Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140711/ 200711	DC	Satellite & Radar Communication	50	10	20	20	-	-	-	100	3	-	_	3

Satellite & Radar Communication (140711/200711)

Course objective: The main objective of the course is to provide a comprehensive and state of the art knowledge in the area of satellite communication and radar Systems.

Unit I Introduction: Introduction to Satellite Communication, Origin and History of Satellite Communication, Current State of Satellite Communication, Orbital Aspect of Satellite Communication , Orbital Mechanism, Equation of Orbit, Locating Satellite in Orbit , Orbital Elements ,Orbital Perturbation , Frequency Allocations and Applications.

Unit II Space Craft Sub System and Earth Station: Altitude and Orbit Control System , Telemetry Tracking and Commend Power System, Communication Sub System, Earth Station Design , Antenna Tracking, LNA, HPA,RF, Multiplexing Factor Affecting Orbit Utilization, Tracking, Equipment for Earth Station.

Unit III Satellite Link Design: Satellite Link Design, System Noise Temperature and G/T Ratio, Downlink Design, Domestic Satellite System, Uplink Design, Earth Path Propagation Effect, Losses in Link Design.

Unit IV Introduction to RADAR: Principles of RADAR, Radar Frequencies, Pulse RADAR, RADAR Range Equation, RADAR Application, RADAR Cross Section of Targets RADAR Indicator, Noise Figure of Receiver, Mixer Duplexer, Line Pulsar.

Unit V Operational RADAR: MTI RADAR, Delay Line Canceller, Digital Signal Processing, Limitation of MTI RADAR, CW RADAR, FM CW RADAR.

Text Book:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. RADAR System –Skolnik, 4th Edition, Tata McGraw-Hill, 2006.

References Books:

1. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.
2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed, 2007.
3. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.

Course Outcomes

After the completion of this course students will be able to:

- **CO1.** **Explain** Basic Concepts and Terminologies of Satellite Communication
- **CO2.** **Design** the Earth Station and Space Craft System
- **CO3.** **Calculate** the Link Power Budget Including Propagation Effects in Satellite.
- **CO4.** **Evaluate** the Various Performance Factors Related to the RADAR
- **CO5.** **Explain** target Detection and Tracking using Radar Systems.

B.Tech. VII Semester (Electronics Engineering/Electronics and Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140714/ 200714	DC	Antenna & Wave Propagation	50	10	20	20	-	-	-	100	3	-	-	3

ANTENNA & WAVE PROPAGATION (140714/200714)

Course objectives: To develop the students' basic understanding of antenna operation and develop the students' ability to calculate and interpret basic antenna performance parameters.

Unit I Introduction to antenna: Definition of antenna parameters – Radiation Density, Radiation Intensity, Gain, Directivity, Radiation Resistance, Band width, Beam width, Input Impedance, Effective Height, Effective aperture, Network theorems applied to antenna, Self and mutual impedance of antenna.

Unit II Radiation Fields of Wire Antennas: Radiation from current element, Short dipole, Quarter wave Monopole and Half wave Dipole, Loop antenna, helical antenna.

Unit III Antenna Arrays: Antenna arrays of point sources, two element array, End fire and Broad side arrays, Principle of Pattern multiplication, Uniform linear arrays of N-elements, Linear arrays with non-uniform amplitude distribution (Binomial distribution and Chebyshev optimum distribution). Arrays of two-driven half wave length elements (Broad side and end fire case).

Unit IV Aperture and special Antennas: Radiation from rectangular apertures, Horn antenna, Reflector antenna, Babinet's principles and complimentary antennas, Slot antennas, Log periodic antenna, Yagiuda antenna, Travelling wave antenna, Image antenna.

Unit V Propagation of radio wave: Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Flat earth and Curved earth concept, Sky wave propagation – Virtual height, Critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation.

Text Books:

1. Antenna theory- J.D. Kraus, 4th edition, Tata Mc-Graw Hill
2. Electromagnetic Fields & Radiating System - Jordan &Balmain, 2nd edition, PHI

Reference Books:

1. Antennas(for all applications)-Kraus, Marshfka, khan, Tata Mc-Graw Hill
2. Antenna Wave Propagation-K D Prasad, New Delhi : Satya Prakashan

Course Outcome:

After the completion of this course students will be able to:

CO1. **Evaluate** various parameters of the antenna.
CO2. **Analyze** the design parameters and radiation mechanism of wire antennas.
CO3. **Design** antenna array for the given radiation characteristics.
CO4. **Analyze** the design parameters and radiation characteristics of Aperture and special antennas.
CO5. **Describe** effects of earth and its atmosphere on radio wave propagation.

B.Tech. VII Semester (Electronics Engineering/Electronics and Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140715/ 200715	DC	Embedded Systems Design	50	10	20	20	-	-	-	100	3	-	-	3

Embedded Systems Design (140715/200715)

Course Objectives: To introduce the basic concepts of microcontroller and to develop assembly language programming skills along with the introduction of microcontroller applications.

UNIT-I: Introduction: Embedded system architecture, classification, challenges and design issues, fundamentals of embedded processor and microcontrollers, Von Neumann/Harvard architectures, CISC vs. RISC, microcontrollers types and their selection, Overview of the 8051 family, architecture, pin description, Flags, Register Banks, Internal Memory Organization, I/O configuration, Special Function Registers, addressing modes.

UNIT II: **Assembly programming and instruction of 8051:** An Overview of 8051 instruction set, Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.

UNIT III: Introduction to ARM Microcontroller: Introduction to pipelining based processors, applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, and stack operation.

UNIT IV: Interfacing real world devices with 8051 microcontroller: Memory address decoding, 8051 interfacing with memory, 8051 interface with 8255 PPI and various interfacings like: LCD and Matrix Keyboard interfacing with 8051 microcontroller, ADC, DAC and Temperature Sensor interfacing with 8051 microcontroller, Stepper motor interfacing.

Unit V: Embedded System Design with Arduino Board: Overview of Arduino, Configuration, Interfacing, Board layout, Atmega328 specifications, Interfacing of Arduino with LED, Switches, Light dependent resistor (LDR), PWM, 16*2 LCD, Serial, L293D for motor interfacing, ADC.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C" Pearson Education India, 2nd Edition.
2. Shibu K V," Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited.

Reference Books:

1. Kenneth Ayal, "The 8051 Microcontroller", Architecture, Programming and Applications.
2. Subrata Ghoshal, "Embedded Systems and Robots, Projects using the 8051 Microcontroller".
3. David A Patterson and John L. Hennessy, "Computer Organization and Design ARM edition".

Course Outcomes:

After successful completion of the course, students will be able to:

CO1. **Explain** the architecture of embedded system and 8051 microcontroller.
CO2. **Develop** programming skill for 8051 microcontroller.
CO3. **Understand** the 32-bit pipelined architecture of ARM microcontroller.
CO4. **Design** Interfacing circuitry for memory and I/O devices using different interfacing with 8051.
CO5. **Develop** skill in programming for Arduino with different peripherals.

Annexure III

Item 4

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in ***online mode under*** **Departmental Elective (DE)** Courses, with credit transfer in the B.Tech. ***VII Semester under*** the flexible curriculum (*Batch admitted in 2020-21)*

S.No	Category Code	Course Code	Name of The course	Duration of the Course in weeks	Course Registration		Name of the Mentor Faculty
					Start Date	End Date	
Electronics/Electronics & Telecommunication Engineering							
1	DE-3	**140751**	Digital Image Processing	12	24-07-2023	13-10-2022	Prof. Pooja Sahoo
2		**140754/200754**	Microwave Engineering	12	24-07-2023	13-10-2022	Prof. D. K. Parsediya
3		**200755**	An Introduction to Coding Theory	12	24-07-2023	13-10-2022	Dr. Karuna Markam
4	DE-4	**140761**	Introduction to Wireless and Cellular Communication	12	24-07-2023	13-10-2022	Prof. Madhav Singh
5		**140762/200762**	Fiber Optic Communication Technology	12	24-07-2023	13-10-2022	Dr. R. P. Narwaria
6		**200763**	Pattern Recognition and Applications	12	24-07-2023	13-10-2022	Dr. Hemant Choubey

Annexure IV

Item 5

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2020-21)*** under the ***Open Category (OC) Courses*** (in traditional mode) for B. Tech. ***VII semester*** students of other departments along with their COs

S.No	Category	Subject Code	Subject Name
1.	OC-2	900216	Satellite Systems
2.	OC-2	900217	Consumer Electronics

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
910216	OC	Satellite systems	50	10	20	20	-	-	-	100	3	-	_	3

Satellite Systems (910216)

Course objective: The main objective of the course is to provide a comprehensive knowledge in the area of satellite system. The course emphasis is on the study of orbital mechanics, launching techniques, working of Indian Regional Navigation Satellite System.

Unit I Introduction: Introduction of Satellite Communication, Origin and History of Satellite Communication, Current State of Satellite Communication, Orbital Aspect of Satellite Communication , Orbital Mechanism , Equation of Orbit, Locating Satellite in Orbit , Orbital Elements , Orbital Perturbation.

Unit II Space Craft Sub System and Earth Station: , Altitude and Orbit Control System, Telemetry Tracking and Commend Power System, Communication Sub System, Earth Station Design, Antenna Tracking, LNA, HPA,RF, Multiplexing Factor Affecting Orbit Utilization, Tracking, Equipment for Earth Station, Frequency Allocation in Satellite Communication.

Unit III Indian Satellite Launch Vehicle: SLV (Satellite Launch Vehicle), ASLV (Augmented Satellite Launch Vehicle), PSLV (Polar Satellite Launch Vehicle), GSLV (Geosynchronous Satellite Launch Vehicle), GSLV Mk III, Sounding Rockets.

Unit IV Satellite Link Design: Satellite Link Design, System Noise Temperature and G/T Ratio, Downlink Design, Domestic Satellite System, Uplink Design

Unit V Indian Regional Navigation Satellite System: IRNSS System Overview, IRNSS Signal Characteristics, IRNSS Data Structure, Sub Frame Structure.

TEXT BOOK:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. https://www.isro.gov.in/update/06-nov-2015/book-indian-space-programme-released-second-anniversary-of-mars-orbiter

REFERENCES BOOKS:

3. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.
4. IRNSS SIS ICD for standard positioning service, version 1.1, August 2017, ISRO Satellite Centre Indian Space Research Organization Bangalore

Course Outcomes

After the completion of this course students will be able to:

- **CO1.** **Explain** basic concepts and terminologies of Satellite Communication.
- **CO2.** **Design** the Earth station and Space Craft System.
- **CO3.** **Explain** the Indian Satellite Launchers.
- **CO4.** **Calculate** the Link power budget including Propagation effects in Satellite.
- **CO5.** **Examine** the Indian Regional Navigation Satellite System.

B.Tech. VII Semester (Electronics Engineering/Electronics and Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
910217	OC	Consumer Electronics	50	10	20	20	-	-	-	100	3	-	-	3

Consumer Electronics (910217)

Course objectives: Objective of this course is to make the students understand the technology behind consumer electronics appliances. The units in the course are designed to impart the concepts of Audio Video systems, Television and other domestic appliances like Microwave ovens and air-conditioning system.

Unit I Introduction to Audio Systems: Microphone, Carbon, Crystal and Moving Coil Microphone. Loudspeakers: Permanent Magnet Loudspeaker and its Construction, Introduction to Woofers and it's Operation, Audio System, Anatomy of Hi-Fi System.

Unit II Television System: Elements of Television System, Scanning Process, Persistence of Vision and Flicker, Vertical and Horizontal Resolution. Introduction to LCD and Plasma Display. Introduction to LED TV Technology.

Unit III Landline and Mobile Telephony: Telecommunication Systems, Modulation Techniques: Analog and Digital Methods, Radio System Characteristics, Telephone Receiver and Handset.

Unit IV Cellular and Mobile Communication: Cellular Communications, Transmitting Receiving Antenna, Digital Cellular Phone Block Diagram, Types of Mobile Phones, Cellular Systems.

Unit V Domestic Appliances: Microwave Oven: Microwaves, Transit Time, Magnetrons, Wave Guides, Microwave Oven Block Diagram. Air Conditioning System: Components of Air Conditioning System, All-Water Air Conditioning System, All-Air Air Conditioning System.

Text Book:

1. S. P. Bali, "Consumer Electronics" Pearson Education India, 2nd Edition.

Reference Books:

1. Electronic communication systems by Roy Blake, Thomson Delmar, Cengage Learning, inc; 2nd edition, 2011
2. Color Television by R.R. Gulati, New Age international; Second edition, 2007
3. How Electronic Things Work.& What to Do When They Don't –Robert L. Goodman, TMH, 1998
4. Digital Satellite Television Handbook By Mark E. Long, Newnes; Pap/Cdr edition, 1999.

Course Outcome:

After completion of the course the students will be able to:

CO1. **Describe** various types of Audio Systems.
CO2. **State** the working principle of Television System.
CO3. **Analyze** the operation of a Landline Telephone System.
CO4. **Explain** the working of Cellular and Mobile System.
CO5. **Explain** the working of various Consumer Electronic appliances.

Annexure V

Item 6

To prepare and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester ***(for batches admitted in 2020-21)***

S. No	Category	Subject Code	Subject Name
1	DLC	140703/200703	Creative Problem Solving
2	DLC	140704/ 200704	Embedded Systems Design Lab

Subject Code	Category Code	Subject Name	Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Mark	Lab work & Sessional Marks	Skill based mini project		L	T	P	
140703/ 200703	DLC	Creative Problem Solving	25	25	-	50	-	-	6	3

Creative Problem Solving (140703/ 200703)

Lab Objective:

The lab comprises two modules each of which students need to finish passing this course. These 02 modules are named as

1. Communication Systems
2. Antenna Design

Tools Required:

Network Simulator, QualNet, CST Design Studio

List of Experiments

Communication Module:

1. Program in NS(network simulator)/QualNet to implement different topology
2. Program in NS(network simulator)/QualNet for connecting multiple routers and nodes and building a hybrid topology
3. Program in NS(network simulator)/QualNet to implement FTP using TCP bulk transfer
4. Program in NS(network simulator)/QualNet for connecting multiple routers and nodes and building a hybrid topology and then calculating network performance
5. To analyse network traces using Wireshark software.

Antenna Module

1. Study and overview of CST simulation tool.
2. Design and Simulation of Microstrip Antenna Using CST Tool.
3. Design and Simulation of Microstrip Transmission Line Using CST Tool.
4. Design and Simulation of Waveguide Using CST Tool.
5. Design and Simulation of Half Wave Dipole Antenna Using CST Tool.

Course Outcomes:

After the successful completion of this course students will be able to:

CO1. **Write** a program in Network Simulator for various topologies.

CO2. **Design** a network using NS2 or QualNet.

CO3. **Design** an antenna of given specification.

Subject Code	Category Code	Subject Name	Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140704/ 200704	DLC	Embedded Systems Design Lab	60	20	20	100	-	-	6	3

Embedded Systems Design Lab (140704/ 200704)

Course Objectives: The objective of this course is to provide students with hands-on experience in designing, implementing, and testing embedded systems using microcontrollers.

List of Experiments

1. Write an assembly language program to transfer a block of data bytes from source memory to destination memory and demonstrate on 8051 microcontroller board.
2. Write an assembly language program to perform Addition/subtraction of a given number and demonstrate on 8051 microcontroller board.
3. Write an assembly language program to demonstrate conditional bit jump, conditional byte jump, unconditional jump, call and return instructions on 8051 microcontroller board.
4. Write an assembly language program to demonstrate the basic interface between an LCD display and 4 x 4matrix key board and demonstrate on 8051 microcontroller board.
5. Write an assembly language program to implement a basic temperature sensor using an ADC output is displayed on a 2x16 LCD and demonstrate on 8051 microcontroller board.
6. Write an assembly language program to implement the basic wave form generation using DAC, output is displayed on a CRO and demonstrate on 8051 microcontroller board.
7. Write an Arduino IDE program for Blinking an LED with a delay of 2 seconds and demonstrate on 8051 microcontroller Ardunio board.
8. Write an Arduino IDE program for to demonstrate automatic traffic light control using Ardunio board. Turn ON Red LED for 4 seconds, Green LED for 5 seconds, Yellow for 2seconds.
9. Write an Arduino IDE program for Blinking an 5 LEDs with a delay of 2 seconds in a sequence.
10. Write an Arduino IDE program for connecting a servo motor to Arduino board and rotate in clockwise and anti-clockwise direction using switches.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1. **Develop** 8051 assembly language programming skills for the various arithmetic and logical operations.
CO2. **Demonstrate** interfacing of 8051 microcontroller board with various interfacing devices.
CO3. **Design** Arduino board based automated electronic systems.

Skill based mini project

1. Design and simulate Arduino based Temperature and Humidity monitoring system with DHT22 sensor on Proteus.
2. Design and simulate Arduino Password Based Door Lock System on Proteus.
3. Design and simulate Digital voltmeter using Arduino UNO Range: 0-50 volt Using SIMULINO UNO on Proteus.
4. Design and simulate Automatic Door Open System With Vistor Counter using ARDUINO UNO R3 on Proteus.
5. Design and simulate Arduino based light sensor using LDR on Proteus.