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	C	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 Engineering
Subject Code: 3170718
INFORMATION RETRIEVAL
7^{th} Semester

Type of course: Elective

Prerequisite: Basic mathematics background is also required. You are supposed to be familiar basic concepts of probability (e.g., Bayes's theorem), linear algebra (e.g., vector, matrix and inner product).

Rationale: Information Retrieval (IR) systems give access to large amounts of online information stored as text, images, speech or video, e.g., Web documents. IR systems should only retrieve those documents that are relevant to a user's interest but have to deal with the uncertainty of describing what a document is about and what a user is actually interested in.

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	0	3	70	30	0	0	100

Syllabus:

Sr. No.	Content	Total Hrs
1	**Introduction to Information Retrieval:** The nature of unstructured and semi-structured text. Inverted index and Boolean queries.	5
2	**Text Indexing, Storage and Compression:** Text encoding: tokenization, stemming, stop words, phrases, index optimization. Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law. Index construction. Postings size estimation, merge sort, dynamic indexing, positional indexes, n-gram indexes, real-world issues.	7
3	**Retrieval Models:** Boolean, vector space, TFIDF, Okapi, probabilistic, language modeling, latent semantic indexing. Vector space scoring. The cosine measure. Efficiency considerations. Document length normalization. Relevance feedback and query expansion. Rocchio.	7
4	**Performance Evaluation:** Evaluating search engines. User happiness, precision, recall, F-measure. Creating test collections: kappa measure, interjudge agreement.	4
5	**Text Categorization and Filtering:** Introduction to text classification. Naive Bayes models. Spam filtering. Vector space classification using hyperplanes; centroids; k Nearest Neighbors. Support vector machine classifiers. Kernel functions. Boosting.	5
6	**Text Clustering:** Clustering versus classification. Partitioning methods. k-means clustering. Mixture of Gaussians model. Hierarchical agglomerative clustering. Clustering terms using documents.	6
7	**Advanced Topics:** Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information retrieval	6
8	**Web Information Retrieval:** Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS.	5
9	**Retrieving Structured Documents:** XML retrieval, semantic web	3

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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
10	15	30	20	20	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. Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007.
2. Search Engines: Information Retrieval in Practice. Bruce Croft, Donald Metzler, and Trevor Strohman, Pearson Education, 2009.
3. Modern Information Retrieval. Baeza-Yates Ricardo and Berthier Ribeiro-Neto. 2nd edition, Addison-Wesley, 2011.
4. Information Retrieval: Implementing and Evaluating Search Engines. Stefan Buttcher, Charlie Clarke, Gordon Cormack, MIT Press, 2010.

Course Outcome:

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

Sr. No.	CO Statement	Marks % Weightage
1	understand the theoretical basis behind the standard models of IR (Boolean, Vector-space, Probabilistic and Logical models)	35%
2	apply appropriate method of text classification or clustering.	30%
3	use performance evaluation metric for IR	15%
4	understand the standard methods for Web indexing and retrieval	20%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171108
Semester – VII
Subject Name: Internet of Things

Type of course: Professional Elective Course (PEC-VI)

Prerequisite: Computer networking, Embedded systems

Rationale: IoT market is growing rapidly from installed base of about 30 billion devices in the year 2020 and expected to grow up to 75 billion devices by 2025. IoT is useful in many sectors like consumer, commercial, infrastructure, health, industry and military. Industry 4.0 is based on IoT. This course will provide opportunity to the students for contribution in IoT applications.

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	**Introduction to Internet of Things:** IoT Definition, IoT characteristics, M2M and IoT, End to End IoT Architecture, Physical design of IoT, Logical Design of IoT, Overview of IoT protocols, IoT levels and deployment templates, Challenges for IoT, Interdependencies of IoT and cloud computing, Web of things	6
2	**Embedded IoT devices:** Sensors and actuators for IoT applications, IoT components and implementation, Programming of NodeMCU and Raspberry PI, Implementation of IoT with Edge devices, Reading sensor data and transmit to cloud, Controlling devices through cloud using mobile application and web application, Types and configurations of gatways, Specifications of IoT gateways (Practical aspects of this chapter should be covered during lab sessions)	8
3	**IoT Protocols:** Link layer protocols, Network/internet layer protocols, Transport layer protocols, Application layer protocols: Hypertext transfer protocol (HTTP), Systematic HTTP access methodology, Web Socket, Constrained application protocol CoAP), Message Queue Telemetry Transport Protocol (MQTT), XMPP, DDS, AMQP	8
4	**IoT Security and challenges :** IOT Security, Dangers, Assigning values to Information, Security Components, Key Management, Update Management, Challenges in IoT security.	4
5	**IoT Applications and case study** Broad categories of IoT applications: Consumer IoT, Commercial IoT, Industrial IoT, Infrastructure IoT, Military Things (IoMT)	4

	IoT Case studies: Home automation with IoT, River water pollution monitoring, Smart city street light control and monitoring, Health care monitoring, Voice Apps on IoT device	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**30**	**20**	**5**	**5**	**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] Rahul Dubey, "An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications", Cengage India Publication
[2] Raj Kamal, "Internet of Things: Architecture and Design Principles, Mc Graw Hill Education

[3] Hanes et al "IoT Fundamentals", Cisco Press

[4] Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", , Paperback, 2015.

[5] A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.

[6] Yashwant Kanetkar, "21 Internet of Things Experiments", Kindle edition

[7] Adeel Javed, "Building Arduino projects for Internet of Things", Apress publication

[8] Donald Noris, "The Internet of Things: Do it yourself Projects with Arduino, Raspberry PI and BeagleBone Black" Mc Graw Hill Publication

[9] Adrian McEwen & Hakim Cassimally, "Designing the Internet of things", Willey publication

Course Outcomes:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Understand IoT architecture	20%

CO-2	Program Embedded IoT devices	30%
CO-3	Use IoT protocol to upload sensor data and to control devices	30%
CO-4	Design IoT application	20%

Suggested List of Laboratory Experiments:

1. Getting started with NodeMCU, Arduino with ESP8266 and ESP32 in the Arduino IDE.
2. GPIO Interfacing and programming
3. Digital on/off sensor (PIR and IR) Interfacing programming
4. Analog sensor programming and uploading sensor data on cloud
5. Controlling devices remotely using Bluetooth link, WiFi link
6. Interfacing and programming of actuators, Controlling devices remotely using cloud
7. Web based device control
8. Development of Android applications suitable for IoT
9. Experiments on Agriculture IoT (Soil moisture, PH monitor)
10. IoT based home automation
11. Smart energy experiments
12. Smart city IoT applications
13. IoT based mini project
14. Developing Voice App for IoT device

List of Open Source Software/learning website:

1. NPTEL online course on IoT: https://onlinecourses.nptel.ac.in/noc18_cs08
2. IoT Tutorial point www.tutorialspoint.com
3. https://www.microsoft.com/en-us/internet-of-things/
4. https://www.scnsoft.com/blog/iot-architecture-in-a-nutshell-and-how-it-works
5. https://wso2.com/whitepapers/a-reference-architecture-for-the-internet-of-things/

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171608
WIRELESS COMMUNICATION
B.E. 7th Semester

Type of course: Core

Prerequisite: Analog and Digital Communication

Rationale: The course will provide fundamental knowledge and awareness about recent trends of wireless communication systems and Networks. In this course, emphasis is also given for building foundation of cellular concepts which will be useful for understanding the fundamentals of cellular mobile communication systems design.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	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 Wireless Communication System:** Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL), Wireless Local Area Network (WLAN), Bluetooth and Personal Area Networks.	3
2	**The Cellular Concept- System Design Fundamentals:** Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co- channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Improving Coverage & Capacity in Cellular System- cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations.	10

3	**Mobile Radio Propagation Model, Small Scale Fading and diversity:** Large scale path loss:- Free Space Propagation loss equation, Path- loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Statistical for models multipath fading channels and diversity techniques in brief.	06
4	**Multiple Access Techniques:** Introduction, Comparisons of multiple Access Strategies TDMA, CDMA, FDMA, OFDM, CSMA Protocols.	07
5	**Wireless Systems:** GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, CDMA2000 cellular technology, GPRS system architecture.	10
6	**Recent Trends:** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.	09

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 Wireless Communication, Theodore S. Rappaport, Prentice hall.
2 Wireless Communications and Networking, Vijay Garg, Elsevier.
3 Wireless digital communication, Kamilo Feher, PHI.
4 Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications.
5 Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
6 Wireless Communications-T.L.Singh-TMH.
7 Adhoc Mobile Wireless network, C.K.Toh Pearson.

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

Sr. No.	CO Statement	Marks % Weightage
CO-1	Understand the basics of wireless communication and propagation of radio signals.	25

CO-2	Understand the basic concepts of cellular system and design requirements.	20
CO-3	Design mobile radio propagation model.	20
CO-4	Differentiate multiple access techniques.	10
CO-5	Compare various wireless communication systems and networks.	25

List of Experiments:

Experiments and Problems will be based on Concept of GSM, Cellular System Design Concepts, Wi-Fi, -MAX, Zig bee standard, Multipath propagation Environment and its parameter and loss measurement, Adhoc N/Ws & Protocols, Software Defined Radio, UWB Radio, GPRS etc.

Following are the examples of Experiments from the various part of syllabus topic. Same or similar Experiments may be given to the students based on availability of resources in wireless laboratory of the institute.

- **Experiments based on MATLAB OR SCILAB Write a MATLAB/ SCILAB Program/s based on**

1. Free space Propagation Model & Frequency Selective Fading Model
2. Ground Reflection (Two-ray) Model
3. Diffraction (Knife-Edge) Model
4. Large-scale Empirical models
5. Small-scale Empirical models
6. Cellular Systems
7. Wireless LANs

- **Experiments based on GSM (Using Wireless Communication Trainer)**

- Study the implementation of –GMSK modulation, OQPSK detection.
  - Observe phase response of Tx and Rx and Spectrum of Tx and Rx.
  - Measure the BER value
  - GSM AT Commands

- **Experiments based on CDMA (Using Wireless Communication Trainer)**

- Study the performance of DS-CDMA system under multi-path condition for single user case
  - Using RAKE receiver with MRC method and EGC method
  - Observation of SNR vs BER curve for two different combining techniques.

- **Experiments based on OFDM (Using Wireless Communication Trainer)**

- Study OFDM system synchronization requirement
  - Observe the performance of Schmidl-Cox algorithm used for timing acquisition and fractional freq offset estimation
  - Integer Frequency offset estimation

Design based Problems (DP)/Open Ended Problem:-

1. Design of Any Arbitrary Modulation Scheme
   –8PSK, QAM (16, 64 etc), EDGE, WCDMA*, WiFi*, WiMAX*

–Compare at base-band, IF and RF

2. Design of Discrete Multi-tone modem, FM Radio Reception.
3. Design/implement the different Channel Coder/Decoder
   –Turbo decoder
   –LDPC coder / decoder
4. Project based on Reception of local GSM broadcast channel
5. Project based on Frequency Hopping Spread Spectrum (FHSS)

Major Equipment: -

DSO, CRO, Signal Generators, Spectrum Analyzers, GSM, GPRS, GPS, CDMA Trainer Kits, Mobile Communication & Wireless Communication Trainer Kits etc.

List of Open Source Software/learning website:-

Students may use SCILAB, MATLAB, NETSIM, NS2 and NPTL Videos, MIT open course website, Virtual Labs (Source: http://www.vlab.co.in)

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171609
SOFTWARE PROJECT MANAGEMENT
B.E. 7th Semester

Type of course: Elective

Prerequisite: Fundamentals of Software Engineering

Rationale: Today's world is a digital world driven by software of varying sizes and complexity. Understandably, the effectiveness and efficiency of the work done nowadays, primarily depends on the quality of the software(s) being employed. The quality of the software relies on the way it is managed during its development as well as maintenance.

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

Syllabus:

Sr. No.	Content	Total Hrs
1	**Introduction to Software Project Management (SPM):** Rationale, Software Projects Vs other types of Projects, Contract Management and Technical Project Management, Activities Covered by SPM, Plans, Methods and Methodologies, Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, Project Success and Failure, Management Control, Project Management Life Cycle, Traditional versus Modern Project Management Practices.	4
2	**Project Planning:** Tasks in Project Planning; Work Breakdown Structures (WBS), Planning Methods, Selecting Project Approach, SDLC, Software Processes and Process Models, Choice of Process Models, A Generic Project Model, Software Cost Estimation; COCOMO Model; Budgeting.	6
3	**Project Scheduling, Monitoring & Control:** Scheduling Techniques, Program Evaluation and Review Technique (PERT), Gantt Chart, Critical Path Method (CPM), Automated Tools. Project Status Reporting; Project Metrics; Earned Value Analysis (EVA); Project Communication Plan & Techniques; Steps for Process Improvement.	7
4	**Risk Management:** Concepts of Risks and Risk Management; Risk Management Activities; Effective Risk Management; Risk Categories; Aids for Risk Identification; Potential Risk Treatments; Risk Components and Drivers; Risk Prioritization.	6
5	**Configuration Management:** Software Configuration Management (SCM) – Baselines, Software Configuration Items (SCI), SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, Goals of SCM.	4
6	**Quality Assurance:** Software Quality Assurance Activities, Software Qualities, Software Quality Standards – ISO Standards for Software Organization, Capability Maturity Model (CMM), Comparison between ISO 9001 & SEI CMM, Other Standards.	6

7	**Software Re-engineering:** Software Maintenance Problems, Redevelopment vs. Reengineering, Business Process Reengineering, Software Reengineering Process Model, Technical Problems of Reengineering.	6
8	**Project closure:** Project Closure Analysis, Case Study of Software Company's Project Closure Analysis Report.	3

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) Bob Hughes and Mike Cotterell, "Software Project Management ", Tata McGraw Hill, 4th edition, 2006
2) Walker Royce, "Software Project Management", Pearson Education, 2005
3) Kieron Conway, "Software Project Management", Dreamtech Press, 2001
4) S. A. Kelkar, "Software Project Management", PHI Publication, 15th edition, 2013.
5) Roger S. Pressman , "Software Engineering – A Practitioner's approach", Tata McGraw Hill, 2009
6) Ramesh, "Managing Global software Projects", Tata McGraw Hill, 2001
7) Shailesh Mehta, "Project Management and Tools & Technologies – An overview", SPD, 2017

Course Outcome:

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

Sr. No.	CO Statement	Marks % Weightage
1	Describe and determine the purpose and importance of a software project and project management practices.	15%
2	Compare project approaches for given software project and identify risk factors.	20%
3	Estimate and evaluate project cost and schedules and determine risk management approaches.	25%
4	Define and evaluate quality assurance measures.	15%
5	Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.	25%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171609

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 3-5 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 *Project closure analysis report* is given to the students to study.

Stage 2:

The groups are expected to perform closure analysis report for their own semester project

Stage 3:

Each group prepares a short 2 – 5 page report on their results and a 10 min oral presentation of their project closure analysis.

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

1. Prepare SRS for given software project
2. Compare SDLC models for the given project
3. Estimate project cost and prepare project schedule
4. Evaluate risk management approaches suitable for the project
5. Design test suite to ensure software quality

List of Open Source Software/learning website:

1. www.rspa.com/spi
2. www.sei.cmu.edus

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171610
Semester – VII
Subject Name: Agile Development and UI/UX design

Type of course: Elective

Prerequisite: None

Rationale: Agile software development methodology helps software development teams to have high degree of collaboration with the clients, providing more opportunities for the team to truly understand the client's vision hence significantly improve the quality of their software at each release. The developers can adapt to changes quickly. UX is important in fulfilling the user's needs.

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	0	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	AGILE DEVELOPMENT: Agile Practices, Overview of Extreme Programming, Planning, Testing, Refactoring.	7
2	AGILE DESIGN. What Is Agile Design?, SRP: The Single-Responsibility Principle, OCP: The Open-Closed Principle, LSP: The Liskov Substitution Principle, DIP: The Dependency-Inversion Principle,ISP: The Interface-Segregation Principle.	11
3	UX and UX Design, The Wheel:UX Processes, Lifecycle, Methods and Techniques, Scope, rigor, complexity and Project perspective,Agile lifecycle Processes and the Funnel model of Agile UX.	7
4	The nature of UX design, Bottom up versus Top-down Design Generative Design :ideation,sketching,critiquing Prototype candidate design	7
5	UX evaluation methods and techniques	7

	Empirical UX evaluation :UX goals , metrics and Targets Analytic UX evaluation:Data collection methods and Techniques	
6	Connecting Agile UX with Agile Software Engineering	3

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**30**	**20**	**10**	**0**	**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) Agile Software Development, Principles, Patterns, and Practices: International Edition by Robert C. Martin, Pearson Publication
2) The UX Book Agile UX Design for a Quality User Experience By Rex Hartson, Pardha S. Pyla, Morgan Kaufman publication
3) Designing Interfaces Patterns for Effective Interaction Design By Jenifer Tidwell, Charles Brewer, Aynne Valencia-Brooks · 2020 O'reilly

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the practices and philosophies of agile methods.	40
CO-2	Examine the User experiences and User designs with empirical and analytic evaluations.	30
CO-3	Demonstrate the connection between UX design with Agile software Development.	10
CO-4	Use an agile UX design and Agile software development method as per the need of the project.	20

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171611

GRAPH THEORY AND COMBINATORICS

B.E. 7th Semester

Type of course: Elective

Prerequisite: Calculus, Linear Algebra, and comfort with mathematics

Rationale: This course will introduce students to graph theory through foundational concepts and fundamental existential and algorithmic problems related to trees, matchings, connectivity and planarity, using proof techniques based on induction, extremal choices, and algorithms.

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	0	3	70	30	0	0	100

Syllabus:

Sr. No.	Content	Total Hrs
1	Introduction to Graph Theory: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits, de Bruijn sequences, Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials	11
2	Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes, Planar duality, Spanning trees in planar graphs	05
3	Optimization and Matching: Transport Networks – Max-flow, Min-cut Theorem, Matching's, Hall's marriage theorem, Optimal matching's, The stable matching problem,	06
4	Fundamental Principles of Counting : The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalon Numbers	05
5	The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials	05
6	Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator	05
7	Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions	05

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	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) J. A. Bondy and U. S. R. Murty, Graph Theory with Applications
2) Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004
3) B Bollobás, Graph theory, An Introductory Course.
4) B Bollobás, Modern Graph Theory, Springer - 1998
5) D Jungnickel, Graphs, Networks and Algorithms

Course Outcome:

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

Sr. No.	CO Statement	Marks % Weightage
1	Understand and apply the basic concepts of graph theory, including Eulerian trails, Hamiltonian cycles, bipartite graphs, planar graphs, and Euler characteristics.	20%
2	Use permutations and combinations to solve counting problems with sets and multisets	15%
3	Apply the inclusion/exclusion principle	15%
4	Compute a generating function and apply them to solve a variety combinatorial problems	20%
5	formulate problems in terms of graphs and apply the theorems and algorithms taught in the course to solve them	15%
6	Set up and solve a linear recurrence relation	15%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171612

VIRTUAL AND AUGMENTED REALITY

B.E. 7th Semester

Type of course: NA

Prerequisite: NA

Rationale: This course covers the development of Virtual/Augmented reality (VR/AR) worlds, including mathematical basis of motion and physics in VR/AR 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	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

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, Virtuality and Immersion, Current trends and state of the art in immersive technologies, developing platforms and consumer devices. 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	7
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.	7
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	**Augmented and Mixed Reality:** Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	8
5	**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 & 3D Scanner etc. Output -- Visual /Auditory / Haptic Devices.	8

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171612

6	**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

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.
7) Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016
8) Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson Education India, 2016
9) Kent Norman (Ed), Wiley Handbook of Human Computer Interaction, Wiley 2017
10) Andy Field, "Discovering Statistics Using SPSS", SAGE Publications Ltd., 2009

Course Outcome:

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

Sr. No.	CO Statement	Marks % Weightage
1	Demonstrate understanding and design of VR/AR technology relates to human perception and cognition	25%
2	Ability to design 3D interaction techniques	20%
3	Demonstrate understanding of fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR	25%
4	Demonstrate insights to key application areas for VR/AR	20%
5	Able to create applications of VR to the conduct of scientific research, training, and industrial design.	10%

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

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171612

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: 3171613
PATTERN RECOGNITION
B.E. 7th Semester

Type of course: Elective

Prerequisite: Familiarity with linear algebra, probability, random process, and statistics

Rationale: Pattern recognition techniques are used to design automated systems that improve their own performance through experience. This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives.

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

Syllabus:

Sr. No.	Content	Total Hrs
1	**Basics of Probability, Random Processes and Linear Algebra (recap)**: Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra.	06
2	**Linear Algebra**: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors.	03
3	**Bayes Decision Theory**: Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.	03
4	**Parameter Estimation Methods**: Maximum-Likelihood Estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation, K-Nearest Neighbour method.	12
5	**Dimensionality reduction**: Principal component analysis - it relationship to Eigen analysis. Fisher discriminant analysis - Generalized Eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorization - a dictionary learning method.	08
6	**Linear discriminant functions**: Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.	03
7	**Artificial neural networks**: Multilayer perceptron – feed forward neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.	04
8	**Non-metric methods for pattern classification**: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).	03

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3171613

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	25	25	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) R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2) S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4/e, Academic Press, 2009
3) C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
4) Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.
5) Robert J. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
6) Tom Mitchell, Machine Learning, McGraw-Hill
7) Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

Course Outcome:

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

Sr. No.	CO Statement	Marks % Weightage
1	Know the major approaches in statistical and syntactic pattern recognition.	25
2	Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis	25
3	Become aware of the theoretical issues involved in pattern recognition system design such as the curse of dimensionality.	25
4	Apply pattern recognition techniques in practical problems	25

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

Minimum 10 practical's based on the content of the syllabus.
One Design Based/Open Ended Problem to be assigned in a group of 3 students.

List of Open Source Software/learning website:

- https://nptel.ac.in/courses/117/105/117105101/
- https://nptel.ac.in/courses/117/108/117108048/
- http://videolectures.net/Top/Computer_Science/Machine_Learning/Pattern_Recognition/
- https://www.youtube.com/results?search_query=pattern+recognition

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
				Theory Marks		Practical Marks		
L	T	P	C	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: 3171615
Semester – VII
Subject Name: Data Compression

Type of course: Elective

Prerequisite: None

Rationale: Information is generated and used in digital form in the form of numbers represented by bytes of data. Number of bytes required to represent multimedia data can be huge. Given the explosive growth of data that needs to be transmitted and stored, compression techniques need to be used .

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	20	30	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Compression Techniques, Modeling and Coding Mathematical Preliminaries for Lossless Compression: Models – Physical Models, Probability Models, Markov Models Coding – Uniquely Decodable Codes, Prefix codes	3
2	Huffman coding: The Huffman Coding Algorithm – Minimum variance Huffman codes Adaptive Huffman coding – Update Procedure,Encoding Procedure,Decoding Procedure Golomb Codes Rice codes Tunstall Codes Applications of Huffman Coding – Lossless Image compression, Text compression, Audio Compression Arithmetic coding: Coding a sequence – Generating a Tag, Deciphering the Tag Generating Binary Code – Uniqueness and Efficiency of the Arithmetic code, Algorithm implementation, Integer Implementation Comparison of Huffman and Arithmetic coding Applications	12
3	Dictionaty Techniques: Static Dictionary – Diagram Coding Adaptive Dictionary – The LZ77 approach, The LZ78 Approach	7

	Applications – Image compression	
4	Context based Compression : Prediction with partial match(ppm) – The Basic Algorithm, The Escape symbol, Length of context, The Exclusion Principle The Burrows-Wheeler Transform – Move-to-Front Coding	**5**
5	Lossless Image Compression: The Old JPEG Standard, CALIC, JPEG-LS	**7**
6	Mathematical Preliminaries for Lossy Coding: Distortion criteria – The Human Visual System, Auditory Perception Models – Probability Models, Linear System Models, Physical Models Scalar Quantization: The Quantization Problem Uniform Quantizer Adaptive Quantization – Forward Adaptive , Backward Adaptive Non uniform Quantization – pdf optimized Quantization, Companded Quantization Entropy Coded Quantization – Entropy coding of Lloyd – Max Quantizer Outputs Vector Quantization : Advantages of Vector Quantization over Scalar Quantization The Linde-Buzo-Gray Algorithm Tree structured Vector Quantization Structured Vector Quantization	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**40**	**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) **Introduction to Data Compression –By Khalid Sayood, publication Elsevier**

2) The Data Compression book, By Mark Nelson,Jean Loup Gaily

3) Data Compression : The Complete Reference", By David Salomon, publication Springer

4) Data Compression Methods and Theory - by James A. Storer

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171615

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the Mathematical Preliminaries involved in compression techniques.	15
CO-2	Use Loseless compression algorithm to compress Image, Text and Audio.	35
CO-3	Use Lossy compression algorithm considering the Criteria.	35
CO-4	Differentiate Loseless and Lossy algorithms and test appropriate algorithm for compression of given digital information.	15

List of Experiments:

1) Given the code as sequence of characters and given the probability of characters, write a program to calculate average length of each code.

2) Write a program to generate Huffman code.

3) Write a program to generate binary code for the sequence abacabb, Given the frequency count of a – 37, b-38, c-25.

4) Write a program to implement digram coding for given text file.

5) Write a program to Implement LZ77 algorithm.

6) Write a program to Implement LZ78 algorithm.

7) 8. Write a program to Implement LZW algorithm.

8) Given the sequence of characters, write a program to find unique characters, and write a program to implement ppma algorithm.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171616
Semester – VII
Subject Name: Internetwork security and Web analytics

Type of course: Elective

Prerequisite: Information and Network security, Web Development

Rationale: Internetwork security helps in identifying security points and helps in identifying the protocols where security is deployed. Web Analytics helps in identifying online/offline patterns and trends of web traffic. It is used to collect, measure, report, and analyze website data. Web analytics tracks key metrics and analyze visitors' activity and traffic flow.

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	20	30	150

Content:

Sr. No.	Content	Total Hrs
1	Picking a security policy, Host based security, Perimeter security, strategy for secure network. Security Review of protocols – lower layer and upper layer The Web Threat or Menace? Classes of attacks	8
2	Web Analytics – Present and future Web Analytics Fundamentals : Capturing Data, Selecting Optimal Web Analytics Tool, Understanding Quickstream Data Quality, Implementing Best practices, Apply the "Three Layers of So What" Test Diving Deep into core Web analytics concepts: Preparing to Understand basics, Revisiting foundation Metrics, Understanding standard reports, Using Web site content Quality and Navigation reports	7
3	Jump start Web data analytics: Creating foundation reports, E-commerce website guide, Website Jump start guide, Measurement jump start guide, Blog measurement jump start guide, competitive benchmarking, Reflections	7
4	Search Analytics – Internal search, SEO and PPC Performing internal site search analytics, Beginning search engine optimization, Measuring SEO efforts, Analyzing pay per click effectiveness	7
5	Measuring Email and multichannel marketing Email marketing fundamentals, Email marketing advance Tracking, Multichannel marketing,Tracking and analysis	7
6	Website experimentation and Testing Preparation and A/B testing, Test Important pages and calls to action, Focus on search	6

	traffic, Test content and creatives, Test price and Promotions, Test direct marketing campaigns	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**30**	**20**	**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. Firewalls and Internet Security Repelling the Wily Hacker By William R. Cheswick, Steven M. Bellovin, Aviel D. Rubin, WILEY publication
2. Web analytics by Avinash Kaushik Wiley publication
3. Web Analytics For Dummies by Jennifer LeClaire and Pedro Sostre

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Differentiate the security aspects in lower and upper layer protocols.	35
CO-2	Explain the parameters, metrics and reports involved in analysis of website, blogs, search engine.	30
CO-3	Explain the measurement of analytics parameters involved in E-mail.	20
CO-4	Implement the test strategy for web site testing.	15

List of Experiments:

Consider the college web site or department web site. Use web analytics to..

1) track engagement with home page and other site content.
2) Measure the time taken to load home page and other pages
3) Perform A/B testing
4) Use cookies to store username.
5) Write content so that users come back to the site
6) Build your keyword list (a list or spreadsheet of attainable, relevant keywords), write content around those keywords and track performance and rankings.
7) Find the blogs which takes people to this site.
8) Try password attack to check the site is not vulnerable to this attack.

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171617
Subject Name: Applied Machine Learning
Semester – VII

Type of course: Elective

Prerequisite: Familiarity with programming in Python, Linear Algebra, 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 leaning for various domains.

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 Machine Learning:** Overview of Human Learning and Machine Learning, Types of Learning, Applications of Machine Learning, Tools and Technology for Machine Learning.	02
2	**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 space and inductive bias, Evaluation and Cross Validation, Hypothesis testing, Monte Carlo Approximation	05
3	**Bayesian Concept Learning:** Impotence of Bayesian methods, Bayesian theorem, Bayes' theorem and concept learning, Bayesian Belief Network	04
4	**Classification and Regression:** Supervised Learning vs Unsupervised Learning, Supervised Learning, Classification Model, Learning steps, Classification algorithms, Clustering, Association rules, Linear Regression, Multivariate Regression, Logistic Regression	13
5	**Neural Networks**-Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation	06
6	**Foundations of neural networks and deep learning, Techniques to improve neural networks:** Regularization and optimizations, hyperparameter tuning and deep learning frameworks (Tensorflow and Keras.), Convolutional Neural Networks, its applications, Recurrent Neural Networks and its applications	07
7	Generative Adversarial Networks, Deep Reinforcement Learning, Adversarial Attacks	05

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	12	20	14	10	7

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) Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2) Pattern Recognition and Machine Learning, by Christopher Bishop
3) The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
4) Machine Learning with Python for Everyone, Mark E. Fenner, Pearson
5) Deep Learning: Methods and Applications, Li Deng and Dong Yu
6) Neural Networks and Deep Learning, Michael Nielsen
7) Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
8) Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
9) Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing
10) Machine Learning, Mitchell T, McGraw-Hill, 1997
11) A first course in Machine Learning, S. Rogers and M. Girolami, CRC Press, 2011
12) Pattern Classification, Duda, Hart and Stork, Wiley-Interscience.

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

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

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 Open Source Software/learning website:

1. Andrew Ng,"Machine Learning",Stanford University https://www.coursera.org/learn/machine-learning/home/info
2. Sudeshna Sarkar, "Introduction to Machine Learning", IIT Kharagpur. https://nptel.ac.in/courses/106105152/1
3. Prof. BalaramanRavindran,"Introduction to Machine Learning", IIT Madras. https://nptel.ac.in/courses/106106139/1
4. https://www.geeksforgeeks.org/machine-learning/
5. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
6. http://neuralnetworksanddeeplearning.com/

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171618
Semester – VII
Subject Name: Blockchain

Type of course: Open Elective

Prerequisite: Cryptography

Rationale: Blockchain helps to manage and secure data as a record with their digital relationships in a decentralized manner. **Wi**th blockchain technology, there is no need for a central authority and two parties can securely conduct communication with one another at a faster pace. Blockchain makes the Transaction transparent by keeping the chain of records.

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	20	30	150

Content:

Sr. No.	Content	Total Hrs
1	Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain solution, Components of Blockchain, Block in Blockchain, The Technology Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol Cryptocurrency – Bitcoin, Altcoin, Token: Introduction, Bitcoin and the cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrency, Cryptocurrency usage	6
2	Public Blockchain System: Introduction, Public Blockchain, Popular public Blockchain, The Bitcoin Blockchain, Ethereum Blockchain Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry	7
3	Private Blockchain System: Introduction, Key characteristics of Private Blockchain, Private Blockchain Examples, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault	5
4	Consortium Blockchain Introduction, Key characteristics of Consortium Blockchain, Hyperledger platform,Overview of Ripple, Overview of Corda	5

5	Applications of Blockchain: Introduction, Blockchain in Education, Blockchain in Healthcare	**3**
6	Limitations and Challenges of Blockchain Blockchain Implementation – Limitation, Challenges	**2**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	50	10	0	0	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. Blockchain Technology By Chandramouli Subramanian, Asha George, Abhilash K A and Meena Karthikeyan , Universities Press Publication
2. Blockchain Blueprint for a New Economy, By Melanie Swan,O'Reilly Publication
3. Blockchain For Dummies By Tiana Laurence, Wiley Publication

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain different types of Blockchain	45
CO-2	Describe Consensus algorithms for decentralized network architecture	25
CO-3	Explain the support of Blockchain technology in a cryptocurrency or Digital currency.	15
CO-4	Use the Blockchain technology for given application.	15

List of Experiments:

1) Ethereum – With respect to Ethereum, carry out following :

- Install Geth Client & Configure Ethereum Nodes
- Manage Accounts and Account states.
- Enable Mining and checking balance in Ether
- Setting up Metamask and Testing Fund Transfer – work with Ethereum Ecosystem

- Add Parameters to Cryptocurrency
- Check Balance Before Transfer
- Adding Transfer Event for Logging

2) Hyperledger - **With respect to Hyperledger, carry out following :**

- Installing Hyperledger Fabric(latest version)
- Build Network with Network configuration
- Hyperledger Fabric Demo

3) Corda - **With respect to Corda, carry out following :**

- Corda – Setting up the Environment
- Building the Corda Network