

Semester 6

TCS

Computer Science & Business Systems

Semester 6 Curriculum



Semester 6

COMPUTER NETWORKS (PCC-CS602) + LAB

Introduction: Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures.

Data communication Components: Representation of data and its flow, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media.

LAN: Wired LAN, Wireless LAN, Virtual LAN.

Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Data Link Layer and Medium Access Sub Layer: Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go-back–N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.

Application Layer: DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls.

Network Security: Electronic mail, directory services and network management, Basic concepts of Cryptography.

Computer Networks Lab

- 1. Socket Programming using C/C++
- 2. Network System Administration: Understanding switches and routers

Books:

- 1. Computer Networks, A. Tannenbaum.
- 2. Data and Computer Communication, William Stallings.

Reference Books:

- 3. Network Security, Kaufman, R. Perlman and M. Speciner.
- 4. UNIX Network Programming, Vol. 1,2 & 3, W. Richard Stevens



Semester 6

INFORMATION SECURITY + LAB

Overview of Security Parameters: Confidentiality, integrity and availability; Security violation and threats; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle.

Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models.

Security Policies: Confidentiality policies, integrity policies, hybrid policies, non-interference and policy composition, international standards.

Systems Design: Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.

Logic-based System: Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.

Operating Systems Security: Security Architecture, Analysis of Security in Linux/Windows.

Database Security: Security Architecture, Enterprise security, Database auditing.

Lab

1. Analysis of security in Unix/Linux.

2. Administration of users, password policies, privileges and roles

Books:

- 1. Security Engineering, Ross Anderson.
- 2. Computer Security: Art and Science, M. Bishop, Pearson Education.
- 3. Information Security: Principles and Practice, M. Stamp.

Reference Books:

- 1. Security in Computing, C.P. Pfleeger, S.L. Pfleeger, J. Margulies.
- 2. Secure Programming HOWTO, David Wheeler.
- 3. Browser Security Handbook, Michael Zalewski.
- 4. Handbook of Database Security, M. Gertz, S. Jajodia.



Semester 6

ARTIFICIAL INTELLIGENCE + LAB

Course Outcome(s):

This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence.

Topics to Be Covered:

UNIT – I

Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

UNIT – II

Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

UNIT – III

Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A^{*} search, AO^{*} search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

UNIT – IV

Constraint satisfaction problems: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT – V

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing



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knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

UNIT – VI

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

UNIT – VII

Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Home Assignments:

Assignments should include problems related to the topics covered in lectures, like heuristics, optimal search, and graph heuristics. Constraint satisfaction problems, k-nearest neighbors, decision trees, etc. can be included in home assignments.

Text Books:

- 1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach
- 2. Artificial Intelligence, Russel, Pearson

Reference Books:

- 1. Artificial Intelligence, Ritch & Knight, TMH
- 2. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
- 3. Logic & Prolog Programming, Saroj Kaushik, New Age International
- 4. Expert Systems, Giarranto, VIKAS



Semester 6

FINANCIAL & COST ACCOUNTING

Course Outcome(s):

This course will help students

- To create an awareness about the importance and usefulness of the accounting concepts and their managerial implications
- To develop an understanding of the financial statements and the underlying principles and learn to interpret financial statements
- To create an awareness about cost accounting, different types of costing and cost management

Topics to Be Covered:

UNIT – I

Accounting Concept: Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements

UNIT – II

Accounting Process:

- Book Keeping and Record Maintenance
- Fundamental Principles and Double Entry
- Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts
- Cash Book and Subsidiary Books
- Rectification of Errors

UNIT – III

Financial Statements: Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards.

Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam

UNIT – IV

Cash Flow and Fund Flow Techniques: Introduction, How to prepare, Difference between them



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UNIT – V

Costing Systems:

- Elements of Cost
- Cost Behavior, Cost Allocation, OH Allocation
- Unit Costing, Process Costing, Job Costing
- Absorption Costing, Marginal Costing, Cost Volume Profit Analysis
- Budgets
- ABC Analysis

Class Discussion: Application of costing concepts in the Service Sector

UNIT – VI

Company Accounts and Annual Reports:

- Audit Reports and Statutory Requirements
- Directors Report
- Notes to Accounts
- Pitfalls

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 prepared to discuss these topics in class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

- 1. Topic: Corporate Accounting Fraud: A Case Study of Satyam
- 2. Topic: Application of costing concepts in the Service Sector

Text Books:

- 1. Robert N Anthony, David Hawkins, Kenneth Marchant, *Accounting: Texts and Cases*, McGraw-Hill
- 2. Case Study Materials: To be distributed for class discussion



TATA

TATA CONSULTANCY SERVICES

Semester 6

BUSINESS COMMUNICATION & VALUE SCIENCE – IV

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 5 Hrs./Week	Semester Examination: 50	4
Practical: 2 Hrs. / Week	Continuous Assessment: Yes	
Lab: 1 Hr / Week	Term Work: marks	

		Leadership Oriented Learning (LOL)
Nature of Cours	se	Behavioral
Pre requisites		
		Basic Knowledge of English (verbal and written)
		Completion of all units from Semesters 1, 2, 3, 4 and 5
Course Objectiv	ves:	
	Reco	gnize the importance of diversity in workplace
1		
Recognize th		gnize the best practices of communicative writing
2		
Understand t		rstand the importance of emotional intelligence in personal and professional lives
3		
4	Apply	/ emotional intelligence in real life scenarios
5	Use t	he best practices of public speaking in real life scenarios
6	Unde	rstand the importance of corporate social responsibility (CSR)
7	Unde	rstand the importance of corporate etiquettes
8	Pract	ice corporate etiquettes in real life scenarios



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9	Recognize the best practices to share and receive feedback							
10	10 Use the basic guidelines required to manage conflicts							
11	11 Understand how stress impacts life and work							
12	12 Use the best practices to manage stress							
13	13 Practice the best time management practices							
Course Outcom Upon completio	es: on of the course, students shall have ability to							
	Understand the importance of diversity in workplace	[U]						
	Apply emotional intelligence in real life scenarios	[AP]						
	Recognize the best practices of communicative writing	[AP]						
	Understand the importance of corporate social responsibility (CSR)	[C]						
	Recognize the importance of time management	[U]						
	Apply knowledge of multiple intelligences and learning styles in interpersonal interactions	[AP]						
	Recognize the impact of stress in life and work	[E]						
	Understand how stress impacts life and work	[U]						
	Identify the best practices to manage stress	[AP]						
	Recognize the attributes needed to function and grow in a corporate environment	[U]						
	Recognize the best practices to share and receive feedback	[AP]						
	Identify the best time management practices	[E]						

Course Contents:



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Objectives for Semester 6

- Understand the importance of diversity in workplace
- Identify the key aspects of communicative writing
- Apply communicative writing in real life scenarios
- Use charts and graphs in communicative writing
- Understand what is emotional intelligence
- Recognize the importance of emotional intelligence in personal and professional lives
- Understand why you would need public speaking at your workplace
- Identify the best practices of public speaking
- Apply public speaking in real life scenarios
- Recognize the importance of corporate social responsibility (CSR)
- Recognize the importance of corporate social responsibility (CSR)
- Recognize the attributes needed to function and grow in a corporate environment
- Recognize the best practices to share and receive feedback
- Apply emotional intelligence in real life scenarios
- Apply knowledge of multiple intelligences and learning styles in interpersonal interactions
- Recognize the impact of conflicts
- List the basic guidelines required to manage conflicts
- Recognize the key features of corporate etiquette
- Recognize the business idioms and corporate terms
- Apply the business idioms and corporate terms
- Recognize the impact of stress in life and work
- Identify the best practices to manage stress
- Recognize the importance of time management
- Identify the best time management practices

Total Hours:	
	45 hours
	40 hours of
	must know +
	5 hours of
	nice to know
	learning
Text Books:	



There are no prescribed texts for Semester 6 – there will be handouts and reference						
	links shared.					
Reference Books:	I					
1	Emotional Intelli	igence: Why it Can Matter More Than IQ by Daniel Gold	eman			
2	Putting Emotional Intelligence To Work by Ryback David					
3	How to Develop of Persuasion by	How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion by Dale Carpegie				
4	, TED Talks: The o	fficial TED guide to public speaking: Tips and tricks for	giving			
	unforgettable sp	peeches and presentations				
Web References:						
1	1 <u>https://www.tata.com/about-us/tata-group-our-heritage</u>					
2	https://economy	ictimes.indiatimes.com/tata-success-story-is-based- nd-ethics/articleshow/41766592.cms	-on-humanity-			
Online Resources:						
1	https://youtu.be/reu8rzD6ZAE					
2	https://youtu.be/Wx9v_J34Fyo					
3	https://youtu.be	e/F2hc2FLOdhI				
4	https://youtu.be	e/wHGqp8lz36c				
5	https://youtu.be	e/hxS5He3KVEM				
6	https://youtu.be	e/nMPqsjuXDmE				
Assessment Methods	& Levels (based o	on Bloom's Taxonomy)				
Formative assessmen	t (Max. Marks:20)					
Course Outcome	Bloom's Level	Assessment Component	Marks			
C1.6.1			5			
C1.6.2			4			
	Summative	Assessment based on End Semester Project				
Bloom's Level						



TATA CONSULTANCY SERVICES Experience certainty.

Semester 6

Understand	
Apply	
Analyze	

Lesson Plan

Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
1	NA – Recapitulation activity	Recall information	Auld Lang Syne This will be a group activity in which lecturer will give some key words (from what they taught in the previous semesters). Each group will identify topics related to the key words and take 2 mins to share a summary of what they learnt in that topic. They can refer to their Satori books and finally note down these key learnings too.	Activity	45 mins
1	Understand the importance of diversity in workplace Understand the	2	Introduce the concept of Diversity in corporate environments through an activity. Discussion, role plays and	Activity Discussion and	45 mins 60 mins
-	importance of diversity in workplace	-	sharing reference materials.	Practical	
1	Identify the key aspects of communicative writing	2	 Communicative Writing Principles of Communicative Writing Formal and Business letters 	Lecture and practice	90 mins (30 mins lecture + 60 mins practice)





Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
NO 1	Apply communicative writing in real life scenarios	3	Writing proposals This will be taught through a group activity in which students will be asked to create a business proposal to get funding to begin a start-up of their choice. After they share their presentations, lecturer will share the best practices and templates for writing proposals (will be provided to the lecturer as part of the Faculty guide) and ask students to review their proposal and update it. Students should save this proposal for reference later in the sem. Students will have to continue in these groups for the rest of	Lecture and activity	90 mins
			this sem.		
1	Use charts and graphs in communicative writing	3	How to tell a story with charts and graphs Session will begin with a couple of demo videos. This will be followed by an activity on how to visually	Practical	60 mins



Unit	Objective	Bloom's	Content	Type of Class	Duration
			complete story. Students will be required to use the proposal for the start-up that they created in the previous class for this.		
1	Understand what is emotional intelligence Recognize the importance of emotional intelligence in personal and professional lives	2	 Emotional Intelligence Begin with a short video/movie clip showing manifestations of EI. Introduce the concept of EI and give them the experience through a game/activity. Discuss the findings that students with higher EQ write better exam papers. Ref reading: 10 Ways to Build EI by Daniel Goleman Ask students to note down the names of at least two movies in their Satori slam book, in which the characters display EI. 	Lecture and activity	90 mins
1	Understand why you would need public speaking at your workplace	2	Why do we need public speaking? Any two of the YouTube /IncTalks videos: a. Swami Vivekananda's Chicago speech b. Steve Jobs' first iPhone launch c. Martin Luther King Jr	Lecture and discussion	60 mins



Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
			 (I have a dream) d. J K Rowling commencement speech address 2008 e. APJ Abdul Kalam f. Any regional speakers 		
			Professors to ask what is common in these videos and lead them to the concept of public speaking (directions will be provided in the Facilitator's Guide).		
			Session for students to re-visit the group discussion and value proposition sessions that they participated in during the previous semesters. (This will be integrated in the semester 6 content)		
1	Identify the best practices of public speaking		Public speaking – best practices Ask each group (formed earlier) to research and come up with a list of best practices along with examples (in the class).	Activity	60 mins
			After each group presents their list of best practices, students will discuss and create a consolidated list of best practices by considering all common or overlapping ones and map it against the guidelines provided by the		



Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			TCS team.		
			Additional: Possible guest lecture or webinar (Dr Giri)		
1	Apply public speaking in real life scenarios	3	Get, Set, Go – sell your start- up ideas Each group to pitch their start-up idea to a panel consisting of external professors. They will use the presentation they created earlier and the best practices of public speaking to tell their story leveraging the storytelling and doodling methods they learnt in the previous semester (Design Thinking). Their story should at least include: • Name of their start-up • Who is the target audience/end user? • What problem will their start-up solve? • How do they plan to run start up? • How much money/budget would they need to begin their work? Professors to share the results of this formative assessment with the TCS Team so that we can use it for reference in GD post sem.	Formative assessment	120 mins



Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
1	NA		Let's relax	Activity	45 mins
			This will be a short session in		
			which students will participate		
			in at least 2 Anubhaav		
			Activities (to be specified in		
			the Fac Guide).		
2	Recognize the	1	Corporate Social	Lecture	45 mins
	importance of		Responsibility (CSR)		
	corporate social				
	responsibility		Ubuntu story – A story to		
	(CSR)		introduce the concept of		
			social responsibility.		
			The story will be played		
			through an audio omboddod		
			in the DDT (similar to an		
2	Recognize some of	1	Hear CSR stories	Lecture	60 mins
	the stalwarts in		• Meeting of JNT and Swami		
	CSR		Vivekananda.		
			• Societal connect of JNT.		
			Stalwarts in CSR (Led by		
			Tatas)		
			More Tata Group CSR		
			stories from Titan and		
			Tata Chemicals		
			Initially, Professors will share		
			any two of the above CSR		
			stories. Thereafter, they will		
			discuss the stories in the class		
			and ask the students to share		
			their thoughts.		
			Lacturar to ack students why		
			they need to conduct CSP		
			they need to conduct CSK		



Unit	Objective	Bloom's	Content	Type of Class	Duration
NO		Level	activities? (Answers will be given in handouts provided by the TATA Team)		
			Why do corporates need to engage in CSR? Is it for compliance only? The answers to these questions (given in the content) will refer back to the topics on TCS values, life skills and empathy taught in the earlier semesters.		
			Lecturer to explain to the students how CSR connects to their values and how CSR activities can add value to their resumes.		
2	Recognize the importance of corporate social responsibility (CSR)	1	Tell a CSR story Activity - Groups will research in class, prepare and present CSR activity of Tata Steel, Microsoft, Google, TCS, Starbucks, Titan, Tata Chemicals and TOMS Shoes.	Practice activity	90 mins
2	Recognize the attributes needed to function and grow in a corporate environment	1	 Attributes required for work and life Qualities of a good team member: a) Resilience b) Flexibility c) Strategic thinking and planning d) Decision making e) Resolving conflicts 	Lecture and discussion	60 mins



Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level	Professors to first show		
			evamples and non-evamples		
			and then the participants to		
			identify the traits that set		
			them apart		
	NA		Let's relax	Activity	45 mins
			This will be a short session in		
			which students will participate		
			in at least 2 Anubhaav		
			Activities (to be specified in		
			the Fac Guide).		
3	Recognize the	1	Activity – Who am I? (Image	Activity	60 mins
	attributes needed	attributes needed to function and	Management. Building a		
	to function and		perfect image)		
	grow in a				
	environment		This is an individual activity in		
			which each participant needs		
			to reflect upon the following		
			questions (in the order given		
			below) and jot down the		
			answers. They will be given a		
			handout with the questions		
			printed on it for this activity.		
			1. What do I wish to be		
			seen as?		
			(aspirational state)		
			2. How do I see myself		
			now? (present state)		
			3. How others see me?		
			(perceptions)		
			4. What is the gap between		



Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
			how others see me and		
			how I see myself?		
			5. How do I fill the gap?		
			Why is it important to fill the		
			gap (connect to importance		
			of personal branding to stay		
			relevant). Professor to share		
			examples of personal		
			branding in the corporate		
			world, as mentioned in the		
			content.		
3	Recognize the	1	Examination Result Activity -	Activity	90 mins
	best practices to	Locus of control			
	share and receive		(referring back to		
	TEEUDACK		Emotional intelligence)		
			One person from each		
			group (to be decided		
			through drawing lots) will		
			be asked to step aside to		
			act as teachers. The rest of		
			the group members will		
			participate as students.		
			Each group will be given a		
			scenario in which they will		
			get mock grades in an		
			examination. They will be		
			asked to react to their		
			result. Their reactions will		
			be noted.		
			Examination Result		
			Activity-Phase II – Role play		
			on feedback.		
			Now the teachers will be		



Unit	Objective	Bloom's	Content	Type of Class	Duration
NO		Level	asked to have a discussion		
			with each one to two		
			people from each group		
			sharing their feedback on		
			their reactions		
			After the activity, tips to		
			receive and give feedback		
			will be shared. Handouts		
			will be shared with		
			lecturers.		
3	Apply emotional	3	Applying emotional	Lab Activity	60 mins
	intelligence in real		intelligence		
	life scenarios				
			Activity for applying		
			Emotional Intelligence using		
			scenarios within each start-up		
			group. There will be separate		
			scenarios for each group.		
			Professors will judge the		
			groups based on guidelines		
			provided by the TCS team.		
	NA		Let's relax	Activity	45 mins
			This will be a short session in		
			which students will participate		
			in at least 2 Anubhaav		
			Activities (to be specified in		
			the Fac Guide).		
4	Apply knowledge	3	Sensitivity to diversity - Quiz	Formative	60 mins
1	ormultiple			assessment	



Objective	Bloom's	Content	Type of Class	Duration
	Level			
intelligences and				
learning styles in		A scenario-based quiz on		
interpersonal		(handouts to refresh Sem-1		
Interactions		content on multiple		
		intelligences and learning		
		styles followed by scenario-		
		based quiz) – awareness of		
		multiple intelligences and		
		learning styles in		
		communication. The		
		questions will be based on		
		scenarios that the students		
		might face later in their work		
		environment.		
Recognize the		Understanding conflicts	Activity	90 mins
impact of conflicts				
		This will be a group activity.		
		Each group will be given a		
		scenario of typical conflicts		
		that occurs in a corporate		
		office. In each group roles will		
		be assigned to the group		
		members who would be		
		expected to play it.		
		Each group will enact the		
		situation while others watch		
		and note down their		
		observations on:		
		1. What is the conflict?		
		2. What has caused the		
		conflict?		
	Objective intelligences and learning styles in interpersonal interactions Recognize the impact of conflicts	Objective Bloom's Level intelligences and learning styles in interpersonal interactions	ObjectiveBloom's LevelContentintelligences and learning styles in interpersonal interactionsA scenario-based quiz on (handouts to refresh Sem-1 content on multiple intelligences and learning styles followed by scenario- based quiz) – awareness of multiple intelligences and learning styles in communication. The questions will be based on scenarios that the students might face later in their work environment.Recognize the impact of conflictsUnderstanding conflictsRecognize the impact of conflictsThis will be a group activity. 	ObjectiveBloom's LevelContentType of Classintelligences and learning styles in interpersonal interactionsA scenario-based quiz on (handouts to refresh Sem-1 content on multiple intelligences and learning styles followed by scenario- based quiz) – awareness of multiple intelligences and learning styles in communication. The questions will be based on scenarios that the students might face later in their work environment.ActivityRecognize the impact of conflictsUnderstanding conflictsActivityRecognize the impact of conflictsUnderstanding conflictsActivityRecognize the impact of conflictsThis will be a group activity. Each group will be given a scenario of typical conflictsActivityRecognize the impact of conflictsEach group will be given a scenario of typical conflictsActivityImage: the students might face later in their work environment.Biomy and activity. Each group will be given a scenario of typical conflictsImage: the students might face later in the students might face later in the given a scenario of typical conflictsActivityImage: the student face late in the student face late in a corporate office. In each group probes will be assigned to the group members who would be expected to play it.Each group will enact the situation while others watch and note down their observations on:1.What is the conflict?Yhat has caused the conflict?



Unit No	Objective	Bloom's	Content	Type of Class	Duration
No		Level	 3. What is the negative impact of the conflict? 4. What can be a positive impact of the conflict? Each group will be requested to draw up a list of tips to manage conflicts at work and share in the next class and post on their Fb/Insta page. They can compare it with handout provided to lecturers. Student needs to reflect upon lessons in empathy and active listening (taught in the previous semesters) while managing conflicts. 		
4	List the basic	1	Each person will be requested to capture at least one Satori moment from these enactments of real-life scenarios.	Lecture	60 mins
	guidelines required to manage conflicts		Each group will share their list of guidelines to manage conflicts, post which the lecturer can share the standard list provided (as a		



Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
			hand-out) and discuss the		
			main points in the class.		
			After that the lecturer will ask		
			them to reflect on what are		
			the changes they need to		
			bring about in their behaviour,		
			based on Belbin's Team Player		
			roles (Sem 2 Unit 3).		
4	Recognize the key	1	Corporate etiquette	Activity	60 mins
	features of				
	corporate		Mock interview rounds for		
	etiquette		each group with a prospective		
			employer followed by		
			discussions on corporate		
			etiquette (leverage Interview		
			Ready app)		
			, , , , , , , , , , , , , , , , , , , ,		
4	Recognize the	1	Business idioms and	Lab activity	60 mins
	business idioms		Corporate Terms		
	and corporate				
	terms		This will begin with a quiz in		
		_	which in the first four rounds		
	Apply the business	3	each group needs to identify		
	idioms and		the business idioms and		
	corporate terms		excernts. In the next four		
			rounds they will be asked to		
			supply the correct idiom or		
			term in a given business		
			scenario.		
			After the quize the lectures		
			Alter the quiz, the lecturer		
			common husiness idioms and		
			guide them to download the		
			TCS BizVocab on their		



Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			smartphones.		
4	Recognize the impact of stress in life and work	1	Managing Stress Participants will first watch a	Lecture	60 mins
			short YouTube video: Managing Stress - Brainsmart		
			Then the lecturer will discuss stress and its impact through the following questions:		
			 Have you ever felt stressed? What are the situations that make you feel stressed? Does the stress help you in overcoming the situation? Do you know how stress affects your health? 		
			After this they will watch a video on how stress impacts health:		
			YouTube: The Long-term Effects of Stress (5 mins)		
			Finally, each group will be asked to create a poster with stress management tips to be presented in the next class and uploaded on their Fb/Insta pages.		



Unit No	Objective	Bloom's	Content	Type of Class	Duration
5	Identify the best	1	Tips to manage stress	Discussion Activity	60 mins
	manage stress		Each group will present their posters and the class will come up with a list of stress management tips to be put up on the Fb/Insta page.		
			They should also note this in their journals so that they can refer to it whenever they feel stressed.		
	Recognize the importance of time management	1	Time management Session begins with an introductory activity that establishes the fact that we often manage time poorly and as a result experience stress. After that participants will watch the YouTube video: Importance of Time Management For Better Life Style (3:33 mins) Now the lecturer will conduct an open house discussion, where the participants will share their challenges to manage time. Now the lecturer will ask the	Lecture	45 mins
			participants to evaluate their ability to handle their daily task within 24 hrs on a scale		



Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
			of 10. This is a confidential		
			rating which participants		
			needs to note down in their		
			satori book with date and		
			time for future reference. (
			this activity will be repeated		
			at a later stage)		
	Identify the best time management	1	Managing your time better	Activity	90 mins
	practices		The class will start with the		
			YouTube video:		
			A valuable lesson for a happy		
			life (2:33 mins)		
			After viewing this the		
			facilitator will ask the		
			narticipants to identify the		
			rocks nebbles and sands in		
			their life.		
			This will be followed by the		
			Time Squared Activity:		
			Each participant gets 3 pages		
			with 24 squares representing		
			the hours in a day.		
			Participants need to fill out:		
			The first page with the		
			everyday activities in their day		
			(example, brushing teeth,		
			bathing, meals, travelling, etc)		
			The second page with the		
			non-productive work that		
			they do every day (social		



Unit	Objective	Bloom's	Content	Type of Class	Duration
No		Level			
			media, mobile-games, etc)		
			On the third page they can add everything from the first two pages to find out the empty spaces. That is their productive time when they can study. This gives them a view of what they can adjust in order to increase their study time. Reference video: Study Skills – Managing your time (4:29 mins) Participants to repeat the self- evaluation exercise. In this instant, the participants will evaluate their ability to plan their daily task on a scale of 1 to 10 with date and time. Lecturer to encourage participants to evaluate their time management skills on a regular basis		
	NA		Let's relax This will be a short session in which students will participate in at least 2 Anubhaav Activities (to be specified in the Fac Guide).	Activity	45 mins
		1	Create memories Recap activity on the entire BCVS Course.		30 mins



Semester 6

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
				Total	20 hours
				TOtal	50 110015
			Project		
			Each group to create a POC (Proof of Concept) for their start-up applying their learnings from the CSBS course (core subjects + BCVS). The evaluation for this POC will be done as part of the Sem end assessment by the TCS team. During the assessment, students need to share the journey of creating their start-up: from inception to POC.		10 hours

MODERN DAY ROBOTICS AND ITS INDUSTRIAL APPLICATIONS + LAB [DO-IT-YOURSELF PROJECTS] (ELECTIVE **)



Semester 6

Course Outcome(s):

Students will be able to

- 1. Understand basic concepts and technological advancements in AI and robotics
- 2. Develop skills of using advanced software for solving practical problems in robotics pertaining to various industries
- 3. Understand and apply several statistical analysis techniques and business analytics for cognitive robotics
- 4. Understand and apply the programming of robots using python and R languages.

Topics to Be Covered:

UNIT – I

Introduction to Modern Day Robotics and their industrial applications: Industry 4.0 Concept: Background and Overview-Industry 4.0 technologies: implementation patterns in manufacturing companies-Evolution of Industrial Robots and their Applications-Advancements in Robotics and Its Future Uses-Types of robotics in various fields for applications

UNIT – II

Technologies essential for Cognitive Robotics: Computer systems and Technologies relevant to modern day robotics-Robotic Process Automation: Overview of RPA and its applications-RPA, AI, and Cognitive Technologies for Leaders-Introduction to Robotics: Analysis, Control, Applications

UNIT – III

Introduction to computer vision and application of Vision Systems in Robotics: Concepts of computer vision and the how vision systems are becoming essential part of Robotics-Computer Vision: Models, Learning, and Inference -Mastering Computer Vision with TensorFlow 2.x: Build advanced computer vision applications using machine learning and deep learning techniques- Machine Vision Applications-Application areas for vision systems-Robot inspection case study-Autonomous driving using 3D imaging case study.



Semester 6

UNIT – IV

Al in the context of Cognitive Robotics and Role of Al in Robotics: Foundation for Advanced Robotics and Al- A Concept for a Practical Robot Design Process- Demo to train A Robot Using Al - Deep learning core applications-Deep learning business applications

UNIT – V

Data Science and Big Data in the context of Cognitive Robotics: Cognitive Technologies: The Next Step Up for Data and Analytics in robotics-Cognitive Deep Learning Technology for Big Data Cognitive Assistant Robots for Reducing Variability in Industrial Human-Robot Activities

Artificial Intelligence and Robotics - The Review of Reliability Factors Related to Industrial Robots - Failure analysis of mature robots in automated production- Data Analytics for Predictive Maintenance of Industrial Robots - Failure Is an Option: How the Severity of Robot Errors Affects Human-Robot Interaction

UNIT – VI

Concepts of Cloud computing, cloud platforms and it applications in Robotics: Learning Cloud Computing: Core Concepts - Cloud Computing: Private Cloud Platforms -Robot as a Service in Cloud Computing -Cloud Computing Technology and Its Application in Robot Control - A Comprehensive Survey of Recent Trends in Cloud

Robotics Architectures and Applications - Google's cloud robotics and high computing needs of industrial automation and systems-The role of cloud and opensource software in the future of robotics-The Power of Cloud Robotics by Robotics Industry Association



Semester 6

Basics of Robotic operating System: ROS for beginners an overview- Introduction to the Robot Operating System (ROS) Middleware - Secure communication for the Robot Operating System - An Introduction to Robot Operating System: The Ultimate Robot Application Framework by Adnan Quality of Service and Cybersecurity Communication Protocols -Analysis for the Robot Operating System Robotics systems communication- Threat modelling using ROS

Towards cloud robotic system: A case study of online co-localization for fair resource competence-A Case Study on Model-Based Development of Robotic Systems using Monti Arc with Embedded Automata

UNIT – VIII

Introduction to Python and R Programming in the context of Robotics: Introduction to Python - Python Functions for Data Science-Basic ROS Learning Python for robotics- An introduction to R -The R in Robotics rosR: A New Language Extension for the Robot Operating System-

Home Assignments:

• Program a Robot in a Code Free Environment with Machine Logic (reference: https://www.youtube.com/watch?v=rjK7nHYeEwE)

DIY projects:

- Sloth Arduino DIY DOF Humanoid Robot Learning Kit with Programming (reference: https://www.youtube.com/watch?v=-T0yIQ7CmUU)
- DIY Raspberry Pi robot: Making of remote control/autonomous wandering 4WD robot (reference: https://www.youtube.com/watch?v=i_y8J30bpUg)

Text Books:



Semester 6

- 1. Saeed Benjamin Niku, "Introduction to Robotics: Analysis, Control, Applications", Wiley Publishers, 2nd edition,2011.
- 2. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
- 3. Francis X. Govers," Artificial Intelligence for Robotics: Build Intelligent Robots that Perform Human Tasks Using AI Techniques", Packt publishing, 2018.

Reference Books:

- Krishnendu Kar, "Mastering Computer Vision with TensorFlow 2.x: Build Advanced Computer Vision Applications Using Machine Learning and Deep Learning Techniques", Packt publishing, 2020.
- Armando Vieira, Bernardete Ribeiro," Introduction to Deep Learning Business Applications for Developers from Conversational Bots in Customer Service to Medical Image processing", Apress, 2018.



Semester 6

MODERN WEB APPLICATIONS + Lab (Elective III)

Overall Objective:

- Enable students to develop modern web application by leveraging latest technologies.
- Build strong foundation in students making them job ready as per industry requirements.
- Enable them to learn new technologies by applying foundation paradigms
- Building strong expertise to develop end to end application web frontend and backend development.

Unit 1 Introduction: Concept of website, its need and purpose, Types of websites: Static and dynamic website, Introduction to HTML, XML, JSON, Web Browsers, – Web Servers, Uniform Resource Locator, Tools and Web Programming Languages. Web Standards, Tiered Architecture: Client Server Model, Three Tier Model, Service Oriented Architectures, REST services,

Unit 2 HyperText Mark Up Language: - Languages used for website development, HTML5: basic tags, formatting tags, Adding images, Lists, Embedding multimedia in Web pages, Inserting tables, Internal and External Linking, Frames, Forms

Unit 3 Cascading Style Sheets (CSS3): Basics of Cascading Style sheets, Advantages of CSS, External Style sheet, Internal style sheet, Inline style sheet, CSS Syntax, color, background, Font, images

Unit 4 Java Script: Features of JavaScript, extension of JavaScript, Syntax of JavaScript: data types, operators, variables, tag, Document Object Model (DOM) with JavaScript, Selection Statement using if and Switch, Iterative statement: for, for/in, while, do while, break and continue

Unit 5 Front End Framework: Introduction to jQuery - Syntax, Selectors, Events, Traversing, AJAX ; Introduction to Bootstrap – Basics, Grids, Themes ; Angular JS – Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, Validation



Semester 6

Unit 6 Back End Technologies: Introduction to RESTful services, Resources, Messages (Request, Response), Addressing, Methods – (GET, POST, PUT, DELETE)

Modern Web Applications Laboratory

Instead of having Unit wise lab assignment suggest having, a single web application development exercise covering all the units. This exercise can be also done in group of 2-3 students.

Assignment Guideline:

Student can define the suitable web application example to implement as per their choice. It should cover followings:

- Application should cover Create, Read, Update, Delete scenarios of data.
- Front end to be developed covering all the technologies (HTML5, CSS3, jQuery, AngularJS)
- Back end connectivity to be established through RESTful services and must have database connectivity.
- Student can choose any backend technologies and database for developing REST services required for the application development. RESTful services should be developed using technologies already familiar. E.g. Java OR C# OR Python etc.



Semester 6

DATA MINING AND ANALYTICS + LAB (ELECTIVE III)

Course Outcome(s):

Students will be able to

- 1. Understand basic concepts and techniques of Data Mining
- 2. Develop skills of using data mining software for solving practical problems
- 3. Understand and apply several statistical analysis techniques: regression, ANOVA, data reduction

Topics to Be Covered:

UNIT – I

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications

UNIT – II



Semester 6

Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization

Data mining knowledge representation: Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques

Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures

UNIT – III

Data mining algorithms - **Association rules:** Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis

Data mining algorithms - Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules

Data mining algorithms – Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), linear models

UNIT – IV

Descriptive analytics: Data Modeling, Trend Analysis, Simple Linear Regression Analysis

Forecasting models: Heuristic methods, predictive modeling and pattern discovery, Logistic Regression: Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models **Generalized Linear model**: link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma.

Non Linear Regression (NLS): Linearization transforms, their uses & limitations, examination of nonlinearity, initial estimates, iterative procedures for NLS, grid search, Newton-Raphson, steepest descent, Marquardt's methods. Introduction to semiparametric regression models, additive regression models. Introduction to nonparametric regression methods

UNIT – V

Time Series Analysis: Auto - Covariance, Auto-correlation and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing

Linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARMA models such as Yule-Walker



Semester 6

estimation for AR Processes, Maximum likelihood and least squares estimation for ARMA Processes, Forecasting using ARIMA models

Prescriptive Analytics: Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modeling, Decision and Risk analysis, Decision trees.

Home Assignments:

- 1. **Experiments with Weka** Visualization Techniques, using filters and statistics, mining association rules, decision trees rules, Prediction
- 2. **Mining real data:** Preprocessing data from a real domain (Medical/ Retail/ Banking); Applying various data mining techniques to create a comprehensive and accurate model of the data
- Analytics Assignment 1: Conduct and Present a summary report on an End to end statistical model building exercise using sample data – Data preprocessing, Descriptive Analysis (Exploratory Data Analysis), Hypothesis building, Model Fitting, Model Validation and Interpretation of results
- Analytics Assignment 2: Build statistical models using any two linear and non-linear regression techniques: Simple Linear Regression; Multiple Regression; Variable Selection Problem; Multicollinearity and Ridge Regression; Nonlinear regression; Non-parametric regression; Logistic regression (binary and multiple); Poisson/Negative binomial regression (Use sample data sets)

Text Books:

- 4. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 3rd ed, 2010.
- 5. Lior Rokach and Oded Maimon, "Data Mining and Knowledge Discovery Handbook", Springer, 2nd edition, 2010
- 6. Box, G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting and Control, Holden-Day.

Reference Books:

3. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis (John Wiley) Third Edition.

Hosmer, D. W. and Lemeshow, S. (1989). Applied Logistic Regression (Wiley).