



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170001

Semester –VII

Subject Name: Summer Internship

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
0	0	4	2	0	0	80	20	100

The duration of internship will be two weeks. It will be after completion of 6th Semester and before the commencement of Semester VII.

Following five options can be opted by the students:

1. Offline internship in industry - Internship in industry subjected to permissions from Government and concern Industry subject to the conditions of following the SOP issued by Government and written consent of the student and parents. Student is supposed to produce joining letter and relieving letter once the internship is over in case of Offline internship in any industry.
2. Online internship in industry / other agencies
3. Seminar by student under mentorship of a faculty. The topic shall be as per UG Syllabus topics
4. Preparation of consolidated report on survey of materials used in the respective branch of the student. The work should include the study of catalogues, price list specifications, properties, usage notes and other technical details and drawings etc, Work shall be carried out under the guidance of faculty. A detailed report shall be submitted. It shall be done by only one student. It is to be completed individually.
5. A Mini Project- on some suitable topic related to respective branch. It can be small fabrication / experimental results/ simulations / Programmes/ application development etc depending on the branch of the student. Preferably a single student should do it.

Other guidelines:

- Student has to prepare detailed report and submit to his/her college. A copy of report can be kept in the departments for record.
- Each student must be assigned a faculty as a mentor from the college and an Industry expert as co-mentor.
- The evaluation of the work done by students will be carried out after 2 weeks by the internal and external examiner.
- External examiner will evaluate for 80 marks and internal examiner will evaluate for 20 marks.
- The presentation by student in the presence of all student is desirable.

Student should produce successful completion certificate in case of offline / online internship in industry.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Computer Engineering

Subject Code: 3170701

Semester – VII

Subject Name: Compiler Design

Type of course: Compulsory/Core

Prerequisite: Algorithms, Data Structures, Assembly Language Program, Theory of Computation, C/C++ Programming Skills

Rationale: Compiler Design is a fundamental subject of Computer Engineering. Compiler design principles provide an in-depth view of translation, optimization and compilation of the entire source program. It also focuses on various designs of compiler and structuring of various phases of compiler. It is inevitable to grasp the knowledge of various types of grammar, lexical analysis, yacc, FSM(Finite State Machines) and correlative concepts of languages.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		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	Overview of the Compiler and its Structure: Language processor, Applications of language processors, Definition-Structure-Working of compiler, the science of building compilers, Basic understanding of interpreter and assembler. Difference between interpreter and compiler. Compilation of source code into target language, Cousins of compiler, Types of compiler	03
2	Lexical Analysis: The Role of the Lexical Analyzer, Specification of Tokens, Recognition of Tokens, Input Buffering, elementary scanner design and its implementation (Lex), Applying concepts of Finite Automata for recognition of tokens.	05
3	Syntax Analysis: Understanding Parser and CFG(Context Free Grammars), Left Recursion and Left Factoring of grammar Top Down and Bottom up Parsing Algorithms, Operator-Precedence Parsing, LR Parsers, Using Ambiguous Grammars, Parser Generators, Automatic Generation of Parsers. Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L-Attributed Definitions, syntax directed definitions and translation schemes	11



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4	Error Recovery Error Detection & Recovery, Ad-Hoc and Systematic Methods	04
5	Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Syntax Directed Translation Mechanisms, Attributed Mechanisms And Attributed Definition.	05
6	Run-Time Environments: Source Language Issues, Storage Organization. Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management,	04
7	Code Generation and Optimization: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Machine dependent optimization, Machine independent optimization Error detection of recovery	06
8	Instruction-Level Parallelism: Processor Architectures, Code-Scheduling Constraints, Basic-Block Scheduling, Pass structure of assembler	04

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	25	20	10	05	00

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.

Text Books

1. Compiler Tools Techniques - A.V.Aho, Ravi Sethi, J.D.Ullman, Addison Wesley
2. The Theory And Practice Of Compiler Writing - Trembley J.P. And Sorenson P.G. Mcgraw-Hill

Reference Books:

1. Modern Compiler Design - Dick Grune, Henri E. Bal, Jacob, Langendoen, WILEY India
2. Compiler Construction - Waite W.N. And Goos G., Springer Verlag
3. Compiler Construction-Principles And Practices - D.M.Dhamdhare, Mcmillian
4. Principles of Compiler Design, V. Raghavan, McGrawHill



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Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the basic concepts; ability to apply automata theory and knowledge on formal languages.	35
CO-2	Ability to identify and select suitable parsing strategies for a compiler for various cases. Knowledge in alternative methods (top-down or bottom-up, etc).	25
CO-3	Understand backend of compiler: intermediate code, Code optimization Techniques and Error Recovery mechanisms	25
CO-4	Understand issues of run time environments and scheduling for instruction level parallelism.	15

Sample List of Experiments

Sr No	Title of Experiment
1	Implementation of Finite Automata and String Validation
2	Introduction to Lex Tool.
3	Implement following Programs Using Lex a. Generate Histogram of words b. Ceasor Cypher c. Extract single and multiline comments from C Program
4	Implement following Programs Using Lex a. Convert Roman to Decimal b. Check weather given statement is compound or simple c. Extract html tags from .html file
5	Implementation of Recursive Descent Parser without backtracking Input: The string to be parsed. Output: Whether string parsed successfully or not. Explanation: Students have to implement the recursive procedure for RDP for a typical grammar. The production no. are displayed as they are used to derive the string.
6	Finding "First" set Input: The string consists of grammar symbols. Output: The First set for a given string. Explanation: The student has to assume a typical grammar. The program when run will ask for the string to be entered. The program will find the First set of the given string.
7	Generate 3-tuple intermediate code for given infix expression
8	Extract Predecessor and Successor from given Control Flow Graph
9	Introduction to YACC and generate Calculator Program
10	Finding "Follow" set Input: The string consists of grammar symbols. Output: The Follow set for a given string. Explanation:



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	The student has to assume a typical grammar. The program when run will ask for the string to be entered. The program will find the Follow set of the given string.
11	Implement a C program for constructing LL (1) parsing.
12	Implement a C program to implement LALR parsing.
13	Implement a C program to implement operator precedence parsing.

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170710

MOBILE COMPUTING AND WIRELESS COMMUNICATION

7th Semester

Type of course: Professional Elective

Prerequisite: Computer Network

Rationale: Wireless communication provides mobility, flexibility, convenience. Wireless communication devices are used in various areas including healthcare. Wireless communication has opened many areas for research also.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA	ESE (V)	PA (I)		
3	0	0	3	70	30	0	0	100

Sr. No.	Content	Total Hrs.
1	Introduction, Transmission Fundamentals: Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, Transmission Media, Multiplexing Communication Networks: LANs, MANs and WANs, Switching Techniques, Circuit Switching, Packet Switching	07
2	Cellular Wireless Networks: Principles of Cellular Networks, First-Generation Analog Second-Generation TDMA Second-Generation CDMA, Third-Generation Systems Antennas and Propagation: Antennas, Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment Spread Spectrum- The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum Coding and Error Control: Error Detection, Block Error Correction Codes, Convolutional Codes, Automatic Repeat Request	10
3	Multiple access in Wireless System: Multiple access scheme, frequency division multiple access, Time division multiple access, code division multiple access, space division multiple access, packet radio access, multiple access with collision avoidance. Global system for mobile communication: Global system for mobile communication, GSM architecture, GSM entities, call routing in GSM, PLMN interface, GSM addresses and identifiers, network aspects in GSM, GSM frequency allocation, authentication, and security. General packet radio service (GPRS): GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, Applications of GPRS, Billing and charging in GPRS. Wireless System Operations and Standards: Cordless Systems, Wireless Local Loop, WiMAX and IEEE 802.16 Broadband Wireless Access Standards Mobile IP and Wireless Application, Protocol	13
4	Wi-Fi and the IEEE 802.11 Wireless LAN Standard: IEEE 802.11 architecture and services, IEEE 802.11 Medium access control, IEEE 802.11 physical layer, Wi-Fi	04



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	protected access.	
5	Bluetooth: Radio specification, baseband specification, link manager specification, logical link control and adaption protocol.	04
6	Android APIs, Android Architecture, Application Framework, The Application components, The manifest file, downloading and installing Android, Exploring the Development Environment, Developing and Executing the first Android application, Working with Activities, The Linear Layout , The Relative Layout , The Scroll View Layout, The Table Layout, The Frame Layout, Using the Text View, Edit Text View, Button View, Radio Button, Checkbox, Image Button, Rating Bar, The options Menu, The Context Menu.	07

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	40	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. Wireless Communications & Networks, Second Edition, William Stallings by Pearson.
2. Mobile Computing Technology, Applications, and service creation by Asoke K Telukder, Roopa R. Yavagal, TMH.
3. Wireless Communications, Principles and Practices by T. S. Rappaport, Pearson Education India.
4. Android Application Development Black Book by Pradeep Kothari, Dreamtech Press.
5. Wireless and Mobile Networks by Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S.Kakkasageri, WILEY.
6. Wireless Networks by P. Nicopolitidis, M.S. Obaidat, G. I. Papadimitriou, A.S.Pomportsis by Wiley
7. Mobile Computing by Raj Kamal, Oxford.
8. Mobile Computing Theory and Practice-Kumkum Garg-Pearson.
9. Lauren Darcey and Shane Conder, Android Wireless Application Development, Pearson Education, 2nd ed. (2011).



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Course Outcome: After learning the course the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
CO-1	Understand the mobile and wireless network systems such as 2G/3G/4G	20
CO-2	Understand GSM and GPRS	20
CO-3	Implement various error coding techniques.	10
CO-4	Differentiate between multiple access schemes and various Spread Spectrum techniques.	25
CO-5	Understand the working with local area network, Bluetooth and Android APIs environment.	25

List of Open-Source Software/learning website:

<http://www.wirelessdevnet.com/>

<http://www.protocols.com/>

www.tutorialspoint.com/mobile_computing



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Bachelor of Engineering

Subject Code: 3170717

CLOUD COMPUTING

Semester - 7th Semester

Type of course: Professional Elective

Prerequisite: Fundamentals of Distributed Computing

Rationale: This course aims students to understand the hardware, software concepts and architecture of cloud computing. Students realize the importance of Cloud Virtualization, Abstractions and Enabling Technologies.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Contents:

Sr. No.	Content	Total Hrs
1	Introduction: Cloud Computing, Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Virtualization: Virtualization of Computing, Storage and Resources. Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS	04
2	Software as a Service (SaaS): Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms. Infrastructure As a Services (IaaS): Introduction, Background & Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. Platform As a service (PaaS): Integration of Private and Public Cloud, Technologies and Tools for Cloud Computing, Resource Provisioning services	08
3	Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Center Automation	08
4	Cloud Infrastructure and Cloud Resource Management: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards	08
5	Security: Security Overview, Cloud Security Challenges and Risks, Software-as-a Service Security, Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Data Security, Application Security, Virtual Machine Security, Identity and Presence, Identity Management and Access Control, Autonomic Security Establishing Trusted Cloud	07



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	computing, Secure Execution Environments and Communications, , Identity Management and Access control Identity management, Access control, Autonomic Security Storage Area Networks, Disaster Recovery in Clouds.	
6	Cloud Middleware: OpenStack, Eucalyptus, Windows Azure, CloudSim, EyeOs, Aneka, Google App Engine	05
7	Cloud Based Case-Studies: Overview of Cloud services, Designing Solutions for the Cloud, Implement & Integrate Solutions, Emerging Markets and the Cloud, Tools for Building Private Cloud: IaaS using Eucalyptus, PaaS on IaaS - AppScale	05

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	30	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 from above table.

Books:

1. Rajkumar Buyya, James Broberg, Andrzej M Goscinski, Cloud Computing: Principles and Paradigms, Wiley publication.
2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media.
3. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication.
4. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press.

Course Outcomes: Students will be able to

Sr. No.	CO Statement	Marks % Weightage
1	Compare the strengths and limitations of cloud computing	15
2	Identify the architecture, infrastructure and delivery models of cloud computing	25
3	Apply suitable virtualization concept.	20
4	Choose the appropriate cloud player, Programming models and approach	20
5	Address the core issues of cloud computing such as security, privacy and interoperability	20

List of Open Source Software/learning website:

- technolamp.blogspot.com
- www.intelligentedu.com/
- NITTR Instructional Resources Videos



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170722

BIG DATA ANALYTICS

B.E. 7th Semester

Type of course: Elective

Prerequisite: Programming skills

Rationale: Today's world is a data-driven world. Increasingly, the efficient operation of organizations across sectors relies on the effective use of vast amounts of data. Big data analytics helps us to examine these data to uncover hidden patterns, correlations, and other insights. It is a fast-growing field and skills in the area are some of the most in-demand today.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Syllabus:

Sr. No.	Content	Total Hrs
1	Introduction to Big Data: Introduction to Big Data, Big Data characteristics, Challenges of Conventional System, Types of Big Data, Intelligent data analysis, Traditional vs. Big Data business approach, Case Study of Big Data Solutions.	04
2	Hadoop: History of Hadoop, Hadoop Distributed File System: Physical organization of Compute Nodes, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features, Hadoop environment. Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, security in Hadoop, Administering Hadoop, Monitoring-Maintenance, Hadoop benchmarks, Hadoop in the cloud	12
3	NoSQL: What is NoSQL? NoSQL business drivers; NoSQL case studies; NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns; Using NoSQL to manage big data: What is a big data NoSQL solution? Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; Four ways that NoSQL systems handle big data problems	07
4	Mining Data Stream: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating moments, Counting oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	10
5	Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper, IBM InfoSphere BigInsights and Streams.	08



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6	Spark: Introduction to Data Analysis with Spark, In-Memory Computing with Spark, Spark Basics, Interactive Spark with PySpark, Writing Spark Applications	07
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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	30	20	15	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) Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007
- 2) Bill Franks, "Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics", Wiley
- 3) Anand Rajaraman and Jeff Ullman "Mining of Massive Datasets", Cambridge University Press,
- 4) Michael Minelli, Michele Chambers, Ambiga Dhiraj, "Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses", Wiley India
- 5) Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley.
- 6) Chris Eaton, Dirk derooset al., "Understanding Big data", McGraw Hill, 2012.
- 7) BIG Data and Analytics, Seema Acharya, Subhashini Chhellappan, Willey
- 8) MongoDB in Action, Kyle Banker, Piter Bakkum, Shaun Verch, Dream tech Press
- 9) Tom White, "HADOOP: The Definitive Guide", O Reilly 2012.
- 10) Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packet Publishing 2013.
- 11) Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau

Course Outcome:

After learning the course, the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
1	identify big data application areas	15%
2	use big data framework	30%
3	model and analyze data by applying selected techniques	25%
4	demonstrate an integrated approach to big data	30%



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Subject Code: 3170722

List of Experiments and Design based Problems (DP)/Open Ended Problem:

Case Study:

Stage 1:

Selection of case study topics and formation of small working groups of 2/3 students per group. Students engage with the cases, read through background material provided in the session and work through an initial set of questions to deepen the understanding of the case. Sample applications and data will be provided to help students familiarize themselves with the cases and available (big) data.

Stage 2:

The groups are given a specific task relevant to the case in question and are expected to develop a corresponding big data concept using the knowledge gained in the course and the parameters set by the case study scenario. A set of questions that help guide through the scenarios will be provided.

Stage 3:

Each group prepares a short 2 – 5 page report on their results and a 10 min oral presentation of their big data concept.

Apart from case student students will perform at the following programming exercises:

1. Implement following using Map- Reduce
 - a. Matrix multiplication
 - b. Sorting
 - c. Indexing
2. Distributed Cache & Map Side Join, Reduce side Join Building and Running a Spark Application Word count in Hadoop and Spark Manipulating RDD
3. Implementation of Matrix algorithms in Spark Sql programming
4. Implementing K-Means Clustering algorithm using Map-Reduce
5. Implementing any one Frequent Item set algorithm using Map-Reduce
6. Create A Data Pipeline Based On Messaging Using PySpark And Hive - Covid-19 Analysis

List of Open Source Software/learning website:

1. <http://in.reuters.com/tools/rss>
2. <http://www.altova.com/xmlspy.html>
3. <https://www.w3.org/RDF/>



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170724
Semester – VII
Subject Name: Machine Learning

Type of course: Elective

Prerequisite: Programming and Data Structure, Algorithms, Probability and Statistics

Rationale: The objective of the course is to introduce the students with concepts of machine learning, machine learning algorithms and building the applications using machine learning for various domains.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:g

Sr. No.	Content	Total Hrs
1	Introduction to Machine Learning: Overview of Human Learning and Machine Learning, Types of Machine Learning, Applications of Machine Learning , Tools and Technology for Machine Learning .	02
2	Preparing to Model: Machine Learning activities, Types of data in Machine Learning, Structures of data, Data quality and remediation, Data Pre-Processing: Dimensionality reduction, Feature subset selection.	04
3	Modelling and Evaluation: Selecting a Model: Predictive/Descriptive, Training a Model for supervised learning, model representation and interpretability, Evaluating performance of a model, Improving performance of a model.	05
4	Basics of Feature Engineering: Feature and Feature Engineering, Feature transformation: Construction and extraction, Feature subset selection : Issues in high-dimensional data, key drivers, measure and overall process	03
5	Overview of Probability: Statistical tools in Machine Learning, Concepts of probability, Random variables, Discrete distributions, Continuous distributions, Multiple random variables, Central limit theorem, Sampling distributions, Hypothesis testing, Monte Carlo Approximation	04
6	Bayesian Concept Learning: Importance of Bayesian methods, Bayesian theorem, Bayes' theorem and concept learning, Bayesian Belief Network	05



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7	Supervised Learning: Classification and Regression: Supervised Learning, Classification Model, Learning steps, Classification algorithms, Regression, Regression algorithms,	10
8	Unsupervised Learning: Supervised vs. Unsupervised Learning, Applications, Clustering, Association rules	06
9	Neural Network: Introduction to neural network, Biological and Artificial Neurons, Types of Activation functions, Implementation of ANN, Architecture, Learning process, Backpropagation, Deep Learning	06

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	14	21	14	7	7

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

Reference Books:

1. Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2. Machine Learning with Python for Everyone, Mark Fenner, Pearson
3. Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
4. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
5. Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Explore the fundamental issues and challenges in Machine Learning including data and model selection and complexity	25
CO-2	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms	15
CO-3	Evaluate the various Supervised Learning algorithms using appropriate Dataset.	25
CO-4	Evaluate the various unsupervised Learning algorithms using appropriate Dataset.	20
CO-5	Design and implement various machine learning algorithms in a range of real-world applications.	15



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Subject Code: 3170724

List of Experiments:

Minimum 10 Experiments are to be designed covering various activities and algorithms in machine learning with datasets from different domains

List of e-Learning Resources:

1. <https://www.geeksforgeeks.org/machine-learning/>
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. <https://nptel.ac.in/>
4. <https://www.coursera.org/>

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171614

COMPUTER VISION

B.E. 7th Semester

Type of course: Professional Elective

Prerequisite: Calculus, Linear algebra, Probability, Programming knowledge

Rationale: In this course students will learn basic principles of image formation, image processing algorithms and recognition from single or multiple images (video). This course emphasizes the core vision tasks of scene understanding and recognition. Applications to object recognition, image analysis, image retrieval and object tracking will be discussed.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Contents:

Sr. No.	Content	Total Hrs
1	Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation	7
2	Image Processing: Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal	9
3	Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations	7
4	Segmentation: Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, mean shift and model finding, Normalized cut	6
5	Camera calibration: camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models.	5
6	Motion representation: the motion field of rigid objects; motion parallax; optical flow, the image brightness constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation	4
7	Motion tracking: statistical filtering; iterated estimation; observability and linear systems; the Kalman filter	4
8	Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces	4



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171614

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	15	5	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 from above table.

Books:

1. Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011.
2. Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011.
3. Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998.

Course Outcomes: Students will be able to

Sr. No.	CO Statement	Marks % Weightage
1	Learn fundamentals of computer vision and its applications	20
2	Understand the basic image processing operations to enhance, segment the images.	25
3	Understand the analyzing and extraction of relevant features of the concerned domain problem.	25
4	Understand and apply the motion concepts and its relevance in real time applications	15
5	Apply the knowledge in solving high level vision problems like object recognition, image classification etc.	15

List of Experiments:

1. Implementing various basic image processing operations in python/matlab/open-CV: Reading image, writing image, conversion of images, and complement of an image
2. Implement contrast adjustment of an image. Implement Histogram processing and equalization.
3. Implement the various low pass and high pass filtering mechanisms.
4. Use of Fourier transform for filtering the image.
5. Utilization of SIFT and HOG features for image analysis.
6. Performing/Implementing image segmentation
7. Implement optical flow computation algorithm.
8. Demonstrate the use of optical flow in any image processing application
9. Object detection and Recognition on available online image datasets
10. Character or digit or face classification project



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173207

SATELLITE COMMUNICATION AND NETWORKING

B.E. 7th Semester

Type of course: Professional Elective

Prerequisite: Analog and Digital Communication

Rationale: In this course students will learn the basics of satellite communications, satellite systems, satellite access and networks. Course provides an in-depth treatment of satellite communication systems operation and planning. The course aims to teach the designing of satellite links and understand the signal processing required for satellite communications with the earth station details and their designing.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction to Satellite Communication: Historical background, Basic concepts of Satellite Communications, Advantages of Satellite Communication, Block diagram of Satellite Communication, Growth of Satellite communications.	2
2	Orbits and Launching Methods: Introduction, Kepler's First Law, Kepler's Second Law, Kepler's Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit Perturbations, Effects of a non-spherical earth, Atmospheric drag.	5
3	The Geostationary Orbit: Introduction, Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Launching Orbits	4
4	Radio Wave Propagation: Introduction, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Other Propagation Impairments	2
5	Polarization: Introduction, Antenna Polarization, Polarization of Satellite Signals, Cross Polarization, Discrimination, Ionospheric Depolarization, Rain Depolarization, Ice Depolarization	3
6	The Space Segment: Introduction, The Power Supply, Attitude Control, spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier, The Antenna Subsystem	5
7	The Earth Segment: Introduction, Receive-Only Home TV Systems, Outdoor unit, indoor unit for analog (FM) TV, Master Antenna TV System, Community Antenna TV System, Transmit-Receive Earth Stations	4



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8	The Space Link: Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio. The Uplink. Saturation flux density. Input backoff. Downlink.	8
9	Satellite Access: Introduction, Single Access, Preassigned FDMA, Demand- Assigned FDMA, Spade System, TDMA, Preassigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code- Division Multiple Access	5
10	Satellite in Networks: Introduction, Network Basics, Asynchronous Transfer mode (ATM), ATM over satellite, The TCP Link, Satellite link and TCP, Enhancing TCP over satellite channels using Standard Mechanics (RFC-2488)	7

Suggested Specification table with Marks (Theory):

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

1. Satellite Communications, by Dennis Roddy (Fourth edition), McGraw Hill.
2. Satellite Communication Systems Engineering, by Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson (Second Edition), Pearson.
3. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnut(Second Edition), John Wiley & Sons.
4. Satellite Technology, Principles and Applications, by Anil K. Maini, Varsha Agarwal (Second Edition), Wiley.

Course Outcome: After learning the course the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
CO-1	Understand principle, working and operation of various sub systems of satellite as well as the earth station.	25
CO-2	Apply various communication techniques for satellite applications.	20
CO-3	Analyze and design satellite communication link.	20
CO-4	Learn advanced techniques and regulatory aspects of satellite communication.	15
CO-5	Understand role of satellite in various applications.	20



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Bachelor of Engineering

Subject Code: 3173207

Suggested List of Experiments:

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 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.

Design based Problems (DP)/Open Ended Problems:

1. To write a program to observe the variations in the antenna look angles for the earth station antennas.
2. To write a program to calculate to determine the limits of visibility for an earth station.
3. To obtain the plot of Orbital altitude versus satellite antenna diameter.
4. To write a Program for Estimated tropospheric attenuation due to Oxygen and water.
5. To write a Program for plot of Semi major axis versus rate of change of argument of perigee.
6. To write program to calculate the rain attenuation (in dB) for horizontal polarization, vertical polarization and circular polarization for satellite wave propagation.
7. To write a program to determine the combined carrier to noise power spectral density ratio for satellite link budget.
8. To determine the degradation in the downlink C/I ratio when satellite orbital spacing is reduced.
9. To write a program to plot the degradation in downlink C/I.
10. To plot the variation in Carrier to Noise power spectral density ratio (uplink, downlink and combined) for changes in the input SFD for uplink and EIRP for downlink.
11. To write a program for plotting Half power beam width Vs. Maximum number of days sun transit occurs at an earth station.
12. To write a program for plotting BER vs Eb/No for BPSK signal for Sat Com.

List of Open Source Software/learning website:

1. <http://nptel.iitm.ac.in/course.php>
2. <http://ocw.mit.edu>
3. www.radio-electronics.com
4. <http://en.wikipedia.org>
5. www.youtube.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173207

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173211

SYSTEMS AND NETWORK SECURITY

B.E. 7th Semester

Type of course: Professional Elective

Prerequisite: Basics of Data Communication, Computer Networks, Basics of Number Theory

Rationale: The information exchanged through Internet plays vital role for their owners and the security of such information/data is of prime importance. Knowing the concepts, principles and mechanisms for providing security to the information/data is very important. The subject covers various important topics concern to security like symmetric and asymmetric cryptography, IP Security, key distribution, SSL, secure electronic transaction (SET), electronic money and overview of the malware technologies. The subject also covers the applications of all of these in real life applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Contents:

Sr. No.	Content	Total Hrs
1	Network Fundamentals: LANs, WANs, MANs, Network Software: Protocol Hierarchies, Design Issues in layers, Services Primitive, Critique of the OSI and TCP, Birth and Growth of the Internet, ARPANET, NSFNET, Common networks: X.25, ATM, Ethernet, WLANs	04
2	Introduction to Security issues: Security trends, OSI security architecture, Security attacks, Security services and Mechanism, Model of Network security	04
3	Symmetric Ciphers: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography, Block Cipher principles and Design issues, Data Encryption Standard, Advance Encryption Standard, Traffic Confidentiality, Key Distribution.	08
4	Public Key Cryptography: Principles, RSA Algorithm, Key Management, Deffie-Hellman Key Exchange	06
5	Network Security: Digital Signatures, Authentication Protocols, DSS, Kerberos, X.509 Authentication Services, Public Key Infrastructure, IP Security Overview, IP Security Architecture	07
6	Web Security: Introduction to PGP, Introduction to S/MIME, SSL, TLS, Secure Electronic Transaction (SET), SSL vs SET, 3D Secure protocol, Electronic money, Intrusion detection, Password Management	11
7	Malicious software: Viruses and Related Threats, Virus Countermeasures, Distributed Denial of Service attacks, Firewalls Design Principles, Trusted System	05



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173211

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	15	5	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 from above table.

Books:

1. Computer Networks Fourth Edition Andrew S. Tenenbaum, Publisher: Prentice Hall
2. Cryptography and Network Security: Principles and Practices Fourth Edition William Stallings, Pearson.
3. Data Communication Networking Forth Edition Behrouz A.Forouzan.
4. Cryptography & Network Security, Forouzan, Mukhopadhyay, McGrawHill.
5. Cryptography and Network Security (2nd Ed.), Atul Kahate, TMH.
6. Information Systems Security, Godbole, Wiley-India.
7. Information Security Principles and Practice, Deven Shah, Wiley-India

Course Outcomes: Students will be able to

Sr. No.	CO Statement	Marks % Weightage
1	Learn fundamentals of network security	30
2	Understand the basic symmetric and asymmetric techniques and their relevance in securing the system	30
3	Understand the importance to safeguard their internet browsing activity and also able to utilize various tools for security.	20
4	Understand and apply web security in financial and commercial applications	20



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173212

TELECOMMUNICATION ENGINEERING

B.E. 7th Semester

Type of course: Core

Prerequisite: Basic Switching Mechanisms, Digital Electronics

Rationale: Students of ICT Engineering need to have good understanding of the fundamentals and application of telecommunication networks. They will be able to understand recent topics like Time Division Switching systems, Space Division Switching systems and data networks.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Sr.No	Content	Total Hrs
1.	Electronic switching systems: Basics of a switching system, electronic space division switching - stored program control, Centralized SPC, Distributed SPC, Enhanced Services, Time division switching – Time division Space and Time division Time Switching, time multiplexed space switching, time multiplexed time switching - two stage, three stage and N-stage combination switching.	15
2	Digital circuit switching networks: Two-stage network, three-stage network, n-stage network, non- blocking switches, blocking probability analysis of multistage switches – lee approximation, examples of digital switching systems - AT & T 5ESS and NTI - DMS 100 switching Systems	5
3	Elements of traffic engineering: Network traffic load and parameters, grade of service and blocking probability, incoming traffic and service time characterization, blocking models and loss estimates, delay systems.	5
4	Telephone Networks: Subscriber Loop System, Switching Hierarchy and Routing, Transmission Plan, Numbering Plan, Charging Plan.	5
5	Data networks: Data transmission in PSTNs, Switching Techniques for data Transmission, Data communication Architecture, Link to Link Layers, End layers, Satellite based data networks, LAN, End to Metropolitan Area Network, Fiber Optic Networks, and Data Network Standards.	10
6	Signaling: Customer line signaling – out band signaling – in band signaling - PCM signaling -inter register signaling - common channel signaling principles - CCITT signaling system No.7(SS7).	5



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Bachelor of Engineering

Subject Code: 3173212

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	0

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. Viswanathan T., Telecommunication Switching Systems and Networks, Prentice Hall of India Pvt. Ltd.
2. Schwartz M., Telecommunication Networks - Protocols, Modeling and Analysis, Addison Wesley Publishing Company
3. Telecommunication Systems – V. S. Bagad, Technical Publication

Course Outcome: After learning the course the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
CO-1	Understand various switching systems in telecommunication.	25
CO-2	Analyze single stage and multi-stage digital circuit switching networks.	20
CO-3	Evaluate the different elements of traffic engineering.	10
CO-4	Understand the fundamentals of Telephone networks.	15
CO-5	Differentiate various data networks.	20
CO-6	Identify signaling for telecommunication.	10

Suggested List of Experiments:

1. To study the working of a manual switch board (switching).
2. To study of Switching Matrix for PSTN.
3. To Study the working of Dialer Section & DTMF Signals Using High Pass Filter and Low Pass Filter.
4. To Study the working of ringer circuit.
5. Write a program for Erlang B for traffic calculation.
6. Study of PING command of networking.
7. Implementation of Star topology using 100 Base Tx.
8. To study TCP/IP Protocol Suite.
9. To study SNMP protocol.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173212

Design based Problems (DP)/Open Ended Problem:

1. Analysis of single stage and multi-stage switches in telecommunication systems.
2. MATLAB implementation to find traffic carried per server and group of servers.

List of Open-Source Software/learning website:

1. www.nptel.ac.in

GTUQuestionPapers.com



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3173213
SOFTWARE ENGINEERING
 B.E. 7th Semester

Type of course: Core

Prerequisite: Object Oriented Programming fundamental, UML

Rationale:

- To study Software Development Life Cycle, Development models and Agile Software development.
- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn the process of improving the quality of software work products.
- To gain the techniques and skills on how to use modern software testing tools to support software testing projects.
- To expose Software Process Improvement and Reengineering

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Contents:

Sr. No.	Content	Total Hrs
1	Software Process Models and lifecycle: Software Product, Product, Software Processes, Evolving Role of Software, Software: A Crisis on the Horizon and Software Myths, Software Engineering: A Layered Technology, Study of different Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models, Component-Based Development, Process, Product and Process, Object Oriented Software Engineering.	06
2	Project Management Concepts & Project Metrics: The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains (FP & LOC), Software Measurement, Metrics for Project and Software Quality.	03
3	Software Project Planning, Scheduling and Tracking: Project Planning Objectives, Software Project Estimation using COCOMO Model, Software Scope and Resources, Empirical Estimation Models, Automated Estimation Tools, Basic Concepts and Relationship Between People and Effort, Defining a Task Set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network and Scheduling, Earned Value Analysis and Error Tracking	05
4	Software Requirements Specification: Requirement Gathering and Analysis, Software Requirement Specification (SRS), Formal requirements specification and verification - axiomatic and algebraic specifications	04
5	Analysis Modeling, Software Design Concepts and Principles: The Elements of the	06



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	Analysis Model, Data Modeling, Functional Modeling and Information Flow, Behavioral Modeling and Structured Analysis, Software Design and Software Engineering, The Design Process, Design Principles, Design Concepts, Modular Design, Design Heuristics for Effective Modularity, The Design Model ,Design Documentation, Function oriented v/s object-oriented design, Object Modeling using UML, Software Architecture and Data Design, Architectural Styles, Analyzing Alternative Architectural Designs, Mapping Requirements into a Software Architecture	
6	User Interface Design, Component Level Design: User Interface Design, Task Analysis and Modeling, Interface Design Activities and Implementation Tools, Design Evaluation, Structured Programming and Comparison of Design Notation.	04
7	Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks (Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation), Risks Monitoring and Management	03
8	Coding, Software Testing Techniques & Software Testing Strategies: Software Testing Fundamentals and Test Case Design, White-Box Testing and Black-Box Testing, ISO/IEC/IEEE Software Testing standards, Testing for Specialized Environments, A Strategic Approach to Software Testing and Issues, Unit Testing, Integration and Validation Testing, System Testing, Software Documentation and Debugging Techniques.	06
9	Software Quality Assurance and Configuration Management: Quality Concepts and Software Quality Assurance, Quality Planning and Control, Software Reviews (Formal Technical Reviews), Software Reliability and Fault Tolerance, The ISO 9000 Quality Standards, The SCM Process, Identification of Objects in the Software Configuration, Six Sigma, Version Control and Change Control.	04
10	Emerging and advanced topics in Software Engineering: Security Engineering, Agile Methods, Client Server Software Engineering, Aspect Oriented Software Development, Software Engineering Aspects of Programming Languages, Reverse Engineering, Re-engineering, Web Engineering, CASE.	04
11	DevOps Viewpoints: Overview, Problem Case Definition, Benefits of Fixing Application Development Challenges, DevOps Adoption Approach through Assessment, Solution Dimensions, What is DevOps?, DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools, Challenges with DevOps Implementation, Must Do Things for DevOps, Mapping My App to DevOps - Assessment, Definition, Implementation, Measure and Feedback	04

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	25	20	10	--	--

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



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Bachelor of Engineering

Subject Code: 3173213

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 from above table.

Books:

1. Roger S.Pressman, Software Engineering- A practitioner's Approach, McGraw-Hill International Editions
2. Ian Sommerville, Software engineering, Pearson education Asia
3. Pankaj Jalote, Software Engineering – A Precise Approach Wiley
4. Behhforoz & Frederick Hudson, Software Engineering Fundamentals, OXFORD
5. Rajib Mall, Fundamentals of software Engineering, Prentice Hall of India.
6. Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's ViewPoint, Wiley
7. Merlin Dorfman (Editor), Richard H. Thayer (Editor), Software Engineering
8. Robert C. "Uncle Bob" Martin, Clean Architecture: A Craftsman's Guide to Software Structure and Design

Course Outcomes: Students will be able to

Sr. No.	CO Statement	Marks % Weightage
1	Prepare SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.	25
2	Apply the concept of Functional Oriented and Object Oriented Approach for Software Design.	30
3	Recognize how to ensure the quality of software product, different quality standards and software review techniques.	25
4	Apply various testing techniques and also upgrade it using advanced Software Engineering Methods.	20

List of Experiments:

(Pl. Note: List of Experiments and Tutorials should be as per theory covered in the class, below mentioned practical are just for the reference purpose)

Tutorial-1

Study the complete Software Development Life Cycle (SDLC) and analyze various activities conducted as a part of various phases. For each SDLC phase, **identify** the objectives and **summaries** outcomes.



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Tutorial-2

Consider any project to be developed in any technology as a Software Architect or Project Manager. **Construct** Software Requirement Specification (SRS) document for the project.

Tutorial-3

Considering your immense expertise in software development, The Absolute Beginners Inc. has recently allotted you a mega project. The goal of the project is to create a database of all Hindi films released since 2000. The software would allow one to generate a list of top ten hit films, top ten flop films, best comedy films, and so on. Using your prior experience, you have decided the approximate sizes of each module of the software as follow:

- Data entry (0.9 KDSI)
- Data update (0.7 KDSI)
- Query (0.9 KDSI)
- Report generation and display (2 KDSI)

Also take into consideration the following cost drivers with their ratings:

- Storage constraints (Low)
- Experience in developing similar software (High)
- Programming capabilities of the developers (High)
- Application of software engineering methods (High)
- Use of software tools (High)

(All other cost drivers have nominal rating).

Now answer the following:

- **Solve** the problem by **Applying** Basic and intermediate COCOMO
 - Find Project Type?
 - Find Project Size?
 - Find Initial Effort Estimation?
 - Find Adjusted Effort Estimation?
 - Find schedule?
 - Find minimum size of the team you would require to develop this system?
- If your client would pay Rs. 50,000 per month of development, how much would be the likely billing?

Tutorial-4

Function Point: <http://conferences.embarcadero.com/article/32094#Bonus> .

Analyze the case study and **identify** the error and **solve** it. At the end, need to **assess** calculation part of effort using FP oriented estimation model.

Tutorial-5

Consider the following Java code segment:



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Bachelor of Engineering

Subject Code: 3173213

```
public Hashtable countAlphabet(String aString){
    Hashtable table = new Hashtable();
    If (aString.length > 4000) return table;
    StringBuffer buffer = new StringBuffer(aString);
    while (buffer.length() > 0){
        String firstChar = buffer.substring(0, 1);
        Integer count = (Integer)table.get(firstChar);
        if (count == null){
            count = new Integer(1);
        } else{
            count = new Integer(count.intValue() + 1);
        }
        table.put(firstChar, count);
        buffer.delete(0, 1);
    }
    return table;
}
```

1. Guarantees that all independent execution path is exercised at least once;
2. Guarantees that both the true and false side of all logical decisions are exercised;
3. Executes the loop at the boundary values and within the boundaries.

Sketch out Design control flow diagram and **Apply** Cyclomatic complexity for given Code. **Identify** numbers of Independence path require for testing.

Tutorial 6

Subject Project: For below mentioned Systems and other systems assign a mini-project two a group of students to prepare Software documents mentioned as A to E

1. Library Information System
 2. Villager Telephone System
 3. Waste Management Inspection Tracking System (WMITS)
 4. Flight Control System
 5. Ambulance Dispatching System
- A. Development of Software Requirements Specification (SRS)
 - B. Function oriented design using SA/SD
 - C. Object-oriented design using UML
 - D. Test case design
 - E. Implementation using Java and testing

Design based Problems (DP)/Open Ended Problem:

1. Assume that you are Software Architect or Project Manager in organization. You have been assigned the task of constructing a website for a specific company with your team. Design and priorities the test cases using test case templates for this project.
2. For Natural Language Processing (NLP) applications, estimate project failure rate.



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3. Design and develop an open source method of detecting the DIFFERENCE between two Engineering designs for the same problem.

List of Open Source Software/learning website:

- www.en.wikipedia.org/wiki/Software_engineering
- www.win.tue.nl
- www.rspa.com/spi
- www.onesmartclick.com/engineering/software-engineering.html
- www.sei.cmu.edu
- <https://www.edx.org/school/uc-berkeleyx>
- <https://devops.com/most-popular-open-source-devops-tools/>
- <https://www.guru99.com/devops-tutorial.html>

Various Web Based SE Tools

- Software-Rational Rose, Microsoft Visio, Enterprise resource planning
- Project Management Tools
- SCM Tools
- SQA Tools
- Analysis and Design Tools
- User Interface Development Tools
- Object-Oriented Software Engineering Tools
- Testing Tools



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173214

VIRTUAL REALITY

B.E. 7th Semester

Type of course:

Prerequisite:

Rationale: This course covers the development of virtual reality worlds, including mathematical basis of motion and physics in VR worlds, human visual perception, design practices to enable immersive experiences for users, and development on heterogeneous device hardware.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Syllabus:

Sr. No.	Content	Total Hrs
1	Introduction of Virtual Reality: Introduction, Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms	6
2	Interactive Techniques in Virtual Reality: Introduction, From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.	5
3	Visual Computation in Virtual Reality: Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.	7
4	Multiple Models of Input and Output Interface in Virtual Reality: Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML, Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.	7
5	Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.	5



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173214

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	30	20	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) Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.
- 2) Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
- 3) Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
- 4) John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.
- 5) Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
- 6) Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.

Course Outcome:

After learning the course, the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
1	Able to understand design of virtual reality technology relates to human perception and cognition	15%
2	Ability to design 3D interaction techniques	30%
3	Ability to develop immersive virtual reality applications.	30%
4	Able to create applications of VR to the conduct of scientific research, training, and industrial design.	25%

List of Experiments:

1. Developing architecture of a house using Virtual Reality.
2. Perform CRO based experiment using Virtual Reality.
3. Undertaking qualitative analysis in Chemistry using Virtual Reality.
4. Carry out assembly/disassembly of an engine using Virtual Reality.
5. Explore human anatomy using Virtual Reality.
6. Simulation of circulation of blood in heart.
7. Simulation of Fight/Vehicle/Space Station.
8. Building Electronic circuit using Virtual Reality, given basic electronic components.
9. Developing concept of Virtual class room with multiplayer.



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173215

IOT and Applications

7th Semester

Type of course: Open Elective

Prerequisite: C Programming, Microprocessor, Networking

Rationale: Internet of Things plays an important role in connecting the things i.e. variety of devices through the Internet. The IoT has emerged as an cutting-edge technology with applications in manufacturing, healthcare, Agriculture, transport, mining, smart cities and many more. This subject covers the fundamentals of IoT with its architecture, protocols and Applications. It also covers the overview and programming of two widely used IoT platforms Arduino and Raspberry Pi.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
					PA	ESE		
2	0	2	3	70	30	30	20	150

Content:

Sr No	Course content	Total Hrs
1	Introduction to Internet of Things: Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling technologies, IoT challenges, IoT levels, IoT and cyber physical system, IoT and WSN	04
2	Sensors, Microcontrollers, and Their Interfacing: Sensor interfacing, Types of sensors, Controlling sensors, Microcontrollers, ARM	04
3	Protocols for IoT : Messaging protocols, Transport protocols, IPv4, IPv6, URI	06
4	Cloud for IoT: IoT and cloud, Fog computing, Security in cloud, Case study	04
5	Application Building with IoT: Various application of IoT : Food, Healthcare, Lavatory maintenance, Water quality, Warehouse, Retail, Driver Assistance, Collision impact	04
6	Arduino and Raspberry Pi: Arduino : Architecture, Programming and Application Raspberry Pi : Architecture, Programming and Application	06
7	IoT Security: Various security issues and need, architecture, requirement, challenges and algorithms	02



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3173215

Reference Books:

1. Internet of Things, Vasudevan, Nagrajan and Sundaram, Wiley India
2. IoT Fundamentals, David Hence at el, Cisco Press
3. 21 IoT Experiments, Yashavant Kanetkar, Shrirang Korde, BPB
4. IoT Based Projects, Rajesh Singh at el, BPB
5. Internet of Things with ARDUINO and BOLT, Ashwin Pajankar, BPB
6. Star Expert IoT Specialist, STAR CERTIFICATION

Course Outcomes: Students should able to

Sr. No.	CO statement	Weightage
CO-1	Demonstrate the architecture and functioning of IoT systems including the sensors and microcontrollers with their interfacing and software need considering application areas.	20
CO-2	Diagnose the various IoT protocols with detailing of their elements and overall functioning within IoT systems for efficient communication.	20
CO-3	Design an IoT system to take the benefit of the Clouds for computing and storage considering security issues.	20
CO-4	Leverage the benefits of IoT technologies for automating the various real-life challenges in various application areas.	20
CO-5	Develop the software components of IoT system using Arduino/Raspberry Pi Programming.	20

List of Practical:

Practical should be performed by students based on

- Using Arduino or Raspberry Ri boards and its software platforms

List of Open Source Software/learning website:

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. <https://www.iotworldtoday.com/>
3. <https://aws.amazon.com/iot/>
4. https://www.cisco.com/c/en_in/solutions/internet-of-things/overview.html
5. https://www.cisco.com/c/en_in/solutions/internet-of-things/iot-network-connectivity.html