# GUJARAT TECHNOLOGICAL UNIVERSITY
### Bachelor of Engineering
### Subject Code: 3170726
### Semester – VII

## Subject Name: Mobile Application Development

**Type of course:** Elective

**Prerequisite: Basic Knowledge of OOPS concept and Core java**

**Rationale:** There is a growing number of people who uses smartphones and tablets and hence **mobile app development** has ability to access a large segment. Android has an advantage of being open source. This course will enable the students to develop mobile application using Android.

**Teaching and Examination Scheme:**

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

| Sr. No. | TOPICS | Hrs. |
|---|---|---|
| 1 | **Pre Requirements (Basic Knowledge of OOPS concept and Core java)** | 1 |
| 2 | **Fundamental :** Software Engineering with SDLC, Flow chart, DFD, SQL database | 1 |
| 3 | **Android OS**<br>Introduction to Android, Android System with Architecture, Android Architecture, Development with Android – Platforms, Tools, Versions, Setup Android Environment, Say Hello to Android Application, Building Blocks of Android Application, Work with Activity, Activity Lifecycle, Intents Fragments, Fragment Lifecycle | 2 |
| 4 | **Android UI And Component using Fragments**<br>Create Android UI, Working with Layout, Create Custom Layouts, Work with UI Components and Events, Material Design Toolbar, Tab Layout, Recycler View and Card View, Android Menus | 5 |
| 5 | **Database Connectivity**<br>Storage in Android, Shared Preferences, Shared Preferences Layout, Android Requesting Permission at run time (Android 6.0), Work with SD Card and Files, Database in Android, Realm-No SQL Database | 5 |
| 6 | **Applicability to Industrial Projects**<br>Web services and Parsing, JSON Parsing, Access web data with JSON, Connect to Web Services, Using Async Task & Third Party Library : Retrofit | 4 |
| 7 | **Advanced Android Development**<br>Google Map, Location Service and GPS, Creating Google Map, Work with Location, Location service with Location Manager, Find Current Location, Geo coding | 5 |

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| | | |
|---|---|---|
| | Graphics and Animation, Work with 2D Graphics, Bitmap, Animation, Frame Animation, Tween Animation, View  Animation, Multimedia in Android, Play Audio Files, Play Video Files | |
| | Work in Background, Services, Notification Services, Broadcast Receiver | |
| | Introduction to Firebase with simple CRUID Operation | |
| 8 | **Work with android system**<br>Text to Speech, Camera, Taking Picture with Camera, Manage Bluetooth Connection, Monitor and Manage Wi-Fi, Accelerometer Sensor & Gyroscope.<br>**Development and Deployment**<br>Delvik Debug Tool, Logcat, Emulator Control, Device Control, Work with ADB, Connect Real Devices, Execute Application on Real Device, Publish your Application | 5 |
| | **Total** | 28 |

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

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| 10 | 30 | 60 | - | - | - |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C:**

**Create and above Levels (Revised Bloom's Taxonomy)**

**Course Outcomes:** Students will be able to

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Understand Android architecture, activities and their life cycle. | 10 |
| CO-2 | Apply the knowledge to design user interface using Android UI And Component | 40 |
| CO-3 | Manage system database, remote database operations using web services and Firebase | 20 |
| CO-4 | Apply knowledge of map, location services, Graphics, android system and background services | 25 |
| CO-5 | Publish and distribute Android Application | 05 |

**Books:**

1) Android Application Development Black Book by Pradeep Kothari, DreamTech

2) Beginning Android 4 Application Development by Wei Meng Lee, Wrox

3) Android Wireless Application Development By Lauren Darcey, Shane Conder, Pearson U

**List of Open Source Software/learning website:**

1. https://developer.android.com/

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**List of Practical:**

| Sr | Practical |
|----|-----------|
| 1 | Design Login activity and implement control events : Use EditText, Checkbox and Buttons |
| 2 | Implement Practical 1 using following layouts:<br>1. Linear Layout<br>2. Relative Layout<br>3. Table Layout |
| 3 | Create Activities & implement following<br>1. Implicit intent<br>2. Explicit Intent<br>3. StartActivityForResult |
| 4 | Implement activity Lifecycle and State Callbacks |
| 5 | Practical : Use an Options Menu |
| 6 | Create a Recycler View and list the details of student using following fields:<br>1. Name<br>2. Address<br>3. Photo (Image)<br>4. Delete ( Button Operation) |
| 7 | Practical: Theme, Custom Styles, Drawables |
| 8 | Practical: Save user data in a database |
| 9 | Use an AsyncTask to access remote database (make a use of simple PhP Web service) |
| 10 | Use Retrofit to access remote database (make a use of simple PhP Web service) |
| 11 | Practical : Use Firebase to perform CRUID operation |
| 12 | Practical: BroadcastReceiver |
| 13 | Practical: Notifications |
| 14 | Practical: Get and Save User Preferences |
| 15 | Practical : make a use of android system |
| 16 | Using location service get the current location and display in TextView |
| 17 | Practical : Display the use of animations |

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3170725**
**Semester –VII**
**Subject Name: Digital Forensics**

**Type of course:** Open Elective

**Prerequisite:** Understanding of digital logic, operating system concepts, Computer hardware knowledge

**Rationale:** With the rapid growth of internet users over the globe, the rate of cybercrime is also increasing. Nowadays, Internet applications become an essential part of every discipline with their variety of domain-specific applications. The basic objectives to offer this course as an open elective category to aware engineering graduates of every discipline to understand cybercrimes and their Operandi to analyze the attack.

**Teaching and Examination Scheme:**

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

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Introduction:** <br> Understanding of forensic science, digital forensic, The digital forensic process, Locard's exchange principle, Scientific models. | 3 |
| 2 | **Understanding of the technical concepts:** <br> Basic computer organization, File system, Memory organization concept, Data storage concepts | 6 |
| 3 | **Digital Forensics Process Model:** <br> Introduction to cybercrime scene, Documenting the scene and evidence, maintaining the chain of custody, forensic cloning of evidence, Live and dead system forensic, Hashing concepts to maintain the integrity of evidence, Report drafting. | 6 |
| 4 | **Computer Operating system Artifacts:** <br> Finding deleted data, hibernating files, examining window registry, recycle bin operation, understanding of metadata, Restore points and shadow copies | 6 |
| 5 | **Legal aspects of digital forensics:** <br> Understanding of legal aspects and their impact on digital forensics, Electronics discovery | 3 |
| 6 | **Understanding of digital Forensic tools** <br> Quality assurance, Tool validation, Tool selection, Hardware and Software tools | 3 |
| 6 | **Case Study:** <br> Understanding of Internet resources, Web browser, Email header forensic, social networking sites | 3 |

**Bachelor of Engineering**
**Subject Code: 3170725**

**Suggested Specification table with Marks (Theory):**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| 14 | 21 | 21 | 14 | 0 | 0 |

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

**Reference Books:**

1. The basics of digital Forensics (Latest Edition) – The primer for getting started in digital forensics by John Sammons – Elsevier Syngress Imprint
2. Cybersecurity – Understanding of cybercrimes, computer forensics and Legal perspectives by Nina Godbole and Sunit Belapure – Wiley India Publication
3. Practical Digital Forensics – Richard Boddington [PACKT] Publication, Open source community

**Course Outcomes:**

After completion of the course, students will able to

| Sr. No. | CO statement | Marks |
|---|---|---|
| CO-1 | Describe Forensic science and Digital Forensic concepts | 14 |
| CO-2 | Determine various digital forensic Operandi and motive behind cyber attacks | 07 |
| CO-3 | Interpret the cyber pieces of evidence, Digital forensic process model and their legal perspective. | 14 |
| CO-4 | Demonstrate various forensic tools to investigate the cybercrime and to identify the digital pieces of evidence | 21 |
| CO-5 | Analyze the digital evidence used to commit cyber offences. | 14 |

**List of Experiments:** Practical work will be based on the above syllabus with a minimum of 10 experiments to be performed. It is suggested that the following tools/e-resources can explore during the practical sessions
- Wireshark
- COFEE Tool
- Magnet RAM Capture
- RAM Capture
- NFI Defragger
- Toolsley
- Volatility

**List of e-Learning Resources:**

1. https://nptel.ac.in/
2. https://www.coursera.org/
3. Ministry of Electronics and Information Technology (MeitY) – Govt of India – Information Security Project - https://www.infosecawareness.in/

# 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 leaning for various domains.

**Teaching and Examination Scheme:**

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

**Content: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:** Impotence of Bayesian methods, Bayesian theorem, Bayes' theorem and concept learning, Bayesian Belief Network | 05 |

| | | |
|---|---|---|
| **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, Leaning process, Backpropogation, 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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**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/**

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3170723**
**Semester – VII**
**Subject Name: Natural Language Processing**

**Type of course: Elective**

**Prerequisite:** Probability and statistics, Programming and data structures

**Rationale:** Automated processing of human languages is increasingly becoming important for different types of applications including language translation, surveys, chatbots etc. This subject introduces the fundamentals of natural language processing and its applications in various problem domains.

**Teaching and Examination Scheme:**

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

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Introduction to NLP:** <br> What is NLP? Why NLP is Difficult? History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, How to build an NLP pipeline? Phases of NLP, NLP APIs, NLP Libraries | 6 |
| 2 | **Language Modeling and Part of Speech Tagging:** <br> Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition | 12 |
| 3 | **Words and Word Forms:** <br> Bag of words, skip-gram, Continuous Bag-Of-Words, Embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge Based and Supervised Word Sense Disambiguation | 7 |
| 4 | **Text Analysis, Summarization and Extraction:** <br> Sentiment Mining, Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Relation Extraction, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR | 10 |
| 5 | **Machine Translation:** <br> Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation (SMT), Parameter learning in SMT (IBM models) using EM), Encoder-decoder architecture, Neural Machine Translation | 10 |

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**Bachelor of Engineering**
**Subject Code: 3170723**

**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. Speech and Language Processing: AnIntroduction to Natural Language Processing, Computational Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON
2. Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schütze, Cambridge, MA: MIT Press
3. Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing Company Inc..
4. Natural Language Processing with Python – Analyzing Text with the Natural Language ToolkitSteven Bird, Ewan Klein, and Edward Loper.

**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Understand comprehend the key concepts of NLP and identify the NLP challenges and issues | 14 |
| CO-2 | Develop Language Modeling for various text corpora across the different languages | 28 |
| CO-3 | Illustrate computational methods to understand language phenomena of word sense disambiguation | 14 |
| CO-4 | Design and develop applications for text or information extraction/summarization/classification. | 24 |
| CO-5 | Apply different Machine translation techniques for translating a source to target language(s) | 20 |

**List of Experiments:** Practical work will be based on the above syllabus with minimum 10 experiments to be performed.

**List of e-Learning Resources:**

1. https://www.kaggle.com/learn/natural-language-processing
2. https://www.javatpoint.com/nlp
3. https://nptel.ac.in/
4. https://www.coursera.org/

# GUJARAT TECHNOLOGICAL UNIVERSITY
### Bachelor of Engineering
### Subject Code: 3170722
### BIG DATA ANALYTICS
### B.E. 7<sup>th</sup> 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 | C | 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 Compte 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, ecurity 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 |
|---|---|---|

**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% |

# GUJARAT TECHNOLOGICAL UNIVERSITY
**Bachelor of Engineering**
**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/

*w.e.f. AY 2018-19*

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3170721**
**Semester – VII**
**Subject Name: Parallel and Distributed Computing**

**Type of course:** Elective

**Prerequisite:** Fundamental of programming and operating system, computer networking, and computer Organization

**Rationale:** To introduce the fundamentals of parallel and distributed programming models, design principles, and application development in different parallel programming environments.

**Teaching and Examination Scheme:**

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

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Introduction to Parallel Computing:** <br> The Idea of Parallelism, Power and potential of parallelism, Examining sequential and parallel programs, Scope and issues of parallel and distributed computing, Goals of parallelism, Parallelism and concurrency using multiple instructions streams. | 05 |
| 2 | **Parallel Architecture:** <br> Pipeline architecture, Array processor, Multi processor architecture, Systolic architecture, Dataflow architecture, Architectural classification schemes, Memory access classification, Memory Issues : Shared vs. distributed, Symmetric multiprocessing (SMP), SIMD, Vector processing, GPU co-processing, Flynn's Taxonomy, Instruction Level support for parallel programming, Multiprocessor caches and Cache Coherence, Non-Uniform Memory Access (NUMA). | 10 |
| 3 | **Parallel Algorithm Design Principles and Programming:** <br> Need for communication and coordination/synchronization, Scheduling and contention, Independence and partitioning, Task- Based Decomposition, Data Parallel Decomposition, Characteristics of task and interaction, Load balancing, Data Management, parallel algorithm models, Sources of overhead in parallel programs, Performance metrics for parallel algorithm implementations, Parallel algorithmic patterns like divide and conquer, Map and Reduce, Specific algorithms like parallel Merge Sort, Parallel graph Algorithms. | 10 |
| 4 | **Introduction to Distributed Systems:** <br> Goals of the Distributed Systems, Relation to parallel systems, synchronous versus asynchronous execution, design issues and challenges, Types of Distributed | 06 |

| | | |
|---|---|---|
| | Systems, Distributed System Models, Hardware and software concepts related to distributed systems, middleware models. | |
| 5 | **Distributed Computing and Communication design principles:** <br> A Model of distributed executions, Models of communication networks, Global state of distributed system, Models of process communication. Communication and Coordination: Shared Memory, Consistency, Atomicity, Message- Passing, Consensus, Conditional Actions, Critical Paths, Scalability, and cache coherence in multiprocessor systems, synchronization mechanism. | 08 |
| 6 | **Parallel and Distributed Programming Frameworks** <br> Overview of CUDA, OpenMP, POSIX Threads, Apache Hadoop (DFS), and current trends in parallel and distributed computing. | 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) Introduction to Parallel Computing (2nd Edition), Ananth Grama, Anshul Gupta, and George Karypis, Vipin Kumar, Addition Wesley
2) Parallel and Distributed Systems 2nd Edition, Arun Kulkarni, Nupur Prasasd Giri, Nikhilesh Joshi, Bhushan Jadhav, Wiley
3) Introduction To Parallel Programming, Steven Brawer, Academic Press
4) Introduction To Parallel Processing, M.Sasikumar, Dinesh Shikhare and P. Ravi Prakash, Randy Chow, T. Johnson, Distributed Operating Systems and Algorithms, Addison Wesley
5) Distributed Operating Systems, A.S. Tanenbaum, Prentice Hall
6) Ian Foster: Designing and Building Parallel Programs – Concepts and tools for Parallel Software Engineering, Pearson Publisher, 1st Edition, 2019.
7) Parallel Programming in C with MPI and OpenMP Michael J.Quinn, McGrawHill Higher Education

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**Bachelor of Engineering**
**Subject Code: 3170721**

**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Apply the fundamentals of parallel and distributed computing including parallel architectures and paradigms. | 30% |
| CO-2 | Analyze the various design principles of parallel algorithms. | 20% |
| CO-3 | Learn the intricacies of parallel and distributed programming | 30% |
| CO-4 | Develop and execute basic parallel and distributed applications using basic programming models and tools. | 20% |

**List of Experiments:**

The laboratory will be based on the implementation of the parallel algorithms (on a PC-cluster under Linux platform). The programs will be based on POSIX Thread, MPI programming, Hadoop, Apache Spark etc.

**List of e-Learning Resources:**

1. https://hpc.llnl.gov/training/tutorials/introduction-parallel-computing-tutorial
2. https://www.geeksforgeeks.org/introduction-to-parallel-computing/
3. https://nptel.ac.in/
4. https://www.coursera.org/

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3170720**
**Semester – VII**
**Subject Name: Information Security**

**Type of course: Elective**

**Prerequisite:** Mathematical concepts: Random numbers, Number theory, finite fields

**Rationale:** The use of the Internet for various purpose including social, business, communication and other day to day activities has been in common place. 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 for the students of Computer Engineering/Information technology. The subject covers various important topics concern to information security like symmetric and asymmetric cryptography, hashing, message and user authentication, digital signatures, key distribution 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 | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | Symmetric Cipher Model, Cryptography, Cryptanalysis and Attacks; Substitution and Transposition techniques | 03 |
| 2 | Stream ciphers and block ciphers, Block Cipher structure, Data Encryption standard (DES) with example, strength of DES, Design principles of block cipher, AES with structure, its transformation functions, key expansion, example and implementation | 08 |
| 3 | Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode | 04 |
| 4 | Public Key Cryptosystems with Applications, Requirements and Cryptanalysis, RSA algorithm, its computational aspects and security, Diffie-Hillman Key Exchange algorithm, Man-in-Middle attack | 08 |
| 5 | Cryptographic Hash Functions, their applications, Simple hash functions, its requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA) | 05 |
| 6 | Message Authentication Codes, its requirements and security, MACs based on Hash Functions, Macs based on Block Ciphers | 05 |
| 7 | Digital Signature, its properties, requirements and security, various digital signature schemes (Elgamal and Schnorr), NIST digital Signature algorithm | 04 |
| 8 | Key management and distribution, symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 certificates, Public key | 04 |

| | | |
|---|---|---|
| | infrastructure | |
| **9** | Remote user authentication with symmetric and asymmetric encryption, Kerberos | **04** |

**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. Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings, Pearson
2. Information Security Principles and Practice By Mark Stamp, Willy India Edition
3. Cryptography & Network Security, Forouzan, Mukhopadhyay, McGrawHill
4. Cryptography and Network Security Atul Kahate, TMH
5. Cryptography and Security, C K Shyamala, N Harini, T R Padmanabhan, Wiley-India
6. Information Systems Security, Godbole, Wiley-India
7. Information Security Principles and Practice, Deven Shah, Wiley-India
8. Security in Computing by Pfleeger and Pfleeger, PHI
9. Build Your Own Security Lab : A Field Guide for network testing, Michael Gregg, Wiley India

**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Explore the basic principles of the symmetric cryptography and techniques with their strengths and weaknesses from perspective of cryptanalysis | 10 |
| CO-2 | Implement and analyze various symmetric key cryptography algorithms and their application in different context. | 25 |
| CO-3 | Compare public key cryptography with private key cryptography and Implement various asymmetric key cryptography algorithms. | 25 |
| CO-4 | Explore the concept of hashing and implement various hashing algorithms for message integrity. | 20 |
| CO-5 | Explore and use the techniques and standards of digital signature, key management and authentication. | 20 |

**List of Experiments:**

Minimum 10 practices are to be performed covering the contents of the syllabus. Use of the tools for performing practices is highly recommended.

**List of e-Learning Resources:**

1. Software: cryptool (www.cryptool.org)
2. Software: Wireshark (**www.wireshark.org**)
3. http://www.cryptix.org/
4. http://www.cryptocd.org/
5. http://www.cryptopp.com/
6. **https://nptel.ac.in/**
7. **https://www.coursera.org/**

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Computer Engineering**
**Subject Code: 3170719**
**Semester –VII**
**Subject Name: Distributed System**

**Type of course: Elective**

**Prerequisite:** Data Structure and Algorithm, Operating System, Computer Network

**Rationale:** A distributed system is a system whose components are located on different networked computers, which communicate and coordinate their actions by passing messages to one another.The components interact with one another in order to achieve a common goal. Three significant characteristics of distributed systems are: concurrency of components, lack of a global clock, and independent failure of components. From this course, students may learn foundations of distributed systems, idea of peer to peer services and file system, and security issues in distributed system.

**Teaching and Examination Scheme:**

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

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Fundamentals of Distributed System**: Definition of a Distributed System, Goals of a Distributed System, Types of Distributed Systems, Basics of Operating System and Networking. | **02** |
| 2 | **Basics of Architectures, Processes, and Communication:** Architectures - Types of System Architectures, Self Management in Distributed Systems; Processes - Basics of Threads, Virtualization, Roles of Client and Server, Code Migration; Communication - Types of Communications, Remote Procedure Calls, Message-Oriented Communication, Stream-Oriented Communication, Multicasting | **08** |
| 3 | **Naming** - Names, Identifiers, And Addresses, Flat Naming, Structured Naming, Attribute-Based Naming | **02** |
| 4 | **Synchronization** - Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning Of Nodes, Election Algorithms | **04** |

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| | | |
|---|---|---|
| **5** | **Consistency, Replication and Fault Tolerance**-Introduction To Replication, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, Consistency Protocols, Basics of Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery | **10** |
| **6** | **Security:** Introduction to Security- Security Threats, Policies, and Mechanisms, Design Issues, Basics of Cryptography, Secure Channels- Authentication, Message Integrity and Confidentiality, Secure Group Communication; Access Control- General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service; Security Management-Key Management, Secure Group Management, Authorization Management | **07** |
| **7** | **Categories of Distributed System:**Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, Security: Distributed Object-based System;Distributed File System;Distributed Web-based System; Distributed Coordination based System | **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** | **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.

**Reference Books:**

1. Tanenbaum, A.S. and Van Steen, M., 2007. *Distributed systems: principles and paradigms.* Prentice-Hall.

2. Sinha, P.K., 1998. *Distributed operating systems: concepts and design.* PHI Learning Pvt. Ltd..

3. Liu, M.L., 2003. *Distributed computing: principles and applications.* Pearson Education Inc..

4. Lynch, N.A., 1996. *Distributed algorithms.* Elsevier.

5. Coulouris, G.F., Dollimore, J. and Kindberg, T., 2005. *Distributed systems: concepts and design.*pearson education.

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**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---------|--------------|-------------------|
| CO-1 | Understand architecture and communication systems in Distributed Systems | 30 |
| CO-2 | Understand synchronization and various election algorithms in Distributed Systems | 10 |
| CO-3 | Analyze various consistency and replication protocols and methods | 30 |
| CO-4 | Recognize security threats and apply cryptography methods for security in Distributed Systems | 15 |
| CO-5 | Understand various types of Distributed Systems | 15 |

**Sample List of Experiments:**

1. Write a Program to implement Concurrent Echo Client Server Application.
2. Write at least 2 Programs for Remote Procedure call.
3. Write at least 2 Programs for Remote Method Invocation.
4. Write the Programs for Thread Programming in JAVA.
5. Implement Network File System (NFS).
6. Creation of a BPEL (Business Process Execution Language) Module and a Composite Application.
7. Implement CORBA file.
8. Study of Web Service Programming
9. Study of open source key management tool.

# GUJARAT TECHNOLOGICAL UNIVERSITY
**Bachelor of Engineering**
**Subject Code: 3170718**
**INFORMATION RETRIEVAL**
7<sup>th</sup> 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 |
|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | 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% |

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**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 | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | 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, Eucaluptus, 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

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Computer Engineering**
**Subject Code: 3170716**
**Semester – VII**
**Subject Name: Artificial Intelligence**

**Type of course:** Regular

**Prerequisite:** Data Structures, Mathematics

**Rationale:** With the usage of Internet and World Wide Web increasing day by day, the field of AI and its techniques are being used in many areas which directly affect human life. Various techniques for encoding knowledge in computer systems such as Predicate Logic, Production rules, Semantic networks find application in real world problems. The fields of AI such as Game Playing, Natural Language Processing, and Connectionist Models are also important. Student should know some programming language for AI.

**Teaching and Examination Scheme:**

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

**Contents:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Introduction :** The AI Problems, The Underlying Assumption, AI techniques, The Level of The Model, Criteria For Success | 2 |
| 2 | **Problems, State Space Search & Heuristic Search Techniques:** Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics and Issues in the Design of Search Programs, Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. | 6 |
| 3 | **Knowledge Representation:** Representations And Mappings, Approaches To Knowledge Representation, Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions and Predicates, Resolution, Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning. | 7 |
| 4 | **Symbolic Reasoning Under Uncertainty:** Introduction To Nonmonotonic Reasoning, Logics For Non-monotonic Reasoning. | 2 |
| 5 | **Probabilistic Reasoning:** Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic | 3 |
| 6 | **Game Playing:** Overview, MiniMax Search Procedure, Alpha-Beta Cut-offs, Refinements, Iterative deepening. | 2 |
| 7 | **Planning:** The Blocks World, Components Of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems | 3 |
| 8 | **Natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking | 3 |

| 9 | **Connectionist Models:** Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI. | 4 |
|---|---|---|
| 10 | **Expert Systems:** Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition. | 2 |
| 11 | **Genetic Algorithms:** A Peek into the Biological World, Genetic Algorithms (GAs), Significance of the Genetic Operators, Termination Parameters. | 4 |
| 12 | **Introduction to Prolog:** Introduction, Converting English to Prolog Facts and Rules, Goals, Prolog Terminology, Variables, Control Structures, Arithmetic Operators, Matching in Prolog, Backtracking, Cuts, Recursion, Lists. | 4 |

**Suggested Specification table with Marks (Theory):**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| **10** | **20** | **20** | **10** | **05** | **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. "Artificial Intelligence" -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
2. "Artificial Intelligence: A Modern Approach" -By Stuart Russel, Peter Norvig, PHI
3. "Introduction to Prolog Programming" -By Carl Townsend.
4. "PROLOG Programming For Artificial Intelligence" -By Ivan Bratko( Addison-Wesley)
5. "Programming with PROLOG" –By Klocksin and Mellish.

**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Understand the search technique procedures applied to real world problems | 25 |
| CO-2 | Understand and use various types of logic and knowledge representation schemes. | 30 |
| CO-3 | Understand various Game Playing techniques and apply them in programs. | 15 |
| CO-4 | Gain knowledge in AI Applications and advances in Artificial Intelligence | 20 |
| CO-5 | Use Prolog Programming language using predicate logic | 10 |

**Sample List of Experiments:**

1. Write a program to implement Tic-Tac-Toe game problem.
2. Write a program to implement BFS (for 8 puzzle problem or Water Jug problem or any AI search problem) .

3. Write a program to implement DFS (for 8 puzzle problem or Water Jug problem or any AI search problem)

4. Write a program to implement Single Player Game (Using any Heuristic Function)

5. Write a program to Implement A* Algorithm.

6. Write a program to implement mini-max algorithm for any game development.

7. Assume given a set of facts of the form father(name1,name2) (name1 is the father of name2).

8. Define a predicate brother(X,Y) which holds iff X and Y are brothers.

Define a predicate cousin(X,Y) which holds iff X and Y are cousins.

Define a predicate grandson(X,Y) which holds iff X is a grandson of Y.

Define a predicate descendent(X,Y) which holds iff X is a descendent of Y.

Consider the following genealogical tree:

        father(a,b).
        father(a,c).
        father(b,d).
        father(b,e).
        father(c,f).

Say which answers, and in which order, are generated by your definitions for the following queries in Prolog:

        ?- brother(X,Y).
        ?- cousin(X,Y).
        ?- grandson(X,Y).
        ?- descendent(X,Y).

9. Write a program to solve Tower of Hanoi problem using Prolog.

10. Write a program to solve N-Queens problem using Prolog.

11. Write a program to solve 8 puzzle problem using Prolog.

12. Write a program to solve travelling salesman problem using Prolog.


**List of Open Source Software/learning website:**

https://nptel.ac.in/courses/106/105/106105077/
http://www.journals.elsevier.com/artificial-intelligence/

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3170710**
**MOBILE COMPUTING AND WIRELSS 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 |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | 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 <br> **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 <br> **Antennas and Propagation:** Antennas, Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment <br> **Spread Spectrum-**The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum <br> **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. <br> **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. <br> **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. <br> **Wireless System Operations and Standards:** Cordless Systems, Wireless Local Loop, WiMAX and IEEE 802.16 Broadband Wireless Access Standards <br> **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 |

| | | |
|---|---|---|
| | 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).

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3170710**

**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

# 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 | C | Theory Marks | | Practical Marks | | |
| | | | | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Overview of the Compiler and its Structure**: <br> 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:** <br> 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:** <br> 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 |

| | | |
|---|---|---|
| 4 | **Error Recovery**<br>Error Detection & Recovery, Ad-Hoc and Systematic Methods | 04 |
| 5 | **Intermediate-Code Generation:**<br>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:**<br>Source Language Issues, Storage Organization. Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, | 04 |
| 7 | **Code Generation and Optimization:**<br>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:**<br>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.Dhamdhere, Mcmillian
4. Principles of Compiler Design, V. Raghavan, McGrawHill

*w.e.f. AY 2020-21*

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Computer Engineering**
**Subject Code: 3170701**

**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<br>a. Generate Histogram of words<br>b. Ceasor Cypher<br>c. Extract single and multiline comments from C Program |
| 4 | Implement following Programs Using Lex<br>a. Convert Roman to Decimal<br>b. Check weather given statement is compound or simple<br>c. Extract html tags from .html file |
| 5 | Implementation of Recursive Descent Parser without backtracking<br>Input: The string to be parsed.<br>Output: Whether string parsed successfully or not. Explanation:<br>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<br>Input: The string consists of grammar symbols.<br>Output: The First set for a given string.<br>Explanation:<br>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<br>Input: The string consists of grammar symbols.<br>Output: The Follow set for a given string.<br>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 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. |

*w.e.f. AY 2020-21*

# 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.

*w.e.f. AY 2018-19*