

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: Compiler Design

SUBJECT CODE: 2170701

B.E. 7th SEMESTER

Type of course: Core

Prerequisite: Data Structures and Algorithms, Theory of Computation,

Rationale: Compiler Design is a fundamental/core subject of Computer Engineering. It teaches how Compiler of a Programming Language works. It also focuses on various designs of Compiler and structuring and optimizing various phases of a Compiler. It is also necessary to learn types of Grammar, Finite state machines, lex, yacc and related 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)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Overview of the Translation Process, A Simple Compiler, Difference between interpreter, assembler and compiler. Overview and use of linker and loader, types of Compiler, Analysis of the Source Program, The Phases of a Compiler, Cousins of the Compiler, The Grouping of Phases, Lexical Analysis, Hard Coding and Automatic Generation Lexical Analyzers, Front-end and Back-end of compiler, pass structure	08	15
2	Lexical Analyzer Introduction to Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, A Language for Specifying Lexical Analyzers, Finite Automata From a Regular Expression, Design of a Lexical Analyzer Generator, Optimization of DFA	08	15
3	Parsing Theory Top Down and Bottom up Parsing Algorithms, Top-Down Parsing, Bottom-Up Parsing, 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	10	22

4	Error Recovery Error Detection & Recovery, Ad-Hoc and Systematic Methods	06	08
5	Intermediate Code Generation Different Intermediate Forms, Syntax Directed Translation Mechanisms And Attributed Mechanisms And Attributed Definition.	06	10
6	Run Time Memory Management Source Language Issues, Storage Organization, Storage-Allocation Strategies, and Access to Non local Names, Parameter Passing, Symbol Tables, and Language Facilities for Dynamic Storage Allocation, Dynamic Storage Allocation Techniques.	06	10
7	Code Optimization Global Data Flow Analysis, A Few Selected Optimizations like Command Sub Expression Removal, Loop Invariant Code Motion, Strength Reduction etc.	06	10
8	Code Generation Issues in the Design of a Code Generator, The Target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, A Simple Code Generator, Register Allocation and Assignment, The DAG Representation of Basic Blocks, Peephole Optimization, Generating Code from DAGs, Dynamic Programming Code-Generation Algorithm, Code-Generator Generators.	06	10

Suggested Specification table with Marks (Theory):

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

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

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

Reference Books:

1. Compilers: Principles, Techniques and Tools By Aho, Lam, Sethi, and Ullman, Second Edition, Pearson, 2014
2. Compilers: Principles, Techniques and Tools By Aho, Sethi, and Ullman, Addison-Wesley, 1986
3. Compiler Design in C By Allen I. Holub, Prentice-Hall/Pearson.
4. Advanced Compiler Design and Implementation By Muchnick, Morgan and Kaufmann, 1998.

Course Outcome:

After learning the course the students should be able to:

1. Understand the basic concepts and application of Compiler Design
2. Apply their basic knowledge Data Structure to design Symbol Table, Lexical Analyser , Intermediate Code Generation, Parser (Top Down and Bottom Up Design) and will able to understand strength of Grammar and Programming Language.
3. Understand various Code optimization Techniques and Error Recovery mechanisms.
4. Understand and Implement a Parser.

List of Experiments:

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language
2. Write a C program to identify whether a given line is a comment or not
3. Write a C program to test whether a given identifier is valid or not.
4. Write a C program to simulate lexical analyzer for validating operators
5. To Study about Lexical Analyzer Generator(LEX) and Flex(Fast Lexical Analyzer)
6. Implement following programs using Lex.
 - a. Create a Lexer to take input from text file and count no of characters, no. of lines & no. of words.
 - b. Write a Lex program to count number of vowels and consonants in a given input string.
7. Implement following programs using Lex.
 - a. Write a Lex program to print out all numbers from the given file.
 - b. Write a Lex program to printout all HTML tags in file.
 - c. Write a Lex program which adds line numbers to the given file and display the same onto the standard output.
8. Write a Lex program to count the number of comment lines in a given C program. Also eliminate them and copy that program into separate file.
9. Write a C program for implementing the functionalities of predictive parser for the mini language.
10. Write a C program for constructing of LL (1) parsing.
11. Write a C program for constructing recursive descent parsing
12. Write a C program to implement LALR parsing.
13. Write a C program to implement operator precedence parsing.
14. To Study about Yet Another Compiler-Compiler(YACC).
15. Create Yacc and Lex specification files to recognizes arithmetic expressions involving +, -, * and / .
16. Create Yacc and Lex specification files are used to generate a calculator which accepts, integer and float type arguments.

Design based Problems (DP)/Open Ended Problem:

Students can do a mini project in C to implement various phases of a Compiler considering a simple set of Instructions and other assumptions. They can also practice on LEX and YACC for various applications involving different Grammars etc.

Major Equipment: PC, Unix Server/Client.

List of Open Source Software/learning website:

1. nptel.ac.in
2. https://en.wikipedia.org/wiki/Principles_of_Compiler_Design
3. https://en.wikipedia.org/wiki/Compiler_construction

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

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: Information and Network Security

SUBJECT CODE: 2170709

B.E. Semester VII

Type of course: Core course

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)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment;

Contents:

Sr. No.	Content	Total HRS	% Weightage
1	Symmetric Cipher Model, Cryptography, Cryptanalysis and Attacks; Substitution and Transposition techniques	3	5%
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	10	25%
3	Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode	4	5%
4	Public Key Cryptosystems with Applications, Requirements and Cryptanalysis, RSA algorithm, its computational aspects and	7	15%

	security, Diffie-Hillman Key Exchange algorithm, Man-in-Middle attack		
5	Cryptographic Hash Functions, their applications, Simple hash functions, its requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA)	4	10%
6	Message Authentication Codes, its requirements and security, MACs based on Hash Functions, Macs based on Block Ciphers	3	10%
7	Digital Signature, its properties, requirements and security, various digital signature schemes (Elgamal and Schnorr), NIST digital Signature algorithm	4	8%
8	Key management and distribution, symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 certificates, Public key infrastructure	4	7%
9	Remote user authentication with symmetric and asymmetric encryption, Kerberos	4	5%
10	Web Security threats and approaches, SSL architecture and protocol, Transport layer security, HTTPS and SSH	5	10%

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	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 slightly from above table.

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 Outcome:

After learning the course the students should be able to:

- Define the concepts of Information security and their use.
- Describe the principles of symmetric and asymmetric cryptography.
- Understand and apply the various symmetric key algorithms.
- Understand and apply the various asymmetric key algorithms.
- Understand the concepts of hashing with algorithms and apply them.
- Understand and use the message authentication and its requirement.
- Understand the concepts of digital signature and digital certificates.
- List and explain various digital signature algorithms.
- Understand and use the various key management and remote authentication mechanisms.
- Understand the concept transport layer security.

List of Experiments:

1. Implement Caesar cipher encryption-decryption.
2. Implement Monoalphabetic cipher encryption-decryption.
3. Implement Playfair cipher encryption-decryption.
4. Implement Polyalphabetic cipher encryption-decryption.
5. Implement Hill cipher encryption-decryption.
6. To implement Simple DES or AES.
7. Implement Diffi-Hellmen Key exchange Method.
8. Implement RSA encryption-decryption algorithm.
9. Write a program to generate SHA-1 hash.
10. Implement a digital signature algorithm.
11. Perform various encryption-decryption techniques with cryptool.
12. Study and use the Wireshark for the various network protocols.

Design based Problems (DP)/Open Ended Problem:

1. Study the standard document for the security policy for an organization and prepare the detailed security policy document for managing information security for your institute.
2. Study the keytool provided by the Java to generate key pairs for public key cryptography. Design and develop your own such tool to generate the key pair and test the pair with RSA implementation for encryption-decryption.
3. Study how the browsers manage the digital certificates for various secured websites for making secured communication.

Major Equipments:

- Latest PCs with related software

List of Open Source Software/learning website:

- Software: cryptool (www.cryptool.org)
- Software: Wireshark (www.wireshark.org)
- <http://www.cryptix.org/>
- <http://www.cryptocd.org/>
- <http://www.cryptopp.com/>

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

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: Mobile Computing and Wireless Communication

SUBJECT CODE: 2170710

B.E. 7th SEMESTER

Type of course: Core

Prerequisite: None

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

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	<p>Introduction, Transmission Fundamentals-Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, TransmissionMedia, Multiplexing</p> <p>Communication Networks-LANs,MANs,andWANs,SwitchingTechniques,CircuitSwitching,Packet Switching,</p> <p>Protocols and the TCP/IP Suite- The Need for a Protocol Architecture,TheTCP/IP Protocol Architecture,The OSI Model,Internetworking</p>	10	20
2	<p>Cellular Wireless Networks-Principles of Cellular Networks,First-Generation Analog Second-Generation TDMA Second-Generation CDMA,Third-Generation Systems</p> <p>Antennas and Propagation-Antennas, Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment</p>	12	25

	<p>Modulation Techniques-Signal Encoding Criteria, Digital Data- Analog Signals, Analog Data-Analog Signals, Analog Data-Digital Signals</p> <p>Spread Spectrum-The Concept of Spread Spectrum,Frequency Hopping Spread Spectrum,Direct Sequence Spread Spectrum,Code Division Multiple Access,</p> <p>Coding and Error Control-Error Detection, Block Error Correction Codes , Convolutional Codes, Automatic Repeat Request</p>		
3	<p>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.</p> <p>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</p> <p>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</p> <p>Wireless System Operations and standards - Cordless Systems,Wireless Local Loop, WiMAX and IEEE 802.16 Broadband Wireless Access Standards</p> <p>Mobile IP and Wireless Application. Protocol</p>	12	25
4	Wi-Fi and the IEEE 802.11 Wireless LAN Standard – IEEE 802 architecture, IEEE 802.11 architecture and services, IEEE 802.11 Medium access control, IEEE 802.11 physical layer, Wi-Fi protected access.	04	10
5	Bluetooth , - Radio specification, baseband specification, link manager specification, logical link control and adaption protocol.	04	10
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 LinearLayout Layout, The RelativeLayout Layout, The ScrollView Layout, The TableLayout Layout, The FrameLayout Layout, Using the TextView, EditText View, Button View, RadioButton, CheckBox, ImageButton, RatingBar, The options Menu, The Context Menu.	07	10

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:

- **Wireless Communications & Networks, Second Edition, William Stallings by Pearson**
- **Mobile Computing Technology, Applications and service creation ,Asoke K Telukder, Roopa R Yavagal by TMH**
- **Android Application Development Black Book, Pradeep Kothari, dreamtech press.**
- **Wireless and mobile networks, Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S.Kakkasageri by WILEY**
- **Wireless networks, P. Nicopolitidis, M.S. Obaidat, G.I. Papadimitriou, A.S. Pomportsis by WILEY**
- **Mobile Computing, Raj Kamal by Oxford**
- **Mobile Computing Theory and Practice-Kumkum Garg-Pearson**
- **Lauren Darcey and Shane Conder, Android Wireless Application Development, Pearson Education, 2nd ed. (2011).**

Course Outcome:

After learning the course the students should be able to:

- Understand mobile and wireless network systems such as 2G/3G/4G mobile telephony/data networks,
- Understand GSM and GPRS
- Understand the working of wireless local area network, Bluetooth.

List of Experiments:

- 1) Write a program to simulate Fixed Time Division Multiplexing. Take 12 stations. Every station has time slice of 417 microseconds. Delay should be 10ms. Every time the station gets turn, it shows message.
- 2) Write a program that identifies the bluetooth devices in the wireless range.
- 3) Write a program that prints the signal strength of WiFi connection of the given computer.
- 4) Prepare a wireless ad hoc network and show its working.
- 5) Write a program to find hamming distance. For example Hamming distance $d(v_1, v_2)=3$ if $v_1=011011, v_2=110001$.
- 6) Write a program to perform infrared communication.
- 7) Write a program to perform Bluetooth file transfer.

- 8) Develop an android app which displays “Hello, welcome to Android Lab” message.
- 9) Develop an android app which displays a form to get following information from user.
 - Username
 - Password
 - Email Address
 - Phone Number
 - Country
 - State
 - State
 - Gender
 - Interests
 - Birth Date
 - Birth Time

Form should be followed by a Button with label “Submit”. When user clicks the button, a message should be displayed to user describing the information entered.

Utilize suitable UI controls (i.e. widgets). [When user enters country in AutoCompleteTextView, list of states should be displayed in Spinner automatically.]

- 10) Using Android, Create a login Activity. It asks “username” and “password” from user. If username and password are valid, it displays Welcome message using new activity.
- 11) Develop calculator Android Application.

Design based Problems (DP)/Open Ended Problem:

- 1) **Radio connectivity is inherently poor. How to ensure data delivery without retransmission?**
- 2) **Resource manager might have allocated resources to applications. How to revoke those resources? How to utilize available resources optimally?**

Major Equipment:

Computer, Laptop

List of Open Source Software/learning website:

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

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

www.tutorialspoint.com/mobile_computing

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

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: IMAGE PROCESSING

SUBJECT CODE: 2170712

B.E. 7th SEMESTER

Type of course: Bachelor of Engineering (Information Technology)

Prerequisite:

1. Knowledge of Fourier transform
2. Probability theory
3. Good programming skills.

Rationale:

This course will provide students with more techniques in the digital image processing for image enhancement as well as restoration of noisy images. Emphasis is given more on implementation of various algorithms so that students will be able to develop their own algorithm. The techniques covered in the syllabus have wide applicability in any field which needs to handle the image data.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
L	T	P	C	Theory Marks		Practical Marks			
				ESE (E)	PA (M)	PA (V)		PA (I)	
						ESE			
3	0	2	5	70	30	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment;

Content:

Sr No	Course Content	No of Hrs	% Weight
1	<u>Digital image fundamentals:</u> Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbours of pixel adjacency connectivity, regions and boundaries, Distance measures, Applications.	08	20
2	<u>Image Enhancements:</u> In spatial domain: Basic gray level transformations, Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters. In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.	15	30
3	<u>Image Restoration:</u> Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.	07	20
4	<u>Colour Image processing:</u> Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation.	05	05

5	<u>Wavelet and Multi-resolution processing:</u> Image pyramids, Multi-resolution expansion, wavelet transform.	04	10
6	<u>Image compression:</u> Introduction, Image compression model, Error-free compression, Lossy compression.	04	05
8	<u>Image segmentation:</u> Detection of discontinuities, Edge linking and boundary detection, thresholding.	05	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
20	20	15	10	05

Legends: R : Remembrance ; U = Understanding; A = Application; N= Analyze and E=Evaluation 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. Digital Image Processing, Second Edition by Rafael C. Gonzalez and Richard E. Woods, Pearson Education
2. Digital Image Processing by Bhabatosh Chanda and Dwijesh Majumder, PHI
3. Fundamentals of Digital Image Processing by Anil K Jain, PHI
4. Digital Image Processing Using Matlab, Rafael C. Gonzalez and Richard E. Woods, Pearson Education

Course Outcome:

After learning the course the students should be able to:

1. Understand the basic image enhancement techniques in spatial & frequency domains
2. Understand the various kind of noise present in the image and how to restore the noisy image.
3. Understand the basic multi-resolution techniques and segmentation methods.
4. To apply this concepts for image handling in various fields.

List of Experiments:

- Experiments will be based on the topics taught in the theory.

Major Equipments:

1. Computer system with high computing power and main memory.

List of Open Source Software/learning website:

1. MATLAB with image processing toolbox.
2. Scilab (SIP)

Open ended problems:

1. Enhance the given degraded image (pick up any suitable degraded image which contains letters also) such that we may be able to read the letter properly. Try to get best possible quality of image.
2. Identify type of the noise present in the image using frequency as well as in spatial domain concepts and judge the basic behavioral characteristics of the various noises.
3. Capture the real time binary photo and apply the various segmentation algorithms to identify the various objects presents in the image (i.e road, trees, river etc.)
4. Assign face recognition problem.

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: Service Oriented Computing

SUBJECT CODE: 2170713

B.E. 7th SEMESTER

Type of course: Bachelor of Engineering

Prerequisite: Nil

Rationale: This course describes the foundation of Service Oriented Architecture with its characteristics and advantages. It strongly describes distinction between client-server, two-tier, three-tier and Enterprise architectures. Course continuous with Basic of web services and Introduction to SOAP, REST, WSDL and UDDI. It also highlight the SOAP and REST architecture along with its importance and standards. At the end, WS-BPEL specifies the framework for Web services.

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)		
						ESE	OEP	PA	RP	
03	02	0	05	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	SOC Introduction Distributed computing in the large, Motivations for composition, Challenges for composition, Web Services Architectures and Standards, Computing with Services , W3C	03	05
2	Roots of SOA Fundamental of SOA, Characteristics of SOA, Comparing SOA to client-server and distributed internet architectures, Anatomy of SOA, How components in an SOA interrelate,	03	10
3	Enterprise Architectures and SOC Principles Introduction, Integration versus interoperation , Model Driven Architecture , Concepts of Distributed Computing, XML, Use cases: Intra-enterprise and Inter-enterprise Interoperation, Application, Configuration, Dynamic Selection, Software Fault Tolerance,	05	15
4	Service Oriented Analysis Business-centric SOA – Deriving business, Services, Service modeling, Service Oriented Design; WSDL Basics, SOAP Basics, UDDI Basics, REST Basics, Difference between SOAP v/s REST	05	15
5	Web Service Basics	06	15

	Service Description, Messaging with SOAP, Message Exchange pattern, Coordination, Transaction, Business Activities, Orchestration, Choreography. Service layer Abstraction - Application Service Layer, Business Service Layer, Orchestration Service Layer		
6	Service Composition Service composition guidelines – Entity-centric business service design, Application service design, Task centric business, service design	02	05
7	SOA Platform basics SOA support in J2EE: Java API for XML based web services (JAX-WS), Java architecture for XML binding (JAXB), Java API for XML Registries (JAXR), Java API for XML based RPC (JAX-RPC), Web Services Interoperability Technologies (WSIT). SOA support in .NET: Common Language Runtime, ASP.NET web forms, ASP.NET web services, Web Services Enhancements (WSE).	08	20
8	WS-* Specifications and WS-BPEL WS-Addressing, WS-ReliableMessaging, WS-Policy (including WS-Policy Attachments and WS-PolicyAssertions), WS-Metadata Exchange, WS-BPEL basics, WS-Coordination overview, WS-Choreography, WS-Security (including XML-Encryption, XML-Signature, and SAML)	07	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10	18	18	18	06

Legends: R : Remembrance ; U = Understanding; A = Application; N = Analyze; E = Evaluation and above Levels (Revised Bloom's Taxonomy)

Reference Books:

- Munindar Singh & Michael Huhns, "Service Oriented Computing: Semantics, Processes, Agents", Wiley Publication, 2004
- Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005
- Thomas Erl, "SOA Principles of Service Design" (The Prentice Hall Service-Oriented Computing Series from Thomas Erl), 2005
- Mark D Hansen, "SOA using Java™ Web Services", Prentice Hall Publication, 2007
- Dan Woods and Thomas Mattern, "Enterprise SOA Designing IT for Business Innovation" O'REILLY.
- Shankar Kambhampaty, "Service-oriented Architecture for Enterprise Applications", John Wiley & Sons, 2008

Course Outcome:

After learning the course, the student will be able:

1. To understand the principles of service oriented architecture.
2. To understand and describe the standards & technologies of modern web services implementations.

3. To properly use market-leading development tools to create and consume web services.
4. To analyze and select the appropriate framework components in the creation of web service solutions.
5. To apply object-oriented programming principles to the creation of web service solutions.
6. To identify the requirements of a medium-difficulty programming task, and create software that meets the requirements.

List of Experiments:

1. Develop DTD and XSD for University Information System having Exam Enrollment from beginning of Semester, along with Exam Registration and Marks submission by Teachers to University from Various Colleges and Results Sheets Generation by University on Online Report
2. Develop Mark sheet XML Document and display Mark sheet based on CSS and XSL presentation Format.
3. Develop Java Based Program using JAXP or XML API in reading XML file for Students Information and Display HTML Table.
4. Develop Java Based web Service using REST and SOAP Based web service in Netbeans for University Course List and Search Course based Course Title and Course ID.
5. Create DTD file for student information and create a valid well-formed XML document to store student information against this DTD file.
6. Create XMS schema file for student information and create a valid well-formed XML document to store student information against this DTD file.
7. Create web calculator service in .NET Beans and create Java client to consume this web service.
8. Develop same web service using JX-WS.
9. Create web calculator service in .NET and Experiment. 9 Create java client to consume web service developed using Apache AXIS.
10. Using WS –GEN and WS-Import develop the java web service & call it by Java Client.

Design based Problems (DP)/Open Ended Problem:

1. Think, analyze and implement SOAP based web service to create to-do list application in your preferred language.
2. Consider library management system for your college and create REST based web service for it to manage all the functionalities of your college library.

Major Equipment:

Computer system with latest hardware, Java Environment with IDE (Eclipse or NetBeans), .NET Environment with Microsoft framework.

List of Open Source Software/learning website:

- http://www.bogotobogo.com/WebTechnologies/OpenAPI_RESTful.php
- http://www.bogotobogo.com/python/python_http_web_services.php
- <http://www.xmlmaster.org/en/article/d01/c03/>

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: Distributed DBMS

SUBJECT CODE: 2170714

B.E. 7th SEMESTER

Type of course: Elective

Prerequisite: Database Management Systems & Networking

Rationale: Students are familiar with Centralized DBMS. This subject will give introduction to Distributed DBMS and associated problems. Students will be able to understand various algorithms and techniques for managing distributed database.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Complicating factors, Problem areas	03	7
2	Overview of RDBMS: Concepts, Integrity, Normalization	02	5
3	Distributed DBMS Architecture : Models- Autonomy, Distribution, Heterogeneity DDBMS Architecture – Client/Server, Peer to peer, MDBS	03	7
4	Data Distribution Alternatives: Design Alternatives – localized data, distributed data Fragmentation – Vertical, Horizontal (primary & derived), hybrid, general guidelines, correctness rules Distribution transparency – location, fragmentation, replication Impact of distribution on user queries – No Global Data Dictionary(GDD), GDD containing location information, Example on fragmentation	05	15
5	Semantic Data Control : View Management, Authentication – database authentication, OS authentication, Access Rights, Semantic Integrity Control – Centralized & Distributed , Cost of enforcing semantic integrity	03	10

6	Query Processing : Query Processing Problem, Layers of Query Processing Query Processing in Centralized Systems – Parsing & Translation, Optimization, Code generation, Example Query Processing in Distributed Systems – Mapping global query to local, Optimization,	04	10
7	Optimization of Distributed Queries: Query Optimization, Centralized Query Optimization, Join Ordering Distributed Query Optimization Algorithms	06	10
8	Distributed Transaction Management & Concurrency Control: Transaction concept, ACID property, Objectives of transaction management, Types of transactions, Objectives of Distributed Concurrency Control, Concurrency Control anomalies, Methods of concurrency control, Serializability and recoverability, Distributed Serializability, Enhanced lock based and timestamp based protocols, Multiple granularity, Multi version schemes, Optimistic Concurrency Control techniques	08	18
9	Distributed Deadlock & Recovery Deadlock concept, Deadlock in Centralized systems, Deadlock in Distributed Systems – Detection, Prevention, Avoidance, Wait-Die Algorithm, Wound-Wait algorithm Recovery in DBMS - Types of Failure, Methods to control failure, Different techniques of recoverability, Write- Ahead logging Protocol, Advanced recovery techniques- Shadow Paging, Fuzzy checkpoint, ARIES, RAID levels, Two Phase and Three Phase commit protocols	08	18

Suggested Specification table with Marks (Theory):

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

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

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

Reference Books:

1. Principles of Distributed Database Systems, Ozsu, Pearson Publication
2. Distributed Database Management Systems, Rahimi & Haug, Wiley
3. Distributed Database Systems, Chanda Ray, Pearson Publication
4. Distributed Databases, Sachin Deshpande, Dreamtech

Course Outcome:

After learning the course the students should be able to:

- Understand what is Distributed DBMS
- Understand various architectures of DDBMS
- Apply various fragmentation techniques given a problem
- Understand and calculate the cost of enforcing semantic integrity control
- Understand the steps of query processing
- How optimization techniques are applied to Distributed Database
- Learn and understand various Query Optimization Algorithms
- Understand Transaction Management & Compare various approaches to concurrency control in Distributed database
- Understand various algorithms and techniques for deadlock and recovery in Distributed database

List of Experiments:

- [1] Create two databases either on single DBMS and Design Database to fragment and share the fragments from both database and write single query for creating view.
- [2] Create two databases on two different computer systems and create database view to generate single DDB.
- [3] Create various views using any one of examples of database and Design various constraints.
- [4] Write and Implement algorithm for query processing using any of Example in either C /C++ /Java / .NET
- [5] Using any of example, write various Transaction statement and show the information about concurrency control [i.e. various lock's from dictionary] by executing multiple update and queries.
- [6] Using Transaction /commit rollback, Show the transaction ACID properties.
- [7] Write java JDBC program and use JTA to show various isolation level's in transaction.
- [8] Implement Two Phase Commit Protocol
- [9] Case study on noSQL
- [10] Case study on Hadoop

Design based Problems (DP)/Open Ended Problem:

1. Countrywide drug supplier chain operates from five different cities in the country and it maintains following database.
Shop(ds-id, ds-city, ds-contactno)
Medicine(med-id, med-name,manuf-id)
Manufacturer(manuf-id, manuf-name, manuf-city)
Order(med-id, ds-id,qty)
Suggest fragmentation and allocation schema considering following frequent queries”
 - (a) List manufacturer names who belong to the same city in which the drug shop that has placed an order resides.
 - (b) How many orders are generated from a city say “Ahmedabad”?Justify your design and mention assumptions if any clearly.

2. Consider relations EMP(eno,ename,title) and ASG(eno,pno, resp,dur). Write down suitable queries in SQL-like syntax and in relational algebra for finding the names of employees who are managers of any project. Is the query optimized? If not, optimize it.

Major Equipment:

Networking of computers, RDBMS

List of Open Source Software/learning website:

1. https://docs.oracle.com/cd/B10501_01/server.920/a96521/ds_concepts.htm
2. <https://cs.uwaterloo.ca/~tozsu/ddbook/presentation-slides.php>
3. http://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm

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

GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT NAME: DATA MINING and BUSINESS INTELLIGENCE

SUBJECT CODE: 2170715

B.E. 7th SEMESTER

Objective of the Course:

The main objective to give the course

- To understand the basics of data mining and business intelligence
- To understand the basics of data warehousing
- To understand the use of the various data mining techniques, tasks and tools
- To understand big data and hadoop framework

Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to Data Warehousing and Business Intelligence	05
2.	The Architecture of BI and DW	07
3.	Introduction to data mining (DM)	04
4.	Data Pre-processing	07
5.	Concept Description & Association Rule Mining	07
6.	Classification and Prediction	07
7.	Data Mining for Business Intelligence Applications	04
8.	Advance topics	04

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

Teaching and Examination Scheme:

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

Detailed Syllabus:

- 1. Overview and concepts Data Warehousing and Business Intelligence** **05 Hours 12%**
Why reporting and Analysing data, Raw data to valuable information- Lifecycle of Data - What is Business Intelligence - BI and DW in today's perspective - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data 1marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing - Basic elements of data warehousing - trends in data warehousing.
- 2. The Architecture of BI and DW** **07 Hours 16%**
BI and DW architectures and its types - Relation between BI and DW - OLAP (Online analytical processing) definitions - Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice or rotation - OLAP models - ROLAP versus MOLAP - defining schemas: Stars, snowflakes and fact constellations
- 3. Introduction to data mining (DM)** **04 Hours 08%**
Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process
- 4. Data Pre-processing** **07 Hours 16%**
Why to pre-process data? - Data cleaning: Missing Values, Noisy Data - Data Integration and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression - Numerosity Reduction - Data Mining Primitives - Languages and System Architectures: Task relevant data - Kind of Knowledge to be mined - Discretization and Concept Hierarchy.
- 5. Concept Description and Association Rule Mining** **07 Hours 16%**
What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons Association Rule Mining: Market basket analysis - basic

concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm – Incremental ARM – Associative Classification – Rule Mining

6. Classification and Prediction 07 Hours 16%

What is classification and prediction? – Issues regarding Classification and prediction:

- Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network
- Prediction methods: Linear and nonlinear regression, Logistic Regression

Introduction of tools such as DB Miner /WEKA/DTREG DM Tools

7. Data Mining for Business Intelligence Applications 04 Hours 08%

Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc.,

- Data Analytics Life Cycle: Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists
- Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

8. Advance topics 04 Hours 08%

Introduction and basic concepts of following topics.

Clustering, Spatial mining, web mining, text mining,

Big Data: Introduction to big data: distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce. Introduction to Hadoop architecture: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster

Setup – SSH & Hadoop Configuration – HDFS Administering –
Monitoring & Maintenance.

Instructional Method and Pedagogy:

- Lectures will be taken in class room with the use of multi-media presentations and black board – mix of both.
- Assignments based on above course content will be given to the students at the end of each chapter. Each assignment contains minimum 5 questions.
- Quizzes and Surprise tests will be conducted for testing the knowledge of students for particular topic.

Student Learning Outcomes:

By taking this course,

- Students will be able to use mining tool.
- Students are able to perform various data warehouse related exercise.

Recommended Study Material:

❖ **Text Books:**

1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann
2. M. Kantardzic, “Data mining: Concepts, models, methods and algorithms, John Wiley & Sons Inc.

❖ **Reference Books:**

1. Paulraj Ponnian, “Data Warehousing Fundamentals”, John Willey.
2. M. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education.
3. G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, Wiley India.