GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION (11)
AUDIO VIDEO SYSTEMS
SUBJECT CODE: 2151101
B.E. 5th SEMESTER

Type of course: Undergraduate

Prerequisite: Basic Electronics, Digital electronics

Rationale: The state of the art in Audio and Video system will enable the students to comprehend concept, working principle and its application in various types of modern electronic system. The knowledge acquired by students will help them to become familiar with designing concepts and troubleshooting of audio and video systems.

The low cost video systems, cameras have brought video revolution in the field of home entertainment, education, training, advertising and electronic newsgathering. Dramatic developments in flat panel display, reduction in the cost of image scanning system, LCD display and integrated subsystems has affected our communication capabilities and life-style in broad sense. It is taken care to include these latest developments in the present syllabus.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Characteristics of Sound: Nature of Sound, Pressure and Intensity of sound waves, Sensitivity of human ear for sound, Frequency of sound waves, Overtones and timbre, Intervals octaves and harmonics, Pitch, Resonance effect in sound systems, Helmholtz resonator, Reflection and diffraction of sound waves.	**2**	**5**
2	Audio devices and their applications: Microphones: Introduction, Characteristics of a Microphone, Requisites of a Good Microphone, Moving Coil Microphone, Ribbon Microphone, Crystal Microphone, Capacitor(or Condensor) Microphone, Electret Microphone, Carbon Microphone, Comparisons of Various Types of Microphones, Special Microphones, Precautions while Using Microphones Loudspeakers: Characteristics of Loudspeakers, Moving-Coil Cone Type Loudspeaker, Electrodynamic Loudspeaker, Horn-type or Indirect Radiating Type Loudspeaker, Comparison between Cone-type and Horn-type speakers,	**7**	**15**

	Loudspeaker column or line source speakers, Baffles and Enclosures, Multi-way Speaker System(Woofers and Tweeters), Crossover networks, Consequence of Mismatch between Amplifier Output and Loudspeaker Impedance Optical recording: Types of Optical Recording of sound, Methods of Optical Recording of Sound on Film, Reproduction of Sound from Films, Modern method of recording of sound for movie films, Compact Disc, Optical recording on Disc, Playback process, Comparison of Compact Discs and Conventional(Gramaphone) Discs. Introduction to Blue ray technology, Introduction to High Fidelity(Hi-fi) systems, Introduction to Public Address Systems(PA-Systems), Introduction to Audio Amplifiers, Introduction to Acoustic Reverberation, Introduction to AM/FM tuners, Introduction to USB Mp3 players.		
3	Digital Audio Fundamentals: Audio as Data, What is an Audio Signal, Why Binary, Why Digital, Some Digital Audio Processes Outlined, Time Compression and Expansion, Error Correction and Concealment, Channel Coding, Audio Compression, Disk-Based Recording, Rotary Head Digital Recorders, Digital Audio Broadcasting, Networks.	**2**	**5**
4	Television Fundamentals: Elements of TV communication system, Scanning, Synchronization, Aspect ratio, Pixels, Resolution, Bandwidth, Composite video signal, Modulation of video and audio signals, Monochrome and color cameras, Compatibility, Luminance and Chrominance signal, Picture tubes, Solid state picture transducers, TV broadcasting systems, Video monitors.	**6**	**15**
5	Digital video, compression techniques and standards: Digital Video, The RGB and YUV Representation of Video Signals, The Need for Compression, How compression works, Compression formats for video - MPEG-x format, H.26x format	**3**	**5**
6	Digital Television-Transmission and Reception: Digital system hardware, Signal quantizing and encoding, digital satellite television, Direct-To-Home(DTH) satellite television, Digital TV receiver, Merits of digital TV receivers, Digital Terrestrial Television(DTT), Introduction to Video on demand, Introduction to CCTV, Introduction to CATV	**4**	**10**
7.	Stereophonic sound, Flat panel TV receivers, 3-Dimensional TV, EDTV, HDTV and Digital Studio equipments: Stereo sound systems, Projection television, Flat panel display TV receivers, Three Dimensional (3-D) television, Advances in 3D TV technology, Present status of new 3D receivers, Extended Definition Television(EDTV), Digital equipment for television studios, Electronic control of studio lights, Digital audio recorders and editing, Colour receivers of new generation	**6**	**15**
8.	Liquid Crystal and Plasma Screen Televisions: LCD technology, LCD matrix types and operation, LCD screens for television, Plasma and conduction of charge, Plasma television screens, Signal processing in Plasma TV receivers, A Plasma colour receiver, LCD colour receivers, Single LCD receivers, 3-LCD colour receivers, Plasma or LCD-which is the best choice, Performance comparison of Plasma and LCD televisions, Introduction to LED TV, RGB dynamic LEDs, Edge-LEDs, Differences between LED-backlit and Backlit LCD displays, Comparison of Plasma TV and LED TV, Introduction to OLED	**6**	**20**

	TVs		
9.	Projection Display Systems and Television Home Theaters: Direct View and rear projection systems, front projection TV system, Transmittive type projection systems, Reflective projection systems, Digital Light Processing(DLP) projection system, Projection television for home theatres, Choice of projection TV system, Essential features of front projectors, Comparison and choice of rear projection receivers, Satellite Off-Air tuners and Digital Video Recorders, Surround sound stereo receiver, Top of the line Home Theatre	**5**	**5**
10.	Troubleshooting in Audio and Video Equipment: Introduction, Modern Electronic Equipment, Maintenance Policy, Maintenance Aids for Fault Diagnosis, Procedure of Servicing and Maintenance, Shielding and Grounding, Fault location, Identifying the faulty component in the Faulty stage, Some common Faults in Components, Intermittent Faults, Troubleshooting in a power supply unit, Troubleshooting in a Public Address system, Troubleshooting in Stereo Amplifier, Troubleshooting in DVD Players.	**4**	**5**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**15**	**10**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Modern Television Practice(Fourth revised edition) - R.R.Gulati , New Age International Publishers.
2. Audio and Video Systems(Second Edition) - R.G.Gupta, McGraw Hill Education Limited.
3. Television & Video Engineering(Second edition) - A.M.Dhake, McGraw Hill Education Limited.
4. Video Demystified – Keith Jack, LLH Technology Publishing.
5. Audio Engineering, Know it all series, Newnes Press
6. Essential Guide to Digital Video - John Watkinson, Snell & Wilcox Inc. Publication.
7. Guide To Compression - John Watkinson, Snell & Wilcox Inc Publication
8. Audio Video Systems Principles Practices and Troubleshooting - Bali & Bali, Khanna Publishing Company.
9. Consumer Electronics - S.P.Bali, Pearson Education.

Course Outcome:

After learning the course the students should be able to:

1. Describe the basic idea and fault finding in audio and video transmitter, and receiver sections.
2. Explain importance of Digital Audio and Video systems including importance of compression.
3. Distinguish between Stereo & Hi-fi Amplifier.

4. Understand CD/DVD player mechanism and fault finding in CD player.
5. Explain AM/FM tuners, MP3 players and Blue-Ray Technology.
6. Explore advanced Digital color Television systems (LCD, LED, Plasma) and fault finding.
7. Exposure of the HDTV, 3D TV and OLED TV

List of Experiments:

1. To study public address system and its components.
2. To obtain the Directional Response of Loudspeaker.
3. To obtain the Directional response of micro phone.
4. To obtain the frequency response of loudspeaker.
5. To obtain the frequency response of Microphone.
6. Draw and study drive mechanism layout of CD player.
7. Fault finding in CD player (Three different faults).
8. To perform digitization of sound signal and edit it using Computer Software.
9. To test color TV using pattern generator.
10. To obtain frequency response of IF amplifier using VHF sweep generator.
11. To perform fault identification in Colour TV.
12. To perform analysis of Composite Video Signal.
13. To study installation of DTH System.
14. To design and obtain frequency response of Cross- over network.

Design based Problems (DP)/Open Ended Problem:

1. Simulation of Video Compression technique/s.
2. Study of CD/DVD/MP3/AM/FM Player.
3. Study of Digital TV.
4. Study of High Definition TV.
5. Study of LCD TV.
6. Study of LED TV.
7. Study of 3D TV.
8. Study of OLED TV.
9. Study of Cable TV System.
10. Estimate the cost, labor of cable TV installation.
11. Collect information about Set Top box used for Cable TV at home.

Visit to a Cable TV Operator/TV/Radio stations and prepare comprehensive report of your observations..

List of Open Source Software/learning website:

1. http://www.electronicsandyou.com/
2. http://electronics.howstuffworks.com/
3. http://electronicdesign.com/
4. http://electronicsforu.com/
5. http://www.101science.com/Radio.htm#Television
6. http://tv.manualsonline.com/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the

group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION (11)

MINI PROJECT

SUBJECT CODE: 2151102

B.E. 5th SEMESTER

Type of course: Undergraduate

Prerequisite: Basic Knowledge of Electronics

Rationale: This is a laboratory oriented course which will provide a platform to students to enhance their practical knowledge and skills by development of small scale electronics circuits/systems**.**

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	2	2	0	0	80	20	100

Guidelines:

1. Students should select a problem which addresses some basic home, office or other real life applications.
2. The electronic circuit for the selected problem should have at least 20 to 25 components.
3. Students should understand testing of various components.
4. Soldering of components should be carried out by students.
5. Students should develop a necessary PCB for the circuit.
6. Students should see that final circuit submitted by them is in working condition.
7. 5-10 pages report to be submitted by students.
8. Group of maximum three students can be permitted to work on a single mini project.
9. The mini project must have hardware part. The software part is optional.
10. Department may arrange demonstration with poster presentation of all mini projects developed by the students at the end of semester.
11. It is desirable that the electronic circuit/systems developed by the students have some novel features.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION (11)
MICROCONTROLLER AND INTERFACING (EC)
SUBJECT CODE: 2151001
B.E. 5th SEMESTER

Type of course: Microcontroller Architecture and Programming

Prerequisite: Students should have in depth knowledge of Digital Logic Design, Microprocessor architecture as well as logical ability and programming skills to develop the code

Rationale: The knowledge of microcontroller is very essential for a student of BE in Electronics and Communication Engineering as the world is migrating towards automation rapidly in each and every fields. The students studying the subject are supposed to learn the architecture and programming of typical microcontroller. Students will be taught the basic use of an assembly as well as embedded C programming environment to control peripheral devices. Students will also understand the interfacing of various peripheral elements with microcontroller to design an automated system. The course will cover AVR, 8-bit Microcontroller in detail with sufficient exposure to design an automated system.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction To 8-bit Microcontroller :** Microcontrollers and Embedded processors, Overview of AVR family, AVR Microcontroller architecture, Register, AVR status register, ROM space and other hardware modules, ATmega32 pin configuration & function of each pin.	8	15
2	**AVR Assembly Language Programming:** Addressing modes of AVR, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions. AVR data types and assembler directives, AVR assembly language programs, AVR I/O Port Programming, Time delay loop, BCD, ASCII conversion Program, Look-up table, Bit addressability, MACROs.	15	25
3	**AVR Programming in C :** Data types, I/O programming, logic operations, Intel HEX file, Timer programming in assembly and C, Interrupt programming in assembly and C, Serial Port programming in assembly and C	15	30
4	**Peripheral Interfacing :** LCD and Keyboard Interfacing, ADC, DAC and sensor interfacing,	18	30

	Relay, Opto-isolator and Stepper Motor Interfacing, Input capture and Wave Generator, PWM programming and DC motor control, SPI protocol and Display interfacing, I2C Protocol and RTC interfacing		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**25**	**25**	**20**	**15**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
2. Programming and Customizing the AVR Microcontroller, By Dhananjay Gadre, McGraw Hill Education
3. AVR ATmega32 data sheet

Course Outcome:

After learning the course the students should be able to:

1. Understand the architecture of AVR 8-bit Microcontroller.
2. Describe the importance and function of each pin of AVR ATmega32 Microcontroller.
3. Write, debug and simulate assembly as well as embedded C language programs.
4. Understand Timer operation, Interrupt environment and Serial Communication.
5. Interface I/O peripheral devices with microcontroller.
6. Summarize the functionality of I2C and SPI protocol.

List of Experiments:

1. Familiarization with AVR simulator and trainer kit.
2. Write and simulate minimum of 15 programs (Assembly as well as Embedded C) to be written making effective use of all the instructions and on-chip peripheral.
3. Installation of Arduino software and write program for blinking LED.
4. Read Push-button switch and display its status on LED.
5. Interfacing Buzzer with AVR Board.
6. Interfacing 7-Segment LED Display with AVR Board.
7. Interfacing of 16x2 LCD with Arduino board and display message on it.
8. Interface 4x4 matrix keyboard with AVR microcontroller. Display value of pressed switch on LCD.
9. Read analogue voltage using Arduino board and display its equivalent digital value on LCD.
10. Interface temperature sensor LM35 with Arduino board and display temperature on LCD.

11. Interface Stepper motor with AVR Microcontroller and Write program to rotate stepper motor in clockwise and anticlockwise direction.
12. Interface DC Motor with AVR Microcontroller and write program to rotate DC motor in clockwise and anticlockwise direction.
13. Generate PWM using AVR and use it for speed control of DC motor

Design based Problems (DP)/Open Ended Problem:

1. Connect infrared sensor with AVR microcontroller. Control electrical device with help of IR remote control.
2. Read 100 temperature readings using LM35 and Arduino board, take average of it and send it to PC using serial communication.
3. Interface LDR with Arduino board. Display light intensity on LCD. If light intensity is less than certain threshold value, switch ON lamp connected with Arduino board with help of driver circuit.

Major Equipments:

1. AVR ATmega32 microcontroller trainer kit with peripheral devices.
2. Programmer/Loader
3. Arduino Board
4. Computer system.
5. CRO, Power supply

List of Open Source Software/learning website:

1. Open source AVR simulator.
2. www.atmel.com
3. http://www.arduino.cc/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

CYBER SECURITY
SUBJECT CODE: 2150002
B.E. 5th SEMESTER

Type of course: NA

Prerequisite: Basic fundamental knowledge of computers, Internet and network

Rationale: NA.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
0	1	2	3	0	0	0	50	30	20	100

Content:

Sr. No.	Topics	Weightage %
1	**Systems Vulnerability Scanning** Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet	25
2	**Network Defense tools** Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System	25
3	**Web Application Tools** Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra	25
4	**Introduction to Cyber Crime and law** Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.	10
5	**Introduction to Cyber Crime Investigation** Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks	15

Reference Books:

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley

Course Outcome:

After learning the course the students should be able to: student should understand cyber-attack, types of cybercrimes, cyber laws and also how to protect them self and ultimately society from such attacks

List of Experiments:

1. TCP scanning using NMAP
2. Port scanning using NMAP
3. TCP / UDP connectivity using Netcat
4. Network vulnerability using OpenVAS
5. Web application testing using DVWA
6. Manual SQL injection using DVWA
7. XSS using DVWA
8. Automated SQL injection with SqlMap

Design based Problems (DP)/Open Ended Problem:

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION (11)
ENGINEERING ELECTROMAGNETICS
SUBJECT CODE: 2151102
B.E. 5th SEMESTER

Type of course: Electromagnetics Theory and Wave Propagation

Prerequisite: Basic knowledge of vector calculus, Electric and Magnetic fields and its laws.

Rationale: This course provides strong foundation for understanding the fundamental principles and laws of electromagnetism to understand transmission, radiation and propagation theory. Students can understand the physical interpretation and application of various laws and theorems of electric and magnetic fields. The students can also understand the transmission lines, antennas and waveguides theory.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Vector Analysis:** Scalars and Vectors, Vector Algebra, The Rectangular Coordinate System, Vector Components and Unit Vectors, The Vector Field, The Dot Product, The Cross Product, Other Coordinate Systems: Circular, Cylindrical Coordinates & The Spherical Coordinate System.	**04**	**05**
2	**Coulomb's Law and Electric Field Intensity:** The Experimental Law of Coulomb, Electric Field Intensity, Field Arising from a Continuous Volume Charge Distribution, Field of a Line Charge, Field of a Sheet of Charge, Streamlines and Sketches of Fields	**05**	**10**
3	**Electric Flux Density, Gauss's Law and Divergence:** Electric Flux Density, Gauss's Law and Application of Gauss's Law: Some Symmetrical Charge Distributions and Differential Volume Element, Divergence and Maxwell's First Equation, The Vector Operator ∇ and the Divergence Theorem.	**05**	**15**
4	**Energy and Potential:** Energy Expended in Moving a Point Charge in an Electric Field, The Line Integral, Definition of Potential Difference and Potential, The Potential Field of a Point Charge, The Potential Field of a System of Charges: Conservative Property, Potential Gradient, The Electric Dipole, Energy Density in the Electrostatic Field.	**06**	**10**

5	**Conductors and Dielectrics:** Current and Current Density, Continuity of Current, Metallic Conductors, Conductor Properties and Boundary Conditions, The Method of Images, Semiconductors, The Nature of Dielectric Materials, Boundary Conditions for Perfect Dielectric Materials.	**06**	**05**
6	**Capacitance:** Capacitance, Parallel-Plate Capacitor, Several Capacitance Examples, Capacitance of a Two-Wire Line, Using Field Sketches to Estimate Capacitance in Two-Dimensional Problems, Poisson's and Laplace's Equations, Examples of the Solution of Laplace's Equation, Example of the Solution of Poisson's Equation: the *p-n* Junction Capacitance	**06**	**05**
7	**The Steady Magnetic Field:** Bio-Savart Law, Ampere's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux and Magnetic Flux Density, The Scalar and Vector Magnetic Potentials, Derivation of the Steady-Magnetic-Field Laws.	**06**	**15**
8	**Magnetic Forces, Materials and Inductance:** Force on a Moving Charge, Force on a Differential Current Element, Hall Effect, Force between Differential Current Elements, Force and Torque on a Closed Circuit, The Nature of Magnetic Materials, Magnetization and Permeability, Magnetic Boundary Conditions, The Magnetic Circuit, Potential Energy and Forces on Magnetic Materials	**06**	**10**
9	**Time-Varying Fields and Maxwell's Equations:** Faraday's Law, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, The Retarded Potentials	**06**	**10**
10	**Electromagnetic Wave Propagation:** Wave Propagation in Free Space, Lossy and Lossless Dielectrics and in Good Conductors. Reflection of Plane Wave, Poynting Vector, Wave Power, Skin Effect, Wave Polarization and Standing Wave Ratio	**06**	**15**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	**20**	**10**	**20**	**10**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Engineering Electromagnetics, William H Hayt And John A Buck - Tata McGraw-Hill Publishing Company Limited, Seventh Edition
2. Principles of Electromagnetics, Matthew N. O. Sadiku - Oxford university press, 2007 - fourth edition
3. Electromagnetics with applications by J.D.Krauss and Daniel Fleisch fifth edition, Mcgraw Hill.

4. Fundamentals of Electromagnetics with MATLAB, Karl Erik Lonngren, Sava Vasilev Savov, SCITECH Publishing Inc.

Course Outcome:

After learning the course the students should be able to:

1. Explain the physical interpretation of coulomb's law, Gausses law, Biot Savart law and Amperes Circuital law
2. Explain the physical interpretation and application of divergence, curl and gradient.
3. Analyze the electromagnetic waves using divergence theorem and stock theorem.
4. Design, analyze and test the capacitor, co-axial cable, waveguide and antennas.
5. Analyze the electromagnetic waves using Maxwell's equations, Poisson's and Laplace equations.
6. Determine skin effect, Hall Effect, pointing vector, and standing wave ratio of electromagnetic waves.
7. Describe and analyze electromagnetic wave propagation in free-space, dielectrics and conductors.

List of Experiments: Assignments from different chapters to be given to students. Numerical to be solved from each chapter in tutorial class.

Design based Problems (DP)/Open Ended Problem:

1. Design the MATLAB programs for vector calculus.
2. Design MATLAB programs to calculate electric field intensity due to line, surface and volume charge density.
3. Design MATLAB programs for gradient operation.
4. Design MATLAB programs for divergence operation.
5. Design MATLAB programs for curl operations.

List of Open Source Software/learning website:

1. CD available with first reference book.
2. nptel.ac.in
3. Scilab
4. http://www.Scitechpub.com/
5. wikipedia.org

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION (11)
ELECTRONICS & COMMUNICATION
SUBJECT CODE: 2151004
B.E. 5th SEMESTER

Type of course: Mathematical analysis, designing, building and testing analog communications systems with applications to telecommunication systems.

Prerequisite: Fourier series, Fourier Transforms, Circuit Theory

Rationale: This course explores the fundamentals of electronic communication systems. The course has two primary focuses:

(1) Understanding electronic communications systems in analog form from deterministic approach

(2) Design and analysis of analog communications systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	%Wei
1	**Introduction to communication systems:** Communication system, Analog and digital Messages, Channel effect, Modulation and detection, Bandwidth of different information signals, Historical review of telecommunication, Applications	3	2
2	**Analysis and transmission of signals:** Aperiodic (non-periodic) signal representation by Fourier integral, Fourier transforms of some useful functions, signal transmission through a linear system, signal distortion over a communication channel, Signal energy and energy spectral density, signalpower and power spectral density.	6	12
3	**Passive Circuits:** Introduction, Series tuned circuits, Parallel tuned circuits, self-capacitance of a coil, Skin effect.	3	5
4	**Amplitude modulation(AM)/Demodulation:** Concept of modulation, Mathematical representation of sinusoidal Amplitude modulated signals in time and frequency domain- Double sideband Full carrier (DSBFC) , Double sideband suppressed carrier(DSBSC) and single sideband suppressed carrier modulations(SSBSC), Vestigial Sideband (VSB)	10	18

	modulation and Quadrature amplitude modulation(QAM), power and bandwidth calculations for DSBFC, DSBSC, SSBSC, VSB and QAM modulations, Non sinusoidal AM – effective modulation index, Effective voltage and current for sinusoidal and non-sinusoidal AM, AM generation: FET balanced modulator and IC balanced modulator circuits, Diode ring modulator, SSB generation: balanced modulator-filter method, phasing method and the third method, AM detection: peak (envelope detector), synchronous detectors, square law detectors.		
5	Angle modulation/demodulation: Conceptof instantaneous frequency and angle modulation, sinusoidal FM and its time domain representation, spectral components of angle modulated signals, power in sinusoidal FM and modulation index, Carson's rule, equivalence between Frequency modulation(FM) and Phase modulation(PM), Angle modulator circuits, Fm transmitters, Armstrong method of FM generation, Fm stereo broadcast, FM detection: Basic slope detector, Foster-Seeley discriminator, ratio detector, PLL detector and Quadrature detector, Concept of Amplitude limiter, Pre-emphasis and de-emphasis circuits, Interference in angle modulated systems.	**12**	24
6	Radio receivers: Functions of radio receivers, working of super heterodyne radio receivers, tuning ranges, tracking, sensitivity and gain, image rejection, spurious responses, Adjacent channel selectivity, Automatic gain control, Electronically tuned, receivers, IC receivers, AM receivers, FM receivers	**8**	16
7	Noise: Introduction, thermal noise, Shot noise, Partition Noise, Low frequency noise, Burst noise, a noise, High frequency noise, BJT and FET noises, Equivalent input noise generators, Signal to noise ratio (SNR), SNR of Tandem connection, Noise factor and noise figure, Amplifier input noise in terms of noise figure, Noise factor in cascaded amplifiers, Noise factor and equivalent input noise generators, noise factor of a lossy network, Noise temperature, Measurement of noise temperature and noise factor, narrow-band band pass noise.Behavior of Analog systems in presence of Noise	**8**	16
8	Introduction of amateur radio technology What is Ham radio? How to become radio amateur? Importance of Ham radio during natural calamities, Technology used in amateur radio	**2**	6

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**20**	**35**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Electronic Communications by Dennis Roddy & John Coolen IV Edition PHI.
2. Digital and analog communication system by B.P.Lathi .Zhi Ding (international 4th Edition), OXFORD university press.
3. Electronic Communications by Kennedy McGraw Hill Publication.
4. Electronic Communications Systems by Wayne Tomasi. Pearson education India.
5. Electronic Communication Systems by Roy Blake By Cengage learning.
6. Communication Systems By Simon Haykins By Wiley India.
7. Theory and Problem Of Electronic Communication By Lloyd Temes and Mitchel E.Schulz(Second edition), McGraw Hill Publication.

Course Outcome:

After learning the course the students should be able to:

[1] To understand the basics of communication system.
[2] To analyze different type of passive circuits (Tuned circuits).
[3] To study different types of noise in communication systems, their effect on communication systems and parameters to analyze noise in the system.
[4] To understand basic blocks and operations of different stages of super-heterodyne receiver.
[5] To study the Fourier transforms to analyze different signals and systems and observe frequency content of signal using spectrum analyzer.
[6] To study the need of modulation and understand the basic concept of amplitude modulation and phase modulation.
[7] To understand different techniques for amplitude modulation and demodulation.
[8] To understand the different techniques for frequency modulation and demodulation.
[9] To plot frequency response of communication circuits like RF amplifier, IF amplifier, pre-emphasis and de-emphasis.
[10] To learn working of AM/FM Transmitters
[11] To become aware of amateur radio technology

List of Experiments:

1. To observe amplitude modulation waveforms for different modulation index.
2. To observe frequency modulation waveform and to measure peak frequency deviation.
3. To observe frequency spectrum of AM and FM waveforms.
4. To generate amplitude modulation signal.
5. To extract information signal from AM signal using diode detector.
6. To extract information signal from FM signal using ratio detector or PLL detector.
7. To obtain frequency response of pre-emphasis and de-emphasis circuits.
8. To obtain frequency response of RF amplifier.
9. To understand working of AGC circuit. To measure output of amplifier circuit with and without AGC circuit.
10. To generate and detect SSB signal.
11. To obtain fidelity response of AM or FM receiver.
12. To understand block diagram of FM receiver and observe signals at different stages.
13. Visit of AM/FM radio station

Mini Project:
To construct AM or FM transmitter and receiver.

Design based Problems (DP)/Open Ended Problem:

- Design FM transmitter/receiver for 50 MHz to use within educational campus.
- Design parallel LC tune circuit to amplify signal of frequency 890 MHz

.

Major Equipment:

- Digital storage oscilloscope
- RF Signal generator
- Function generator
- Spectrum Analyzer (optional)
- Communication Engineering trainer kits like Generation and detection of Amplitude and frequency modulation

List of Open Source Software/learning website:

- NPTEL Video lectures
- gEDA Analog Simulation tool to simulate analog communication circuits (In Linux operating system)
- Website for Amateur radio technology: http://www.arrl.org/technology
- SCILAB

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.