GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140705
Semester – IV
Subject Name: Object Oriented Programming -I

Type of course: core course

Prerequisite: None

Rationale: Object oriented Programming has become a fundamental part of software development. OOP facilitates Reuse of code, flexibility, effective problem solving. It provides a modular structure for programs and implementation details are hidden. Reuse of code lowers the cost of development.

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)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to java and elementary programming:** Java language specification API, JDK and IDE, Creating, compiling and Executing a simple java program, Programming style, documentation and errors, Reading input from console, identifiers and variables, Assignment statements, Named constants and naming conventions, Data Types (Numeric, Boolean, Character, String) its Operations and Literals, Evaluating Expressions and operator Precedence, Types of Operators (Augmented assignment, Increment and Decrement, Logical), operator precedence and associativity, numeric type conversions.	4
2	**Selections , Mathematical functions and loops:** If statements, Two way, Nested if and multi-way if statements, Switch statements, Conditional Expressions, Common mathematical functions ,While , do-while and for loop, nested loops, Keyword break and continue.	4
3	**Methods and Arrays:** Defining and calling method, Passing argument by values, Overloading methods and scope of variables, Method abstraction and stepwise refinement, Single Dimensional arrays, copying arrays ,Passing and returning array from method, Searching and sorting arrays and the Array class, Two-Dimensional array and its processing, Passing Two-dimensional Array to methods, Multidimensional Arrays.	6
4	**Objects and Classes:** Defining classes for objects, Constructors, accessing objects via reference variable, using classes from the java library, static variables, constants and methods, visibility modifiers and Data field encapsulation, passing objects to methods, array of objects, immutable	4

	objects and classes, scope of variable and the this reference.	
5	**Object oriented thinking:** Class abstraction and Encapsulation, thinking in objects and class relationships, Primitive data type and wrapper class types, Big integer and Big decimal class, string class, String Builder and String Buffer class, super class and subclass, using super keyword, overriding and overloading methods, polymorphism and dynamic binding, casting objects and instanceof operator, The ArrayList class and its methods, The protected data and methods.	**5**
6	**Exception Handling, I/O, abstract classes and interfaces:** Exception types, finally clause, rethrowing Exceptions, chained exceptions, defining custom exception classes, file class and its input and output, Reading data from web, Abstract classes, interfaces, Comparable and Cloneabal interface.	**4**
7	**JAVAFX basics and Event-driven programming and animations:** Basic structure of JAVAFX program, Panes, UI control and shapes, Property binding, the Color and the Font class, the Image and Image-View class, layout panes and shapes, Events and Events sources, Registering Handlers and Handling Events, Inner classes, anonymous inner class handlers, mouse and key events, listeners for observable objects, animation	**5**
8	**JAVAFX UI controls and multimedia:** Labeled and Label, button, Checkbox, RadioButton, Textfield, TextArea, Combo Box, ListView, Scrollbar, Slider, Video and Audio.	**4**
9	**Binary I/O ,Recursion and Generics:** Text I/O, binary I/O, Binary I/O classes, Object I/o, Random Access files, Problem solving using Recursion, Recursive Helper methods, Tail Recursion, Defining Generic classes and interfaces, Generic methods, Raw types and backward compatibility, wildcard Generic types, Erasure and Restrictions on Generics.	**4**
10	**List, Stacks, Queues and Priority Queues:** Collection, Iterators, Lists, The Comparator interface, static methods for list and collections, Vector and Stack classes, Queues and priority Queues.	**4**
11	**Sets and Maps:** Comparing the performance of Sets and Lists, singleton and unmodifiable collections and Maps.	**2**
12	**Concurrency** **Thread states and life cycle,Creating and Executing threads with the Executor Framework, Thread synchronization**	**2**

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	**50**	**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) **Intro to Java Programming, 10th edition, Y.Daniel Liang, Pearson**

2) **Object oriented programming with Java , Rajkumar Buyya,S Thamarai Selvi, Xingchen Chu, McGrawHill**

3) **Programming in Java, Sachin Malhotra, Saurabh Choudhary, Oxford**

4) **Programming with JAVA , E Balagurusamy, McGrawHill**

5) **CORE JAVA volume -I Cay Horstmann, Pearson**

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Use various Java constructs, features and libraries for simple problems.	20
CO-2	Demonstrate how to define and use classes, interfaces, create objects and methods, how to override and overload methods, compile and execute programs.	20
CO-3	Write a program using exception handling, multithreading with synchronization.	20
CO-4	Write a program using Files, binary I/O, collection Frameworks for a given problem.	30
CO-5	Design and develop GUI based applications in a group using modern tools and frameworks.	10

List of Experiments:

(1)	Write a Program that displays Welcome to Java, Learning Java Now and Programming is fun.

(2)	Write a program that solves the following equation and displays the value x and y: 1) 3.4x+50.2y=44.5 2) 2.1x+.55y=5.9 (Assume Cramer's rule to solve equation ax+by=e x=ed-bf/ad-bc cx+dy=f y=af-ec/ad-bc)
(3)	Write a program that reads a number in meters, converts it to feet, and displays the result.
(4)	Body Mass Index (BMI) is a measure of health on weight. It can be calculated by taking your weight in kilograms and dividing by the square of your height in meters. Write a program that prompts the user to enter a weight in pounds and height in inches and displays the BMI. Note:- 1 pound=.45359237 Kg and 1 inch=.0254 meters.
(5)	Write a program that prompts the user to enter three integers and display the integers in decreasing order.
(6)	Write a program that prompts the user to enter a letter and check whether a letter is a vowel or constant.
(7)	Assume a vehicle plate number consists of three uppercase letters followed by four digits. Write a program to generate a plate number.
(8)	Write a program that reads an integer and displays all its smallest factors in increasing order. For example if input number is 120, the output should be as follows:2,2,2,3,5.
(9)	Write a method with following method header. public static int gcd(int num1, int num2) Write a program that prompts the user to enter two integers and compute the gcd of two integers.
(10)	Write a test program that prompts the user to enter ten numbers, invoke a method to reverse the numbers, display the numbers.
(11)	Write a program that generate 6*6 two-dimensional matrix, filled with 0's and 1's , display the matrix, check every raw and column have an odd number's of 1's.
(12)	Write a program that creates a Random object with seed 1000 and displays the first 100 random integers between 1 and 49 using the NextInt (49) method.
(13)	Write a program for calculator to accept an expression as a string in which the operands and operator are separated by zero or more spaces. For ex: 3+4 and 3 + 4 are acceptable expressions.
(14)	Write a program that creates an Array List and adds a Loan object , a Date object , a string, and a Circle object to the list, and use a loop to display all elements in the list by invoking the object's to String() method.
(15)	Write the bin2Dec (string binary String) method to convert a binary string into a decimal number. Implement the bin2Dec method to throw a NumberFormatException if the string is not a binary string.
(16)	Write a program that prompts the user to enter a decimal number and displays the number in a fraction. Hint: Read the decimal number as a string, extract the integer part and fractional part from the string.
(17)	Write a program that displays a tic-tac-toe board. A cell may be X, O, or empty. What to display at each cell is randomly decided. The X and O are images in the files X.gif and O.gif.
(18)	Write a program that moves a circle up, down, left or right using arrow keys.
(19)	Write a program that displays the color of a circle as red when the mouse button is pressed and as blue when the mouse button is released.

(20)	Write a GUI program that use button to move the message to the left and right and use the radio button to change the color for the message displayed.
(21)	Write a program to create a file name 123.txt, if it does not exist. Append a new data to it if it already exist. write 150 integers created randomly into the file using Text I/O. Integers are separated by space.
(22)	Write a recursive method that returns the smallest integer in an array. Write a test program that prompts the user to enter an integer and display its product.
(23)	Write a generic method that returns the minimum elements in a two dimensional array.
(24)	Define MYPriorityQueue class that extends Priority Queue to implement the Cloneable interface and implement the clone() method to clone a priority queue.
(25)	Write a program that reads words from a text file and displays all the nonduplicate words in descending order.The text file is passed as a command-line argument.

Major Equipment:

Computer, Laptop

List of Open Source Software/learning website:

https://www.tutorialspoint.com/java/

https://www.javatpoint.com/java-programs

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140707
Semester – IV
Subject Name: Computer Organization & Architecture

Type of course: core course

Prerequisite: None

Rationale:

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	5	70	30	30	20	150

Syllabus:

Sr. No.	Content	Total Hrs
1	Computer Data Representation Basic computer data types, Complements, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Register Transfer language, Register Transfer, Bus and Memory Transfers (Tree-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit	4
2	Basic Computer Organization and Design Instruction codes, Computer registers, computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Complete computer description, Design of Basic computer, Design of Accumulator Unit.	4
3	Assembly Language Programming Introduction, Machine Language, Assembly Language Programming: Arithmetic and logic operations, looping constructs, Subroutines, I-O Programming.	8
4	Micro programmed Control Organization: Control Memory, Address sequencing, Micro program example, Design of Control Unit	4
5	Central Processing Unit Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, Data transfer and manipulation, Program control, Reduced Instruction Set Computer (RISC) & Complex Instruction Set Computer (CISC)	5
6	Pipeline And Vector Processing Flynn's taxonomy, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction, Pipeline, RISC Pipeline, Vector Processing, Array Processors	5
7	Computer Arithmetic Introduction, Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Decimal Arithmetic Unit.	4
8	Input-Output Organization Input-Output Interface, Asynchronous Data Transfer, Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPUIOP Communication, Serial communication.	4
9	Memory Organization Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.	6

10	Multiprocessors Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors.	4

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
20	**30**	**15**	**15**	**15**	**5**

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

Reference Books:

1. M. Morris Mano, "Computer System Architecture", Pearson Education
2. Yale N. Patt, Sanjay J. Patel, "Introduction to Computing Systems" McGraw Hill.
3. Hamacher, Vranesic, Zaky, "Computer Organization", McGraw Hill.
4. Andrew S. Tanenbaum and Todd Austin, "Structured Computer Organization", Pearson Education
5. N. D. Jotwani, "Computer system organization", McGraw Hill
6. R.S.Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085A", Penram International
7. Douglas Hall, Microprocessors and Interfacing, TMH.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and explain the basic structure and functional units of a digital computer.	10
CO-2	Write assembly language programs and identify the role and working of various functional units of a computer for executing an instructions.	30
CO-3	Design processing unit using the concepts of ALU and control logic design.	25
CO-4	Design circuits for interfacing memory and I/O with processor.	25
CO-5	Comprehend the features and performance parameters of different types of computer architectures.	10

List of Practical:

Sr. No.	Practical Title	CO
1	Implement Booth's Algorithm	CO-1
2	Write the working of 8085 simulator GNUsim8085 and basic architecture of 8085 along with small introduction.	CO-2, CO-6
3	Write an assembly language code in GNUsim8085 to store numbers in reverse order in memory location.	CO-5
4	Write an assembly language code in GNUsim8085 to implement arithmetic instruction	CO-2
5	Write an assembly language code in GNUsim8085 to find the factorial of a number.	CO-5
6	Write an assembly language code in GNUsim8085 to implement logical instructions.	CO-2
7	Design ALU using Logisim.	CO-6
8	Implement 16-bit single-cycle MIPS processor in Verilog HDL	CO-6

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140708
Semester – IV
Subject Name: Discrete Mathematics

Type of course: Undergraduate

Prerequisite : Algebra, Logic

Rationale : This course introduces the basic concepts of discrete mathematics in the field of computer science. It covers sets, logic, functions, relations, graph theory and algebraic structures. These basic concepts of sets, logic functions and graph theory are applied to Boolean Algebra and logic networks, while the advanced concepts of functions and algebraic structures are applied to finite state machines and coding theory.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	ESE(V)	PA(I)	
3	2	0	5	70	30	0	0	100

Contents:

Sr. No.	Content	Total Hrs.	% weightage
01	**Set Theory**: Basic Concepts of Set Theory: Definitions, Inclusion, Equality of Sets, Cartesian product, The Power Set, Some operations on Sets, Venn Diagrams, Some Basic Set Identities **Functions**: Introduction & definition, Co-domain, range, image, value of a function; Examples, surjective, injective, bijective; examples; Composition of functions, examples; Inverse function, Identity map, condition of a function to be invertible, examples; Inverse of composite functions, Properties of Composition of functions; **Counting:** The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations	06	12%
02	**Propositional Logic**: Definition, Statements & Notation, Truth Values, Connectives, Statement Formulas & Truth Tables, Well-formed Formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Examples **Predicate Logic:** Definition of Predicates; Statement functions, Variables, Quantifiers, Predicate Formulas, Free & Bound Variables; The Universe of Discourse, Examples, Valid Formulas & Equivalences, Examples	06	13%
03	**Relations**: Definition, Binary Relation, Representation, Domain, Range, Universal Relation, Void Relation, Union, Intersection, and Complement Operations on Relations, Properties of Binary Relations in a Set: Reflexive, Symmetric, Transitive, Anti-symmetric Relations, Relation Matrix and Graph of a Relation; Partition and Covering of a Set, Equivalence Relation, Equivalence Classes, Compatibility Relation, Maximum Compatibility Block, Composite Relation, Converse of a Relation, Transitive Closure of a Relation R in Set X **Partial Ordering**: Definition, Examples, Simple or Linear Ordering, Totally Ordered Set (Chain), Frequently Used Partially Ordered Relations, Representation of Partially Ordered Sets, Hesse Diagrams, Least & Greatest Members, Minimal & Maximal Members, Least Upper Bound (Supremum), Greatest Lower Bound (infimum), Well-ordered Partially Ordered Sets (Posets). Lattice as Posets, complete, distributive	10	25%

	modular and complemented lattices Boolean and pseudo Boolean lattices. (Definitions and simple examples only) **Recurrence Relation:** Introduction, Recursion, Recurrence Relation, Solving, Recurrence Relation		
04	**Algebraic Structures:** Algebraic structures with one binary operation- Semigroup, Monoid, Group, Subgroup, normal subgroup, group Permutations, Coset, homomorphic subgroups, Lagrange's theorem, Congruence relation and quotient structures. Algebraic structures (Definitions and simple examples only) with two binary operation- Ring, Integral domain and field.	**10**	**25%**
05	**Graphs:** Introduction, definition, examples; Nodes, edges, adjacent nodes, directed and undirected edge, Directed graph, undirected graph, examples; Initiating and terminating nodes, Loop (sling), Distinct edges, Parallel edges, Multi-graph, simple graph, weighted graphs, examples, Isolated nodes, Null graph; Isomorphic graphs, examples; Degree, Indegree, out-degree, total degree of a node, examples; Subgraphs: definition, examples; Converse (reversal or directional dual) of a digraph, examples; Path: Definition, Paths of a given graph, length of path, examples; Simple path (edge simple), elementary path (node simple), examples; Cycle (circuit), elementary cycle, examples; **Reachability:** Definition, geodesic, distance, examples; Properties of reachability, the triangle inequality; Reachable set of a given node, examples, Node base, examples; **Connectedness:** Definition, weakly connected, strongly connected, unilaterally connected, examples; Strong, weak, and unilateral components of a graph, examples, Applications to represent Resource allocation status of an operating system, and detection and correction of deadlocks; Matrix representation of graph: Definition, Adjacency matrix, boolean (or bit) matrix, examples; Determine number of paths of length n through Adjacency matrix, examples; Path (Reachability) matrix of a graph, examples; Warshall's algorithm to produce Path matrix, Flowchart. **Trees:** Definition, branch nodes, leaf (terminal) nodes, root, examples; Different representations of a tree, examples; Binary tree, m-ary tree, Full (or complete) binary tree, examples; Converting any m-ary tree to a binary tree, examples; Representation of a binary tree: Linked-list; Tree traversal: Pre-order, in-order, post-order traversal, examples, algorithms; Applications of List structures and graphs	**10**	**25%**

Reference Books:

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill,1997.
2. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,1999.
3. K. H. Rosen, Discrete Mathematics and its applications, Tata McGraw-Hill, 6th Ed., 2007.
4. David Liben-Nowell, Discrete Mathematics for Computer Science, Wiley publication, July 2017.
5. Eric Gossett, Discrete Mathematics with Proof, 2nd Edition,Wiley publication, July 2009.

Suggested Specification table with Marks (Theory):					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	10	10	

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

Course Outcomes:

After Completion of this course students will be able

Sr. No.	Course Outcomes	Weightage in %
1	Understand the basic principles of sets and operations in sets and apply counting principles to determine probabilities, domain and range of a function, identify one-to- one functions, perform the composition of functions and apply the properties of functions to application problems.	12%
2	Write an argument using logical notation and determine if the argument is or is not valid. To simplify and evaluate basic logic statements including compound statements, implications, inverses, converses, and contra positives using truth tables and the properties of logic. To express a logic sentence in terms of predicates, quantifiers, and logical connectives.	13%
3	Apply relations and to determine their properties. Be familiar with recurrence relations	25%
4	Use the properties of algebraic structures.	25%
5	Interpret different traversal methods for trees and graphs. Model problems in Computer Science using graphs and trees.	25%

List of Open Source Software/learning website: NPTEL Discrete Mathematics lectures

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140709
Semester – IV
Subject Name: PRINCIPLES OF ECONOMICS AND MANAGEMENT

Type of course: Undergraduate

Prerequisite: Linear and non-liner data structures, working experience of any one structured programming language

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

Content:

Sr. No	Topics	Hrs.	Module Weightage
1.	Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity	5	12
2.	Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical	4	12
3.	Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income.	4	12
4.	Basic economic problems; Poverty-meaning, absolute & relative poverty, causes, measures to reduce Unemployment: meaning, types, causes, remedies Inflation; meaning, types, causes, measures to control	4	12
5.	Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.	4	12
6.	Introduction to Management; Definitions, Nature, Management Difference between Management & administration, skill, types and roles of managers Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory	5	12
7.	Functions of Management; Planning, Organizing, Staffing, Directing, Controlling (meaning, nature and importance) Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization, chain of command, centralization and decentralisation	6	12
8.	Organisational culture of Environment concept of culture and its importance,	4	10

	attributes culture, How does culture affect managers and employees		
9.	Corporate Social Responsibility; meaning, importance Business Ethics; meaning, importance.	03	6%

Reference Books:

1. Engineering Economics, R.Paneerselvam, PHI publication
2. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
3. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
4. Principles and Practices of Management by L.M.Prasad
5. Principles of Management by Tripathy and Reddy
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

Course Outcomes:

After learning the course the students will be able to

Sr. No.	CO statements	Marks %Weightage
CO-1	Analyze how elasticity affects revenue.	25
CO-2	Relate production function and cost function.	20
CO-3	Analyze the optimal quantity and pricing decisions of firms in different market structures (perfect competition, monopoly, monopolistic competition) to achieve profit maximization.	20
CO-4	Describe the basic principles of management: planning, organizing, controlling, and directing	25
CO-5	Analyze ethical dilemmas faced by business and managers	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
0	0	20	55	25	0

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

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

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3141601
Semester – IV
Subject Name: Operating System and Virtulization

Type of course: Undergraduate

Prerequisite: Linear and non-liner data structures, working experience of any one structured programming language

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)	
4	0	2	5	70	30	30	20	150

Syllabus:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction:** Computer system overview, Architecture, Goals & Structures of O.S, Basic functions, Interaction of O.S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real-time O.S.	5	10
2	**Process and Threads Management:** Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR, Priority, Thread Scheduling, Real Time Scheduling. System calls like ps, fork, join, exec family, wait.	8	15
3	**Concurrency:** Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Pipes, Message Passing, Signals, and Monitors.	4	08
4	**Inter Process Communication:** Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc., Scheduling, Scheduling Algorithms.	8	15
5	**Deadlock:** Principles of Deadlock, Starvation, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, System calls.	4	08
6	**Memory Management:** Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Swapping, Paging and Fragmentation. Demand Paging, Security Issues. **Virtual Memory:** Concepts, VM management, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing.	8	15

7	**I/O Management & Disk scheduling:** I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache.	6	10
8	**Unix/Linux Operating System:** Development Of Unix/Linux, Role & Function Of Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure, System Administration Case study: Linux, Windows Operating System	4	07
9	**Virtualization Concepts:** Virtual machines; supporting multiple operating systems simultaneously on a single hardware platform; running one operating system on top of another. True or pure virtualization.	3	05
10	Approaches to Virtualization: Processor Issue, Memory Management, I/O Management, VMware ESXi, Microsoft Hyper-V and Xen Variants, Java VM, Linux VServer Virtual Machine Architecture, Android Virtual Machine.	5	8

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level

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	Learn and understand the concepts, core structure of Operating Systems and basic architectural components involved in operating systems design.	
CO-2	Understand the process management policies and scheduling of processes by CPU.	
CO-3	Evaluate the requirement for process synchronization and coordination handled by operating system.	
CO-4	Describe and analyze the memory management and its allocation policies.	
CO-5	Analyze various device and resource management techniques for timesharing	
CO-6	Conceptualize the components involved in designing a contemporary Operating Systems	

Reference Books:

1. Operating Systems: Internals & Design Principles, 8th Edition, William Stallings, Pearson Education India
2. Operating System Concepts, 9th edition Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
3. Modern Operating Systems-By Andrew S. Tanenbaum (PHI)

1. **List of Experiments:** Study of Basic commands of Linux/UNIX.
2. Study of Advance commands and filters of Linux/UNIX.
3. Write a shell script to generate marksheet of a student. Take 3 subjects, calculate and display total marks, percentage and Class obtained by the student.
4. Write a shell script to display multiplication table of given number
5. Write a shell script to find factorial of given number n.
6. Write a shell script which will accept a number b and display first n prime numbers as output.
7. Write a shell script which will generate first n fibonnacci numbers like: 1, 1, 2, 3, 5, 13, …
8. Write a menu driven shell script which will print the following menu and execute the given task.
    a. Display calendar of current month
    b. Display today's date and time
    c. Display usernames those are currently logged in the system
    d. Display your name at given x, y position
    e. Display your terminal number
9. Write a shell script to read n numbers as command arguments and sort them in descending order.
10. Write a shell script to display all executable files, directories and zero sized files from current directory.
11. Write a shell script to check entered string is palindrome or not.
12. Shell programming using filters (including grep, egrep, fgrep)
13. Study of Unix Shell and Environment Variables.
14. Write a shell script to validate the entered date. (eg. Date format is : dd-mm-yyyy).
15. Write an awk program using function, which convert each word in a given text into capital.
16. Write a program for process creation using C. (Use of gcc compiler).
17. Study of Basic commands of Linux/UNIX.
18. Study of Advance commands and filters of Linux/UNIX.
19. Write a shell script to generate marksheet of a student. Take 3 subjects, calculate and display total marks, percentage and Class obtained by the student.
20. Write a shell script to display multiplication table of given number
21. Write a shell script to find factorial of given number n.
22. Write a shell script which will accept a number b and display first n prime numbers as output.
23. Write a shell script which will generate first n fibonnacci numbers like: 1, 1, 2, 3, 5, 13, …
24. Write a menu driven shell script which will print the following menu and execute the given task.
    a. Display calendar of current month
    b. Display today's date and time
    c. Display usernames those are currently logged in the system
    d. Display your name at given x, y position
    e. Display your terminal number
25. Write a shell script to read n numbers as command arguments and sort them in descending order.
26. Write a shell script to display all executable files, directories and zero sized files from current directory.
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List of Open Source Software/learning website:- www.nptel.ac.in