GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161008
B.E. (E.C.) Semester – VI
Subject Name: Sensors and Transducers

Type of course: Professional Elective Course

Prerequisite: Knowledge of Analog circuit, Electronic Measurement

Rationale: Introduce students to the principle of various Transducers, their construction, applications and principles of operation, standards and units of measurements. Provide students with opportunities to develop basic skills in the design of electronic equipment.

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Electronics Measurement and Instrumentation:** Transducers and sensors- Static and Dynamic Characteristics Static characteristics: Accuracy, repeatability, reproducibility, range/span, linearity, threshold, sensitivity, resolution, hysteresis, precision, drift etc. Dynamic characteristics: Speed of response, settling time, fidelity, lag etc. Errors: Types of errors, statistical analysis, probability of errors, limiting errors, performance measures of sensors Classification of sensors, Sensor calibration techniques	6
2	**Temperature Sensors:** Resistance Vs Temperature characteristics for different materials, Thermistors, Thermocouples - thermoelectric effects for thermocouples, thermocouple tables, RTD, Other Thermal Sensors. Radiation temperature sensors, Pyro-electric type Temperature Sensor	3
3	**Motion, Proximity And Ranging Sensors:** Motion Sensors – Potentiometers, Resolver, Encoders – Optical, LVDT – RVDT, Accelerometer, Proximity Sensors - Magnetic, Inductive, Capacitive, Optical, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).	5
4	**Pressure, Force, Displacement And Weight Measurement, Magnetic Sensor:** Capacitive and inductive transducers, Piezo-electric sensors, Tactile sensor, Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor	6
5	**Flow Measurement, Power Measurement, Optical Sensors:** Flow Measurement - Magnetic and ultrasonic flow meter, Power Measurement - Electrodynamometer type of wattmeter and power factor meter, Single-phase induction and Electronic energy meters, Optical Sensors - Photo conductive cell, photo voltaic, Photo resistive, IR sensor, LDR,	6

	Fiber optic sensors	
6	**Special Sensors:** GPS, Bluetooth, Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors. Touch screen sensor, Heading Sensors – Compass, Gyroscope, Inclinometers, Applications of sensors in drone	4
7	**Analog Signal Conditioning:** Signal conditioning, Loading effects, Bridges for measurement techniques, Wheatstone, Wein, Kelvin's, Maxwell bridge and Hey bridge, Applications of Attenuators, Amplifiers and Passive filters in signal conditioning, Op-amp based signal conditioning circuits, Inverting and Non-Inverting Amplifiers, Linearization, Differential amplifiers and Instrumentation amplifiers.	6
8	**Digital Signal Conditioning:** Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Weighted Resistor DAC, R-2R ladder DAC, Dual Slope, Parallel-comparator Successive Approximation ADC techniques, Single channel and multi-channel Data Acquisition System (DAS).	6

Reference Books:

1. Rangan & Mani "Instrumentation: Devices and Systems", McGraw Hill
2. Curtis D. Johnson, "Process Control Instrumentation Technology", Prentice Hall India
3. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.
4. D.V.S. Murty, "Transducers and Instrumentation", Prentice Hall India.
5. Helfrick Albert D. and Cooper W. D., "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall India.
6. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2010.
7. Kalsi H. S. "Electronic Instrumentation", Tata McGraw-Hill Education.
8. Shawhney A. K. "A Course In Electrical and Electronics Measurements and Instrumentation", DhanpatRai& Sons, 11th Ed., 1999.
9. Bell David A. "Electronic Instrumentation and Measurements", PHI / Pearson Education.
10. Sensors and Signal Conditioning By Ramón Pallás-Areny, John G. Webster, Wiley Interscience

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the principles of various sensors and transducers for measurement and instrumentation.	30
CO-2	Evaluate various measurements techniques for industrial applications	30
CO-3	Apply signal conditioning for measurements	20
CO-4	Implement the principles and signal conditioning for measurement for real life applications.	20

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161008

Suggested List of Experiments:

Sr.No.	Experiment Title
1.	To find the value of unknown resistor using Wheatstone bridge
2.	To find the value of unknown capacitance and inductance using Maxwell's bridge
3.	Design signal conditioning circuit using Op-Amp and temperature sensor
4.	Verify characteristic of RTD and find out sensitivity
5.	Verify characteristic of Thermocouple and design signal conditioning circuit
6.	Verify characteristic of variable resistor transducer (strain gauge).
7.	Measurement of distance using LVDT plot ac and dc characteristics
8.	Interface Load Cell with Arduino and display weight
9.	Interface accelerometer with Arduino
10.	Interface gyroscope with Arduino
11.	Interface Tilt Sensor with Arduino
12.	Presentation on latest topics

Faculty may carry out additional experiments based on resources available in the laboratory

Open Source Platform:

https://www.tinkercad.com/

NPTEL Course:

https://nptel.ac.in/courses/108/108/108108147/

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161009
EMBEDDED SYSTEM
SEMESTER-VI

Type of course: Programme Elective Course

Prerequisite: Knowledge of microprocessor/microcontroller hardware, programming concept in assembly and C.

Rationale: Embedded System plays crucial role in today's industry, where automation is generally achieved by microcontroller based system. Some of higher end multi-processing application requires OS/RTOS level programming to achieve real time requirements. Also, Internet of Thing (IOT) gives basic idea of future trends, application area and challenges.

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction to Embedded Systems** Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices In a System, Embedded Software in a system, Examples of Embedded Systems, Embedded System-on-chip (SOC) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design Process in Embedded System, Formulization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills Required for an Embedded System Designer	3	5%
2	**Device and Communication Buses** Timer and Counting Devices: Watch dog timer, Real time clock, Brown Out Reset, Serial Communication protocols : UART, I2C, SPI, SDIO, CAN, SDIO, USB, JTAG, Spy-Bi-Wire Parallel Communication protocols : ISA, AMBA, PCI, PCI-X, Wireless Communication Protocols : IrDA, Bluetooth, WiFi, Zigbee	6	15%
3	**Device Drivers and Interrupt Services Mechanism** Programmed-I/O Busy-wait Approach without Interrupt Services Mechanism, ISR Concept, Interrupt Sources, Interrupt Servicing(Handling) Mechanism, Multiple Interrupts, Context and the Periods for Context Switching, Interrupt Latency and Deadline, Classification of Processor Interrupt Service Mechanism from Context-Saving Angle, Direct Memory	5	5%

	Access, Device Driver Programming		
4	**Inter-process Communication:** Multiple process in an application, Multiple Threads in an application, Task and Task state, Task and Data, Clear-cut Distinction between Functions, ISRS and Tasks by their Characteristics, Concept of Semaphores, Shared Data, Inter process Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions	**8**	**20%**
5	**Introduction to OS and Real Time Operating System:** Overview of OS: Multirate Systems, Processes and Threads, Context Switching, Multi tasking, Cooperative Multi-tasking, Pre-emptive Operating Systems structure, Operating system function, Timing requirements on processes, Features of an Operating System, Features of RTOS, Case studies: FreeRTOS. µCOS, RTx51 TinyOS, Benchmarking RTOS, VxWorks.	**7**	**20%**
6	**Software architectures and Real Time Task Scheduling:** Requirements of Embedded Software, Interrupts- Basics, latency, Process state and scheduling, Clock driven and Event driven scheduling, Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Fault-Tolerant Scheduling, Round Robin, Round robin with interrupt, function queue scheduling.	**6**	**20%**
7	**MSP430 (Case Study):** Motivation for MSP 430 Microcontrollers, MSP430 RISC CPU architecture, Compiler-friendly features, On-chip peripherals and programming for - Watchdog Timer, Basic Timer, Real Time Clock (RTC), ADC, Universal Serial Communication Interface (USCI), Low-power features of MSP430	**7**	**15%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
5	**15**	**25**	**10**	**10**	**5**

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.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161009

Reference Books:

[1] Embedded System: Architecture, Programming and Design by Raj Kamal, 2nd Edition, TMH Publication
[2] Embedded Software Premier David Simon (Pearson)
[3] Computers as Components Principles of Embedded Computing System Design by Wayne Wolf, Morgan Kaufman
[4] Real Times Systems Theory and Practice by Rajib Mall (Pearson Education)
[5] Embedded Real-time Systems Programming Sri Ram Iyer and Pankaj Gupta (TMH)
[6] The Linux Programming Interface , Michael Kerrisk
[7] MSP430 Microcontroller Basics by John H. Davies, 1st Edition, Elsevier

Course Outcome:

After learning the course the students should be able to:

- Understand the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
- Recognize basics of various embedded hardware and protocol standards.
- Learn and analyze basics of operating system fundamentals and real-time operating systems concepts.
- Analyze Inter-Process Communication methods.
- Learn programming using POSIX concept.
- Design software for embedded computer systems using a real-time operating system.

List of Experiments:

(General guidelines.. Institute may change list of experiments based on laboratory set up available)

- GPIO Programming with MSP430 – LED, Switches, seven-segment, 16x2 LCD
- MSP430 – Timer, UART, SPI, I2C Programming
- Watch Dog Timer, Brown-out reset design using MSP430
- MSP430 with RTOS programming
- POSIX pthread : create, delete, merge
- Tiny RTx51, uCOS , VxWork (study and/or basic programming)
- Raspberry Pi based OS controlled IO programming.

Design based Problems (DP)/Open Ended Problem:

1. Design of microcontroller application based on RTOS.
2. Design of petrol-pump system with/without RTOS.
3. Design Air-bag system with/without RTOS.

Major Equipment:

1. MSP430 Hardware Boards or Proteous based environment

2. LINUX System
3. Switches, LEDs, Relay, Solenoid valves, motor drivers
4. WiFi, Bluethooth boards.
5. Robot for demonstration

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161010
Semester – VI
Subject Name: Satellite Communication

Type of course:

Prerequisite: Analog and Digital Communication, Microwave Engineering

Rationale: The students need to learn basic concepts of satellite communication, components of satellite systems, Advantages and disadvantages of Satellite 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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Satellite Communication**: Principles and architecture of satellite communication, Brief history of satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.	4
2	**Orbital Mechanics:** Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.	9
3	**Satellite sub-systems:** Study of architecture and roles of various sub-systems of a satellite system such as Telemetry, tracking , command and monitoring (TTC&M),Attitude and orbit control system (AOCS),Communication sub-system, power sub-system etc.	8
4	**Typical Phenomena in Satellite Communication:** Solar Eclipse on satellite, its effects, remedies for eclipse, sun transit outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.	4
5	**Satellite link budget:** Flux density and received signal power equations, Calculation of system noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clean air and rainy conditions.	10

6	**Modulation and Multiple Access Schemes:** Various modulation schemes used in satellite communication, Meaning of multiple access, Multiple access schemes based on time, frequency and code sharing namely TDMA, FDMA and CDMA.	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**10**	**10**	**5**	**5**

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. Timothy Pratt, Charles W.Bostian, Jeremy E Allnutt: Satellite Communications: Wiley India
2. Dennis Roddy: Satellite Communication: McGraw Hill

Course Outcomes:

After learning the course, the students should be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Visualize the architecture of satellite systems as a means of high speed, high range communication system	20
CO-2	State various aspects related to satellite systems such as orbital equations, subsystems in a satellite, link budget, modulation and multiple access schemes	40
CO-3	Solve numerical problems related to orbital motion and design of link budget the given parameters and conditions	40

List of Experiments:

Sr.No.	**Experiment Title**
1.	Understanding the basic concepts of satellite communication
2.	To setup a communication link between uplink transmitter and downlink receiver using Satellite
3.	To setup an Active satellite communication link and demonstrate link fail operation
4.	To communicate voice & Video signal through satellite link

5.	Observe the effect of Different combinations of uplink and downlink frequencies on satellite link
6.	To transmit and receive three separate signals (Audio, Video , Tone) simultaneously through satellite link
7.	To transmit and receive function generator signals through satellite link
8.	To measure the signal parameters in an analog FM/FDM TV satellite link
9.	To transmit digital waveforms through a satellite communication link
10.	To Calculate Bit Error Rate in a satellite communication link

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161011
Semester –VI
Subject Name:Cyber Physical systems

Type of course: ProgrammeElective Course

Prerequisite: Knowledge of microprocessor/microcontroller hardware, programming concept in assembly and C.

Rationale: Cyber Physical Systems plays crucial role in today's industry, where automation is generally achieved by interdisciplinary mode involving various branches of engineering to solve real life problems. IT improves the standard of living of human life. It provides challenges to implement next generation systems leading to solutions showing future trends, application area and challenges

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)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Cyber-Physical Systems** Cyber-Physical Systems **(CPS)** in the real world , Basic principles of design and validation of CPS, Industry 4.0, AutoSAR, IIOT implications, Building Automation, Medical CPS	4
2	**CPS – Environment** Human and CPS , Human Computer Interface (HCI), Hardware and Software Co-Design CPS HW platforms - Processors, Sensors, Actuators, CPS Network – Wireless Hart, CAN, Automotive Ethernet, CPS Sw stack - RTOS , Scheduling Real Time control tasks	7
3	**CPS Engineering** CPS Models, Low level Control, Mid High Level Control and Automation, From features to software components, Mapping software components to ECUs, CPS Performance Analysis - effect of scheduling, bus latency, Sense and actuation faults on control performance, network congestion. Architecture and Design Language	6
4	**CPS Analysis and Verification** Advanced Automata based modeling and analysis, Basic introduction and examples, Timed and Hybrid Automata Formal Analysis: Flowpipe construction, reachability analysis, Analysis of CPS Software, Weakest Pre-conditions, Hybrid Automata Modeling : Flowpipe construction using SpaceX and Phaver tools, CPS SW Verification: Frama-C	**6**
5	**CPS Security** Information and Cyber Security basics, Privacy in CPS, Threats to CPS in various domains such as Automotive, Medical , Industrial control etc. , CPS Attack models	**5**

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161011

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
5	**15**	**25**	**10**	**10**	**5**

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. Rajeev Alur , Principles of Cyber-Physical Systems, MIT Press
2. A. Lee, Sanjit Seshia, Introduction to Embedded Systems – A Cyber–Physical Systems Approach , MIT Press
3. P. Tabuada, "Verification and control of hybrid systems: a symbolic approach", Springer-Verlag

Course Outcomes:

After learning the course, the students should be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Address challenges in implementing a cyber-physical system from a computational perspective	30%
CO-2	Design of Cyber Physical Systems using formal methods, safety assurance and security aspects	30%
CO-3	Analyze and Implement CPS systems	40%

List of Experiments:

(General guidelines. Institute may change list of experiments based on laboratory set up available)

1. Study of HCI for CPS

2. Study of Communication Technologies in CPS
3. Modeling of CPS
4. Simulation of CPS
5. Analysis of CPS
6. Design of CPS for Hardware/Software Co-Design
7. Hybrid Model Analysis of CPS
8. CPS Performance Analysis
9. Study of CPS Security Attacks
10. Implementation of mechanism to mitigate security attacks of CPS

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161012
Semester – VI
Subject Name: Web Technology

Type of course: Elective Course

Prerequisite: Basic knowledge of Programming, Internet

Rationale: There is an ever-increasing demand for web developers: Businesses are always on a lookout for good web developers and designers and the demand is only going to grow in the future. This course will enable students to understand the basics of web development. It also covers latest Web development technologies like HTML5, CSS3 which will enable students to develop rich user interface.

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)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction to Web:** What is Web, Protocols and programs, Secure connections, application and development tools, the web browser, What is server, Types of Web Servers, Setting up UNIX and Linux web servers, Logging users, dynamic IP. **Web Design:** Web site design principles, planning the site and navigation.	**04**	10
2	**Introduction to HTML:**HTML Basics, Elements, Attributes, Comments, Formatting, Links, Images, Tables, Lists, Block, Frames, HTML Meta Tags, HTML Forms, Form Elements, Various Input Elements. **HTML 5:** Introduction to HTML5, New Elements, HTML5 Semantics, Storage API, Location API, Migration to HTML5.	**06**	25
3	**JavaScript:** Introduction to Client-Side Scripting, Purpose of JavaScript, Basic Syntax, Variables, Operators, Loops, Functions, Arrays, Array Methods, Strings, String Methods, Regular Expression, HTML Form Validation, Debugging and Best Practices.	**06**	20

4	**Cascading Style Sheets:**Introduction, Basic Syntax, Colors, backgrounds, Border, Margin, Padding, Height, Width, BOX Model, Other basic style elements. Layouts, Positions, Forms, Pseudo class, and elements, 2D and 3D transitions, Animations, CSS grids, Responsiveness. **CSS 3.0:**Rounded Corners, Border Images, Multi background, Multi columns, Shadow, Gradients, Web Fonts, Media Types.	**06**	25
5	**Server-Side Scripting with PHP:** Introduction to PHP, Basic Syntax, Variables, Operators, Loops, Functions, Strings, Constants, Arrays, Superglobals, PHP Form Handling, Validations, File Uploads, Cookies, Sessions, Error Handling. Connecting to Database, CRUD operations with Database, Prepared Statements and Bound Parameters, Limiting Data, Get Last ID, Example application.	**06**	20

Suggested Specification table with Marks (Theory): (For BE only)

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

- Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2009.
- P.J.Deitel, H.M.Deitel, Internet and World Wide Web: How to program, Third Edition, Pearson publication.
- U. K. Roy, Web Technologies, First Edition, Oxford Higher Education

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Implement interactive web page(s) using HTML, CSS and JavaScript	15%

CO-2	Design a responsive web site using HTML5 and CSS3	15%
CO-3	Demonstrate use of web technology	10%
CO-4	Build Dynamic website using server-side PHP Programming	30%
CO-5	Design web page to control devices for IoT application	30%

List of Experiments:

1. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
2. Create your class timetable using table tag.
3. Create user Student feedback form (use textbox, text area, checkbox, radio button, select box etc.)
4. Create a web page using frame. Divide the page into two parts with Navigation links on left hand side of page (width=20%) and content page on right hand side of page (width = 80%). On clicking the navigation Links corresponding content must be shown on the right-hand side.
5. Write html code to develop a webpage having two frames that divide the webpage into two equal rows and then divide the row into equal columns fill each frame with a different background color.
6. Design a web page of your hometown with an attractive background color, text color, an Image, font etc. (use internal CSS).
7. Use External, Internal, and Inline CSS to format college web page that you created.
8. Develop simple calculator for addition, subtraction, multiplication and division operation using JavaScript
9. Create HTML Page that contains form with fields Name, Email, Mobile No,Gender , Favorite Color and a button now write a JavaScript code to combine and display the information in textbox when the button is clicked.
10. Use regular expression for validation in Feedback Form.
11. Write a php program to display today's date in dd-mm-yyyy format.
12. Write a php program to check if number is prime or not.
13. Create HTML page that contain textbox, submit / reset button. Write php program to display this information and also store into text file.
14. Write a php script to read data from txt file and display it in html table (the file contains info in format Name: Password: Email)
15. Design web page to control devices for IoT applications
16. Design webpage to get sensor data from IoT Embedded device and display it on screen

Open Ended Problems:

1. Develop an attractive Web site for an event to be organized in your institute.
2. Develop a Web based application to manage the Visiting Cards which allows user to add new

cards, delete the cards, update the cards etc.
3. Develop a web-based application for Internet of Things

Major Equipment:

- Computer system with Web Server and Database Server.
- Embedded IoT device

List of Open Source Software/learning website:

- https://www.w3schools.com/html/
- https://www.tutorialspoint.com/css
- https://www.javatpoint.com/javascript-tutorial
- NPTEL Video Lectures of Internet Technology by Indranil Sengupta, IIT Kharagpur [Available at: http://nptel.ac.in/courses/106105084/]

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161013
Semester – VI
Subject Name: Systems Engineering

Type of course: Programme Elective Course

Prerequisite: Knowledge of Control Theory, microprocessor/microcontroller hardware, programming concept in C, MATLAB : System Level Software.

Rationale: Systems Engineering plays crucial role in today's industry, where system level design, planning and implementation is generally achieved by interdisciplinary mode involving various branches of engineering to solve real life problems. It involves the project policies standards, human factor engineering in production lines.
Systems engineering is a discipline that utilizes an inter-disciplinary problem-solving approach across the entire technical effort irrespective of whether the systems or the systems of systems are for military, industrial, commercial or civil applications. This course will provide an overview of both theory and practice of the systems engineering discipline along with systems engineering design approach. The aim of the course is also to equip students with capability to develop system solutions that optimally fulfill customer objectives with available resources. Focus will be on creating now-how on solving open-ended problems, utilizing creativity, problem formulation, generation of need statements, requirements analysis, alternative solutions generation and examination, concurrent engineering design, enforcing various realistic aspects such as safety, reliability, manufacturability, operations, aesthetics, ethics, and sustainability.

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)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Fundaments of Systems Engineering, Discipline specific Engineering Standards: Systems Engineering: History and Examples, System Engineering as Profession, Power of System Engineering, Systems Engineering view Point, Perspectives, Domains, fields, approaches, activities and products, System Engineering Management(SEM), Program, /Project Life Cycle, Lifecycle Integration, Engineering standards	5
2	Complex System Structure: Building blocks, hierarchy, interfaces , environment, interactions, life cycle, evolutionary characteristics, Systems Engg method , Systems testing throughout development	3
3	Systems development Management: Work breakdown structure (WBS), Systems Engineering Management Plan (SEMP), Systems risk management, organizing for systems engg Need analysis – originating, operations, functional, and feasibility Need validation, systems opperations requirement System requirements development, performance requirements	4

4	Engineering Concept Stage: Concept exploration, validating requirements, Concept definition – selection and validation, functional analysis and allocation Systems architecture, system modeling languages, Model-Based Systems Engg (MBSE) Decision making, modeling for decisions Simulation, Trade-of analysis	**4**
5	Engineering development Stage: Program risk reduction, prototype development for risk mitigation, Development testing, risk reduction, Revision of functional analysis and design, Overview of probability data analysis, Hypothesis testing	**3**
6	Engineering design Stage: Implementing system building blocks, component design, Design validation, Change management Concepts of reliability, redundancy, Concepts of maintainability, availability, predictability, User interface design and GUI	**3**
7	Integration, testing and evaluation of Total system: Test planning and preparation, system integration Developmental and operational test and evaluation Engineering for production, transition from development to production, Production operations Installation, maintenance and upgrading Installation testing In-service support Upgrades and modernization	**6**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
5	**15**	**25**	**10**	**10**	**5**

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. *NASA Systems Engineering Handbook, NASA/SP-2007–6105 Rev 1*. Military Bookshop,
2. INCOSE,. *Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities*. 4th ed. Wiley, 2015. p. 304. ISBN: 9781118999400.
3. ISO/IEC/IEEE 15288:2015, Systems and Software Engineering—System Life Cycle Processes.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage

CO-1	Describe the most important Systems Engineering standards and best practices as well as newly emerging approaches	
CO-2	Structure the key steps in the systems engineering process starting with stakeholder analysis and ending with transitioning systems to operations	
CO-3	Analyze the important role of humans as beneficiaries, designers, operators and maintainers of aerospace and other systems	
CO-4	Characterize the limitations of the way that current systems engineering is practiced in terms of dealing with complexity, lifecycle uncertainty and other factors	
CO-5	Apply some of the fundamental methods and tools of systems engineering to a simple cyber-electro-mechanical system as a stepping stone to more complex and real world projects	

List of Experiments:

(General guidelines.. Institute may change list of experiments based on laboratory set up available)

1. Study of Project Management Software Platform/Tools
2. Study of Project Life Cycle Software Platform/ Tools
3. Study of Need Analysis Software Platform/ Tools
4. Study of Requirement Analysis Software Platform/ Tools
5. Study of Model Based System Engineering Software Platform/Tools (UML/ SysML, MATLAB, Simulink, LABVIEW etc.)
6. Study of Design Synthesis Software Platform/Tools
7. Design of cyber-electro-mechanical system
8. System Design of Unmanned Aerial Vehicle (UAV) System
9. System Design of Battery Operated Electric Vehicle
10. System Design of Automated Robotic arm
11. System Design of Underwater Vehicle
12. System Design of Nano Satellite for Local Communication
13. System Design of Smart Meter for Air Quality Monitoring /Control
14. System Design of Smart Meter for Water Quality/Water Management Monitoring /Control
15. System Design of Smart Meter for Electricity Distribution/Management Monitoring /Control

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject code: 3160002
Contributor Personality Development Program

SEMESTER VI

Type of course: Work-Personality Development

For Year: Pre-final year for all Diploma, Degree & Masters programmes over 2 semesters. For e.g. for Bachelors of Pharmacy and Engineering, the course will be conducted in Semesters V & VI.

Rationale: The Contributor Program aims to accomplish the following outcomes in the lives of students–

- Improve the employability of students by giving them the right work ethic and thinking that employers are looking for.
- Build their confidence with which they can go into any job and contribute meaningfully.
- Improve their ability to engage better in the workplace and to be able to handle the challenges that come up there.
- Build their career-worthiness and help them develop into future-ready contributors with ability to navigate a career in a volatile, changing world.
- Widen their choices of career and success, so that they are able to open up more opportunities for themselves and take up unconventional career pathways.
- Enable them to recognize how they, as technical professionals, can participate and make a positive contribution to their communities and to their state.

Towards this goal, the Contributor Program has been designed to awaken and strengthen students from within, in terms of building positive self-esteem, increasing their confidence level and I-can attitude, improving their aspirations, giving them new methods of thinking, building their cognitive capacities, exposing them to the skills and practices associated with being contributors in the workplace (not mere employees).

The Program content is also designed to expose students to real-world workplace scenarios and sensitize them to some of the challenges faced in society around them, especially in the local communities around them and in their own state of Gujarat.

The Contributor Program syllabus has been evolved and fine-tuned over several years, (a) to address the changing need and contemporary challenges being faced by industry and what employers of today are looking for in the people they hire and (b) by working extensively with universities and students building an appreciation of their challenges and concerns. At the core, the program is guided by the higher ideas and principles of practical Vedanta in work.

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	2	70	30	30	20	150

COURSE CONTENT :

Sr. No.	Content	Total Hrs
1	**Finding Solutions** The market environment in which organizations are operating, is becoming increasingly dynamic and uncertain. So, employers are increasingly seeking out people who can innovate and figure out solutions in the face of any challenge (unlike in the past when it was the	1.5 hrs Classroom engagement (including self-discovery/ solutioning sessions)

	people who were most efficient and productive, who were valued by organizations). At the heart of innovation lies this way of thinking of "finding solutions" rather than "seeing problems or roadblocks". Students learn how to build this way of thinking, in this topic.	
2	**Creating Value** Companies are also looking for employees who do not just work hard, or work efficiently or productively - but those who will make a valuable difference to the fortunes of the company. This difference may come from innovation, but it may also come from focusing on the right things and identifying what really matters – both to the company and to the customers. In this topic, students learn how to build this capability.	Same as above
3	**Engaging deeply** The environment we live in is becoming increasingly complex because more and more things are getting interconnected, new fields are emerging, technologies are rapidly changing, capabilities and knowledge one is trained in will become fast obsolete. In such a scenario, the student's ability to quickly understand and master what is going on, dive deep, get involved in any area, rapidly learn new capabilities that a job demands, is important. Engaging deeply is a core way of thinking that can help them in this. In this topic, students learn how to engage deeply.	Same as above
4	**Enlightened self-interest & collaboration at work** The changing nature of work in organizations and in the global environment is increasingly demanding that people work more collaboratively towards shared goals and more sustainable goals. A key to working successfully when multiple stakeholders are involved is "thinking in enlightened self-interest". In this topic, students learn how to develop this way of thinking (going beyond "narrow self-interest").	Same as above
5	**Human-centered thinking & Empathy** In this topic, students explore a human-centric approach to work – where the ability to recognize and respond to other people (whether they are users or customers or team members) as a human being with human needs and difficulties, is essential. This is at the heart of user-centric design of products and solutions, at the heart of genuine customer-centricity in services, and of any successful interaction with other people.	Same as above
6	**Trust Conduct** The biggest currency in a sustainable career is "trust" i.e. being trusted by team members, bosses, and customers. When we are trusted, people listen to us, they are willing to give us the chance to grow, give us the space to make mistakes, and work seamlessly with each other without always having to "prove ourselves". In this topic, students learn how to demonstrate conduct that builds the trust of people.	Same as above
Showcase Lab Sessions		3 hrs
Project work		Beyond classroom

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject code: 3160002

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

Reference resources:

A. Basic reference for both students and teachers

1. Contributor Personality Program textbook cum workbook developed by Illumine
2. Web-based ActivGuide™ for self-exploration of rich media resources to vividly understand many of the ideas, watch role models, learn from industry people, get reference readings – that help them enrich the understanding they gained in the class published by Illumine Foundation

B. Advanced reference for teachers

1. On Contributors, Srinivas V.; Illumine Ideas, 2011
2. Enlightened Citizenship and Democracy; Swami Ranganathananda, Bharatiya Vidya Bhavan, 1989
3. Eternal Values for a Changing Society – Vol I-IV, Swami Ranganathananda; Bharatiya Vidya Bhavan
4. Karma Yoga, Swami Vivekananda; Advaita Ashrama
5. Vivekananda: His Call to the Nation, Swami Vivekananda; Advaita Ashrama
6. Six Pillars of Self Esteem, Nathaniel Branden; Bantam, 1995
7. Mindset: The New Psychology of Success, Carol S. Dweck; Random House Publishing Group, 2007
8. Lasting Contribution: How to Think, Plan, and Act to Accomplish Meaningful Work, Tad Waddington; Agate Publishing, 2007
9. Why not?: how to use everyday ingenuity to solve problems big and small, Barry Nalebuff, Ian Ayres; Harvard Business School Press, 2003
10. The value mindset: returning to the first principles of capitalist enterprise (Ch 8 & 9); Erik Stern, Mike Hutchinson; John Wiley and Sons, 2004
11. The Power of Full Engagement: Managing Energy, Not Time, is the Key to High Performance and Personal Renewal, Jim Loehr, Tony Schwartz; Simon and Schuster, 2003
12. Creating Shared Value, Michael E. Porter and Mark R. Kramer; Harvard Business Review; Jan/Feb2011, Vol. 89 Issue 1/2
13. The Speed of Trust: The One Thing That Changes Everything, Stephen M. R. Covey, Rebecca R. Merrill, Stephen R. Covey; Free Press, 2008
14. The Courage to Meet the Demands of Reality, Henry Cloud; HarperCollins, 2009
15. Responsibility at work: how leading professionals act (or don't act) responsibly, Howard Gardner; John Wiley & Sons, 2007

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject code: 3160002

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
Outcome of theory sessions		
CO-1	Students will be able to recognize & appreciate the thinking required to find solutions in the face of any challenge.	10-12%
CO-2	Students will be able to recognize & appreciate different types of value that can be created and the different ways to create value for others.	10-12%
CO-3	Students will be able to recognize & appreciate how to engage deeply, and its need, value, payoffs and consequences in different contexts.	10-12%
CO-4	Students will be able to differentiate between 'enlightened self-interest' and 'narrow self-interest' & appreciate the payoffs/ consequences of both when working with multiple stakeholders.	10-12%
CO-5	Students will be able to recognize & appreciate the human side of situations or interactions or projects that will help them develop a more human-centric approach/ response to work.	10-12%
CO-6	Students will be able to recognize & appreciate conduct which builds trust of people in contrast to conduct which breaks trust of people - in teams / organization & the value of trust conduct in various situations.	10-12%
Outcome of practical sessions		
CO-7	Students complete their 'Contributor Showcase Profile' on the Showcase Platform. This includes (a) completing Illumine's Contributor Mindset Assessment (b) building evidence to demonstrate their functional orientations as contributors.	15%
CO-8	Students learn to apply contributor thinking to think-through and address real-world challenges.	15%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject code: 3160003
INTEGRATED PERSONALITY DEVELOPMENT COURSE

SEMESTER VI

TYPE OF COURSE –

- Value-based holistic personality development course for university students.

RATIONALE -

- This course aims to help a person understand and know his / her purpose in life, get a positive thought pattern, gain confidence, improve behaviour, learn better communication and develop a healthy physique with morality and ethics in its core.
- Todays youth lack the guidance to face insecurity about their health and career, premature relationships and family breakdown, addictions and substance abuse, negative impact of internet and social media etc. This course includes such topics that will cover all aspects and provide solution to the current challenges through creative and interactive activities.
- This course will allow students to enjoy, understand and practice invaluable lessons preparing them for a successful future.

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	2	70	30	30	20	150

COURSE CONTENT :

Lecture No.	Content	Hours
1	**Facing Failures** - Insignificance of Failures	2
2	**Facing Failures** - Power of Faith	2
3	**Facing Failures** - Practicing Faith	2
4	**From House to Home** - Bonding the Family	2
5	**Learning from Legends** - Leading without Leading (Pramukh Swami Maharaj)	2
6	**Review Lecture** – Words of Wisdom	2
7	**My India My Pride** - Glorius Past - Part 1	2
8	**My India My Pride** - Glorius Past - Part 2	2

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject code: 3160003

9	**My India My Pride** - Present Scenario	2
10	**Remaking Yourself** - Begin with the End in Mind	2
11	**My India My Pride** - An Ideal Citizen - 1 (Accountability - Responsibility - Honesty - Integrity)	2
12	**My India My Pride** - An Ideal Citizen - 2 (Loyalty - Sincerity - Punctuality)	2
13	**My India My Pride** - An Ideal Cititzen - 3 (Ethical & Moral Values/Practices)	2
14	**Financial Wisdom** - Financial Planning Process	2
15	**Review Lecture** - Student Voice-2	2

BASIC STUDY MATERIAL / MAIN COURSE WORK-BOOK -

1. IPDC Workbook-I
2. IPDC Workbook-II

IPDC REFERENCES –

- *These are the reference material for each lectures of IPDC.*

Module No.	Module/ Course Topics	Lectures	References
1	Facing Failures	Factors Affecting Failures Failures are not Always Bad Insignificance of Failures Power of Faith Practicing Faith	1. Thomas Edison's factory burns down, New York Times Archives, Page 1, 10/12/1914 2. Lincoln Financial Foundation, Abraham Lincoln's "Failures": Critiques, Forgotten Books, 2017 3. J.K. Rowling Harvard Commencement Speech | Harvard University Commencement, 2008 4. Born Again on the Mountain: A Story of Losing Everything and Finding It Back, Arunima Sinha, Penguin, 2014 5. Failing Forward: Turning Mistakes Into Stepping Stones for Success, John C. Maxwell, Thomas Nelson, 2007 6. Steve Jobs: The Exclusive Biography Paperback, Walter Isaacson, Abacus, 2015

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject code: 3160003

2	Learning from Legends	Tendulkar & Tata Leading Without Leading	1. Chase Your Dreams: My Autobiography, Sachin Tendulkar, Hachette India, 2017 2. Playing It My Way: My Autobiography, Sachin Tendulkar, Hodder & Stoughton, 2014 3. The Wit and Wisdom of Ratan Tata, Ratan Tata, Hay House, 2018 4. The Tata Group: From Torchbearers to Trailblazers, Shashank Shah, Penguin Portfolio, 2018 5. The Leader Who Had No Title, Robin Sharma, Jaico Publishing House, 2010 6. In the Joy of Others: A Life Sketch of Pramukh Swami Maharaj, Mohanlal Patel and BAPS Sadhus, Swaminarayan Aksharpith, 2013
3	Mass Management	Project Management	1. Project Management Absolute Beginner's Guide, Gregory Horine, Que Publishing, 2017 2. The Fast Forward MBA in Project Management, Eric Verzuh, Wiley, 2011 3. Guide to Project Management: Getting it right and achieving lasting benefit, Paul Roberts, Wiley, 2013
4	My India My Pride	Glorious Past - Part 1 Glorious Past - Part 2 Present Scenario An Ideal Citizen - 1 An Ideal Citizen - 2 An Ideal Citizen - 3	1. Hidden Horizons, Dr. David Frawley and Dr. Navaratna S. Rajaram, 2006 2. Rishis, Mystics and Heroes of India, Sadhu Mukundcharandas, Swaminarayan Aksharpith, 2011 3. Physics in Ancient India, Narayan Dongre, Shankar Nene, National Book Trust, 2016 4. The Rise of Civilization in India and Pakistan, Raymond Allchin, Bridget Allchin, Cambridge University Press, 1982 5. The Āryabhaṭīya of Āryabhaṭa: An Ancient Indian Work on Mathematics and Astronomy (1930), Walter Eugene Clark, University of Chicago Press, reprint, Kessinger Publishing, 2006
5	Remaking Yourself	Restructuring Yourself Power of Habit Being Addiction-Free Begin with the End in Mind Handling the Devil – Social Media	1. Power of Habit, Charles Duhigg, Random House Trade Paperbacks, 2014 2. Change Your Habit, Change Your Life, Tom Corley, North Loop Books, 2016 3. The Seven Habits of Highly Effective People, Stephen Covey, Simon & Schuster, 2013 4. Seven Habits of Highly Effective Teens, Sean Covey, Simon & Schuster, 2012 5. Atomic Habits, James Clear, Random House, 2018 6. How a handful of tech companies control billions of minds every day, Tristan Harris, TED Talk, 2017

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject code: 3160003

6	Financial Wisdom	Basics of Financial Planning Financial Planning Process	1. Rich Dad Poor Dad, Robert Kiyosaki, Plata Publishing, 2017 2. The Warren Buffett Way, Robert Hagstrom, Wiley, 2013 3. The Intelligent Investor, Benjamin Graham, Harper Business, 2006 4. Yogic Wealth: The Wealth That Gives Bliss, Gaurav Mashruwala, TV18 Broadcast Ltd, 2016
7	From House to Home	Affectionate Relationships Forgive & Forget Listening & Understanding Bonding the Family	1. "What Makes a Good Life? Lessons from the Longest Study on Happiness", R. Waldinger, Ted Talks, 2015 2. Long Walk To Freedom, Nelson Mandela, Back Bay Books, 1995 3. Outliers, Malcolm Gladwell, Back Bay Books, 2011
8	Soft Skills	Teamwork & Harmony Networking - Decision Making - Leadership	1. The 17 Indisputable Laws of Teamwork, John Maxwell, HarperCollins, 2013 2. Team of Teams: New Rules of Engagement for a Complex World, Stanley McChrystal, Portfolio, 2015 3. Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decisions, Harper Perennial, Dan Ariely, 2010
9	Review	Student Voice – 1 Student Voice – 2 Words of Wim	

COURSE OUTCOMES –

- To provide students with a holistic education – focused on increasing their intelligence quotient, physical quotient, emotional quotient and spiritual quotient.
- To provide students with hard and soft skills, making them more marketable when entering the workforce.
- To educate students on their social responsibilities as citizens of India and have a greater sense of social responsibility.
- To provide students with a value-based education which will enable them to be successful in their family, professional, and social relationships by improving their moral and ethical values.
- To teach self-analysis and self-improvement exercises to enhance the potential of the participants.
- To have a broader sense of self-confidence and a defined identity.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161003

Semester – VI
Subject Name: Antennas and Propagation

Type of course: Compulsory

Prerequisite: Higher Engineering Mathematics, Fundamental knowledge of Engineering Electromagnetics (Maxwell's equations, three basic coordinate systems and polarization).

Rationale:
PDDC Students of EC Engineering need to possess good understanding of the fundamentals and applications of Antenna and wave propagation, including radiation from point sources as applied to antenna, antenna types and their radiation patterns. They are expected to be able to design different antennas for specific given frequency and application. They should be acquainted with concept of arrays and antenna measurement methods. They will be practiced in study of antenna radiation patterns and in measurement of different antenna parameters. They will be able to design and analyze some basic antennas in hardware and application specific antenna in HFSS or CST.

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)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Basic antenna concepts**: Definition and functions of an antenna, comparison between an antenna & transmission line, radio communication link with transmitting antenna and a receiving antenna, radiation patterns of antennas-field and power patterns, all antenna types.	3
2	**Radiation of Electric dipole:** Potential functions and the electromagnetic field, Oscillating electric dipole-derivations for E and H field components in spherical coordinate systems, Power Radiated by a current element, Application to antennas, Radiation from quarter wave monopole and half wave dipoles, Derivation for radiation resistance, application of reciprocity theorem to antennas, equality of directional patterns and effective lengths of transmitting and receiving antennas, directional properties of dipole antennas, antenna feeding methods.	5
3	**Antenna parameters and definitions:** beam area, beam width- Half-Power Beam width (HPBW)and First Null Beam width(FNBW) ,Polarisation, Radiation Intensity ,Beam Efficiency, Directivity and	5

	directive gain, radiation resistance, radiation efficiency, resolution, Antenna aperture-physical and effective apertures, effective height, transmission formula, antenna field zones, Transmission loss as a function of frequency. Antenna temperature and signal to noise ratio.	
4	**Arrays of point sources :** Expression for electric fields from two, three and N element arrays- linear arrays: Broad-side array and End-Fire array- Method of pattern multiplication- Binomial array- Horizontal and Vertical Antennas above the ground plane, Effect of ground on ungrounded antenna, Schelkunoff theorems for linear arrays, Dolph-Tchebysheff distribution for linear arrays.	**6**
5	**Loop Antenna:** Small loop short magnetic dipole, comparison of far field of small loop and short dipole loop antennas, field pattern of circular loop antenna & radiation resistance of loop antenna, directivity of circular loop antennas with uniform current.	**2**
6	**Helical antenna:** Helical geometry, transmission radiation modes, practical design considerations, wide band characteristics of helical antenna.	**2**
7	**Arrays of dipoles & apertures**: 3 element dipole Array with parasitic elements, Yagi-Uda array-function and its design, Phased arrays, frequency scanning arrays, smart antennas, long wire antennas, location methods of feeding antennas, folded dipole antennas, matching arrangements.	**4**
8	**Reflector antennas**: Parabolic reflector, paraboloidal reflector, aperture Pattern of large circular apertures with uniform illumination, off axis operation of paraboloidal reflectors, Cassegrain feed system.	4
9	**Slot patch & Horn antennas**: Slot antenna, its pattern, Babinet's principle and complementary antennas, impedance of slot antennas, and horn antenna-function and types.	3
10	**Microstrip (patch) antennas :** Rectangular and circular types-function, features analysis ,design considerations and applications	4
11	**Lens antennas**: Non-metallic Dielectric lens and artificial dielectric lens antennas, reflector lens antennas.	2
12	**Broadband & Freq. Independent antennas**: Broadband antenna, Frequency independent antenna, log periodic antennas.	2
13	**Antennas for special applications:** Antennas design consideration for satellite communication, antenna for terrestrial mobile communication systems, GPR, Embedded antennas, UWB, Plasma antenna.	2
14	**Antennas measurements**: Experimental set ups for measurement of radiation patterns, gain, phase polarization, terminal impedance.	2
15	**Radio wave propagation** : Modes of propagation, Ground Wave Propagation, Structure of troposphere and ionosphere, Characteristic of Ionospheric layers, Sky wave propagation, Definitions for Virtual height, MUF and Skip distance, OWF, Fading, ionospheric absorptions, Multi-hop propagation, Space wave propagation and Super refraction.	6

Reference Books:

1. "Antennas for all applications", J.D. Krauss 3RD Edition (TMH)
2. "Electromagnetic wave & radiating systems", Jordan & Balmain PHI Publication
3. "Antenna & Wave Propagation", K.D. Prasad Satyaprakash Publications
4. "Antenna Theory: Analysis and design", C. Balanis Wiley India

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the radiation phenomenon and identify different types of antennas	20
CO-2	Create strong foundation of basic antenna parameters.	25
CO-3	Design and analyze different antennas, antenna arrays **a**nd matching / feeding networks for antennas	25
CO-4	Demonstrate the antenna measurement techniques.	10
CO-5	Understand the fundamentals of radio-wave propagation	20

List of Experiments:

Sr.No.	**Experiment Title**
1.	To study the variation of radiated field with distance from transmitting antenna.
2.	To demonstrate the reciprocity theorem for transmitting and receiving radiation patterns of an antenna.
3.	To plot the radiation pattern of an Omni directional antenna.
4.	To plot radiation pattern of directional antenna.
5.	To study Phenomena of Circular, Linear and Elliptical Polarization of antennas.
6.	To study and plot the radiation pattern of the dipole/Folded dipole antennas in Azimuth & Elevation planes.
7.	To study and plot the radiation pattern of the helical antenna.

8.	To study and plot the radiation pattern of the parabolic reflector.
9.	To study and plot the radiation pattern of the Log-Periodic antenna.
10.	To study and plot the radiation pattern of the Broadside antennas and Measure its Gain, Bandwidth and Beam width.
11.	To plot radiation pattern of 3λ/2 dipole antenna and compare with λ/2 dipole antenna.
12.	To plot the radiation pattern of a Slot antenna.
13.	Design and simulate micro strip patch antenna in HFSS simulator.

Major Equipment:

1. RF Synthesizer
2. RF Detector or spectrum analyzer
3. Antenna kit

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161005
Semester – V
Subject Name: Fiber Optic Communication

Type of course: NA

Prerequisite: Semiconductor Physics, Electromagnetic, Mode theory of waveguide, Analog Communication.

Rationale: To introduce the students to various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system, optical amplifiers, fiber network elements, basic optical components, and techniques of fiber optic measurement.

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Overview of Optical fiber Communications :** Electromagnetic spectrum, Optical Spectral bands, Evolution of fiber optic system, Multiplexing Techniques, Elements of an optical fiber transmission link with the functional description of each block, WDM concepts, transmission widows, advantages of optical fiber link over conventional copper systems, applications of fiber optic transmission systems.	2	6
2	**Optical fibers : Structures, Wave guiding and Fabrication** : Optical laws and definitions, optical fiber modes and configurations, Mode theory, Step Index and Graded Index (GI) fibers ,single mode and graded index fibers, Derivation for numerical aperture, V number and modes supported by step index fiber, mode field ,Numerical aperture and modes supported by GI fibers, fiber materials, linearly Polarized modes fiber fabrication techniques, and mechanical properties of fibers, fiber optic cables.	6	13
3	**Signal Degradation in Optical Fibers :** Attenuation, signal distortion in optical waveguides, pulse broadening in graded index fiber, Characteristics of Single Mode Fibers, mode coupling, International Standards for optical transmission fibers.	5	10
4	**Optical Sources :** Semiconductor Physics background, Light emitting diode (LEDs)- structures,	4	12

	materials, Figure of merits, characteristics & Modulation. Laser Diodes -Modes & threshold conditions, Diode Rate equations, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, Spectral width , temperature effects, and Light source linearity.		
5	**Power Launching and Coupling :** Source to fiber power launching, Lensing schemes, fiber-to-fiber joints, LED coupling to single mode fibers, fiber splicing, Optical fiber connectors.	**4**	**8**
6	**Photodetectors :** Principles of operation, types, characteristics, figure of merits of detectors photodiode materials, photodetector noise, detector response time,temperature effects on gain, comparison of photodetectors.	**4**	**8**
7	**Optical Receiver Operation :** Receiver operation, Preamplifier types, receiver performance and sensitivity, Eye diagrams, Coherent detection, Specification of receivers.	**4**	**10**
8	**Transmission Systems :** Point –to-point link –system considerations, Link power budget and rise time budget methods for design of optical link, BER calculation	**3**	**6**
9	**Optical Amplifiers :** Semiconductor optical Amplifier, EDFA, Raman Amplifier, Wideband Optical Amplifiers	**4**	**5**
10	**Advances in Optical Fiber Systems :** Principles of WDM, DWDM, Telecommunications & broadband application, SONET/SDH, MUX, Analog & Digital broadband, optical switching.	**3**	**10**
11	**Overview of Optical Components :** Optical couplers, Tunable sources and Filters ,optical MUX/DEMUX, Arrayed waveguide grating, optical add drop multiplexer (OADM), optical cirulators, attenuators, optical cross connects, wavelength converter, Mach-Zender Interferometer	**3**	**6**
12	**Fiber Optical Measurements :** Test Equipments, OTDR , Set ups for Measurement of Attenuation, Dispersion, NA and EYE pattern .	**3**	**6**

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**10**	**15**	**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. Optical Fiber Communications by Gerd Keiser, 4th Edition (Mc Graw Hill)
2. Optical Fiber Communication by John M. Senior (PHI/Pearson)
3. Fiber optical communication Technology by Djafar Mymbaev & Lowell L, Scheiner. (Pearson)
4. Fiber optic Communication Systems by G. Agrawal (John Wiley and sons)

Course Outcome:

After completion of this course students will be able …

Sr. No.	CO statement	Marks % weightage
CO-1	To understand the principles and operation of fibre optic communication system	40
CO-2	To be familiar with use of various optical components constituting optical fiber links and to calculate different kind of losses and signal distortion	25
CO-3	Design an optical fiber link with encapsulation of different system components.	25
CO-4	Understand the measurement techniques for performance parameters of optical fiber	10

List of Experiments:

1. Setting -up of Analog/ Digital Optical communication Link
2. Measurement of attenuation characteristics of an optical fiber
3. Measurement of NA of a multimode fiber
4. Measurement of Mode field diameter of a single mode fiber.
5. Measurement of Dispersion of optical fiber
6. Performance of PAM on fiber optic link
7. Performance of PWM on fiber optic link
8. Performance of PPM on fiber optic link

9. Measurement of attenuation with OTDR
10. Measurement of emission wavelength of LED/LASER source
11. Measurement of Data quality with EYE PATTERN
12. Preparation of optical fiber end and practices on splicing/connectorization.
13. Performance of TDM on fiber optic link
14. Setting -up of voice link on Optical communication Link.
15. Performing Experiments on the VI characteristics of the optical Sources.
16. Performing Experiments on the characteristics of the optical detectors.
17. Simulation based Experiments and Design using Optisystem.

Major Equipments: Fiber Optical Trainer Kit, Laser Source, Photo Detector, Optical Power Meter, OTDR,WDM trainer setup, splicing and connector kits.

List of Open Source Software/learning website:

- http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Optical%20Communication/Course%20Objective.htm
- OptiSystem Version 14.0 Software
- NPTEL Videos.
- AICTE SWYAM Portal.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161007
Semester – VI
Subject Name: Computer Networks

Type of course: Elective

Prerequisite: Basics of Computer hardware and software

Rationale: This course imparts a unified system view of the broad field of data and computer communications. The fundamentals of data communication are thoroughly explained to an extent of implementation in various networks.

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Data Communication and Networking Data communication, use of Networks, Internet Protocols and standards, layering of Models, OSI model, TCP/IP Internet model.	2
2	Physical Layer Transmission media (Twisted pair, Coaxial cable, Fiber optic cable), Wireless Medium as Physical Layer (Electromagnetic Spectrum, ISM Band, Lighwave Transmission), Circuit switching, DSL technology, Cable modem.	4
3	Data Link Layer Services to N/W layer, Framing, Bit Stuffing, Character Stuffing, Error control, Flow control mechanism stop & wait, Go-back-, Selective repeat. Example data link protocol HDLC, PPP.	7
4	Medium Access Layer Channel allocation problem, Multiple Access, CSMA, CSMA/CD, CSMA/CA	5
5	Local Area Network Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN, Blue tooth, Zigbee, Connecting devices- Repeaters, Hub, Bridges, Switch, Router, Gateways, Broadband Wireless Networks	7
6	Network Layer Packet Switching, Virtual circuits and datagram, Static and Dynamic Routing Algorithms (Optimality principle, Static Routing Algorithms: Shortest Path, Flooding, Dynamic routing Algorithms: Distance Vector, Link state routing.), Congestion Control, IP	8

	Addressing, CIDR & NAT, IP layer protocols (ICMP, ARP, RARP, DHCP, BOOTP), IPv4 and IPv6.	
7	Transport layer Elements of Transport protocols - TCP & UDP	4
8	Application Layer DNS- Domain Name System, E-mail, FTP, HTTP, WWW, Firewall, Network Security	5

Reference Books:

1. Computer Networks by Andrew S. Tanenbaum, 4th Edition, Prentice Hall Publication
2. Data Communication and Networking by Behrouz Forouzan, 4th Edition, Tata McGraw-Hill Publication
3. Data and Computer Communication by William Stallings, Prentice Hall Publication
4. Computer Networks by Bhushan Trivedi, Oxford Publication
5. Computer networking: A top-down approach featuring the internet by Kurose, F James, 3rd Edition, Pearson Education India.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Differentiate unique responsibilities and tasks performed by various layers in top-down and bottom-up approach of data flow	10%
CO-2	Design and troubleshoot customized small scale – short distance to large scale long distance networks to mitigate network hardware aspect	30%
CO-3	Simulate, modify, develop and implement algorithms and protocols at different layers to mitigate implementation aspects of the networks	45%
CO-4	Identify various network threats and implement standard security algorithms for safe and effective utilization of the Internet	15%

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Tentative / Proposed List of Experiments:

1. Implementation of bit stuffing and de-stuffing

2. Implementation of character stuffing and de-stuffing

3. Implementation of parity checker

4. Implementation of CRC

5. Implementation of checksum

6. Implementation of pure and slotted ALOHA

7. Implementation of shortest path algorithm

10. Implementation of encryption and decryption algorithms

Design based Problems (DP)/Open Ended Problems:

1. Identification of various networks components

a. Connections, BNC, RJ-45, I/O box
b. Cables, Co-axial, twisted pair, UTP
c. NIC (network interface card)
d. Switch, Hub

2. Sketch network diagram of any network

3. Interfacing with the network card (Ethernet)

4. Preparing of network cables

5. Establishment of a LAN

6. Troubleshooting of networks

7. Installation of Linux operating System and basic commands

8. Introduction to Network Simulation Tools like Cisco Packet Tracer (CPT)

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List of Open Source Software/ Learning website:

1. **Virtual Lab: http://vlabs.iitkgp.ernet.in/ant/**
2. **Learning Website:** http://nptel.ac.in