



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Information Technology

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Tech. (Computer Science and Business Systems –TCS)

SEMESTER-IV (2025-2029)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCBSBS401	PCC	Operating Systems	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Introduce the structural components, system call layers, and architectural process management views of modern operating systems.
2. Cultivate core knowledge in process scheduling logic, multi-threaded concurrency barriers, and programmatic deadlock mitigation metrics.
3. Detail hardware resource distribution mechanisms, including logical paging, virtual storage, device controllers, and file systems.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Model operational transitions across process contexts and Process Control Block (PCB) metadata fields during scheduling cycles.
2. Evaluate multi-processor pre-emptive, non-pre-emptive, and real-time CPU scheduling logic (including Round Robin, RM, and EDF patterns).
3. Solve critical section race conditions and deadlock states utilizing semaphores, hardware monitors, and the Banker's algorithm.
4. Analyze physical-to-logical memory paging setups and page replacement policies to prevent system thrashing.
5. Build robust shell automation terminal script files utilizing Unix text filters, system utilities, and standard I/O management calls.

SYLLABUS

UNIT I

10 HOURS

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

UNIT II

8 HOURS

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

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Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT III

9 HOURS

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem, Barber's shop problem.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

UNIT IV

7 HOURS

Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

UNIT V

8 HOURS

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling-FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

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TEXTBOOKS:

1. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

REFERENCE:

1. Operating Systems: Internals and Design Principles. William Stallings.
2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
3. Operating Systems: A Modern Perspective. Gary J. Nutt.
4. Design of the Unix Operating Systems. Maurice J. Bach.
5. Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.

LIST OF PRACTICALS

1. Unix commands (files directory, data manipulation, network communication etc), shell programming and vi editor
2. C program implementation of the following:
 - a. Scheduling Algorithms
 - b. Shared memory
 - c. Thread and Multi Thread
 - d. Inter Process Communication
 - e. Deadlock Avoidance and Deadlock Detection
 - f. Semaphore
 - g. Memory Management
 - h. Indexing and Hashing

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BTC SBS402	PCC	Design And Analysis of Algorithms	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES:

The student will have ability to:

1. Teach formal mathematical evaluation techniques for bounding best, average, and worst-case algorithmic runtime behaviors.
2. Introduce core problem-solving paradigms including Greedy strategies, Dynamic Programming, Backtracking, and Heuristics.
3. Delineate abstract tractability boundaries (P vs NP classes) alongside advanced randomized, approximation, and quantum systems.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Compute runtime complexities for iterative and recursive procedures using Master's theorems and recurrence graphs.
2. Apply Greedy and Dynamic Programming design frameworks to resolve combinatorial problems like Knapsack and the Traveling Salesman Problem.
3. Design efficient graph algorithms handling maximum network flow caps, minimum spanning trees, and topological sequencing.
4. Categorize abstract computational problems into P, NP, NP-Complete, and NP-Hard difficulty classes utilizing Cook's theorem reduction rules.
5. Explain modern algorithmic formulations governing approximation limits, randomized distributions, and introductory quantum mechanics.

SYLLABUS

UNIT I 9 HOURS

Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.

UNIT II 8 HOURS

Fundamental Algorithmic Strategies: Brute-Force, Heuristics, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Travelling Salesman Problem.

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BTC SBS402	PCC	Design And Analysis of Algorithms	60	20	20	30	20	3	0	2	4

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UNIT III	9 HOURS
Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	
UNIT IV	7 HOURS
Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook’s theorem, Standard NP-complete problems and Reduction techniques.	
UNIT V	8 HOURS
Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.	
TEXTBOOKS:	
1.	Fundamental of Computer Algorithms, E. Horowitz and S. Sahni.
2.	The Design and Analysis of Computer Algorithms, A. Aho, J. Hopcroft and J. Ullman.
REFERENCE:	
1.	Introduction to Algorithms, T. H. Cormen, C. E. Leiserson and R. L. Rivest.
2.	Computer Algorithms: Introduction to Design and Analysis, S. Baase.
3.	The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, .D. E. Knuth.
4.	Quantum Computation and Quantum Information, Michael A. Nielsen and Isaac L. Chuang.
LABORATORY	
1.	Implementation of Different Algorithms based on various algorithmic strategies using C/C++

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BTCBSBS403	HSSM	Introduction to Innovation, IP Management & Entrepreneurship	60	20	20	-	-	2	0	0	2

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Introduce strategic innovation management as an actionable, systemic process driven by knowledge-push and need-pull workflows.
2. Deconstruct startup formation procedures, creative ideation metrics, and structural business architecture selection models.
3. Provide legal understanding regarding the strategic acquisition, mapping, exploitation, and defense of multi-tier Intellectual Property Rights (IPR).

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

The major emphasis of the course will be on creating a learning system through which management students can enhance their innovation and creative thinking skills, acquaint themselves with the special challenges of starting new ventures and use IPR as an effective tool to protect their innovations and intangible assets from exploitation.

As a part of this course, students will:

- Learn to be familiar with creative and innovative thinking styles
- Learn to investigate, understand and internalize the process of founding a startup
- Learn to manage various types of IPR to protect competitive advantage

SYLLABUS

UNIT I

10 HOURS

Innovation: What and Why? : Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations. Innovation, invention and creativity, Types of Innovation, Challenges of Innovation, Steps of Innovation Management, Idea Management System.

Class Discussion-Is innovation manageable or just arandom gambling activity?

Case Study: Innovation management in the IT industry.

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BTC SBS403	HSSM	Introduction to Innovation, IP Management & Entrepreneurship	60	20	20	-	-	2	0	0	2

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UNIT II	8 HOURS
Building an Innovative Organization: Basics of Innovation ecosystem Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture, Divergent V/s Convergent Thinking, Design Thinking and Entrepreneurship Class Discussion-Innovation: Co-operating across network svcs. 'go-it-alone' approach.	
UNIT III	9 HOURS
Entrepreneurship: - What is a Business Model, - Who is an Entrepreneur, - Social Entrepreneurship, - Blue Ocean Strategy-I, Blue Ocean Strategy-II - Opportunity recognition and entry strategies - Entrepreneurship as a Style of Management - Role of IP strategy in entrepreneurship? - Maintaining Competitive Advantage- Use of IPR to protect Innovation	
UNIT IV	7 HOURS
Entrepreneurship-Financial Planning: - Financial Projections and Valuation - Stages of financing - Debt, Venture Capital and other forms of Financing - Business Models and value proposition,	

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- Business Model Failure: Reasons and Remedies,
- Incubators: Business Vs Technology,
- Managing Investor for Innovation,
- Future markets and Innovation needs for India.

UNIT V

8 HOURS

Intellectual Property Rights (IPR):

- Management of Innovation,
- Creation of IPR,
- Types of IPR,
- Introduction and the economics behind development of IPR: Business Perspective
- IPR in India–Genesis and Development
- International Context
- Concept of IP Management, Use in marketing

Types of Intellectual Property:

- Patent-Procedure, Licensing and Assignment, Infringement and Penalty
- Trademark-Definition, Type, Registration, Trademark in infringement, Use in marketing, example of trademarks- Domain name
- Geographical Indications-What is GI, Why protect them?
- Copyright-What is copyright
- Industrial Designs-What is design? How to protect?
- Patents and Copyrights,

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- Patents in India

Class Discussion-Major Court battles regarding violation of patents between corporate companies.

TEXTBOOKS:

- Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
- Case Study Materials: To be distribute for class discussion.

Home Assignment

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.

Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

Topic 1- Is innovation manageable or just a random gambling activity?

Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach.

Topic 3- Major Court battles regarding violation of patents between corporate companies.

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 B.Tech. (Computer Science and Business Systems –TCS)
 SEMESTER-IV (2025-2029)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
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BTC SBS404	CEP	Design Thinking	0	0	0	30	20	0	0	4	2

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<u>TEACHING SCHEME:</u>		<u>EXAMINATION SCHEME:</u>	<u>CREDITS ALLOTTED:</u>
		Semester Examination: 50 marks	1
Practical: 1 Hr. / Week		Continuous Assessment: Yes	
Activity: 1 Hr. / Week		Term Work: 50 marks	
	Leadership Oriented Learning (LOL)		
Nature of Course		Behavioural	
Pre requisites		Completion of all units from Semesters 1, 2, 3 and 4	
Course Terminal Objectives:			
1	Recognize the importance of DT		
2	Explain the phases in the DT process		
3	List the steps required to complete each phase in DT process		
4	Apply each phase in the DT process		
5	Use doodling and storytelling in presenting ideas and prototypes		
6	Create value proposition statements as part of their presentations		
7	Recognize how DT can help in functional work		
8	Recognize how Agile and DT complement each other to deliver customer satisfaction		

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Choice Based Credit System (CBCS) in the light of NEP-2020
B.Tech(CSE/IT), B.Tech+MBA(CSE/IT) and B.Tech+M.Tech(CSE/IT)
SEMESTER-V(2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
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BTC SBS404		Design Thinking/ Community Engagement Project With Design Thinking	60	20	20	-	-	3	1	0	4

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Course Enabling Objectives:

Upon completion of the course, students shall have ability to

1	Recognize the importance of Design Thinking	[U]
2	Identify the steps in the DT process	[C]
3	Recognize the steps in the empathize phase of DT	[C]
4	Identify the steps required to conduct an immersion activity	[C]
5	Conduct an immersion activity and fill up the DT question template	[AP]
6	Recognize the steps to create personas in the define phase of DT	[C]
7	Create personas in the define phase of DT	[AP]
8	Recognize the steps to create problem statements in the define phase of DT	[AP]
9	Define the problem statements in the define phase of DT	[E]
10	Recognize the steps in the ideate phase of DT	[C]
11	Apply the steps in the ideate phase of DT	[AP]
12	Recognize how doodling can help to express ideas	[U]
13	Recognize the importance storytelling in presenting ideas and prototypes	[U]
14	Recognize the importance of the prototype phase in DT	[C]
15	Create a prototype	[AP]
16	Recognize the importance of service value proposition	[C]
17	Create a value proposition statement	[AP]
18	Recognize the best practices of the testing phase in DT	[U]
19	Test a prototype created through a DT process	[AP]
20	Recognize how DT can help in functional work	[E]
21	Recognize how Agile and DT complement each other to deliver customer satisfaction	[C]

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B.Tech(CSE/IT), B.Tech+MBA(CSE/IT) and B.Tech+M.Tech(CSE/IT)
SEMESTER-V(2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
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BTCSBS404		Design Thinking/ Community Engagement Project With Design Thinking	60	20	20	-	-	3	1	0	4

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Course Contents:	
Total Hours:	
45 hours	
Textbooks:	
	There are no prescribed texts for Semester 5 – there will be handouts and reference links shared.
Reference Books:	
1	Hooked by Nir Eyal
2	The Art of Creative Thinking by Rod Judkins
3	Start Up nation by Dan Senor and Saul singer
4	Start with Why by Simon Sinek
Web References:	
1	What is Design Thinking? Interaction Design Foundation
2	What are some of the good examples of design thinking? - Quora
3	Design thinking 101: Principles, Tools & Examples to transform your creative process
Online Resources:	
1	Understanding Design thinking WF NEN
2	Design Thinking and Innovation at Apple Wei Li
3	Stanford Webinar- Design Thinking = Method, Not Magic
4	Stanford Design Thinking Virtual Crash Course
5	So Many Uses- activity to spark creativity and design

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Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
	Apply	Defining problem statement	5
	Apply	Ideating solutions	5
	Apply	Creating a prototype	10

Summative Assessment based on End Semester Project

Bloom's Level		
Understand	Understand, Analyze, Apply	50
Apply		
Analyze	Conduct and apply DT in the project.	

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Lesson Plan

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Recognize the importance of Design Thinking	2	Why is Design Thinking important for business? Stories and examples will be used to introduce Design Thinking to the participants. We will use relevant stories and the following videos. 1. YouTube video: The Design Thinking Process – Sprouts (3.57 mins) 2. Leverage TCS-provided DT content to show the evolution of DT and why is important in present business environment. Can be a video. (2 mins) Lecturer to encourage the students to maintain their Satori slam book and capture their learning points in it.	Introduction and discussion	60 mins
1	Recognize the importance of Design Thinking	2	Why is Design Thinking important for you? Experiential activity	Activity	90 mins

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			Products that you loved and hated: In this activity, learners will have to share about a product they like of disliked based on their experience. What would they need in a bad product to make it good?		
1	Identify the steps in the DT process	2	What is DT? Introduce the 5-Step Stanford Model using YouTube videos: The video will give a brief idea about the five steps: • Empathize (search for rich stories and find some love) • Define (user need and insights – their POV) • Ideate (ideas, ideas, ideas) • Prototype (build to learn) • Test (show, don't tell) Start all over and iterate the flow as much as possible	Lecture and demo	60 mins
1	Recognize the steps in the empathize phase of DT	2	What is empathy? Touch the target activity (Recap from Sem 2 Unit 4) Discussions in class	Activity	60 mins

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			Reference: FHIL Stages of Design Thinking EMPATHY (2:29 mins)		
1	Identify the steps required to conduct an immersion activity	1 and 2	How to empathize? Moccasin Walk activity for 1 hour to allow learners experience stepping into the shoes of another person. <i>This is an individual activity.</i> Sharing observations with the group. Suggest that students try this even in their free time away from studies.	Activity lecture and	90 mins
1	Identify the steps required to conduct an immersion activity	1 and 2	Intro to Immersion Activity Introduction to immersion activity through flowcharts and handouts and examples (to be provided by TCS DT Team) (steps and the question template: 1. We met; 2. We were amazed to realize that; 3. We wonder if this means 4. It would change the world if)	Lecture	45 mins
1	Conduct an immersion activity	3	Immersion activity	Practical	180 mins
	and fill up the DT question template		Participants will be divided into four groups. Each group will need to visit any one of the following places to conduct an immersion activity. They need to interview people and fill up		

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			the DT question template (explained in the last class)		
			- College cafeteria - College library - College sports facility - Transport facility near college		
2	Recognize the steps to create personas in the define phase of DT	2	Creating personas Start with YouTube videos explaining the process of persona creation:	Lecture and practical	120 mins
	Create personas in the define phase of DT	3	Personas – What is a persona and how do I create one? (2019) https://www.youtube.com/watch?v=GNvLpfXCge8 Each group will create at least one persona based on the immersion study they conducted in the empathize stage (refer to the four question templates). The group can use A4 pages, colours and other props to create and display their respective persona.		
2	Recognize the steps to create personas in the define phase of DT	2	Creating personas Start with YouTube videos explaining the process of persona creation:	Lecture and practical	120 mins
	Create personas in	3	Personas – What is a persona and how do I		

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	the define phase of DT		create one? (2019) https://www.youtube.com/watch?v=GNvLpfXCge8 Each group will create at least one persona based on the immersion study they conducted in the empathize stage (refer to the four question templates). The group can use A4 pages, colours and other props to create and display their respective persona.		
			Reference: https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them Lecturer to guide participants on getting the personas right (based on guidelines provided by TCS DT Team).		
2	Recognize the steps to create problem statements in the define phase of DT	2	Problem statements Session will begin with YouTube videos on how to define problem statements in the Define phase. 1. FHIL Stages of Design Thinking REFRAME (1:55 mins)	Lecture and demo	60 mins

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			Lecturer will provide examples of problem statements in class (based on handouts provided by TCS DT Team)		
2	Define the problem statements in the define phase of DT	3	Defining problem statements Group activity, in which each group will define the key problem statements (max three) for their lead personas.	Formative assessment	90 mins
			Each group will present while the remaining groups will do a peer review. Finally, lecturer will moderate/validate the problem statements (based on handouts provided by TCS DT Team)		
3	Recognize the steps in the ideate phase of DT	1 and 2	How to Ideate? The session will start with YouTube videos: 1. FHIL Stages of Design Thinking IDEATE (1:54 secs) 2. What Is Six Thinking Hats? (Litmos Heroes) (1:58 secs) Lecture to briefly tell them about the guidelines of ideating (to be provided by TCS DT Team)	Lecture and demo	60 mins
3	Apply the steps in	3	Ideation games	Activity	90 mins

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	the ideate phase of DT		Game 1: Six Thinking Hats Game 2: Million-dollar idea		
3	Apply the steps in the ideate phase of DT	3	Ideate to find solutions Participants will work in their assigned groups to ideate solutions for the problem statements they identified (as continuation of immersion activity) applying ideation methods discussed in the previous session. They will get scores based on how well they can apply the ideation methods.	Formative assessment	90 mins
			Lecturers will observe the groups separately and assign them scores based on specific rubric (provided by the TCS DT Team).		
3	Recognize how doodling can help to express ideas	1	Let's doodle! Participants will first watch a video on doodling: Doodling – how it can help in presenting ideas during ideate and prototype phases After that, participants will complete an activity on doodling.	Demo and activity	60 mins

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3	Recognize the importance of storytelling in presenting ideas and prototypes	1	What is Storytelling in DT? Activity- Research to find out about people who have used DT in providing solutions. Present their findings in forms of stories. (Recap from Unit- Sem-) Suggested topics to be provided by the TCS DT team.	Activity	120 mins
4	Recognize the importance of the prototype phase in DT	2	Why is a Prototype important in Design Thinking? The session will start with an activity to drive home the importance of creating a protoStype in the design thinking process. As part of debrief of the activity, lecturer will share relevant examples and prototyping guidelines (provided by the TCS DT Team.)	Activity and demo	60 mins
			Finally, the participants will watch two YouTube videos: 1. FHIL Stages of Design Thinking PROTOTYPE 2. Prototyping Phase - Design Thinking Coursera		

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			https://www.coursera.org/lecture/patient-safety-project-planning/prototyping-phase-jVuQn		
4	Create a prototype	3	Prototype your idea This is a group activity in which the participants will work in groups (created at the beginning of the course, in which they did immersion, persona creation, defining problem statement and ideating) to create prototypes based on the solutions they had identified. Lecturer to share feedback based on guidelines provided by the TCs DT team.	Formative assessment	180 mins
4	Recognize the importance of service value proposition Create a value proposition	2 3	Value Proposition Statement You Tube: What is Value Proposition (by Venture Well) (3:51 mins)?	Lecture	120 mins 1635 mins

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	statement		Lecturer to discuss the guidelines for creating a value proposition statement (to be provided by the TCS DT Team) Each group now needs to create value proposition statement for the solution they have suggested.		
4	Recognize the best practices of the testing phase in DT	1	Testing in Design Thinking Participants will first watch a YouTube video: FHIL Stages of Design Thinking TESTING After that lecturers will explain them the importance of Testing the prototype through stories (provided by the TCS DT Team). They will also explain how the loop works in DT between the Empathize and Testing phases.	Lecture	60 mins
	Test a prototype created through a DT process	3	Test the Prototype Each group needs to test their prototype created earlier and: 1. Document user feedback 2. Write down their inference from the feedback Suggest next steps (the loop that happens in DT)	Activity	120 mins

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4	Recognize how DT can help in functional work	1	Role of DT in your work Lecturer conducts a group/open house discussion on: “How DT can help me to become a better coder?” Lecturer needs to capture the key learning points in these discussions.	Discussion	60 mins
4	Recognize how Agile and DT complement each other to deliver customer satisfaction	1	Suggested session on: How Agile and DT complement each other to deliver customer satisfaction	Lecture	45 mins
4			Share your Satori Participants will be asked to share their Satori moments from the DT sessions	Reflection activity	60 mins
					33 hours

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			Project Option 1: Each group needs to present a Prototype of how they can apply DT in their functional work or coding. Examples will be provided to explain what exactly they need to do. Option 2: Each group will apply DT to create a prototype to improve any existing product or service. For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their presentation. Lecturers will evaluate the project based on the rubric provided by the TCS DT Team.		12 hours
Total					45 Hours

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Shri Vaishnav Institute of Information Technology

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Tech. (Computer Science and Business Systems –TCS)

SEMESTER-IV (2025-2029)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCBS406		Computer Organization	60	20	20	-	-	2	0	0	2

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Detail the functional structural blocks of a modern computer CPU, register layouts, and instruction set architectures.
2. Demystify hardware arithmetic circuitry configurations for signed binary addition, multi-step multiplication, and floating-point logic.
3. Analyze memory optimization hierarchies, processor pipelining methods, and peripheral interface data transfer controllers.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Illustrate CPU instruction execution cycles and standard architectures through Register Transfer Language (RTL) expressions.
2. Build digital arithmetic logical circuits executing Booth multiplication and IEEE 754 floating-point standards.
3. Compare design parameters, advantages, and limitations of hardwired control units versus micro-programmed processing setups.
4. Classify hardware exception paths, program-privileged configurations, and Direct Memory Access (DMA) transactions.
5. Evaluate processor execution thresholds across multi-tier associative caches, pipelining models, and coherency protocols.

SYLLABUS

UNIT I	10 HOURS
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Revision of basics in Boolean logic and Combinational/Sequential Circuits.

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.

Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

UNIT II	8 HOURS
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Data representation: Signed number representation, fixed and floating point representations, character

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representation.

Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

UNIT III

9 HOURS

Introduction to x86 architecture.

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

Memory system design: Semiconductor memory technologies, memory organization.

UNIT IV

7 HOURS

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB

UNIT V

8 HOURS

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

TEXTBOOKS:

1. Computer System Architecture M. M. Mano., 3rded., Prentice Hall of India, New Delhi, 1993.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.
3. Computer Organization and Embedded Systems, Carl Hamacher.

REFERENCE:

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings.

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3.	Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan.
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LIST OF PRACTICALS

1.	Circuits on breadboard or simulators (a) Implementation of Combinational Digital/Boolean Circuits: Adder, Subtractor, Multiplication Module, Division Module, Multiplexer, Demultiplexer, Encoder, Decoder. (b) Implementation of Sequential Circuits: Counters, Linear Feedback Shift Registers (LFSR)
2.	C/C++ programming to understand the formats of char, int, float, double, long etc.
3.	Machine language programming on x86 or higher version kits or simulators: (i) Add/subtract/multiplication/division/GCD/LCM (ii) Accessing some specific memory locations/ports (iii) Counting odd and even integers from a series of memory locations (iv) Printing values of selected registers (v) Handling interrupts

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BTC SBS407	PCC	Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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<u>TEACHING SCHEME:</u>		<u>EXAMINATION SCHEME:</u>	<u>CREDITS ALLOTTED:</u>
Theory: 2.5 Hrs./Week		Semester Examination: 50 marks	4
Practical: 1.5 Hrs. / Week		Continuous Assessment: Yes	
Lab: 2 Hrs. / Week		Term Work: 50 marks	
	Leadership Oriented Learning (LOL)		
Nature of Course		Behavioural	
Pre requisites		Basic Knowledge of English (verbal and written) Completion of all units from Semesters 1, 2 and 3	
Course Objectives:			
1	Develop technical writing skills		
2	Introduce students to Self-analysis techniques like SWOT & TOWS		
3	Introduce students to key concepts of: a) Pluralism & cultural spaces b) Cross-cultural communication c) Science of Nation building		
Course Outcomes:			
Upogn completion of the course, students shall have ability to			
C2.6.1	Apply & analyze the basic principles of SWOT & life positions.		[U]
C2.6.2	Understand, analyze & leverage the power of motivation in real life		[AP]
C2.6.3	Identify & respect pluralism in cultural spaces		[AP]
C2.6.4	Understand and apply the concepts of Global, glocal and translocational		[C]
C2.6.5	Analyze cross cultural communication		[U]

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SEMESTER-V(2023-2027)

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BTC SBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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C2.6.6	Apply the science of Nation building	[AP]
C2.6.7	Identify the common mistakes made in cross-cultural communication	[E]
C2.6.8	Understand, apply & analyze the tools of technical writing	[U]
C2.6.9	Recognize the roles and relations of different genders.	[AP]
C2.6.10	Understand Artificial intelligence & recognize its impact in daily life	[U]
C2.6.11	Identify the best practices of technical writing	[AP]
C2.6.12	Differentiate between the diverse culture of India	[E]

Course Contents:

Objectives for Semester 4

After completing this semester, learners will be able to:

- Summarize the basic principles of SWOT and Life Positions.
- Apply SWOT in real life scenarios.
- Recognize how motivation helps real life.
- Leverage motivation in real-life scenarios.
- Identify pluralism in cultural spaces.
- Respect pluralism in cultural spaces.
- Differentiate between the different cultures of India.
- Define the terms global, glocal and translocational.
- Differentiate between global, glocal and translocational culture.
- Recognize the implications of cross-cultural communication.
- Identify the common mistakes made in cross-cultural communication.
- Apply cross-cultural communication.
- Differentiate between the roles and relations of different genders.
- Summarize the role of science in nation building.
- Define AI (artificial intelligence).
- Recognize the importance of AI.
- Identify the best practices of technical writing.
- Apply technical writing in real-life scenarios.

Total Hours:

48 hours

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Text Books:	
	There are no prescribed texts for Semester 4 – there will be handouts and reference links shared.
Web References:	
1	Examples of Technical Writing for Students https://freelance-writing.lovetoknow.com/kinds-technical-writing
2	11 Skills of a Good Technical Writer https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/
3	13 benefits and challenges of cultural diversity in the workplace https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/
Online Resources:	
1	https://youtu.be/CsaTslhSDI
2	https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3	https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4	https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5	https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be
Assessment Methods & Levels (based on Bloom's Taxonomy)	
Formative assessment (Max. Marks:20)	

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Course Outcome	Bloom's Level	Assessment Component	Marks
C1.6.1	Analyze	SWOT in real life	5
C1.6.2	Analyze	Motivation in real life	4
Summative Assessment based on End Semester Project			
Bloom's Level			
Understand	Written Assessment, project and group discussion		50
Apply			
Analyze			

Lesson Plan

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			Guest lecture by a renowned personality to kick start this semester.	This will be outside the total hours for this Semester	90 mins
1			REUNION Recap activity on the earlier learning after a 6 months break. If we can flash the projects they completed in the last semester..... End with a Quiz in multiple format rounds testing the objectives.	Activity	60 Minutes

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Summarize the basic principles of SWOT and Life Positions.	2	SWOT and Life Positions Meet Dananjaya: Meet Dananjaya Hettiarachchi The World Champion of Public Speaking 2014 who made the winning speech which was rated amongst the “Most talked-about speeches of 2014”. https://www.youtube.com/watch?v=bbz2boNSeL0&t=24s Debrief on the video. How it relates to SWOT. Intro activity: Give story of an individual* and divide people into 4 groups S W O T and ask them to jot down the SWOT. Start with a different nomenclature (demystifying SWOT)	Lecture and activity	60 Minutes
1	Apply SWOT in real life scenarios.	3	Pat your back activity...strength will be written by others other points by you Create your SWOT	Practical	60 Minutes

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1	Apply SWOT in real life scenarios.	3	SWOT Vs. TOWS The Balancing Act Ted talk on biomimicry: (Only first 8 mins):	Lab	120 minutes
			https://www.youtube.com/watch?v=RHR04t86phA Debrief on the Ted talk in which the facilitator gently guides the group towards the understanding that survival happens only when we seek ideas from the external world to turn the threat into opportunity Research on TOWS and find out how you can turn your threat into opportunity. Two people mutually identifying opportunities from each other's threats.		
1	Apply SWOT in real life scenarios.	3	Presentation on what are the strengths they have identified to survive in the VUCA World. Group presentations of 10 mins each.	Formative evaluation	90 mins
1	Recognize how motivation helps real life.	1	Motivation Stories YouTube videos on Maslow's Theory	Lecture and activity	90 mins

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1	Leverage motivation in real-life scenarios.	3	Scenario based activity on identifying and leveraging motivation	Formative evaluation/Lab	60 mins
1	Recognize how motivation helps	1	Present their findings and approaches as groups. They	Practical	60 mins
	real life.		need to explain the idea of motivation with the help of examples.		

Unit 2

2	Identify pluralism in cultural spaces.	1	Rivers of India a. Divide participants into groups of 5. Each group should assign themselves a name from the Indian Rivers. These groups will continue throughout this Unit. b. Learn and Exchange Group activity in which participants need to learn the following four greetings of a state (different from their own) and exchange it with another group: • Good morning • Thank you • Sorry • Good night Indicative only	Activity	90 Minutes
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2	Identify pluralism in cultural spaces. Respect pluralism in cultural spaces.	2 3	a. Awareness and respect for pluralism in cultural spaces b. Announce the Rhythms of India activity to be held in the next session. The rules of the activity will be detailed at this point. Teams to prepare for the performance beyond class hours.	Theory/Discussion using Phir Miley Sur Mera Tumhara	90 Minutes
2	Differentiate between the different cultures of India.	2	Rhythms of India (Cultures in India) Group activity: Each group to perform a short dance piece (3 mins) from any of the Indian states (to be decided by lots). They have to present the background and unique features of the dance form (5min).	Practical/Discussion	120 Minutes

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BTCBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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2	- Define the terms global, glocal and translocational. - Differentiate between global, glocal and translocational culture.	1, 2	a. Global, glocal, translocational Use Ted and YouTube videos to show examples b. Announce debate to be held in the next session. They have to come prepared for the debate/discussion.	Lecture/Discussion	60 mins
2	Differentiate between global, glocal and translocational culture.	2	Debate on Global, glocal, translocational impacts (topics to be decided by the faculty or suggested by the students). Debate to be held in the presence of an external moderator. Eight groups will get four topics to debate upon.	Activity	60 mins
2	- Recognize the implications of cross-cultural communication. - Identify the	1, 2	Cross-cultural communication A. Verbal and non-verbal communication (approach is through videos). Point out	Lecture/Discussion	60 mins

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Choice Based Credit System (CBCS) in the light of NEP-2020
B.Tech(CSE/IT), B.Tech+MBA(CSE/IT) and B.Tech+M.Tech(CSE/IT)
SEMESTER-V(2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCSBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Common mistakes made in cross-cultural communication.		the obvious mistakes. From our perspective...how anyone would feel if someone else made mistakes about our cultures. B. Let participants have a group discussion on the implications of cross cultural communication.		
2	Apply cross cultural communication.	3	Suggested long-term activity: A VR game in which learners can visit different locations of the world and overcome challenges by using cross cultural skills.		
2	Identify the common mistakes made in cross-cultural communication	2	Culture shock Group activity to perform skits based on situations provided by the lecturer.	Practical	60 mins

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCSBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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2	Differentiate between the roles and relations of different genders.	2	Gender awareness Participants will view relevant scenarios in the class and then participate in a reflection activity in group. The scenarios can be presented using an Augmented Reality intervention.	Discussion	90 mins
2	Differentiate between the roles and relations of different genders.	2	Gender awareness campaign Groups to present the detailed plan of Gender awareness campaigns with four different themes.	Activity	60 mins
			- College - Workplace - Family - Friends		
2			Quiz Time	Summative Evaluation for Unit	60 Minutes

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BTCSBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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Unit 3

3	Summarize the role of science in nation building.	2	Role of science in nation building Introduce the topic and discuss the role of scientists and mathematicians from ancient India. Break the students into groups and give them ten minutes to access internet and get information about ten eminent scientists and mathematicians of ancient India. Groups will be given five minutes to present on the next day. Groups will also frame two questions which they will ask after presenting. This can also be taught through Augmented Reality, where images of the scientists will be put up around the class and they will be able to gather the information by using their phones and AR app.	Theory and lab	90 mins
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BTCBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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			Groups present their findings. Other groups note down their learning. At the end there will be a quiz to assess their learning.	Activity	90 mins
	Summarize the role of science in nation building.	2	Role of science post-independence Groups to present using multiple formats on any one of the four given topics. • Inventions • Inventors • Institutes • Information technology	Lab and practical	120 mins
	Identify the best practices of technical writing.	1	Introduction to technical writing Basic rules of technical writing through examples.	Lecture (Guest faculty, over webinar)	60 mins
	Identify the best practices of technical writing.	1	Practice activity on technical writing.	Lab	60 mins

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BTCSBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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	Apply technical writing in real-life scenarios.	3	Assessment on technical writing on the following topic: Explain the following to a visually impaired person: - DNA - Rings of Saturn - Structure of an oxygen atom - Structure of heart	Summative evaluation	60 mins
Unit 4					
4	Define AI (artificial intelligence).	1	“Voice of the Future” Activity How will a voice assistant evolve in 25 years from now? Each group will present a skit.	Activity	90 mins
	Recognize the importance of AI.	1	AI in Everyday Life Discussion in groups on given topics and then cross sharing of discussion points amongst the groups.	Lab and Activity	90 mins

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BTCSBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Recognize the importance of AI.	1	Design your college in the year 2090 Groups need to create the college of future with the future teachers, teaching methods, types of students, etc. We will end the session with the question: How will offices/workplaces change in future? Who do you think would be your colleagues?	Lab and Practical	90 mins
	Recognize the importance of AI.	1	Communicating with machines Theory and Ted talk videos	Lecture	60 mins
	Recognize the importance of AI.	1	Debate in the presence of an external moderator. Will machines control us in future?	Discussion	90 mins
	Identify the best practices of technical writing.	1	Applying technical writing in profession Theory with YouTube and Dr Bimal Ray's videos. Dr Bimal Kumar Roy, a former Director of the	Lecture	90 mins

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BTCBS407		Business Communication & Value Science- III	0	0	0	30	20	0	0	2	1

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			Indian Statistical Institute, is a cryptologist from the Cryptology Research Group of the Applied Statistics Unit of ISI, Kolkata.		
	Apply technical writing in real-life scenarios.	3	Scenario-based Assessment on technical writing Each group will make a presentation on the following: a) Sell Analytics and Insight to the local tea seller. b) Explain the concept of Cloud to your 87 year old grandmother. c) Introduce the concept of friendly robots to a class 3 kid. Explain IOT to your helping hand at home	Summative evaluation	60 mins
Project					
			Visit rural area/	Project	10 hours
			underprivileged parts of city to address some of the local issues; if relevant, suggest a practical technology solution to the issues.		

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Choice Based Credit System (CBCS) in the light of NEP-2020

B.Tech. (Computer Science and Business Systems –TCS)

SEMESTER-IV (2025-2029)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTC SBS408	PCC	Computational Statistics	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Establish quantitative baselines regarding Multivariate Normal Distributions, conditional variance matrices, and multivariable regressions.
2. Teach mathematical dimensionality reduction concepts along with core partitioning and hierarchical dataset clustering mechanisms.
3. Train students to write Python or R programming scripts for complex data cleaning, time-series operations, and analytical charting.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Evaluate multi-variable regression models optimized via LASSO regularization techniques.
2. Execute Linear Discriminant Functions and Factor analysis matrices to systematically categorize high-dimensional fields.
3. Analyze large statistical datasets using Principal Component Analysis algorithms to reduce parameter dimensionality.
4. Implement hierarchical and K-Means partitioning patterns to profile and interpret operational data clusters.
5. Build automated data aggregation, text manipulation, and graphical visualization workflows utilizing Python data science libraries.

SYLLABUS

UNIT I 10 HOURS

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression

UNIT II 8 HOURS

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

UNIT III 9 HOURS

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

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BTCBS408	PCC	Computational Statistics	60	20	20	30	20	3	0	2	4

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UNIT IV		7 HOURS
Factor Analysis: Factor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.		
UNIT V		8 HOURS
Clustering: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.		
TEXTBOOKS:		
1.	An Introduction to Multivariate Statistical Analysis, T. W. Anderson.	
2.	Applied Multivariate Data Analysis, Vol I & II, J. D. Jobson.	
	Statistical Tests for Multivariate Analysis, H. Kris.	
	Programming Python, Mark Lutz.	
	Python3 for Absolute Beginners, Tim Halland J-P Stacey.	
	Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition,2005.	
REFERENCE:		
1.	Regression Diagnostics, Identifying Influential Data and Sources of Collinearity, D. A. Belsey, E. Kuh and R.E. Welsch	
2.	Applied Linear Regression Models, J. Neter, W. Wasserman and M. H. Kutner.	
3.	The Foundations of Factor Analysis, A. S. Mulaik.	
4.	Introduction to Linear Regression Analysis, D. C. Montgomery and E. A. Peck.	
5.	Cluster Analysis for Applications, M. R. Anderberg.	
6.	Multivariate Statistical Analysis, D. F. Morrison.	
7.	Python for Data Analysis, Wes Mc Kinney.	
Laboratory		
1.	Tools: R/ Python	
	• Data Pre-processing: handling missing value, null value, Outlier Detection and Treatment, Removing Duplicates	

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BTCBSBS408	PCC	Computational Statistics	60	20	20	30	20	3	0	2	4

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	• Sampling and Resampling Techniques: Simpler andom sampling, stratified sampling, and cluster sampling. • Descriptive Statistics: Measures of central tendency (mean, median, mode), dispersion (variance, standard deviation), and visualizations (histograms, boxplots). Create different charts for visualization of given set of data. • Regression Analysis: Linear, logistic, and polynomial regression models. Correlation analysis and its significance. • Multivariate Analysis: Principal Component Analysis (PCA), Factor Analysis., Discriminant Analysis., Cluster Analysis (Hierarchical and k-means)
2.	Python Concepts, Data Structures, Classes: Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files - Reading and Writing, Data Wrangling: Combining and Merging Datasets, Reshaping and Pivoting, Data Transformation, String Manipulation, Regular Expressions Data Aggregation, Group Operations, Time series: Goup By Mechanics, Data Aggregation, Groupwise Operations and Transformations, Pivot Tables and Cross Tabulations, Time Series Basics, Data Ranges, Frequencies and Shifting Visualization in Python: Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches Python Libraries and Frameworks: Flask/Djang of or web development.

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BTC SBS410	VEC	Environmental Sciences (Non-Credit)	-	-	-	-	-	-	-	-	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. The students will study basic components of the environment and various types of pollution affecting the environment.
2. The students will study how to differentiate various types of waste and ways to manage these wastes.
3. The students will learn the impact studies associated with the environment and social issues, and methods to manage them. They will also be acquainted with various legal aspects associated with the environment and study the roles of various stakeholders associated with the environment.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Discuss various types of environmental Pollution, natural resources and its misuse.
2. Demonstrate a plan for water management, promotion of recycle and reuse, generation of less waste, avoiding electricity waste.
3. Demonstrate a slogan, poster and plan activities for environmental protection and social issues.

SYLLABUS

S.no	Title	Topics to be covered
1	Introduction to Environment and its components:	Natural Resources and it Misuse leading to Environmental degradation. Role of Ecology in Environmental Degradation and Protection. Major industrial and other environmental disasters Environmental pollution-Types, Causes, Effects, Reduction methodology.
2	Waste Generation and Waste Management	Introduction to waste generation, Methods to Reduce, Reuse and Recycle of Waste Importance of 3R's, Promotion of 3R's - Methods Solid wastes, Industrial Waste, Bio-Medical Waste and Hazardous waste management .– Types, Storage, Transportation, Treatment Disposal. C&D and E-waste – Concept, methods for reduction, management Campaigning for waste reduction and management.
3	Assessment and Management	Concept of EIA and SIA, significance, methodology, report drafting. Environmental Management System, ISO 14000 EMS certification

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BTC SBS410	VEC	Environmental Sciences (Non-Credit)	-	-	-	-	-	-	-	-	

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S.no	Title	Topics to be covered
4	Protection, Social Issues	Environmental Protection, Social Issues, Disaster Management Social Issues and Environment International Conventions, Summits and Protocols Generation of less waste and avoiding electricity waste. Environmental management for construction Projects.
5	Government Role	Role of the Government in managing the environmental activities in all sectors. Organisational set up at the Central and state level to manage the environment. Role of judiciary in managing the environment. Role of Citizens, Role of NGOs/ Environmental Activists. Major Laws Air (P&C.P.) Act, Water (P & C.P) Act. Environment Protection Act EPA 1986. Wild life Protection Act etc., PIL

TEXTBOOKS:

1. Benny Joseph, “Environmental Studies”, The McGraw-Hill Companies, 2017.
2. Gerard Kiely, “Environmental Engineering”, Tata McGraw-Hill Education, 2007
3. Mackenzie Davis, David Cornwell, “Introduction to Environmental Engineering”, McGraw-Hill Companies, 2017.
4. P. Aarne Vesilind, Susan M. Morgan, “Introduction to Environmental Engineering”, Thomas/Brook/Cole, 2004

ASSESSMENT COMPONENTS

The students will present a report through seminar, which will be held by a Faculty Coordinator constituted by the concerned department as per norms of the institute. The evaluation through seminar presentation will be based on the following criteria.

- a) Quality of material presented.
- b) Effectiveness of presentation.
- c) Depth of knowledge and skills.

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