions.

- Discussed about the Scheme and syllabus of 7th and 8th semester for 2020 batch
- No comments on final year subjects, so retained same syllabus.
- Discussed about the Scheme and syllabus of 1st and 2nd year PG program.
- Subject Expert Devendra Jalihal remarked that the number of electives are more.
  Sol. PG coordinator clarified that scheme and syllabus is framed as per VTU guidelines.
- Subject Expert Dr. Nagaraju P suggested to include recent edition text books.
  Sol. Recent edition text books are prescribed.

- The meeting was ended with vote of thanks by Dr. Mahalinga V. Mandi, Dean (P&D), Professor and Head, Department of ECE.

Finally, the BOS members approved the following after incorporating the suggested modifications

- Approved the Curriculum Design for the semesters I to VIII of UG Course for the students of the Batch 2023
- Approved the NEP Based Syllabus of Basic Electronics and Communication Engineering for the semesters I/II of UG Course for the academic year 2023-24.
- Approved the NEP Based Scheme and syllabus for semesters III and IV of UG Course for the academic year 2023-24.
- Approved the NEP Based Scheme and syllabus for semesters V and VI of UG Course for the academic year 2023-24.
- Approved the Scheme and syllabus for semesters VII and VIII of UG Course for the academic year 2023-24.
- Approved Basic IoT Skill Lab for 2023 batch students.
- Approved I and II-year scheme and syllabus of PG Course for academic year 2023-24.
- Approved the courses for the Major, Minor Degree
- Approved the List of BOE members.
- Approved the list of Valuers / Examiners.

Mahalinga V. Mandi

CHAIRMAN

BOS Dept. of ECE

BOS Coordinators	**Signatures**
1. **Prof. B. S. Sudha**	Sudha B S 1/12/2023
2. **Mr. Anand H D**	

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

List of BOE Members:

SL. NO.	NAME AND ADDRESS
1.	Dr. Mahalinga V. Mandi, Dean (P & D), Professor and Head, Department of ECE
External BOE members:	
1.	Dr. Dinesh P., Professor and Dean, Department of ECE, DSCE, Bengaluru
2.	Prof. Nagraju P, Associate Professor, Department of TCE, RVCE, Bengaluru
3.	Dr. Rajeshwari Hegade, Professor and Head, Department of TCE, BMSCE, Bengaluru-19
4.	Dr. Revanna, Associate Professor, Department of ECE, Govt. Engineering College, Ramanagara
Internal BOE Members:	
1.	Dr. Umadevi H., Professor
2.	Smt. Sudha B. S., Associate Professor
3.	Dr. Shivaputra, Assistant Professor
4.	Smt. Meenakshi L. Rathod, Assistant Professor
5.	Mr. Mohankumar V., Assistant Professor
6.	Smt. Girija S., Assistant Professor

Mahalinga V. Mandi

CHAIRMAN

BOS, Dept. of ECE

HOD

Dept. of Electronics and Communication Engg.
Dr. Ambedkar Institute of Technology
Bengaluru - 560056

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

12-08-2023

Attendance list:

Sl. No	Position	Name		Signature with date
1.	Chairman	**Dr. Mahalinga V. Mandi** Professor and Head Department of ECE, Dr. AIT, Bengaluru-56		Mahalinga V. Mandi 12/8/23
2.	VTU Nominee	**Dr. Manajanaik N** Professor, Department of ECE, UBDT, Davangere, Karnataka		ABSENT
3.	External Subject Experts	1.	**Dr. Devendra Jalihal** Professor, EEE department IIT Madras, Chennai-600 036	Present Online.
		2.	**Dr. Santanu Mahapatra** Professor, Department of Electronic Systems Engineering, Indian Institute of Science Bangalore,560012	ABSENT
		3.	**Dr. Mandeep Singh** Professor, Department of ECE, NITK, Surathkal	Present Online.
		4.	**Dr. P. Nagaraju** Associate Professor, Dept. of TCE, RVCE, Bengaluru-560 059	P. Nagaraju 12/08/2023
4.	Industry Expert	1.	**Mr. Kubendra K** Senior Design Engineer VLSI Group, Samsung India, Outer ring Road, Near Marathahalli, Bengaluru	Present Online.
		2.	**Mr. Somshekar H** Mobileum India Pvt ltd., Director of Engineering.	ABSENT
		3.	**Mr. Sampath Kumar Srinivas** Mitel, Senior Staff Software Engineer Manyata Tech Park, Bangalore	S. Sampath Kumar 12/8/2023

5.	**Alumni with PG Degree**	**Mr. Premkumar M N** Senior Manager, Intel, India Bengaluru		ABSENT.
6.	**Internal Members**	1.	**Dr. Umadevi H.** Professor, Department of ECE, Dr.AIT, Bengaluru-56	H Umadevi 12/8/2023
		2.	**Dr. Ramesh S.** Professor, Dean (E) Department of ECE, Dr. AIT, Bengaluru-56	12-8-23
		3.	**Smt. Sudha B. S.** Associate Professor, Department of ECE, Dr. AIT, Bengaluru-56	Sudha B.S 12/8/2023.
		4.	**Dr. Shivaputra** Assistant Professor Department of ECE, Dr. AIT, Bengaluru-56	on Leave
		5.	**Dr. Meenakshi L. R.** Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56	12/08/2023.
		6.	**Mr. Mohan Kumar V.** Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56	12/08/2023
		7.	**Dr. Jambunath S. Baligar** Associate Professor Department of ECE, Dr. AIT, Bengaluru-56	12/8/23
		8.	**Dr. Chetan S.** Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56	12/8/23
7.	**Student Representatives:**	1.	Yogesh.N.V 1DA21EC170	Yogeshv
		2.	Yalawathi.V 1DA21EC168	Yalawathi N
		3.	Shulini RR 1DA22EC426	Shulini RR
		4.	LIKHITHA.B 1DA20EC066	Likhitha
		5.	Divyashree.K 1DA20EC041	Diya

		6.	Jagruthi.S 1DA20EC053	Jagruthi
		7.	Spndhu.Hosamani 1DA22LVS03	
		8.	Rashmi.R 1DA22LVS02	Rashmi

Dayalipa V. Nandi 12/8/23

Signature

HOD, Dept. of ECE

BOS Chairman

HOD

Dept. of Electronics and Communication Engg.

Dr. Ambedkar Institute of Technology

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