



## **VISION**

Evolve into a **Centre of Excellence for Education and Research** in Information Technology.

## **MISSION**

- Attaining academic excellence through well designed curriculum adaptable to dynamic technological needs, competent faculty and innovative teaching-learning process.
- Promoting collaborative research through special interest groups, state of the art research labs and Industry Institute Interactions.
- Facilitating value added courses to produce highly competent and socially conscious information technology professionals and entrepreneurs.



# THIAGARAJAR COLLEGE OF ENGINEERING

(A Govt. Aided, ISO 9001:2000 Certified Autonomous Institution Affiliated to Anna University)

MADURAI-625 015

## DEPARTMENT OF INFORMATION TECHNOLOGY

### Programme Specific Outcomes

#### B.Tech (Information Technology) Programme

Upon the successful completion of B-Tech Information Technology, the students will be able to:

PSOs for B.Tech Information Technology		Corresponding POs
PSO1	Provide appropriate IT solutions in Data Engineering, Distributed Computing, Information Security and Mobile Technologies domains.	PO1, PO2, PO3, PO4
PSO2	Select suitable computer-based tools for the analysis, design and development of IT based systems adhering to professional standards and practices.	PO5, PO6
PSO3	Exhibit teamwork skills with professional ethics and serve as effective member of societal and multidisciplinary projects	PO7, PO8, PO9, PO10, PO11, PO12



# **THIAGARAJAR COLLEGE OF ENGINEERING**

(A Govt. Aided, ISO 9001:2000 Certified Autonomous Institution Affiliated to Anna University)

**MADURAI-625 015**

## **DEPARTMENT OF INFORMATION TECHNOLOGY**

---

### **Programme Educational Objectives**

#### **B.Tech (Information Technology) Programme**

- PEO 1. Graduates of the programme will provide IT solutions to address the business and societal needs.
- PEO 2. Graduates of the programme will contribute significantly in the technological developments of Information Technology through research practices.
- PEO 3. Graduates of the programme will hone their professional expertise in quest for improved career opportunities through sustained learning.
- PEO 4. Graduates of the programme will lead a team of diversified professionals with good communication skills, leadership virtues and professional ethics.

### PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply knowledge of Mathematics, Science, Engineering fundamentals and core Information Technology Skills to the solutions of complex engineering problems in Data Engineering, Distributed Systems, Information Security and Management, Mobile Technologies and Software Design and Development.
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems in Data Engineering, Distributed Systems, Information Security and Management, Mobile Technologies and Software Design and Development reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of solutions:** Design software solutions for complex engineering problems in Data Engineering, Distributed Systems, Information Security and Management, Mobile Technologies for a given specification with appropriate consideration for the public health and safety, security, cultural, societal and environmental considerations.
4. **Conduct Investigation of complex problems:** Use research based knowledge and research methods in the design and conduct of experiments, organization, analysis and interpretation of data to identify patterns, produce meaningful conclusions and recommendations for complex problems in Data Engineering, Distributed Systems, Information Security and Management, Mobile Technologies and Software Design and Development.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities in Data Engineering, Distributed Systems, Information Security and Management, Mobile Technologies and Software Design and Development with an understanding of its limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice in Data Engineering, Distributed Systems, Information Security and Management, Mobile Technologies and Software Design and Development.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice in managing information technology resources and in providing IT solutions and services.

9. **Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings to deliver reports, programs, projects, presentations and other deliverables related to information technology requirements of an organization.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a multidisciplinary team, to manage projects in Information Technology and related fields.
12. **Life Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

### PEO vs. PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>PEO1. Career accomplishments</b>	S	S	S	M	S	M	M	S	S	S	S	S
<b>PEO2. Research</b>	S	S	S	S	S	M	M	S	S	S	M	S
<b>PEO3. Sustained learning</b>	S	S	S	S	S	L	S	L	L	L	L	S
<b>PEO4. Transferable skills</b>	L	L	L	L	L	M	M	S	S	S	S	S

### **Graduate Attributes defined by NBA**

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### GA vs. PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>GA1</b>												
<b>GA2</b>												
<b>GA3</b>												
<b>GA4</b>												
<b>GA5</b>												
<b>GA6</b>												
<b>GA7</b>												
<b>GA8</b>												
<b>GA9</b>												
<b>GA10</b>												
<b>GA11</b>												
<b>GA12</b>												

**THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI- 625 015**

(A Govt. Aided, ISO 2000:2008 certified Autonomous Institution affiliated to Anna University)

**CDIO-CATEGORIZATION OF COURSES**

Degree: B.Tech

Programme: INFORMATION TECHNOLOGY

A. Foundation Courses:

Total Credits to be earned: 53-58

a. Humanities and Social Science 9-11

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
<b>THEORY</b>							
1.	21EG140	English	2	0	0	2	NIL
2.	21IT490	Project Management	3	0	0	3	NIL
3.	21IT540	Accounting and Finance	3	0	0	3	NIL
<b>THEORY CUM PRACTICAL</b>							
4.	21EG460	Professional Communication	1	0	2	2	NIL
<b>PRACTICAL</b>							
5.	21EG170	English Laboratory	0	0	2	1	NIL

b. Basic Science 21

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
<b>THEORY</b>							
1.	21MA110	Engineering Calculus	3	1	0	4	NIL
2.	21PHC20	Physics	3	0	0	3	NIL
3.	21CHC30	Chemistry	3	0	0	3	NIL
4.	21MA210	Matrices and Ordinary Differential Equations	3	0	0	3	NIL
5.	21IT310	Discrete Mathematics	3	0	0	3	NIL
6.	21IT410	Probability and Statistics	3	0	0	3	NIL
<b>THEORY CUM PRACTICAL</b>							
<b>PRACTICAL</b>							
7.	21PH210	Physics Lab	0	0	2	1	NIL
9.	21CH190	Chemistry Lab	0	0	2	1	NIL



**c. Engineering Science 23-26**

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
<b>THEORY</b>							
1.	21ES150	Engineering Exploration	3	0	0	3	NIL
2.	21IT220	Problem Solving Using Computers	3	0	0	3	NIL
3.	21ES390	Design Thinking	1	0	2	2	NIL
<b>THEORY CUM PRACTICAL</b>							
5	21ME160	Engineering Graphics	3	0	2	4	NIL
6	21IT360	IT operations and Management	2	0	2	3	NIL
7	21IT361	IT operations and Management	2	0	2	3	NIL
8.	21IT630	Programming for Internet of Things	2	0	2	3	21IT430
9	21ES590	Systems Thinking	1	0	1	2	NIL
<b>PRACTICAL</b>							
10	21IT280	Workshop	0	0	2	1	NIL
11	21ES290	Lateral Thinking	0	0	2	1	NIL

**c.1.Engineering Science Electives****(3)**

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
<b>THEORY</b>							
1.	21ITEA0	Data Analytics	3	0	0	3	NIL
2.	21MTEA0	Integrated Product Development	3	0	0	3	NIL
3.	21MTEB0	Battery Management System	3	0	0	3	NIL
4.	21MEEA0	Total quantity management	3	0	0	3	NIL
5	21CEEA0	Geology	3	0	0	3	NIL
6	21CEEBO	Building Planning and Services	3	0	0	3	NIL
7	21CEEC0	Sustainable Development	3	0	0	3	NIL
8	21CEED0	Energy Science and Engineering	3	0	0	3	NIL
9	21ECEA0	Introduction To MEMS	3	0	0	3	NIL
10	21ECEBO	Foundations FOR Machine Learning	3	0	0	3	NIL
11	21ECECO	IOT Sensors and Device	3	0	0	3	NIL
12	21ECED0	Blockchain Technology	3	0	0	3	NIL
13	21ECEEO	5G Wireless Networks	3	0	0	3	NIL
14	21ECEA0	Introduction To MEMS	3	0	0	3	NIL
<b>THEORY CUM PRACTICAL</b>							
5	21CSEA0	Data Science using Python	2	0	2	3	NIL

**B. Professional Core Courses:****Credits to be earned: 55**

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
<b>THEORY</b>							
1.	21IT230	Operating Systems	3	0	0	3	NIL
2.	21IT240	Computer Organization and Design	3	0	0	3	NIL
3.	21IT320	Object Oriented Programming	3	0	0	3	NIL
4.	21IT330	Software Engineering	3	0	0	3	NIL
5.	21IT340	Data Structures	3	0	0	3	NIL
6.	21IT420	Algorithm Design Principles	3	0	0	3	NIL
7.	21IT430	Computer Networks	3	0	0	3	NIL
8.	21IT440	Database Management Systems	3	0	0	3	NIL
9.	21IT510/21IT511	Web Technologies	3	0	0	3	NIL
10.	21IT520	Information Security	3	0	0	3	NIL
11.	21IT530	Data Mining	3	0	0	3	NIL
12.	21IT610	Cloud Computing	3	0	0	3	NIL
13.	21IT710	Human Computer Interaction	3	0	0	3	NIL
<b>THEORY CUM PRACTICAL</b>							
14.	21IT260	Essentials of Information Technology	2	0	2	3	NIL
15.	21IT660	Mobile Application Development	2	0	2	3	21IT320
<b>PRACTICAL</b>							
16.	21IT270	Python Programming Lab.	0	0	2	1	NIL
17.	21IT370	Object Oriented Programming Lab	0	0	2	1	NIL
18.	21IT380	Data Structures Lab	0	0	2	1	NIL
19.	21IT470	Computer Networks Lab.	0	0	2	1	NIL
20.	21IT480	Database Management Systems Lab	0	0	2	1	NIL
21.	21IT570/21IT571	Web Technologies Lab.	0	0	2	1	NIL
22.	21IT580	Information Security Lab	0	0	2	1	NIL
23.	21IT670	Cloud Computing Lab	0	0	2	1	NIL
24.	21IT770	Multimedia Lab	0	0	2	1	NIL
25.	21IT780	Human Computer Interaction Lab	0	0	2	1	NIL

**C. Elective Courses:****Credits to be earned: 24-48****a. Programme Specific Elective****Credits to be earned: 12-24**

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
<b>Data Engineering</b>							
1.	21ITPA0	Machine Learning	3	0	0	3	21IT530
2.	21ITPK0	Social Network Analysis	3	0	0	3	NIL
3.	21ITPU0	BIG DATA TOOLS AND	3	0	0	3	NIL

		TECHNOLOGIES					
4.	21ITRF0	DATA ANALYTICS FOR INTERNET OF THINGS	3	0	0	3	21IT630
<b>Distributed System</b>							
5.	21ITPD0	Distributed Application Development	3	0	0	3	NIL
6.	21ITPG0	Service Oriented Computing	3	0	0	3	NIL
7.	21ITPY0	Storage systems	3	0	0	3	NIL
8.	21ITPZ0	Next Generation networks	3	0	0	3	NIL
<b>Information Security</b>							
9.	21ITPM0	Ethical Hacking	3	0	0	3	21IT430
<b>Mobile Technologies</b>							
10.	21ITPJ0	Wireless and Mobile Communication	3	0	0	3	21IT430
11.	21ITPL0	Cyber Physical Systems	3	0	0	3	NIL
12.	21ITRC0	Programming Wireless Sensor Networks	3	0	0	3	NIL
13.	21ITRE0	FULL STACK TECHNOLOGIES	3	0	0	3	NIL
<b>Cognitive Science</b>							
14.	21ITPH0	Computer Vision	3	0	0	3	NIL
<b>Software Design and Development</b>							
15.	21ITPQ0	Software Testing	3	0	0	3	NIL
16.	21ITPR0	C# and .NET FRAMEWORK	3	0	0	3	21IT320
<b>Supported Courses</b>							
17.	21ITPS0	Theory of Computation	3	0	0	3	21IT310
18.	21ITPT0	Principles of Compiler Design	3	0	0	3	21IT310
<b>b. Programme Specific Elective for Expanded Scope</b>						<b>Credits to be earned: 6-12</b>	
S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
<b>Data Engineering</b>							
19.	21ITPB0	Deep Learning	3	0	0	3	NIL
20.	21ITPC0	Information Retrieval	3	0	0	3	NIL
21.	21ITPV0	Reinforcement Learning	3	0	0	3	NIL
22.	21ITPW0	Natural Language Processing	3	0	0	3	NIL
23.	21IT2D0	Data Science And AI Applicatons	2	0	0	2	NIL
24.	21IT1A0	Visual Analytics	1	0	0	1	NIL
25.	21ITRG0	Artificial Intelligence	3	0	0	3	NIL
26.	21IT1F0	Knowledge Graph and its applications	1	0	1	1	21IT530
<b>Distributed System</b>							

27.	21ITPE0	Fog Computing	3	0	0	3	21IT430 21IT610
28.	21ITPF0	Software Defined Networks	3	0	0	3	21IT430
29.	21CS1C0	Containerization Technologies(COMMON TO IT AND CSE)	1	0	0	1	NIL
30.	21IT1B0	Virtualization Management	1	0	0	1	NIL
31.	21ITRH0	OPTIMIZATION TECHNIQUES FOR IT	3	0	0	3	NIL
<b>Information Security</b>							
32.	21ITPN0	Cyber forensics	3	0	0	3	NIL
33.	21ITPP0	Blockchain Technologies	3	0	0	3	21IT520
34.	21ITRA0	Information Security Auditing and Management	3	0	0	3	21IT520
35.	21ITRB0	Multimedia Security	3	0	0	3	21IT520
36.	21IT2B0	Penetration Testing Methodologies	2	0	0	2	NIL
37.	21IT2C0	Edge And Mobility Network Security Solutions	2	0	0	2	NIL
<b>Mobile Technologies</b>							
38.	21IT2A0	Multiplatform Mobile Application Development	2	0	0	2	NIL
39.	21ITRD0	Cross Platform Application Development	3	0	0	3	21IT660
40.	21IT2E0	API Development and Deployment	1	0	2	2	NIL
41.	21ITRJ0	Kotlin Programming for Android	3	0	0	3	NIL
42.	21ITRK0	Enterprise Design Patterns	3	0	0	3	NIL

**C. General Elective****Credits to be earned: 3-6**

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
1.	21ITGA0	Database Management System	3	0	0	3	NIL
2.	21ITGB0	Python for Data science	3	0	0	3	NIL
3.	21ITGC0	Object Oriented Programming with Java	3	0	0	3	NIL
4.	21ITGD0	Software Engineering	3	0	0	3	NIL
5.	21ITGE0	Cloud Technologies	3	0	0	3	NIL
6.	21ITGF0	Assistive Technology	3	0	0	3	NIL
7.	21ITGH0	Kotlin Programming	3	0	0	3	NIL
8.	21ITGJ0	Cloud Application Development	3	0	0	3	NIL

**d. Foundation Elective****Credits to be earned:3-6****D. Project,Seminar,Internship in industry or  
Higher Learning institutions****Credits to be earned: 15**

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Prerequisite
			L	T	P		
9.	21ES690	Engineering Design Project	0	0	6	3	-
10	21ES790	Capstone Design Project	0	0	6	3	-
11	21IT810	Project	0	0	21	9	-

**E. MANDATORY COURSES (Not to be included for CGPA)**

S.No	Course Code	Name of the Course	Number of Hours / Week			Credit	Semester
			L	T	P		
THEORY							
1.	21CHAA0	Environmental Sciences	1	-	1	-	II
2	21CHAB0	Constitution of India	1	-	1	-	IV
3.	21CHAC0	Essence of Indian Knowledge	1	-	1	-	V

**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.TECH. INFORMATION TECHNOLOGY DEGREE PROGRAMME**

**SECOND SEMESTER**

**FOR THE STUDENTS ADMITTED IN THE  
ACADEMIC YEAR 2018-19 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A GOVERNMENT AIDED ISO 9001:2008 CERTIFIED  
AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)  
**MADURAI – 625 015, TAMILNADU**

PHONE: 0452 – 2482240, 41  
FAX: 0452 2483427  
WEB: [WWW.TCE.EDU](http://WWW.TCE.EDU)

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**COURSES OF STUDY**

(For the candidates admitted from 2018-19 onwards)

**SECOND SEMESTER**

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
<b>THEORY</b>						
18MA210	Matrices and Ordinary Differential Equations.	BS	3	-	-	3
18IT220	Problem Solving Using Computers	ES	3	-	-	3
18IT230	Operating Systems	PC	3	-	-	3
18IT240	Computer Organization and Design	PC	3	-	-	3
<b>THEORY CUM PRACTICAL</b>						
18IT260	Essentials of Information Technology	PC	2	-	2	3
<b>PRACTICAL</b>						
18IT270	Python programming lab	PC	-	-	2	1
18IT280	Workshop	ES	-	-	2	1
18IT290	Lateral Thinking	ES	-	-	2	1
<b>AUDIT COURSES</b>						
18CHAA0	Environmental Sciences	AC	1	-	1	-
<b>Total</b>			<b>15</b>	<b>-</b>	<b>9</b>	<b>18</b>

BS : Basic Science  
HSS : Humanities and Social Science  
ES : Engineering Science  
PC : Program Core  
PE : Program Elective  
GE : General Elective  
AC : Audit Course

L : Lecture  
T : Tutorial  
P : Practical

**Note:**

1 Hour Lecture is equivalent to 1 credit  
2 Hours Tutorial is equivalent to 1 credit  
2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**Scheme of Examinations**  
(For the candidates admitted from 2018-19 onwards)

**SECOND SEMESTER**

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
<b>THEORY</b>								
1	18MA210	Matrices and Ordinary Differential Equations.	3	50	50	100	25	50
2	18IT220	Problem Solving Using Computers	3	50	50	100	25	50
3	18IT230	Operating Systems	3	50	50	100	25	50
4	18IT240	Computer Organization and Design	3	50	50	100	25	50
<b>THEORY CUM PRACTICAL</b>								
5	18IT260	Essentials of Information Technology	3	50	50	100	25	50
<b>PRACTICAL</b>								
7	18IT270	Python programming lab	3	50	50	100	25	50
8	18IT280	Workshop	3	100	0	100	0	50
9	18IT290	Lateral Thinking	-	50	50	100	25	50
<b>AUDIT COURSES</b>								
10	18CHAA0	Environmental Science	-	50	50	100	25	50

\* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

\*\* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks



18MA210	<b>MATRICES AND ORDINARY DIFFERENTIAL EQUATIONS</b>	Category	L	T	P	Credit
		BS	3	0	0	3

**Preamble**

In engineering, particularly Solid Mechanics, Aerodynamics, Fluid Flow, Heat Flow and Robotics have application that requires an understanding of Vector Calculus and Differential Equations. Also Mathematical tool Laplace Transforms is very much essential to solve ordinary differential equations that occur in the above areas. Eigen values and Eigenvectors are extremely important while creating engineering models in control systems, designing bridges, communication systems and searching algorithms. The course is designed to impart the knowledge and understanding of the above concepts to all Engineers and apply them in their areas of specialization.

**Prerequisite**

18MA110 Engineering Calculus

**Course Outcomes**

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Compute the Laplace transform and inverse Laplace transform of different functions	10%
CO2	Solve the given initial value problem using Laplace transform	15%
CO3	Apply matrix algebra techniques for transformations of conic sections into principle axes	25%
CO4	Solve the model developed for the given system using ordinary differential equation	25%
CO5	Compute divergence and curl of vector functions	10%
CO6	Apply the concepts of vector differentiation and vector integration to fluid flow and heat transfer problems	15%

**CO Mapping with CDIO Curriculum Framework**

CO	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components
		Cognitive	Affective	Psychomotor	
CO1	TPS2	K2	A2	-	1.1
CO2	TPS3	K3	A3	-	1.1
CO3	TPS3	K3	A3	-	1.1
CO4	TPS3	K3	A3	-	1.1
CO5	TPS2	K2	A2	-	1.1
CO6	TPS3	K3	A3	-	1.1

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	S	M			-	-	-	-		-	-	
CO2.	S	S	S		-	-	-	-	M	-	-	M
CO3.	S	S		S	-	-	-	-		-	-	S
CO4.	S	S	S	S	-	-	-	-	M	-	-	M
CO5.	S	M										
CO6.	S	S	S									

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	10	10	10				10
Understand	30	30	30				20
Apply	60	60	60	100	100	100	70
Analyse	00	00	00				00
Evaluate	00	00	00				00
Create	00	00	00				00

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1**

1. Show that Laplace transform of  $\frac{1}{\sqrt{t}}$  is  $\frac{\sqrt{\pi}}{s}$ .
2. Identify the inverse Laplace transform of  $\log\left(\frac{s^2+1}{(s-1)^2}\right)$ .
3. Discuss any three properties of Laplace transforms.

**Course Outcome 2**

1. Apply Laplace transform solve  $y''+9y = \delta\left(t - \frac{\pi}{2}\right)$ ,  $y(0) = 2$ ,  $y'(0) = 0$ .
2. By using Laplace transform, solve  $x''(t) + 3x'(t) + 2x(t) = 2(t^2 + t + 1)$ ; with  $x(0) = 2$ ,  $x'(0) = 0$ .
3. Apply convolution theorem, Solve the Volterra integral equation of the second kind  $y(t) - \int_0^t y(\tau) \sin(t - \tau) d\tau = t$ .

**Course Outcome 3**

1. An elastic membrane in the  $x_1 x_2$  plane with boundary circle  $x_1^2 + x_2^2 = 1$  is stretched so that a point  $P; (x_1, x_2)$  goes over into the point  $Q; (y_1, y_2)$  given by  $y_1 = 5x_1 + 3x_2$   
 $y_2 = 3x_1 + 5x_2$

Find the principal directions that is the directions of the position vector  $X$  of  $P$  for which the direction of the position vector  $Y$  of  $Q$  is the same or exactly opposite.

Predict the boundary circle take under this deformation?

2. Discover the type of conic section the following quadratic form represents and transform it to principal axes:  $Q = 17x_1^2 - 30x_1x_2 + 17x_2^2 = 128$ .

3. Diagonalize the matrix  $\begin{bmatrix} 6 & 0 & 0 \\ 12 & 2 & 0 \\ 21 & -6 & 9 \end{bmatrix}$

**Course Outcome 4**

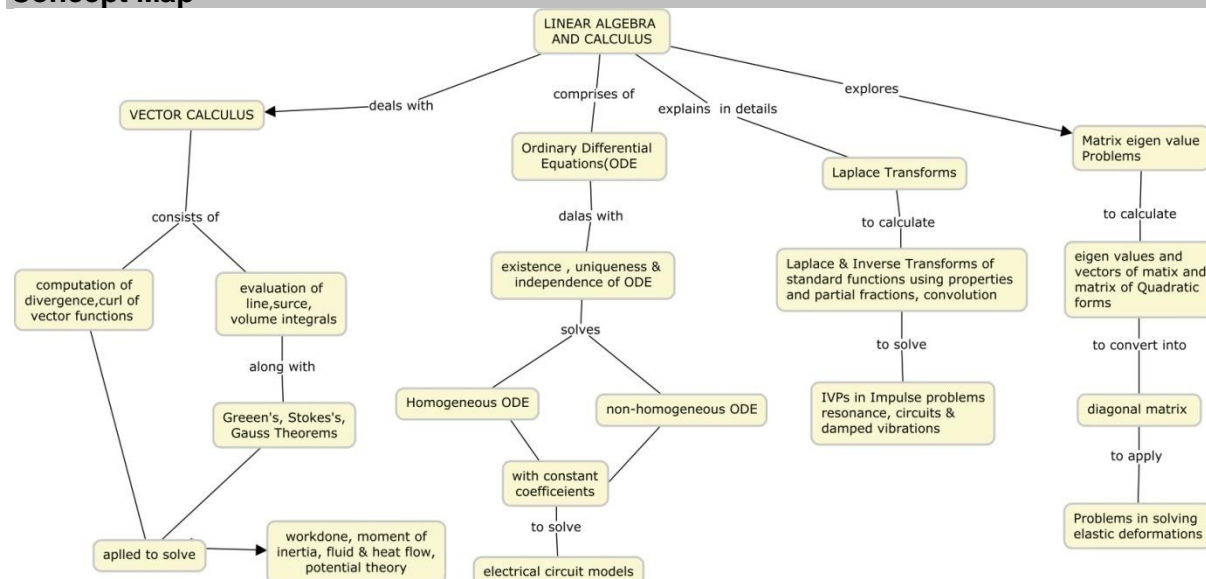
1. Reduce to first order and solve  $y'' - y' = 0$
2. Compute the general solution for  $y'' + y' + (\pi^2 + 1/4)y = e^{-x/2} \sin \pi x$
3. Solve  $(x^2 D^2 - 4xD - 6)y = c$

**Course Outcome 5**

1. Predict the value of  $\text{div}(\text{curl}\vec{F})$ .
2. If  $\phi_1$  and  $\phi_2$  are scalar point functions and  $\vec{F}$  is a vector point function such that  $\phi_1 \vec{F} = \nabla \phi_2$  then identify  $\vec{F} \cdot \text{curl} \vec{F}$ .
3. Estimate  $\text{curl} \vec{v}$ , where  $\vec{v} = [e^{-z^2}, e^{-x^2}, e^{-y^2}]$ .

**Course Outcome 6**

1. Predict the work done by the force  $\vec{F} = [y^2, -x^2]$  acting on a particle in  $y = 4x^2$  from  $(0,0)$  to  $(1,4)$ .
2. Compute the amount of fluid that crosses the surface in a flow per unit time at any one instant, if the velocity field is  $\vec{v} = y\vec{i} + x\vec{j} + z\vec{k}$  over the boundary of the region enclosed by the paraboloid  $z = 1 - x^2 - y^2$  and the plane  $z = 0$ .
3. Apply Stokes theorem to compute  $\int_C \vec{F} \cdot d\vec{r}$  where  $\vec{F} = [y, xz^3, -zy^3]$  and  $C$  is circle  $x^2 + y^2 = 4, z = -3$ .

**Concept Map****Syllabus**

**LAPLACE TRANSFORMS:** Laplace transform, Linearity, First Shifting theorem – Transforms of derivatives and integrals, ODEs – Unit step function, Second shifting theorem – Short Impulses, Dirac's delta function, partial fractions – Convolution, Integral Equations – Differentiation and integration of transforms. **MATRIX EIGEN VALUE PROBLEM:** The Matrix Eigen value Problem, Determining Eigenvalues and Eigenvectors – Some Applications of Eigen value Problems – Symmetric, Skew symmetric and orthogonal matrices – Eigen bases, Diagonalization, Quadratic forms. **ORDINARY DIFFERENTIAL EQUATION:** Homogeneous Linear ODEs of second order – Homogeneous Linear ODEs with constant coefficients – Euler Cauchy Equation – Existence and uniqueness of solutions, Wronskian - Nonhomogeneous ODE – Modelling: Electric Circuits- Solution by Variation of Parameters. **VECTOR CALCULUS:** Divergence of a Vector Field- Curl of a Vector Field- Line Integrals- Path independence of line integrals- Green's Theorem in the plane- Surface Integrals- Triple Integrals, Divergence Theorem of Gauss- Applications of the Divergence Theorem- Stoke's Theorem.

**Learning Resources**

- Erwin Kreszig, "Advanced Engineering Mathematics", 10th edition, Wiley, 2017.
  - Laplace transforms : [sections 6.1,6.2,6.3,6.4,6.5,6.6]
  - Matrix eigen value problem : [sections 8.1,8.2,8.3,8.4]
  - Ordinary differential equations : [sections 2.1,2.2,2.5,2.6,2.7,2.9,2.10]
  - Vector calculus : [sections 9.8,9.9,10.1,10.2,10.4,10.6, 10.7,10.8,10.9]
- Peter V.O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2017.
- Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2016.
- Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
- Made Easy Team, Engineering Mathematics, Made Easy Publications, 2018.

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>LAPLACE TRANSFORMS</b>		
1.1	Laplace Transform. Linearity. First Shifting Theorem ( <i>s</i> -Shifting)	2	CO1
1.2	Transforms of Derivatives and Integrals. ODEs	2	CO2
1.3	Unit Step Function (Heaviside Function). Second Shifting Theorem ( <i>t</i> -Shifting)	1	CO1
1.4	Short Impulses. Dirac's Delta Function. Partial Fractions	1	CO1
1.5	Convolution. Integral Equations	2	CO2
1.6	Differentiation and integration of transforms	1	CO1
2	<b>MATRICES EIGEN VALUE PROBLEMS</b>		
2.1	Determining Eigenvalues and Eigenvectors	2	CO3
2.2	Some Applications of Eigenvalue Problems	1	CO3
2.3	Symmetric, Skew-Symmetric, and Orthogonal Matrices	2	CO3
2.4	Eigenbases. Diagonalization.	2	CO3
2.5	Quadratic Forms	2	CO3
3	<b>ORDINARY DIFFERENTIAL EQUATION</b>		
3.1	Homogeneous Linear ODEs of Second Order	2	CO4
3.2	Homogeneous Linear ODEs with Constant Coefficients	1	CO4
3.3	Euler–Cauchy Equations	1	CO4
3.4	Existence and Uniqueness of Solutions. Wronskian	1	CO4
3.5	Nonhomogeneous ODEs	2	CO4
3.6	Solution by Variation of Parameters	2	CO4
4	<b>VECTOR CALCULUS</b>		
4.1	Divergence and Curl of a Vector Field	2	CO5
4.2	Line Integrals	2	CO6
4.3	Green's Theorem in the Plane	1	CO6
4.4	Surface Integrals	1	CO6
4.5	Triple Integrals. Divergence Theorem of Gauss	1	CO6
4.6	Applications of the Divergence Theorem	1	CO6
4.7	Stoke's Theorem	1	CO6
	<b>TOTAL No. of Hours</b>	36	

**Course Designers**

- Dr.V.Gnanaraj - [vgmat@tce.edu](mailto:vgmat@tce.edu)
- Dr.S.Jeyabharathi - [sjbmam@tce.edu](mailto:sjbmam@tce.edu)
- Dr.G.Jothilakshmi - [gjlmam@tce.edu](mailto:gjlmam@tce.edu)
- Dr.C.S.Senthil kumar - [kumarstays@tce.edu](mailto:kumarstays@tce.edu)
- Dr.R.Suresh - [suresh080183@tce.edu](mailto:suresh080183@tce.edu)

18IT220	PROBLEM SOLVING USING COMPUTERS	Category	L	T	P	Credit
		ES	3	0	0	3

### Preamble

The course on problem solving using computers is intended to introduce the students about computational thinking, the methodology of programming with emphasis on modularity and the coding of computer programs. Upon completion of the course, the students would be able to master the principles of interpreted high-level programming and demonstrate significant experience in problem solving

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Practice the following terms in the context of problem solving by a computer: Problem specification, input-output analysis, algorithm, flowchart, pseudo-code, High level language, assembly language, machine language, and compilation and execution.	10
CO2	Solve the given problem statement using programming concepts such as objects, data types, expression statements, looping and string evaluation	19
CO3	Apply problem solving strategies such as divide and conquer, merging, solving by analogy etc in design of simple applications	19
CO4	Make use of functions, scoping and abstraction in development of simple applications.	11
CO5	Demonstrate mutability and higher order functions using file I/O and exception handling in python.	19
CO6	Take part in software engineering principles like analysis, design, coding, testing and maintenance for the development of engineering applications using python programming.	22

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO6	TPS4	Analyse	Organise	Complex Overt Responses	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.4.1, 4.5.1, 4.5.3, 4.5.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L									M	M		L
CO2	S	M	L									M	M		L
CO3	S	M	L									M	M		L
CO4	S	M	L									M	M		L
CO5	S	M	L									M	M		L
CO6	S	S	M	L	L			S	S	S	L	M	S	L	M

S- Strong; M-Medium; L-Low

### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	10	-	-	-	10
Understand	40	30	30	-	-	-	30
Apply	40	50	60	80	60	30	60
Analyse	0	0	0	20	40	70	0
Evaluate	0	0	0	0	0	0	0
Create	0	0	0	0	0	0	0

### Assessment Pattern: Psychomotor

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	20
Guided Response	20
Mechanism	40
Complex Overt Responses	20
Adaptation	-
Origination	-

### Sample Questions for Course Outcome Assessment

#### Course Outcome 1 (CO1):

1. Differentiate a compiler and interpreter.
2. Draw the flowchart for generation of Fibonacci sequence.
3. Develop the algorithm for exchange of two variables.

#### Course Outcome 2 (CO2):

1. Show the memory model of variables in python.
2. Write a python program to check whether a given number is prime or not using for-else statement.
3. Write a python program to read the string with punctuations and print the same string without punctuations.
4. Illustrate the steps that python follows in creating a object.

**Course Outcome 3 (CO3):**

1. A company needs a program to figure its weekly payroll. The input data, consisting of each employee's identification number, pay rate, and hours worked, is in the file datafile.dat in secondary storage. The program should input the data for each employee, calculate the weekly wages, save the input information for each employee along with the weekly wages in a file, and display the total wages for the week on the screen, so that the payroll clerk can transfer the appropriate amount into the payroll account. Discuss the problem solving approach you would follow to develop the program.
2. Design an algorithm using factoring technique to establish all the primes in first n positive integers.
3. In the Company Payroll Program, use means-ends analysis to develop the algorithm for calculating pay. What are the ends in the analysis? What information did we start with and what information did we want to end up with?

**Course Outcome 4 (CO4):**

1. Write a python program to multiply all the numbers in a list.
2. Write a python program to calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.
3. Write a python program that Accepts a string and calculate the number of upper case letters and lower case letters.

**Course Outcome 5 (CO5):**

1. Write a python program to read the contents of a text file and to write into another file.
2. Show the difference between lists and string in python programming with an example.
3. Write a python program to read a word and print the number of letters, vowels, and percentage of vowels in the word using dictionary.
4. Store the following data in a list, in a set and in a dictionary

India	USA	UK	Japan
99	1	5	60

**Course Outcome 6 (CO6):**

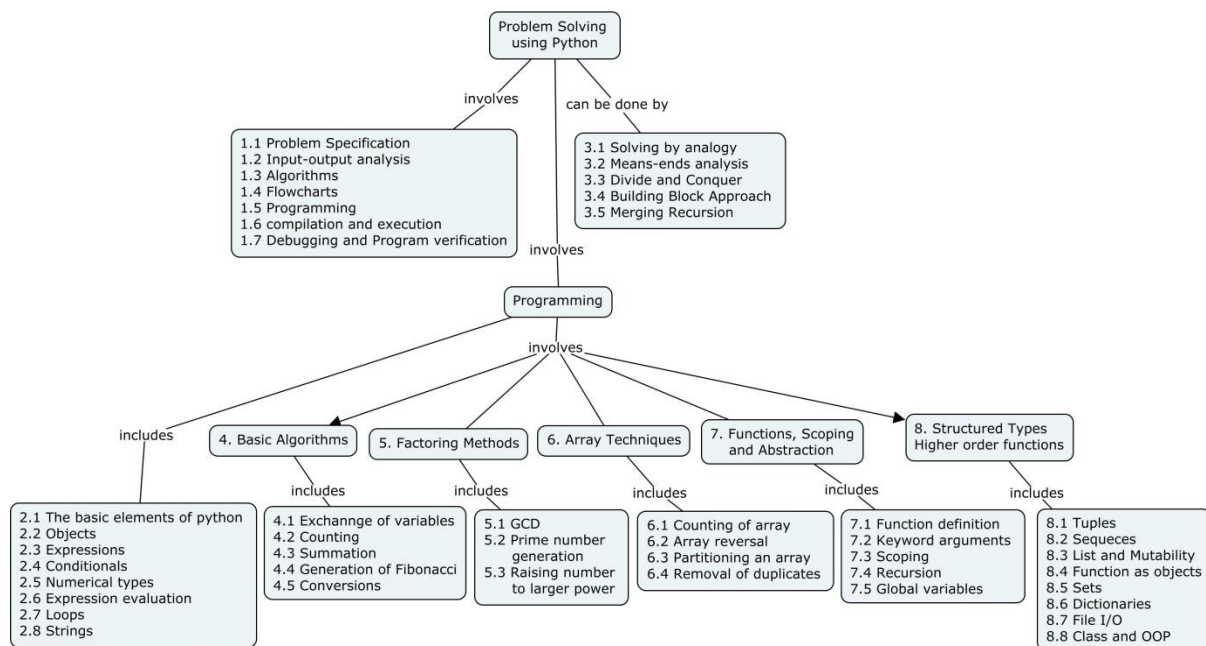
Design and Development of applications like

- a. Encryptor/ Decryptor
- b. Physics problem solver
- c. Sudoku solver
- d. Hospital management system
- e. Random number generator
- f. Electric circuit solver etc.
- g. Scientific Calculator

Mini Project Details: (Team size: 3)

- Problem identification.
- Problem Analysis and Modular design.
- Develop algorithm/pseudo code and draw the flowchart – module wise individually.
- Develop programs module level, test and debug individually.
- Integrate the modular programs and present the results in a team.
- Document the above process as a report.

## Concept Map



## Syllabus

**Introduction to Problem Solving** – Problem Specification, input-output analysis, Algorithms – Design and Analysis, Implementation of Algorithms, Flowcharts, Programming – High level languages, language translators, syntax, semantics, compilation and execution, Debugging and Program verification.

**Fundamentals of Python** – The basic elements of python – objects – expressions – assignment statement – arithmetic operators – operator precedence – boolean expression – conditionals – numerical types – expression evaluation – float representation – loops – for loop – nested loops – break and continue – strings – indexing and slicing strings

**Problem Solving Techniques** – Solving by analogy, Means-ends analysis, Divide and Conquer, Building Block Approach – Merging Recursion

**Basic Algorithms** – Exchange of variables, Counting, Summation of set of numbers, Generation of Fibonacci sequence, Number to character conversion.

**Factoring Methods** – Greatest Common Divisor of two integers, Generation of Prime numbers, raising number to larger power

**Array Techniques** – Counting of array elements, array reversal, partitioning an array, removal of duplicates in an array

**Functions, scoping and Abstraction** – Function definition – keyword arguments and default values – scoping – specifications – recursion – Fibonacci numbers – palindromes – global variables.

**Structured types, Mutability and Higher order functions** – tuples – sequences and multiple assignments – list and mutability – mutable sequence – list comprehension – functions as objects – sets – dictionaries – file I/O – exceptions – Classes and Object Oriented Programming



**Learning Resources**

1. John V.Guttag, "Introduction to Computation and Programming Using Python : With Application to Understanding Data", Prentice-Hall International publishers, Second Edition, 2017.
2. R.G.Dromey, "How to solve it by Computers", Pearson Education India , First Edition, 2008
3. ReemaThareja, "Python Programming using problem solving Approach", Oxford University, Higher Education Oxford University Press, First edition, 2017.
4. E. Bala gurusamy, "Introduction to Computing and Problem Solving using Python", Mcgraw Higher Ed, First Edition, 2016.
5. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Updated for Python 3, Shroff/O'Reilly Publishers, Second Edition, 2016.
6. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., First Edition, 2016.
7. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly, Shroff Publishers and Distributors, Fifth Edition, 2013.
8. Mark Pilgrim, "Dive into Python 3", Apress, 2009

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
<b>1.</b>	<b>Introduction to Problem Solving</b>		CO1
1.1	Problem Specification	1	
1.2	Input-output analysis		
1.3	Algorithms – Design and Analysis, Implementation of Algorithms	1	
1.4	Flowcharts		
1.5	Programming – High level languages, language translators, syntax, semantics	1	
1.6	Compilation and execution	1	
1.7	Debugging and Program verification	1	
<b>2.</b>	<b>Fundamentals of Python</b>		CO2
2.1	The basic elements of python	1	
2.2	Objects		
2.3	Expressions – assignment statement – arithmetic operators – operator precedence – Boolean expression	2	
2.4	Conditionals	1	
2.5	Numerical types – expression evaluation – float representation	1	
2.6	Loops – for loop – nested loops – break and continue	2	
2.7	Strings – indexing and slicing strings	1	
<b>3.</b>	<b>Problem Solving Techniques</b>		CO3
3.1	Solving by analogy	1	
3.2	Means-ends analysis	1	
3.3	Divide and Conquer	1	
3.4	Building Block Approach		
3.5	Merging Recursion	1	

Module No.	Topic	No. of Hours	Course Outcome
<b>4.</b>	<b>Basic Algorithms</b>		
4.1	Exchange of variables	1	
4.2	Counting		
4.3	Summation of set of numbers	1	
4.4	Generation of Fibonacci sequence		
4.5	Number to character conversion		
<b>5.</b>	<b>Factoring Methods</b>		
5.1	Greatest Common Divisor of two integers	1	
5.2	Generation of Prime numbers	1	
5.3	Raising number to larger power	1	
<b>6.</b>	<b>Array Techniques</b>		
6.1	Counting of array elements	3	
6.2	Array reversal		
6.3	Partitioning an array		
6.4	Removal of duplicates in an array		
<b>7.</b>	<b>Functions, scoping and Abstraction</b>		CO4
7.1	Function definition	2	
7.2	Keyword arguments and default values		
7.3	Scoping – specifications	1	
7.4	Recursion – Fibonacci numbers – palindromes	1	
7.5	Global variables		
<b>8</b>	<b>Structured types, Mutability and Higher order functions</b>		CO5
8.1	Tuples	1	
8.2	Sequences and multiple assignments	1	
8.3	List and mutability – mutable sequence – list comprehension	2	
8.4	Functions as objects	1	
8.5	Sets		
8.6	Dictionaries	1	
8.7	File I/O – exceptions		
8.8	Classes and Object Oriented Programming	1	
<b>Total Lecture Hours</b>		<b>36</b>	

**Course Designers:**

1. A.Sheik Abdullah      asait@tce.edu
2. M.Thangavel          mtit@tce.edu

18IT230	Operating Systems	Category	L	T	P	Credit
		PC	3	0	0	3

**Preamble**

The major objective of this course is to introduce basic concepts and principles of Windows, Linux, and Unix operating systems which include memory management, device management, process management, and file management. The students will be able to understand the insights about the security issues and advancements.

**Prerequisite**

- NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Describe the Structure, Process creation, Thread management, Security measures and advancements in OS.	22
CO2	Experiment the multiprogramming and time sharing behaviour with various scheduling strategies.	14
CO3	Identify the various classical synchronization problems with its implementation.	19
CO4	Illustrate the deadlock mechanism in resource sharing and infer memory management using paging algorithms.	31
CO5	Interpret the mechanisms adopted for I/O and file systems in distributed applications.	14

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	-	1.2,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Guided Response	1.2,2.3.1,2.3.2,2.3.3,2.3.4,4.3.2,4.3.3
CO3	TPS3	Apply	Value	Guided Response	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.2.4,4.3.2,4.3.3
CO4	TPS3	Apply	Value	Guided Response	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.2.4,4.3.2,4.3.3
CO5	TPS2	Understand	Respond	-	1.2,2.3.1,2.3.2

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		M				S	S		M	M	L	M
CO3	S	M	L		M				S	S		M	M	L	M
CO4	S	M	L		M				S	S		M	M	L	M
CO5	M	L										M	L		L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	-	-	-	-	-	-	10
Understand	50	40	30	20	20	20	30
Apply	50	60	70	80	80	80	60
Analyse	0	0	0	-	-	-	0
Evaluate	0	0	0	-	-	-	0
Create	0	0	0	-	-	-	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	30
Guided Response	70
Mechanism	-
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\***

\*\* (2 to 3 at the cognitive level of course outcome)

**Course Outcome1 (CO1):**

- List out three main purposes of an operating system?
- State the purpose of system calls.
- Illustrate the working principles of OS System calls with an example.

**Course Outcome2 (CO2):**

- Consider the following set of process, with the length of the CPU-burst time given in milliseconds:

Process	Burst time	Arrival time	Priority
P1	5	3	3
P2	7	1	2
P3	3	2	0
P4	4	4	1

Sketch Gantt charts for the above processes using FCFS, SJF, shortest-remaining-time-first and RR (quantum=1) scheduling and choose the optimized scheduling algorithms.

- Consider the following set of process, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time
P1	5
P2	7
P3	3
P4	4

- Sketch the Gantt charts for the above processes using FCFS, SJF, shortest-remaining-time-first and RR (quantum=1) scheduling. Judge the effects of average waiting time of all algorithms.
3. Show which scheduling algorithm is best for the following input, P1 (BT 3), P2 (BT 6), P3 (BT 7) arrival Time same for all the above.

**Course Outcome3 (CO3):**

1. Construct a monitor that implements semaphore for Dining Philosopher problem.
2. Consider a system with three chef processes and one *agent* process. Each chef continuously prepares a dish. But to prepare a dish, the chef needs three ingredients: SPICE(S), WATER (W), and VEGETABLES (V). One of the chef processes has S, another has W, and the third has V. The agent has an infinite supply of all three ingredients. The agent places two of the ingredients on the table. The chef who has the remaining ingredient then makes the dish, signalling the agent on completion. The agent then puts out another two of the three ingredients, and the cycle repeats. Develop a pseudo code to synchronize the agent and the chef.
3. Develop the algorithm for any classical Synchronization Problem with semaphore.

**Course Outcome4 (CO4):**

1. Assume the snapshot, Find the need and safe state if process requests P1(0,1,0) P2(1,0,0) P3(0,0,0) and estimate whether the requests are granted/denied.

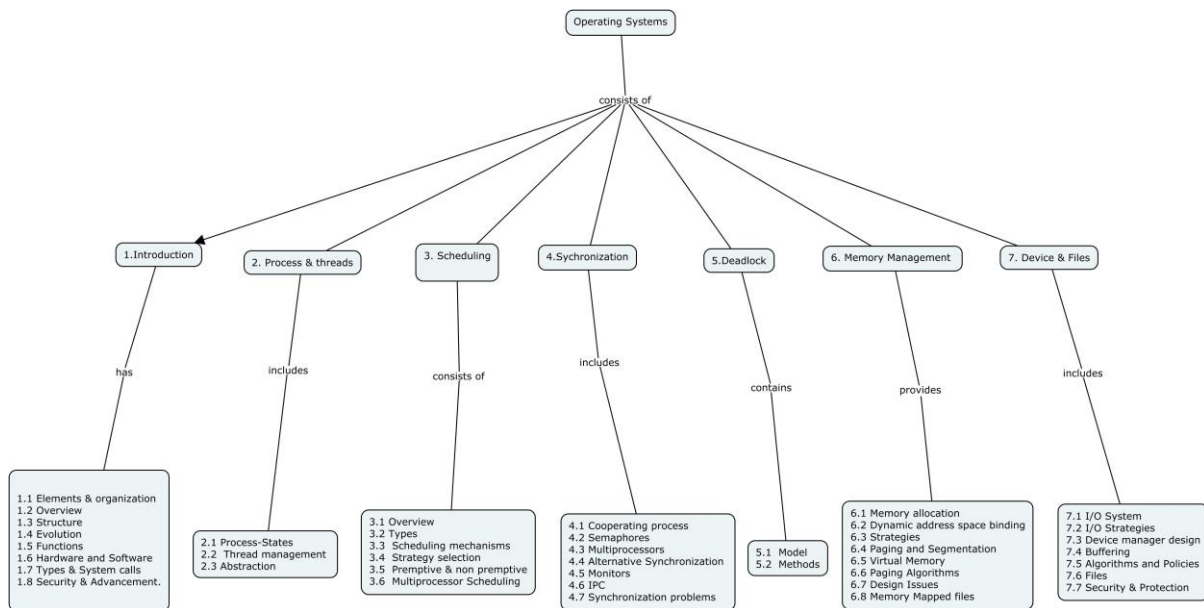
P	Max	Current	Availability
P 1	5,3,2	2,3,0	3,2,2
P 2	1,4,3	1,2,1	
P 3	6,1,2	3,0,1	

2. Suppose the head of moving-head disk with 250 tracks, numbered 0 to 249 is currently serving a request at track 50. If the queue of requests is kept in the order 190, 240,43, 110, 15, 132, 72, 68,210. Identify the total head movement to satisfy these requests for FCFS,SSTF,C-SCAN disk scheduling algorithms?
3. Consider the following page reference string 1,2,3,4,2,1,5,6,1,2,3,7,6,3,1,4,2,3 . Identify the page faults which occur for the following page replacement algorithms assuming three and four frames? (Hint: all frames are initially empty).
  - (i) FIFO
  - (ii) LRU
  - (iii) OPTIMAL.

**Course Outcome 5 (CO5):**

1. Illustrate the I/O mechanism involved (polling & Interrupt) in the device driver when invoking the statement `fp = fopen("c:\test.txt","r/w")` where fp is the FILE pointer.
2. Illustrate Hardware Buffering need in Device Management.
3. Explain the implications of virtualization for disaster recovery.

**Concept Map**



## Syllabus

**Introduction:** Computer System – Elements and Organization, Operating System Overview- Structure, Evolution, Functions, Hardware and Software Support for OS, kernel Types, System Calls, Security measures and Advancements in OS.

**Process and Threads:** Process - States, Thread management - Unix & Windows, Process and Thread abstraction.

**Scheduling:** Overview, Multiprogramming and Time Sharing, Scheduling mechanisms, Strategy selection, Non-pre-emptive and Pre-emptive strategies, Multiprocessor Scheduling. Case Study: Implementing the scheduler in UNIX and Windows using scripting, Thread Scheduling (example using POSIX threads).

**Synchronization:** Cooperating process, Semaphores, Shared memory multiprocessors, Alternative Synchronization primitives, Monitors, Inter-process Communication, Classical Synchronization problems, Case Study: Implementation - Bounded Buffer Problem, Reader's Writer's Problem, Dining Philosopher's Problem.

**Deadlock:** System Deadlock Model, Prevention, Avoidance, Detection and Recovery.

**Memory Management:** Memory allocation, Dynamic address space binding ,memory management strategies-Paging and Segmentation, Virtual Memory, Static and dynamic paging algorithms, Design Issues of Paging Systems, Memory Mapped files.

**Device and File Management:** - I/O System, I/O Strategies, Device manager design, Buffering, Disk Scheduling Algorithms and Policies, File – Files Overview, Directories, Implementing Directories, Security and Protection mechanism.

## Learning Resources

- Silberschatz, Greg Gagne, Peter B. Galvin, "Operating System Concepts", 8<sup>th</sup> Edition, Wiley, 2014.
- Garry Nutt, Nabenduchaki, SarmistaNeogy, "Operating Systems", 3<sup>rd</sup> Edition, Pearson Education, 2009.
- William Stallings, "Operating systems Internal and Design Principles", 6<sup>th</sup> Edition, Pearson Education, 2009.

- Randal Bryant, “Computer Systems: A Programmer's Perspective”, 3<sup>rd</sup> Edition, David O’Halloran, Prentice Hall, 2016.
- Andrew Tanenbaum, “Modern Operating Systems”, 4<sup>th</sup> Edition, Addison Wesley, 2015.
- H M Deitel, P J Deitel and D R Choffnes, “Operating Systems”, 3<sup>rd</sup> Edition, Pearson Education, 2004.

<b>Course Contents and Lecture Schedule</b>				
Module No.	Topic	No. of Hours	Course Outcome	
1	<b>Introduction</b>			
1.1	Computer System – Elements and Organization	1	CO1	
1.2	Operating System Overview			
1.3	Structure	1		
1.4	Evolution			
1.5	Functions			
1.6	Hardware and Software Support for OS	1		
1.7	kernel Types, System calls			
1.8	Security measures and Advancements in OS	1		
2	<b>Process and Threads</b>			
2.1	Process-States	1	CO1	
2.2	Thread management - Unix & Windows	1		
2.3	Process and Thread abstraction	2		
3	<b>Scheduling</b>			
3.1	Overview	1	CO2	
3.2	Multiprogramming and Time Sharing			
3.3	Scheduling mechanisms			
3.4	Strategy selection	1		
3.5	Non-pre-emptive and Pre-emptive strategies	1		
3.6	Multiprocessor Scheduling			
	Case Study: Implementing the scheduler in Unix and Windows using scripting, Thread Scheduling (example using POSIX threads).	1		
4	<b>Synchronization</b>			
4.1	Cooperating process	1	CO3	
4.2	Semaphores	2		
4.3	Shared memory multiprocessors			
4.4	Alternative Synchronization primitives			
4.5	Monitors			
4.6	Inter-process Communication	1		
4.7	Classical Synchronization problems	3		
	Case Study: Implementation - Bounded Buffer Problem, Reader’s Writer’s Problem, Dining Philosopher’s Problem			
5	<b>Deadlock</b>			
5.1	System Deadlock Model	2	CO4	
5.2	Prevention, Avoidance, Detection and Recovery.	3		
6	<b>Memory Management</b>			
6.1	Memory allocation	2	CO4	
6.2	Dynamic address space binding			
6.3	Memory management strategies			
6.4	Paging and Segmentation			
6.5	Virtual Memory			1
6.6	Static and dynamic paging algorithms			1

6.7	Design Issues of Paging Systems	1	
6.8	Memory Mapped files.	1	
7	<b>Device and File Management</b>		
7.1	I/O System	1	CO5
7.2	I/O Strategies		
7.3	Device manager design		
7.4	Buffering	1	
7.5	Disk Scheduling Algorithms and Policies	2	
7.6	File – Files Overview, Directories, Implementation		
7.7	Security and Protection mechanism	1	
	Total Lectures	<b>36</b>	

**Course Designers:**

1. C.Santhiya [csit@tce.edu](mailto:csit@tce.edu)
2. K.Indira [kiit@tce.edu](mailto:kiit@tce.edu)



18IT240	COMPUTER ORGANIZATION AND DESIGN	Category	L	T	P	Credit
		PC	3	0	0	3

**Preamble**

The main objective of this course is to make the students understand the basic building blocks of computers, logic gates, combinational and sequential circuits and to conceptualize the basics of computer organizational and architectural issues.

**Prerequisite**

NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Describe representation of numbers and characters in a computer.	8
CO2	Apply Combinational and Sequential circuit design procedure for a given scenario with the knowledge of Boolean expression and Logic gates.	34
CO3	Explain the basic structure of a computer, instruction types and addressing modes.	17
CO4	Apply MIPS instruction set to write an Assembly level language program for simple applications	11
CO5	Identify the type of hazard in a given sequence of instructions and the methods to overcome it.	16
CO6	Describe storage and retrieval of information from memory and hard drives.	14

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.2,2.3.1,3.1.1,3.2.4
CO3	TPS2	Understand	Respond	Guided Response	1.2,2.3.1,
CO4	TPS3	Apply	Value	Mechanism	1.2, 3.1.1,3.2.4,4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.2,2.3.4
CO6	TPS2	Understand	Respond	Guided Response	1.2

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	M	L											L		
CO2	S	M	L					M	M	M			M		L
CO3	M	L											L		
CO4	S	M	L		L			M	M	M			M	L	L
CO5	S	M	L										M		
CO6	M	L											L		

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	ContinuousAssessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	20	-	-	-	10
Understand	30	30	30	-	-	-	40
Apply	50	50	50	100	100	100	50
Analyse	0	0	0	-	-	-	0
Evaluate	0	0	0	-	-	-	0
Create	0	0	0	-	-	-	0

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	20
Set	20
Guided Response	60
Mechanism	-
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\***

\*\* (2 to 3 at the cognitive level of course outcome)

**Course Outcome1 (CO1):**

- Do the following conversions  
 $(934.89)_{10}$  to Binary  
 $(101.111)_2$  to decimal  
 $(939AB)_{16}$  to decimal  
 $(86.37)_{10}$  into octal
- Describe Binary codes
- Show that Excess-3 code and 2421 code are self-complementing

**Course Outcome2 (CO2):**

- Simplify the following Boolean Expression using K Map  
 $F(a,b,c,d) = \sum (1, 2, 4, 5, 6, 7, 8, 11, 12, 14) + \sum (3, 10, 13)$
- Simplify the following Boolean Expression using Boolean theorems and postulates and construct the logical circuit.  
 $F(p,q,r,s) = pqrs + p"qrs + pq"rs + pq"rs + p"q"rs + pqr"s + pqr"s + p"q"r"s"$
- Simplify the following using QuineMc-Cluskey method.. Construct the logic circuit for the expression  
 $F(w, x, y, z) = \sum 0, 1, 2, 4, 5, 7, 9, 12, 14, 15.$

**Course Outcome3 (CO3):**

- Describe the different addressing modes.

2. Explain the steps involved in the execution of a complete instruction.
3. Distinguish between different Instruction formats.

**Course Outcome 4 (CO4):**

1. Apply MIPS instruction set and write a simple Assembly level language program for finding the factorial of a number.
2. write a MIPS program for doing addition of n floating point numbers.
3. Convert the following code to assembly language program.

```
For (i = 1; i <= n; ++i)
  { printf("%d, ", t1);
  nextTerm = t1 + t2;
  t1 = t2;
  t2 = nextTerm; }
```

**Course Outcome 5 (CO5):**

1. Illustrate how the pipelining improves the performance of computers.
2. Identify the type of hazard in executing the following sequence of instructions and determine the ways to overcome that.

```
DIV R1, R2, R6
ADD R1, R2, R3
SUB R3, R4, R5
```

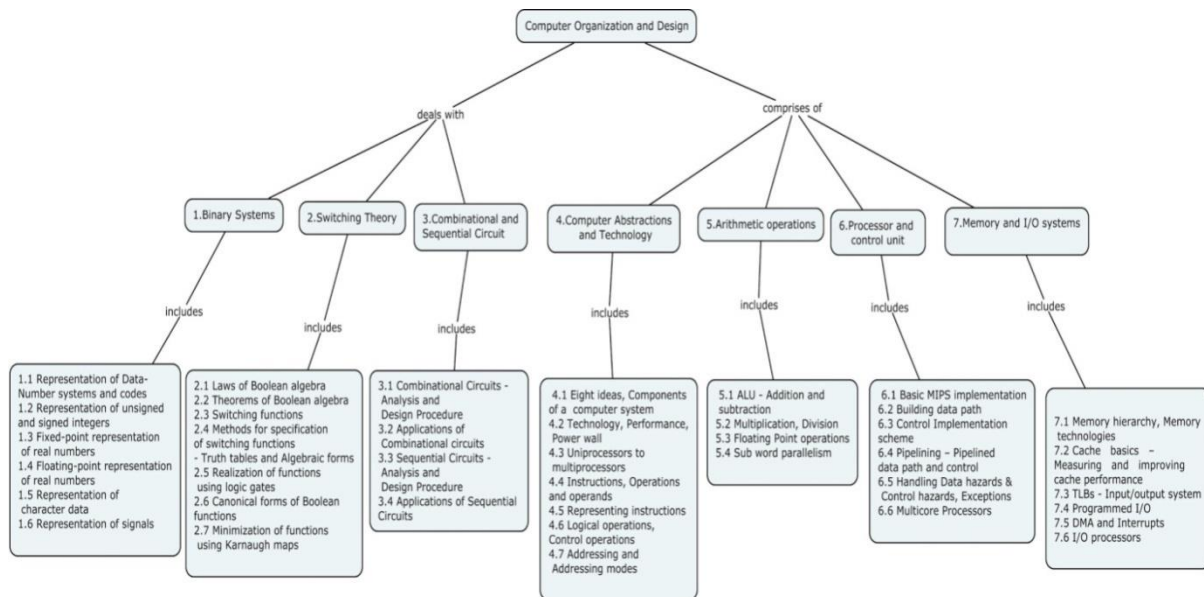
3. Demonstrate Instruction Hazard with an example.

**Course Outcome6 (CO6):**

1. A byte addressable computer has a small data cache capable of holding 8 32-bit words. Each cache block consists of one 32-bit word. When a given program is executed the processor reads data from the following sequence of hex addresses: 200, 204, 208, 2FO, 200, 204, 218, 21C, 24C

- a. Show the contents of the cache at the end of each pass through this loop if a directly mapped cache is used. Compute the hit ratio.
  - b. Repeat the problem for an associative-mapped cache that uses the LRU replacement algorithm.
  - c. Repeat the problem for a four-way-set-associative cache.
2. A block-set-associative cache consists of a total of 64 blocks divided into 4-block sets. The main memory contains 4096 blocks, each consisting of 128 words.
    - a. How many bits are there in the main memory address?
    - b. How many bits are there in each of the TAG, SET and WORD fields?
  3. Explain data transfer using DMA.

**Concept Map**



## Syllabus

**Binary Systems:** Representation of Data- Number systems and codes, Representation of unsigned and signed integers, Fixed-point representation of real numbers, Floating-point representation of real numbers, Representation of character data, Representation of signals.

**Switching Theory:** Laws of Boolean algebra, Theorems of Boolean algebra, Switching functions, Methods for specification of switching functions – Truth tables and Algebraic forms, Realization of functions using logic gates. Simplification of Boolean Expressions and Functions: Algebraic methods, Canonical forms of Boolean functions, Minimization of functions using Karnaugh maps.

**Combinational and Sequential Circuits:** Analysis and Design procedure of Combinational and Sequential Circuits, Applications of Combinational and Sequential Circuits.

**Computer Abstractions and Technology:** Eight ideas, Components of a computer system, Technology, Performance, Power wall, Uniprocessors to multiprocessors, Instructions, Operations and operands, Representing instructions, Logical operations, Control operations, Addressing and Addressing modes.

**Arithmetic operations:** ALU – Addition and subtraction, Multiplication, Division, Floating Point operations, Sub word parallelism.

**Processor and Control Unit:** Basic MIPS implementation, Building data path, Control Implementation scheme. **Pipelining** – Pipelined data path and control, Handling Data hazards & Control hazards, Exceptions. Multicore processors.

**Memory and I/O Systems:** Memory hierarchy, Memory technologies, Cache basics – Measuring and improving cache performance. Input/output system, Programmed I/O, DMA and Interrupts, I/O processors

## Case Study on Recent Processors

## Learning Resources

1. Morris Mano M. "Digital Design:with an Introduction to Verilog HDL :", Pearson Education, Fifth Edition,2013

2. David A. Patterson and John L. Hennessey, "Computer Organization and Design", Morgan Kaufmann, Elsevier, Fifth edition, 2014.
3. <https://www.coursera.org/learn/digital-systems>
4. <http://nptel.ac.in/courses/106103068/> Course Name: Computer Organization and Architecture

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Binary Systems</b>		
1.1	Representation of Data- Number systems and codes	1	CO1
1.2	Representation of unsigned and signed integers	1	
1.3	Fixed-point representation of real numbers	1	
1.4	Floating-point representation of real numbers		
1.5	Representation of character data		
1.6	Representation of signals		
<b>2</b>	<b>Switching Theory</b>		
2.1	Laws of Boolean algebra	1	CO2
2.2	Theorems of Boolean algebra		
2.3	Switching functions	1	
2.4	Methods for specification of switching functions – Truth tables and Algebraic Forms	1	
2.5	Realization of functions using logic gates	1	
2.6	Simplification of Boolean Expressions and Functions :Algebraic methods		
2.7	Canonical forms of Boolean functions	1	
2.8	Minimization of functions using Karnaugh maps	1	
<b>3</b>	<b>Combinational and Sequential Logic</b>		
3.1	Combinational Circuits – Analysis and Design Procedure	2	CO3
3.2	Applications of Combinational circuits	1	
3.3	Sequential Circuits – Analysis and Design Procedure	2	
3.4	Applications of Sequential circuits	1	
<b>4</b>	<b>Computer Abstractions and Technology</b>		
4.1	Eight ideas, Components of a computer system	1	CO3
4.2	Technology, Performance, Power wall	1	
4.3	Uniprocessors to multiprocessors		
4.4	Instructions, Operations and operands	1	
4.5	Representing instructions	1	
4.6	Logical operations, Control operations	1	
4.7	Addressing and Addressing modes	1	
<b>5</b>	<b>Arithmetic operations</b>		
5.1	ALU – Addition and subtraction	1	CO4
5.2	Multiplication, Division	1	
5.3	Floating Point operations	1	
5.4	Sub word parallelism	1	
<b>6</b>	<b>Processor and control unit</b>		
6.1	Basic MIPS implementation	1	CO5
6.2	Building data path		
6.3	Control Implementation scheme	1	
6.4	Pipelining – Pipelined data path and control	1	
6.5	Handling Data hazards & Control hazards, Exceptions	2	
6.6	Multicore Processors	1	
<b>7</b>	<b>Memory and I/O systems</b>		
7.1	Memory hierarchy, Memory technologies	1	

7.2	Cache basics – Measuring and improving cache performance	1	CO6
7.3	TLBs – Input/output system	1	
7.4	Programmed I/O	1	
7.5	DMA and Interrupts	1	
7.6	I/O processors	1	
<b>Total Lectures</b>		36	

**Course Designers:**

- |                 |                     |
|-----------------|---------------------|
| 1. D.Tamilvelvi | dtamilselvi@tce.edu |
| 2. K.V.Uma      | kvuit@tce.edu       |
| 3. R.Parkavi    | rpit@tce.edu        |



18IT260	ESSENTIALS OF INFORMATION TECHNOLOGY	Category	L	T	P	Credit
		PC	2	0	2	3

### Preamble

The course outlines the emerging computing technologies for building enterprise applications. The course introduces basic web design concepts using HTML, Javascript and PHP scripting techniques

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Summarize the need of Computing for Business Organizations and the use of various software and hardware interfaces	8
CO2	Explain the architecture and uses of different computing technologies	13
CO3	Describe the licensing and Copyright Laws for Software Applications	4
CO4	Practice HTML and CSS for designing simple web pages	25
CO5	Develop and demonstrate simple Web Applications with client side scripting	25
CO6	Develop and execute simple Web Applications with server side scripting	25

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2, 3.1.1, 3.2.1-3.2.6
CO2	TPS2	Understand	Respond	Guided Response	1.2, 3.1.1, 3.2.1-3.2.6
CO3	TPS2	Understand	Respond	Guided Response	1.2, 2.5.1
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5



**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L				L			S	S			L	L	L
CO2	M	L							S	S			L		L
CO3	M	L						S					L		L
CO4	S	M	L		L	L		L	S	S		S	M	L	M
CO5	S	M	L		L	L		L	S	S		S	M	L	M
CO6	S	M	L		L	L		L	S	S		S	M	L	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Model Examination	Practical Component/Observation	Terminal Examination
	1	2	3			
Remember	10	10	10	0	0	10
Understand	30	30	30	0	20	30
Apply	60	60	60	100	80	60
Analyse	0	0	0	0	0	0
Evaluate	0	0	0	0	0	0
Create	0	0	0	0	0	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini-project/Practical Component/Observation
Perception	-
Set	20
Guided Response	30
Mechanism	50
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome 1 (CO1):**

1. Discuss the use of Information Systems for an Enterprise Application
2. Explain the Electronic Data Interchange process across systems
3. Describe Transaction Processing of an Enterprise Application

**Course Outcome 2 (CO2):**

1. Explain different types and topology of Networks
2. Discuss different wired and wireless technologies
3. Compare and contrast Client-Server and Distributed Computing

**Course Outcome 3 (CO3):**

1. Discuss Information Technology Act formed by India

2. Explain IT Policies and Standards required for Enterprise Applications
3. Differentiate Copyright and Licensing

**Course Outcome 4 (CO4):**

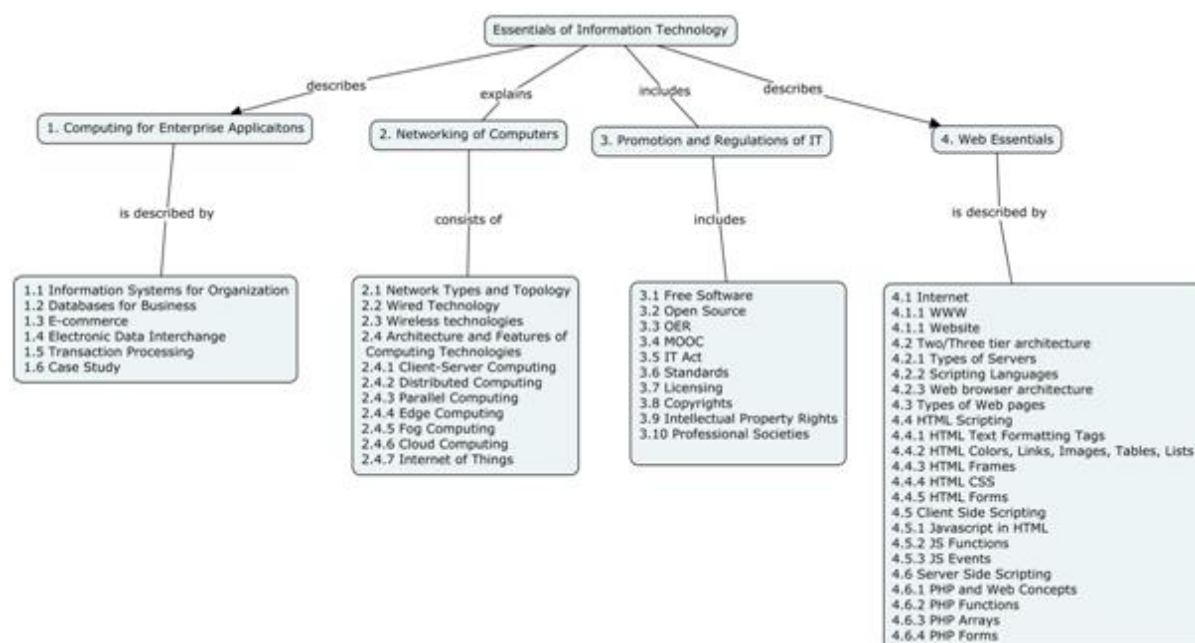
1. Design simple web document using text formatting HTML elements and attributes
2. Develop simple website using HTML Tags and CSS
3. Design your bio-data using suitable HTML tags

**Course Outcome 5 (CO5):**

1. Write Javascript program for input form validations
2. Write Javascript event handling function to check whether the page is loaded or not
3. Write Javascript event handling function to check whether the button is clicked or not

**Course Outcome 6 (CO6):**

1. Design simple web application using suitable HTML, Javascript and PHP scripting
2. Write PHP function to print the values present in the array in tabular format
3. Design simple information retrieval system using HTML, Javascript and PHP

**Concept Map****Syllabus**

**Computing for Enterprise Applications:** Information Systems for Organization – Databases for Business – E-commerce – Electronic Data Interchange – Transaction Processing –**Case Study**– Enterprise Applications in Healthcare, Finance, Transport, Education, Society, Agriculture, Governance

**Networking of Computers:** Network – Types, Topology, Wired, Wireless technologies – Bluetooth, WiFi, ZigBee, GPS, GSM **Architecture and Features of Computing Technologies** – Client-Server Computing, Distributed Computing, Parallel Computing, Edge Computing, Fog Computing, Cloud Computing, Internet of Things

**Promotion and Regulations of IT:** Free Software – Open Source Software – Open Educational Resources (OER) – Massive Open Online Courses (MOOC) – IT Act – Standards – Licensing – Copyrights – Intellectual Property Rights – Professional Societies

**Web Essentials:** Internet – WWW – Website – Two/Three tier architecture – Types of Servers – Application Server, Web Server, Database Server – Scripting Languages – Web browser architecture – Types of Web pages – static and dynamic –**HTML Scripting** – Elements, Attributes, Headings, Paragraphs, Text Formatting, Colors, Links, Images, Tables, Lists, Frames – CSS – inline, internal, external – Forms **Client Side Scripting** – Javascript in HTML – Functions, Events, Forms **Server Side Scripting** PHP and Web Concepts – Functions – Arrays – Forms

### Learning Resources

1. V.Rajaraman, "Introduction to Information Technology", PHI Learning, 3<sup>rd</sup> edition, 2018
2. Robin Nixon, "Learning PHP, MySQL & Javascript with jQuery, CSS, HTML5", 4<sup>th</sup> edition, O'Reilly, 2015.
3. Kenneth Laudon, "Essentials of MIS: Computer Science, Information Technology", Study Guide, 10<sup>th</sup> edition, Content Technologies Inc, 2017
4. Timothy O'Leary, Linda O'Leary, Daniel O'Leary, "Computing Essentials", 26<sup>th</sup> Edition, McGraw Hill Education, 2017.
5. Online Course: Information Technology Essentials – <https://www.udemy.com/information-technology-essentials/>
6. Website Reference MariaDB: <https://mariadb.org/>

### Course Contents and Lecture Schedule

Module No	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Computing for Enterprise Applications</b>		
1.1	Information Systems for Organization	1	CO1
1.2	Databases for Business		
1.3	E-commerce		
1.4	Electronic Data Interchange	1	
1.5	Transaction Processing		
1.6	Case Study		
<b>2</b>	<b>Networking of Computers</b>		
2.1	Network Types and Topology	1	CO2
2.2	Wired Technology	1	
2.3	Wireless Technology (Bluetooth, WiFi, Zigbee, GPS, GSM)		
2.4	Architecture and Features of Computing Technologies	1	
2.4.1	Client Server Computing		
2.4.2	Distributed Computing		
2.4.3	Parallel Computing		
2.4.4	Edge Computing	1	
2.4.5	Fog Computing		
2.4.6	Cloud Computing		
2.4.7	Internet of Things		
<b>3</b>	<b>Promotion and Regulations of IT</b>		
3.1	Free Software	1	CO3
3.2	Open Source Software		

3.3	Open Educational Resources (OER)	1			
3.4	Massive Open Online Courses (MOOC)				
3.5	IT Act				
3.6	Standards				
3.7	Licensing				
3.8	Copyrights				
3.9	Intellectual Property Rights				
3.10	Professional Societies				
<b>4</b>	<b>Web Essentials</b>				
4.1	Internet			1	CO4
4.1.1	WWW				
4.1.2	Website				
4.2	Two/Three tier Architecture	1			
4.2.1	Types of Servers – Application, Web, Database				
4.2.2	Scripting Languages				
4.2.3	Web Browser Architecture				
4.3	Types of Web pages – Static, Dynamic	1			
4.4	HTML Scripting				
4.4.1	HTML Text Formatting tags				
4.4.2	HTML Lists, Tables, Images, Links				
4.4.3	HTML Forms, Frames	2			
4.4.4	HTML CSS				
4.5	Client Side Scripting				
4.5.1	Javascript in HTML	1	CO5		
4.5.2	JS Functions	2			
4.5.3	JS Events	2			
4.6	Server Side Scripting				
4.6.1	PHP – Web Concepts	2	CO6		
4.6.2	PHP Functions				
4.6.3	PHP Arrays				
4.6.4	PHP Forms				
	Total No. of Lecture Hours	24			

#### List of Experiments for Practical Hours

S.No	Description	No. of Hours	Course Outcome
1.	(a). Study of three tier architecture applications (like Online banking, Railways, Healthcare, Facebook, ...) (b). Study of integrated systems (like ATM machine, Biometric Attendance Systems, Skype, ...) (c) Study of Web and Mobile Applications (like Mobile banking, WhatsApp, FingerPrint matching App, ....)	4	CO1,CO2
2.	HTML Web Document Design using Text Formatting, Tables, Lists, Links, Images elements and attributes	2	CO4
3.	(a). HTML Web Document Design using CSS and Graphics (b). HTML Web Document Design using Media and API	2	
4.	Simple Javascript programs	2	CO5
5.	Javascript forms and Validations	2	

6.	Javascript Event Handling functions	2	
7.	Simple PHP scripts	2	CO6
8.	Design simple PHP forms with validation	2	
9.	Mini-Project Design simple information retrieval system using web, PHP and PostgreSQL/MariaDB	6	CO4, CO6
<b>Total Hours</b>		<b>24</b>	

**Course Designers:**

1. P.Karthikeyan      karthikit@tce.edu
2. A.M.Abirami      abiramiam@tce.edu

18IT270	PYTHON PROGRAMMING LAB	Category	L	T	P	Credit
		PC	0	0	2	1

### Preamble

The purpose of this course is to introduce to students to the field of programming using Python language. The students will be able to enhance their analysing and problem solving skills and use the same for writing programs in Python.

### Prerequisite

- None

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Make use of Branching, Looping, String, and Functions concepts to develop Python programs for the given problem.	20
CO2	Apply structured types, and file handling to design a solution for a problem of moderate complexity.	18
CO3	Develop simple applications by applying problem solving strategies such as divide and conquer, merging, solving by analogy etc...	18
CO4	Examine the given problem to Implement, test and debug the solution using Python programming language.	22
CO5	Interpret the usage of packages and libraries in python programming for problem solving by reducing time and space complexity	22

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO4	TPS4	Analyse	Organise	Complex Overt Responses	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.4.1, 4.5.1, 4.5.3, 4.5.5
CO5	TPS4	Analyse	Organise	Complex Overt Responses	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.4.1, 4.5.1, 4.5.3, 4.5.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		L			S				M	M	L	L
CO2	S	M	L		L			S				M	M	L	L
CO3	S	M	L		L			S				M	M	L	L
CO4	S	S	M	L	L			S				M	S	L	L
CO5	S	S	M	L	L			S	S	S	L	M	S	L	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	-	-
Apply	60	60
Analyse	40	40
Evaluate	0	0
Create	0	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Practical Component/Observation
Perception	-
Set	10
Guided Response	20
Mechanism	40
Complex Overt Responses	30
Adaptation	-
Origination	-

**List of Experiments/Activities with CO Mapping**

Exp No.	List of Experiments	No. of Hours	Course Outcome
1	Simple Programs	4	CO1, CO4, CO5
2	Branching Programs	2	
3	Looping Programs	2	
4	String Programs	2	
5	Functions, scoping and Abstraction Programs	2	
6	Structured types and Mutability Programs	2	CO2, CO4, CO5
7	Higher Order Functions	2	
8	File handling with exceptions	2	
9	Programs by applying Problem solving techniques	2	CO3, CO4, CO5
10	Mini-Project	4	
<b>Total Hours</b>		<b>24</b>	

**Sample Programs (not limited to)**

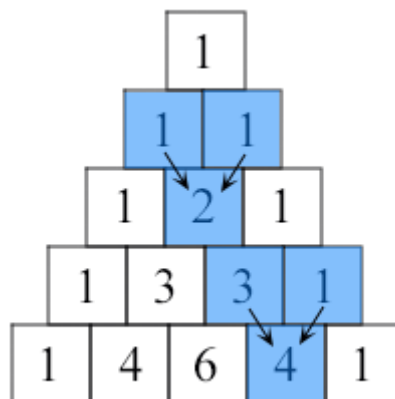
1. Simple Programs
  - a. Print the Python version using.
  - b. Accepts the radius of a circle from the user and compute the area.
  - c. Accepts the user's first and last name and print them in reverse order with a space between them.
  - d. Display the first and last colors from the following list. `color_list = ["Red", "Green", "White", "Black"]`
  - e. Accepts an integer (n) and computes the value of  $n+nn+nnn$ .
  - f. Print the documents (syntax, description etc.) of Python built-in function(s).

## 2. Branching Programs





5. Functions, scoping and Abstraction Programs
  - a. Multiply all the numbers in a list.
  - b. Calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.
  - c. Accepts a string and calculate the number of upper case letters and lower case letters.
  - d. Check whether a number is perfect or not.
  - e. Accepts a hyphen-separated sequence of words as input and prints the words in a hyphen-separated sequence after sorting them alphabetically.
  
6. Structured types and Mutability Programs
  - a. Count the most common words in a dictionary.
  - b. Create an instance of an OrderedDict using a given dictionary. Sort the dictionary during the creation and print the members of the dictionary in reverse order.
  - c. Get the array size of types unsigned integer and float.
  
7. Higher Order Functions
  - a. Create a set.
  - b. Remove an item from a set if it is present in the set.
  - c. Add a key to a dictionary.
  - d. Check if a given key already exists in a dictionary.
  
8. File handling with exceptions
  - a. Read a file line by line and store it into a list.
  - b. Read a file line by line store it into a variable.
  - c. Find the longest words.
  - d. Write a list to a file.
  - e. Read an entire text file.
  
9. Programs by applying Problem solving techniques
  - a. Calculate the sum of the positive integers of  $n+(n-2)+(n-4)...$  (until  $n-x \leq 0$ ).
  - b. Prints the first n rows of Pascal's triangle. Note : Pascal's triangle is an arithmetic and geometric figure first imagined by Blaise Pascal.  
Sample Pascal's triangle:



Each number is the two numbers above it added together

- c. Find validity of a string of parentheses, '(', ')', '{', '}', '[' and ']'. These brackets must be close in the correct order, for example "()" and "()[]{}" are valid but "[)", "({[})" and "{{{" are invalid.
- d. Construct a radius and two methods which will compute the area and the perimeter of a circle.

#### 10. Mini-Project

Design and Development of applications like

- a. Encryptor/ Decryptor
- b. Physics problem solver
- c. Sudoku solver
- d. Hospital management system
- e. Random number generator
- f. Electric circuit solver etc.
- g. Scientific Calculator

Mini Project Details: (Team size: 3)

- Problem identification.
- Problem Analysis and Modular design.
- Develop algorithm/pseudo code and draw the flowchart – module wise individually.
- Develop programs module level, test and debug individually.
- Integrate the modular programs and present the results in a team.
- Document the above process as a report.

#### Learning Resources

1. John V.Gutttag, " Introduction to Computation and Programming Using Python : With Application to Understanding Data", Prentice-Hall International publishers, Second Edition, 2017.
2. R.G.Dromey, "How to solve it by Computers", Pearson Education India , First Edition, 2008
3. NPTEL Online Course on "Joy of Computing using Python" - <https://nptel.ac.in/courses/106106182/>

#### Course Designers

1. A. Sheik Abdullah      asait@tce.edu
2. M. Thangavel          mtit@tce.edu

18IT280	WORKSHOP	Category	L	T	P	Credit
		ES	0	0	2	1

**Preamble**

This is the foundation practical course and aim of this course is to train the students in the basic of operating system and understand the working principles of digital logic gates and IOT devices.

**Prerequisite**

NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weight age*** in %
CO1	Utilize the instructions to assemble/setup and upgrade Personal Computer Systems and Network Device Management.	8
CO2	Examine the given problem to implement CPU scheduling algorithms in a programming environment.	34
CO3	Apply the contiguous memory allocation techniques in a suitable simulation environment	8
CO4	Apply digital circuit design for a given scenario using logic gates.	8
CO5	Construct combinational and sequential circuits using flip flops and counters	25
CO6	Apply simple IOT application by using Arduino board.	17

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Guided Response	1.2,2.3.1,2.3.2,2.3.3,2.3.4
CO2	TPS3	Apply	Value	Guided Response	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.2.4
CO3	TPS3	Apply	Value	Guided Response	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.2.4
CO4	TPS3	Apply	Value	Guided Response	1.2,2.3.1,3.1.1,3.2.4
CO5	TPS3	Apply	Value	Guided Response	1.2,2.3.1,3.1.1,3.2.4
CO6	TPS3	Apply	Value	Guided Response	1.2,2.3.1,3.1.1,3.2.4

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	P O1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	S	M	L						M				M		L
CO2	S	M	L		S	M			S			M	M	S	L
CO3	S	M	L		S				S			M	M	M	L
CO4	S	M	L		M				M			M	M	L	L
CO5	S	M	L		M				M			M	M	L	L
CO6	S	M	L		M				M			M	M	L	L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	-	-
Apply	100	-
Analyse	0	0
Evaluate	0	0
Create	0	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini project /Practical Component/Observation
Perception	-
Set	20
Guided Response	30
Mechanism	50
Complex Overt Responses	-
Adaptation	-
Origination	-

**List of Experiments/Activities with CO Mapping**

Exp No.	List of Experiments	No. of Hours	Course Outcome
1	Operating System Installation and Configuration of a System and Network Device Management	2	CO1
2	Program to implement process and thread management.	2	CO2
3	Program to simulate the following pre-emptive and non pre-emptive CPU scheduling algorithms.	2	
4	Program to simulate the concept of classical synchronization problems.	2	
5	Program to simulate the contiguous memory allocation techniques.	2	
6	Program to simulate disk scheduling algorithms.	2	CO3
7	Implementation of Logic gates: Inverter, AND, OR, NAND, NOR, Exclusive-OR and Exclusive-NOR.	2	CO4
8	Implementation/Simulation of 8 to 1 multiplexer circuit	2	CO5
9	Simulation of a encoder and de-multiplexer using HDL and VHDL.	2	CO6
10	Implementation of SR, D, T, and JK flip flops and basic counters.	2	
11	Basic operation of arduino board for any IOT application	2	
12	Execute a simple C program in 8051 target board.	2	
<b>Total Hours</b>		<b>24</b>	

## Learning Resources

1. Silberschatz, Greg Gagne, Peter B. Galvin, "Operating System Concepts", Wiley, 2014.
2. Garry Nutt, Nabenduchaki, SarmistaNeogy, "Operating Systems", Third Edition, Pearson Education, 2009.
3. Morris Mano M. "Digital Design: With an Introduction to Verilog HDL .:", Pearson Education, Fifth Edition,2013

## Course Designers

- |    |           |              |
|----|-----------|--------------|
| 1. | K.Indira  | kiit@tce.edu |
| 2. | R.Parkavi | rpit@tce.edu |

18ES290	LATERAL THINKING	Category	L	T	P	Credit
		ES	0	0	2	1

### Preamble

The purpose of thinking is to collect information and to make the best possible use of it. Vertical thinking is concerned with proving or developing concept patterns. Lateral thinking is concerned with restructuring such patterns (insight) and provoking new ones (creativity). Lateral and vertical thinking are complementary. Skill in both is necessary. Although the emphasis in education has always been exclusively on vertical thinking, the need for lateral thinking arises from the limitations of the behaviour of mind as a self-maximizing memory system. Lateral thinking can be learned, practised and used. It is possible to acquire skill in it just as it is possible to acquire skill in mathematics. The course provides formal opportunities to practise lateral thinking and also an explanation of the processes involved.

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO #	Course Outcome Statement	Weightage in %
CO1	Explain the concept of lateral thinking, distinguish it from vertical thinking.	10
CO2	Use lateral thinking for problem solving	10
CO3	Generate Alternatives, challenge assumptions and suspend judgment and Practice lateral thinking in design process	20
CO4	Apply the concept of factorization and reversal method for restructuring	20
CO5	Organize brainstorming sessions	10
CO6	Use PO for innovation	10
CO7	Aware of limitation of established patterns and practice lateral thinking in small projects	20

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	-	2.3.1, 3.2.6
CO2	TPS3	Apply	Value	-	2.4.1, 2.4.2, 2.4.3
CO3	TPS3	Apply	Value	-	2.4.1, 2.4.2, 2.4.3, 2.4.5, 2.4.6
CO4	TPS3	Apply	Value	-	2.3.1, 2.4.2, 2.4.3
CO5	TPS4	Analyse	Organize	-	3.1.1, 3.1.2, 3.2.1, 3.2.2
CO6	TPS3	Apply	Value	-	2.1.4, 2.3.1, 2.4.1, 2.4.2, 2.4.3, 2.4.6
CO7	TPS5	Evaluate	Characterize	-	2.3.4, 4.5.1, 4.6.1

### Mapping with Programme Outcomes and Programme Specific Outcomes

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	-	-	-	-	-	-	-	-	-	L
CO2	S	M	L	-	-	-	-	-	-	-	-	L
CO3	S	M	L	-	-	-	-	S	L	L	-	L
CO4	S	M	L	-	-	-	-	S	L	L	-	L
CO5	S	S	M	L	-	-	-	S	S	S	-	L
CO6	S	M	L	-	-	-	-					L
CO7	S	S	S	M	-	S	-	-	S	S	-	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain****Continuous Assessment**

Worksheets (5)	:	20 Marks
Case Studies (3)	:	30 Marks

**Terminal Examination**

Ability Test	:	50 Marks
Case Study (Best) Presentation and Viva Voce	:	50 Marks

**Syllabus**

The way the mind works, Difference between lateral and vertical thinking, Attitudes towards lateral thinking, Basic nature of lateral thinking, The use of lateral thinking Techniques, The generation of alternatives, Challenging assumptions, Innovation, Suspended judgment, Design, Dominant ideas and crucial factors, Fractionation, The reversal method, Brainstorming, Analogies, Choice of entry point and attention area, Random stimulation, Concepts/divisions/polarization, The new word PO, Blocked by openness, Description/problem solving/design

**Learning Resources**

1. Edward de Bono, "Lateral Thinking: Creativity Step by Step", Happer Collins Publisher, 1990.
2. Edward de Bono, "Six Thinking Hats", Little Brown and Company Publisher, 1985.
3. Edward de Bono's Thinking Course, Video Lecture, Weblink: [https://www.youtube.com/watch?v=AUq\\_AL2LNEw](https://www.youtube.com/watch?v=AUq_AL2LNEw)

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
1.	The way the mind works	1	CO1
1.1	Difference between lateral and vertical thinking	1	CO1
1.2	Attitudes towards lateral thinking	1	CO2
2.	Basic nature of lateral thinking	1	CO2
2.1	The use of lateral thinking techniques	1	CO2
2.2	The generation of alternatives	1	CO3
2.3	Challenging assumptions	1	CO3
2.4	Innovation	1	CO3
2.5	Suspended judgment	1	CO3
3.	Design	1	CO3
3.1	Dominant ideas and crucial factors	1	CO3
3.2	Fractionation	1	CO4
4.	The reversal method	1	CO4
4.1	Brainstorming	1	CO5
4.2	Analogies	1	CO5
4.3	Choice of entry point and attention area	1	CO5
4.4	Random stimulation	1	CO5
4.5	Concepts/divisions/polarization	1	CO5
4.6	The new word PO	2	CO6
5.	Blocked by openness	2	CO7
5.1	Description/problem solving/design	2	CO7

**Course Designers:**

S J. Thiruvengadam                      [sjtece@tce.edu](mailto:sjtece@tce.edu)

18CHAA0	ENVIRONMENTAL SCIENCE	Category	L	T	P	Credit
		ES	1	0	1	-

**Preamble**

The objective of this course is intended to make the students to understand the basic concepts of environment, ecology and pollution of the current environmental issues and to participate in various activities on conserving and protecting the environment.

**Prerequisite**

NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome	Weightage*** in %
CO1	Describe the importance and progression of ecological system	15%
CO2	Explain the significance of natural resources	10%
CO3	Demonstrate the effects of pollution on environment and human beings	15%
CO4	Practice the suitable management method during disaster episode	10%
CO5	Explain the ethics and values related to Environment	15%
CO6	Describe the Traditional values and Impact of modernization on Environment	10%
CO7	Carry out group activities	25%

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.1,2.3.1,2.3.2,2.3.4
CO2	TPS2	Understand	Respond	Guided Response	1.1,2.3.1,2.3.2,2.3.4
CO3	TPS3	Apply	Value	Mechanism	1.1,2.1.1,2.1.5,2.4.1,4.1.2
CO4	TPS3	Apply	Value	Mechanism	1.1,2.4.1,2.4.7,4.1.1,4.1.2
CO5	TPS2	Understand	Respond	Guided Response	1.1,2.5.1,2.5.2,
CO6	TPS2	Understand	Respond	Guided Response	1.1,2.4.7,2.5.4,
CO7	TPS4	Analyse	Organise	Complex Overt Responses	3.1.1,3.1.2,3.1.3,3.1.4,4.1.1,4.1.2

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	-	-	-	-	L	S	-	-	-	-	-
CO2	M	-	-	-	-	L	-	L	-	-	-	-
CO3	M	M	-	-	L	M	S	-	-	-	-	-
CO4	M	-	L	L	L	M	M	-	-	-	-	-
CO5	L	-	-	-	-	-	-	M	-	-	-	-
CO6	L	L	-	-	-	-	M	-	-	-	-	-
CO7	S	M	M	M	M	M	-	-	S	M	M	-

S- Strong; M-Medium; L-Low



**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment <sup>#</sup>			Terminal Examination <sup>***</sup>
	1	2	3	1	2	3	
Remember	0	20	0	NA	NA	NA	Presentation on Case study report
Understand	0	40	0				
Apply	0	40	0				
Analyse	0	0	0				
Evaluate	0	0	0				
Create	0	0	0				

# Assignment: Marks will be given for the review I, II & III of case study presentation.

\*\*\* Case study presentation and evaluation

- ❖ Each group comprise of maximum three students
- ❖ Students will submit the case study report similar to final year project report
- ❖ Evaluation of case study presentation is based on the approved rubrics

**Method of Evaluation****a) Internal assessment**

S.No	Description	Max.marks	Final conversion
1	CAT -II	50	40
2	Assignment marks ( from Review I,II & III)	3 X 10 =30	10
		Total	50

**b) End semester examination – Case study presentation**

Performance Index	Marks per Individual
Originality of the work	20
Data collected	20
Suggestion to overcome for the identified issues	20
Final Presentation	40
Total	100

**Model Titles for Case Study:**

1. Environmental impacts of quarry industries in Melur Taluk.
2. A study on impacts of tanneries on ground water and soil quality in Dindigul district.
3. Effect of pharmaceutical industry on groundwater quality in poikaraipatty village, Alagar Kovil.
4. Solid waste and waste water management in TCE hostel.
5. Environmental effect of Kudankulam atomic power plant.
6. Case study on effect of Sterlite industry.
7. Effect on ground water and soil quality by dyeing industries in Tiruppur.
8. Effect of textile wastes in Karur District.
9. Segregation of waste and its recycling by Madurai Municipality at Vellakkal
10. Effect of fire work waste on atmosphere in Sivakasi region

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1(CO1):**

1. Describe the Universal Energy flow model in an Ecosystem.
2. Discuss the conversion of one ecosystem into another ecosystem with example.
3. Explain the multidisciplinary nature of the environment.

**Course Outcome 2 (CO2):**

1. Summarize the importance of Natural resources to animals and human beings.
2. Describe the role of an individual in the conservation of Natural resources.

**Course Outcome 3(CO3):**

1. Demonstrate the effects and control measures of air pollution
2. Investigate the sources and management methods of e-waste.

**Course Outcome 4(CO4):**

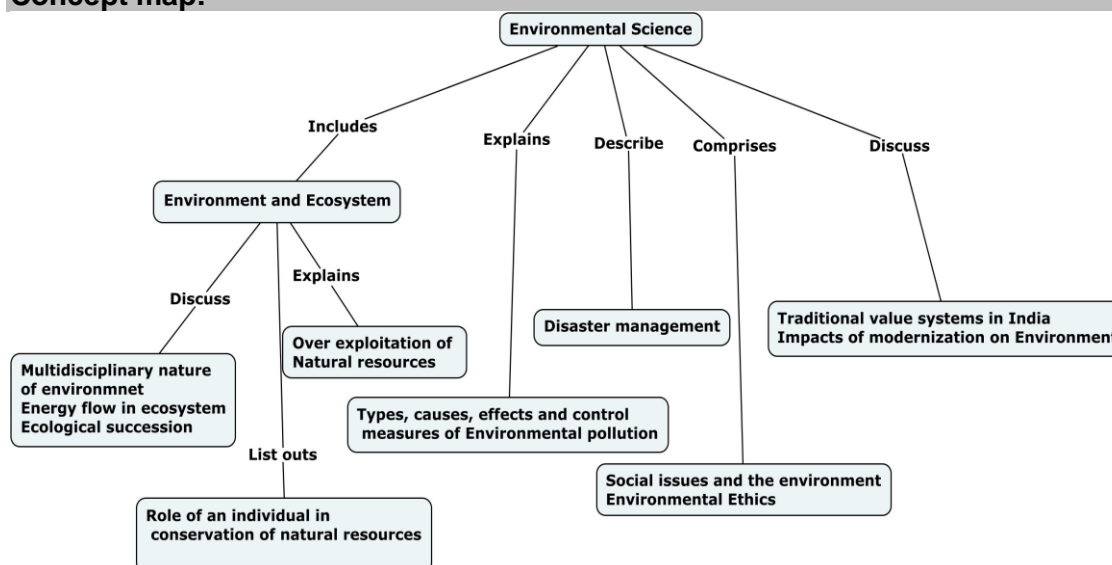
1. Dramatize the mitigation methods adopted in severe cyclone affected areas.
2. Suggest the precautionary steps to prevent life from flood.

**Course Outcome 5 (CO5):**

1. Discuss the need for public awareness on environmental protection.
2. Identify the requirement for the equitable utilization of natural resources.

**Course Outcome 6(CO6):**

1. Describe the traditional value systems of India.
2. Recall the environmental related points discussed in our Indian Vedas.
3. List out the impacts of modernization on environment

**Concept map:****Syllabus**

**Environment and Ecosystem** - Multidisciplinary nature of environment- Ecosystem- Energy flow in ecosystem-Ecological succession-Over exploitation of Natural resources-Role of an individual in conservation of natural resources. **Environmental pollution and control** - Environmental pollution – types, causes, effects and control measures - Disaster management strategies. **Environmental Ethics and Values** - Social issues and the environment -need for public awareness, Environmental Ethics- need for equitable utilization of natural resources- Traditional value systems in India, Impacts of modernization on Environment

**Awareness and actual activities:**

- ✓ Group meeting on water management, promotion of recycle use, reduction of waste,
- ✓ Plantation
- ✓ Cleanliness drive
- ✓ Drive on segregation of waste
- ✓ Energy saving
- ✓ Lectures by Environmentalist
- ✓ Slogan and poster making event

**Learning Resources**

1. Kaushik,A & Kaushik.C.P, Environmental Science and Engineering, 6<sup>th</sup> Edition, New Age International, 2018.
2. Erach Bharucha, Text book of Environmental studies for Undergraduate courses, 2<sup>nd</sup> Edition, UGC, 2013.

3. Gilbert M.Masters, Introduction to Environmental Engineering and Sciences, 2<sup>nd</sup> Edition, Pearson , 2004.
4. Garg S.K & Garg, Ecological and Environmental studies, Khanna Publishers, 2006.
5. Wright & Nebel, Environmental science towards a sustainable future, 8<sup>th</sup> Edition, Prentice Hall of India Ltd, 2002.
6. Documentary titled "HOME" by Yves Bertrand, Video Link: <https://www.youtube.com/watch?v=jqxENMKaeCU>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.0	<b>Environment and Ecosystem</b>		
1.1	Multidisciplinary nature of environment-Ecosystem	1	CO1
1.2	Energy flow in ecosystem – Universal energy flow model	1	CO1
1.3	Ecological succession	1	CO1
1.4	Over exploitation of Natural resources	1	CO2
1.5	Role of individual in conservation of natural resources	1	CO2
2.0	<b>Environmental pollution and control</b>		
2.1	Environmental pollution – types( Air, Water,soil,Marine),	2	CO3
2.2	causes (gaseous, liquid, solid, plastic, e-waste, biomedical waste and radiations),	2	CO3
2.3	Effects and control measures of Pollution	2	CO3
2.4	Disaster managements during cyclone, Tsunami, flood, draught and earthquake	2	CO4
3.0	<b>Environmental Ethics and Values</b>		
3.1	Social issues and the environment -need for public awareness	1	CO5
3.2	Environmental Ethics- need for equitable utilization of natural resources	1	CO5
3.3	Traditional value systems in India,	1	CO6
3.4	Impacts of modernization on Environment	2	CO6
4.0	<b>Awareness and actual activities</b>		
4.1	Group meeting on water management, promotion of recycle use, reduction of waste	2	CO7
4.2	Plantation	1	CO7
4.3	Cleanliness drive	1	CO7
4.4	Drive on segregation of waste	1	CO7
4.5	Energy saving	1	CO7
4.6	Lectures by Environmentalist	1	CO7
4.7	Slogan and poster making event	Through online	CO7

### Course Designers:

1. Dr.M.Kottaisamy      hodchem@tce.edu
2. Dr.S.Rajkumar      rajkumarsubramaniam@tce.edu

**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.TECH. INFORMATION TECHNOLOGY DEGREE PROGRAMME**

**THIRD SEMESTER**

**FOR THE STUDENTS ADMITTED IN THE**

**ACADEMIC YEAR 2018-19 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A GOVERNMENT AIDED ISO 9001:2008 CERTIFIED  
AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)  
**MADURAI – 625 015, TAMILNADU**

PHONE: 0452 – 2482240, 41

FAX: 0452 2483427

WEB: [WWW.TCE.EDU](http://WWW.TCE.EDU)

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**COURSES OF STUDY**

(For the candidates admitted from 2019-20 onwards)

**THIRD SEMESTER**

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
<b>THEORY</b>						
18IT310	Discrete Mathematics	BS	3	-	-	3
18IT320	Object Oriented Programming	PC	3	-	-	3
18IT330	Software Engineering	PC	3	-	-	3
18IT340	Data Structures	PC	3	-	-	3
<b>THEORY CUM PRACTICAL</b>						
18IT361	IT operations and Management	ES	2	-	2	3
18ES390	Design Thinking	ES	1	-	2	2
<b>PRACTICAL</b>						
18IT370	Object Oriented Programming Lab	PC	-	-	2	1
18IT380	Data Structures Lab	PC	-	-	2	1
<b>Total</b>			<b>15</b>	<b>-</b>	<b>8</b>	<b>19</b>

BS : Basic Science  
HSS : Humanities and Social Science  
ES : Engineering Science  
PC : Program Core  
PE : Program Elective  
GE : General Elective  
AC : Audit Course

L : Lecture  
T : Tutorial  
P : Practical

**Note:**

1 Hour Lecture is equivalent to 1 credit  
1 Hour Tutorial is equivalent to 1 credit  
2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**Scheme of Examinations**

(For the candidates admitted from 2019-20 onwards)

**Scheme of Examinations**

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
<b>THEORY</b>								
1	18IT310	Discrete Mathematics	3	50	50	100	25	50
2	18IT320	Object Oriented Programming	3	50	50	100	25	50
3	18IT330	Software Engineering	3	50	50	100	25	50
4	18IT340	Data Structures	3	50	50	100	25	50
<b>THEORY CUM PRACTICAL</b>								
5	18IT361*	IT operations and Management	3	50	50	100	25	50
6	18ES390	Design Thinking	-	50	50	100	25	50
<b>PRACTICAL</b>								
7	18IT370	Object Oriented Programming Lab	3	50	50	100	25	50
8	18IT380	Data Structures Lab	3	50	50	100	25	50

\* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

\*\* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

\*Passed in Board of Studies Meeting on 04.07.2020

Approved in 60th Academic Council Meeting on 25.07.2020

Passed in Board of Studies Meeting on 11.05.2019

Approved in 58<sup>th</sup> Academic Council Meeting on 15.06.2019

18IT310	Discrete Mathematics	Category	L	T	P	Credit
		BS	3	0	0	3

**Preamble**

**Discrete mathematics** is the branch of mathematics devoted to the study of discrete objects. Logic is called as the Calculus of Computer Science and it provides rules to determine whether a particular reasoning argument is valid. Propositions are declarative sentences with values true or false and are concerned with the analysis of propositions. Predicate calculus is the generalization of propositional calculus. **Set** is a collection of definite and distinguishable objects selected by means of some rules or description. Relation in mathematics describes connection between different elements of the same set, whereas function describes connections between two different sets. **Function** is a special class of relations. General recursive function coincides with the function defined by a Turing machine. A **lattice** is an abstract structure studied in the [mathematical](#) sub disciplines of [order theory](#) and [abstract algebra](#). **These topics have wide range of applications** in computer architecture, artificial intelligence, software engineering, expert systems, complexities, digital principles, DBMS, designing concepts, storage methods, managing databases, knowledge representation, distributed computing etc.

**Prerequisite**

Higher Secondary Level– Set Theory, Logic Theory

**Course Outcomes**

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	<b>Verify</b> equivalence for the given binary relation and bijection for the given function.	20%
CO2	<b>Compute</b> generating function and recursive function.	5%
CO3	<b>Understand</b> and <b>interpret</b> the given graph for connectivity, matching and coloring	10%
CO4	<b>Construct</b> Hasse diagram for the given POSET and also verify the constructed Hasse diagram for modular, distributive, bounded and complemented lattice.	20%
CO5	<b>Prove</b> or <b>disprove</b> the implication & equivalence problems using truth table method, replacement process, analyzation method, truth table technique, rules of inference.	20%
CO6	<b>Obtain</b> PCNF and PDNF of given logical expression.	15%
CO7	<b>Symbolize</b> the given predicate statement using quantifiers with the given UOD.	5%
CO8	<b>Pick</b> out free and bound variables, free and bound occurrence, and scope of the quantifiers from the given predicate statement.	5%

**CO Mapping with CDIO Curriculum Framework**

CO	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	-	1.1.1, 2.1.1, 2.3.1, 2.4.4
CO2	TPS3	Apply	Value	-	1.1.1, 2.1.1, 2.1.3, 2.4.4
CO3	TPS3	Apply	Value	-	1.1.1, 2.1.1, 2.1.2, 2.2.1, 2.4.4
CO4	TPS2	Understand	Respond	-	1.1.1, 2.1.1, 2.4.3, 2.4.4
CO5	TPS3	Apply	Value	-	1.1.1, 2.2.3, 2.4.3, 2.4.4
CO6	TPS3	Apply	Value	-	1.1.1, 2.2.3, 2.4.3, 2.4.4
CO7	TPS1	Remember	Receive	-	1.1.1, 2.1.4, 2.2.1, 2.4.4
CO8	TPS1	Remember	Receive	-	1.1.1, 2.1.4, 2.2.1, 2.4.4

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	-	-	-	-	-	-	M	-	M	M		L
CO2	S	S	S	-	-	-	-	-	-	M	-	M	M		L
CO3	S	S	S	-	-	-	-	-	-	M	-	M	M		L
CO4	S	S	S	-	-	-	-	-	-	M	-	M	M		L
CO5	S	S	S	-	-	-	-	-	-	M	-	M	M		L
CO6	S	S	S	-	-	-	-	-	-	M	-	M	M		L
CO7	S	S	S	-	-	-	-	-	-	M	-	M	M		L
CO8	S	S	S	-	-	-	-	-	-	M	-	M	M		L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	10	10	10	-	-	-	----
Understand	30	30	30	50	50	50	30
Apply	60	60	60	50	50	50	70
Analyse	00	00	00	-	-	-	00
Evaluate	00	00	00	-	-	-	00
Create	00	00	00	-	-	-	00

**Course Level Assessment Questions****Course Outcome (CO1)**

- Let R denote a relation on the set of ordered pairs of integers such that  $\langle x, y \rangle R \langle u, v \rangle$  iff  $xv=yu$ . Show that R is an equivalence relation.
- Given  $A = \{1,2,3,4\}$  and  $R = \{(1,2), (1,1), (1,3), (2,4)\}$ ,  $S = \{(1,4), (1,3), (2,3), (3,1), (4,1)\}$  are relations on A. Find  $S \circ R, R \circ S, M_R, M_S, M_{(R \circ S)^{-1}}$  and graph of R,S.
- Let  $f: R \rightarrow R$  and  $g: R \rightarrow R$  where R is the set of all real numbers where  $f(x) = x^2 - 1$  and  $g(x) = x+2$ .
  - Verify 'f', 'g', for bijection.
  - Find fog and gof, gog,  $g^4$ ,  $f^2$
  - Verify commutative law to the function f, g with respect to the operation 'o'.
  - Does  $f^{-1}$ ,  $g^{-1}$  exists? Justify your answer.

**Course Outcome (CO2)**

- Write the generating function for the sequence  $1, a, a^2, a^3, \dots$
- Explain exponential generating function with an example.
- What is meant by a recursive function? Write one application of each first order and second order linear homogeneous recursive function with examples.

**Course Outcome (CO3)**

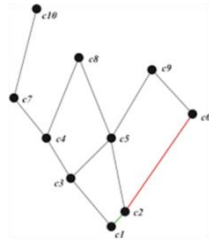
- Identify the matching number, vertex connectivity, edge connectivity and chromatic number of Peterson graph and the complete bipartite graph  $K_{3,4}$ .
- What is the relation between vertex connectivity and edge connectivity?



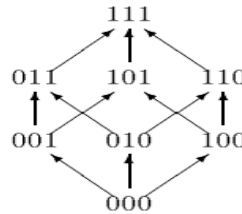
**Course Outcome (CO4):**

1. Which of the following Hasse diagram represents lattice? Justify your answer.

(i)



(ii)



2. Let  $L = \{1, 2, 3, 11, 66\}$  be a poset under the relation divides. Draw the Hasse diagram for L.

Check whether 'L' is a

- (i) Distributive lattice. (ii) Modular (iii) Bounded (iv) Complemented
- (v) Is the complement unique if it exists? Justify your answer

**Course Outcome (CO5):**

1. Prove the following implication by analyzation method.

$$(PVQ) \wedge (P \rightarrow R) \wedge (Q \rightarrow S) \Rightarrow S \vee R$$

2. Show that  $(Q \vee (P \wedge \neg q)) \vee (\neg P \wedge \neg Q)$  is a tautology using replacement process.

3. Verify the following implication by truth table.

$$(P \rightarrow (Q \rightarrow R)) \Rightarrow ((P \rightarrow Q) \rightarrow (P \rightarrow R))$$

4. Show the implication using CP rule if necessary.  $\neg PVQ, \neg QVR, R \rightarrow S \Rightarrow P \rightarrow S$

**Course Outcome (CO6):**

1. Obtain CNF and DNF of  $\neg(PVQ) \leftrightarrow (P \wedge Q)$

2. Obtain PCNF and PDNF of  $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$

3. Obtain principal disjunctive normal form of  $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$  and hence obtain principal conjunctive normal form.

**Course Outcome (CO7):**

1. Let  $C(x)$  : x is a cat.  $A(x)$  : x is an animal.  $B(x)$  : x is black. Write the following in words;

- (i)  $(\forall x)(C(x) \rightarrow A(x))$       (ii)  $(\exists x)(C(x) \wedge B(x))$

2. Symbolize the following arguments:

All integers are rational numbers. Some integers are power of 5. Therefore some rational numbers are powers of 5.

3. Symbolize the following predicate statements using quantifiers where UOD contains everything and hence negate the symbolic form.

- (i) Some men are clever (ii) All birds can fly.

**Course Outcome (CO8):**

1. Pick out free, bound variable and scope of the quantifier from the following

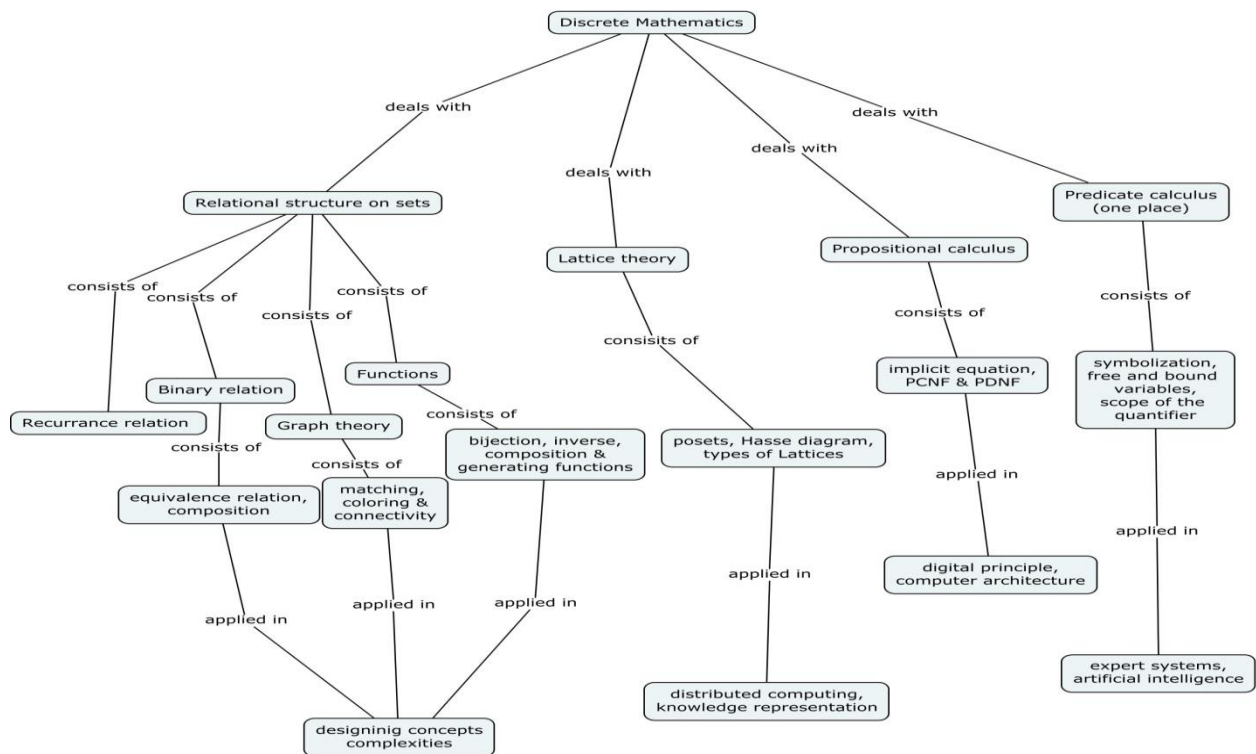
expressions:  $(\forall x)(P(x, y) \rightarrow Q(y))$

2. Symbolize the predicate statements and also pick out free and bound variable, scope of the quantifier, free and bound occurrence from the symbolic form:

(UOD contains everything).

All rock music is loud music. Some rock music exists. Therefore, some loud music exists.

## Concept Map



## Syllabus

### Relational Structures on Sets

Relations, Binary Relations, Equivalence Relations, Composition of relations, recurrence relations, Functions, Bijections, composition of functions, generating functions, Graphs, Connectivity, Matching, coloring.

**Lattice Theory:** Poset, Poset as Lattice, Properties of Lattice, Sublattice, Special Lattices: Modular, Distributive, Complemented, Bounded.

**Propositional Calculus:** Introduction – Statements and Notations, Basic & Higher Connectives:–Truth Tables using connectives – Tautological Implications & Equivalence of Formulas,– Functionally Complete set of connectives **Normal Forms:** Disjunctive-Conjunctive-Principal Disjunctive-Principal Conjunctive. **Validation:** Checking the validity using the truth table, Rules of Inference: P,T,CP,AP rules –Consistency of premises.

**Predicate Calculus:** Predicates-Function, Variables and Quantifiers, Predicate formulas –Free and Bound Variables (One Place Predicate).

## Learning Resources

1. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGrawHill Education, 2017.
2. Kenneth H. Rosen, "Discrete Mathematics and its applications", McGrawHill Education, Seventh Edition, 2017.
3. Dr.M.K.Venkataraman., Dr.N.Sridharan and N.Chandrasekaran, "Discrete Mathematics", National Publishing Company, Chennai.of India, 2004.
4. EitanFarchi, Ben-Chaim, "Mathematical Logic and its Application to Computer Science - Lecture Notes", March 3, 2010.
5. [http://www.research.ibm.com/haifa/dept/svt/papers/Mathematical\\_Logic.pdf](http://www.research.ibm.com/haifa/dept/svt/papers/Mathematical_Logic.pdf)

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
<b>1.</b>	<b>Relational Structures on Sets</b>		
1.1	Definition of Relation – Matrix & Graph representation of a relation - Binary Relation – Properties of Binary Relation.	2	CO1
1.2	Tutorial – I	1	
1.3	Equivalence relation - Composition of Relation - Recurrence relation	2	CO1
1.4	Functions –Bijection Function-Inverse	2	CO2
1.5	Generating Function	1	CO2
1.6	Gaphs, Connectivity	2	CO3
1.7	Matching , Coloring	2	CO3
<b>2</b>	<b>Lattice Theory</b>		
2.1	Poset, Hasse Diagram, Lattices	2	CO4
2.2	Properties of Lattices, Sublattice	1	
2.3	Sublattice, Modular Lattice	2	
2.4	Distributive lattice, Complemented and Bounded Lattice	2	
2.5	De'Morgan's Law	1	
<b>3.</b>	<b>Propositional Calculus</b>		
3.1	Introduction – Statements and Notations	1	CO5
3.2	Negation – Conjunction – Disjunction – Truth table	2	
3.3	Conditional – Biconditional – Tautological Statements – Equivalence of Formulas	2	
3.4	Tutorial – I	1	
3.5	Duality Law – Tautological Implications-Functionally Complete set of Connectives –Other Connectives-Nand , Nor	1	
3.6	Disjunctive – Conjunctive – Principle Disjunctive – Principle Conjunctive	1	CO6
3.7	Tutorial – II	1	
3.8	Checking the validity using the truth table, Rules of Inference – Consistency of premises and Indirect Method	1	
<b>4.</b>	<b>Predicate Calculus</b>		
4.1	Predicates-Function, Variables and Quantifiers	3	CO7
4.2	Predicate formulas – Free and Bound Variables	3	CO8
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

1. M. Kameswari
2. T.Lakshmi
3. AR. Murugan

[mkmat@tce.edu](mailto:mkmat@tce.edu)  
[tlaksshmimdu@tce.edu](mailto:tlaksshmimdu@tce.edu)  
[armmat@tce.edu](mailto:armmat@tce.edu)

18IT320	Object Oriented Programming	Category	L	T	P	Credit
		PC	3	0	0	3

**Preamble**

This course is intended for enabling students to learn Object Oriented Programming concepts and develop solutions for the real world problem. The syllabus emphasizes on OOP concepts, package, interfaces, exception handling, threads, collection, events and swing.

**Prerequisite**

- None

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Make use of programming concepts like Control structures, looping statements, type casting and I/O file operations etc.	16
CO2	Construct object-oriented programs for the given scenario using object oriented concepts like abstraction, encapsulation, polymorphism and inheritance.	17
CO3	Apply package, interface and exception handling mechanism for the given problem.	17
CO4	Implement multithread concepts for the real world scenario.	16
CO5	Make use of Collections and Logging to solve the given problem.	17
CO6	Develop object-oriented applications for the given scenario that uses events through swing.	17

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		L			L				M	M	L	L
CO2	S	M	L		L			L				M	M	L	L
CO3	S	M	L		L			L				M	M	L	L
CO4	S	M	L		M			L				M	M	M	L
CO5	S	M	L		M			L				S	M	M	L
CO6	S	M	L		M			L				S	M	M	L

S- Strong; M-Medium; L-Low

### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	20	-	-	-	20
Understand	30	30	20	20	20	20	20
Apply	50	50	60	80	80	80	60
Analyze	0	0	0	-	-	-	-
Evaluate	0	0	0	-	-	-	-
Create	0	0	0	-	-	-	-

### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	
Set	
Guided Response	20
Mechanism	80
Complex Overt Responses	
Adaptation	
Origination	

### Sample Questions for Course Outcome Assessment\*\*

#### Course Outcome 1 (CO1):

1. Explain about the benefits of Object oriented Programming.
2. Write a Java program to create 2 two-dimensional arrays which hold numbers. Write a method which takes the arrays as arguments to perform matrix multiplication.
3. Write a Java Program to Copy the file contents from one to another.
4. Write a Java Program to generate the Armstrong no within the predefined range.

#### Course Outcome 2 (CO2):

1. Write a java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.

2. Write a Java Program to implement multilevel inheritance for the following classes: Project, Task and Module. Assume the data members and methods used.
3. Illustrate compile time and runtime polymorphism for employee management system using a java program.
4. Produce a Java program for finding volume of different geometric shapes - cylinder, Rectangle and cube. Apply 'encapsulation' to get and set the values of the attributes and apply compile time polymorphism to find the volume of shapes. (Hint: Volume of cylinder:  $3.14*r^2*h$ , rectangle =  $l*b*h$ , Cube =  $a^3$  )

### Course Outcome 3 (CO3):

1. Illustrate the following exceptions with a sample program and handle it using try with multiple catch.
  - Number Format Exception
  - Array Index Out of Bounds Exception
  - Arithmetic Exception
2. Discuss the ways of implementing interface with example program.
3. Differentiate checked exception from unchecked exception.
4. Write a Java program to create a package which has classes and methods to read Student Admission details.

### Course Outcome 4 (CO4):

1. Write a Java Program to print the numbers 1 to 50 alternatively by Threads (Use Multithreading).
2. Write a java program to illustrate synchronization concept in threading.
3. Demonstrate inter-thread communication between ticket booking and cancellation in "Bus Reservation System". Assume appropriate members and member functions
4. Apply multi thread programming concept to demonstrate how threads are running with different priority value. Take any real time application to illustrate the above.

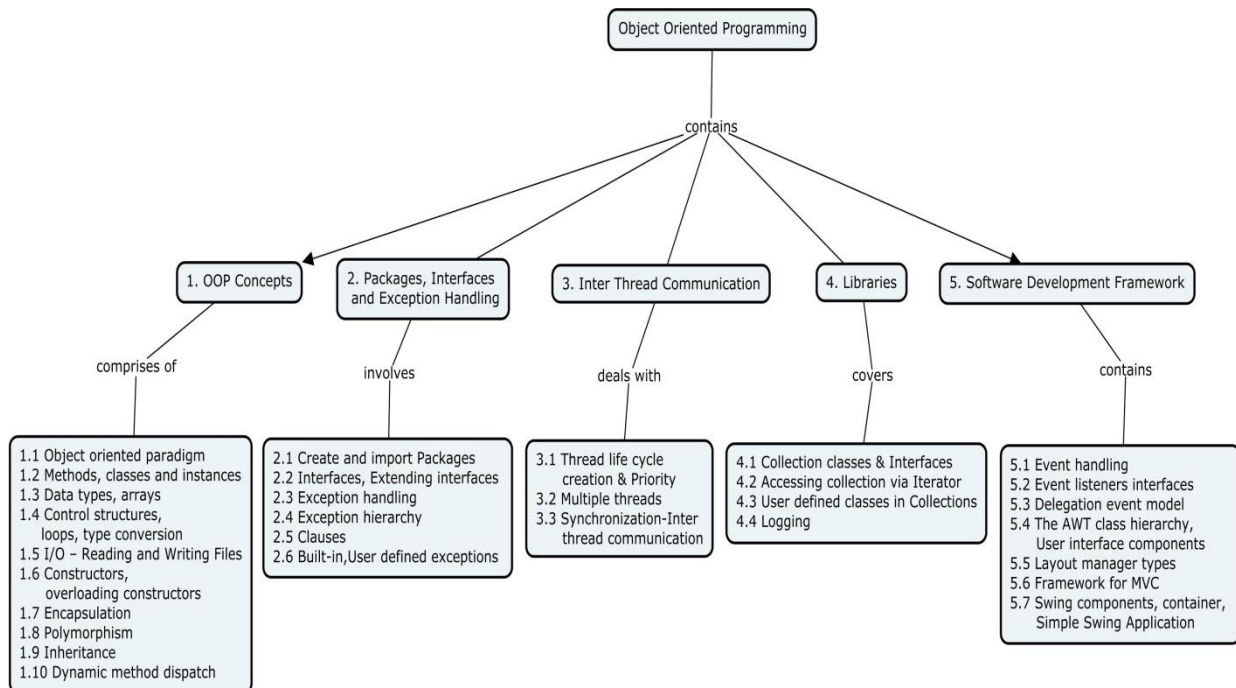
### Course Outcome 5 (CO5):

1. Identify the suitable collection for storing the student name (inclusive of duplicates) in the random order. Perform the following operations.
  - a. Display the student name without duplicate
  - b. Arrange the name in ascending order
  - c. Count the number of students with duplicate
  - d. Remove the student whose index is at '5'
2. Identify any three levels of logs for electrical billing application. Write a program to generate it and store it in a file.
3. List out any four built-in classes in "collections framework".
4. List any four "handlers" that uses to handle log information.
5. Create any 3 collections for different types of books. Find the name of the book based on the given id. Generate the bill for the purchased books.

### Course Outcome 6 (CO6):

1. Design and develop an application for bill calculation of a book shop using swing with events.
2. Write an applet to perform the 4 basic arithmetic operations as buttons in a form accepting two integers in text boxes and display their result.
3. List out any four Listener Interfaces in Event Handling.
4. Recall the syntax of different layouts in swing handling.
5. Write a java program that simulates a traffic signal. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.

## Concept Map



## Syllabus

**Object Oriented Programming Concepts:** object-oriented paradigm, methods, classes and instances, data types, arrays, control structures, looping statements, type conversion and casting, I/O – Reading and Writing Files, Constructors, overloading constructors, encapsulation, polymorphism, inheritance, Dynamic Method Dispatch

**Packages, Interfaces and Exception Handling:** Create and import packages - Interfaces, extending interfaces - Exception handling, exception hierarchy, Clauses, built in exceptions and user defined exceptions

**Inter Thread Communication:** Thread life cycle, creation & priority - Multiple threads, Synchronization - Inter thread communication

**Libraries:** Collection classes & Interfaces - Accessing collection via an Iterator - User defined classes in Collections –Logging

**Software Development Framework: Event Handling:** Events, Event sources, Event classes, Event Listeners Interfaces (Action Listener, Adjustment Listener Focus Listener, Item Listener, Key Listener, Mouse Listener, Text Listener), Delegation event model: handling mouse and keyboard events. The AWT class hierarchy, user interface components - Labels, button, scrollbars, text components, check box, check box groups, choices, lists, layout manager types – boarder, grid, flow and card.

**Swing:** Framework forMVC, components, containers and Simple Swing Application.

## Learning Resources

- Herbert Schildt, “Java: The Complete Reference”, McGraw-Hill. Ninth Edition, 2014.

- Paul Deitel and Harvey Deitel, “Java How to Program (Early Objects)”, Pearson, Eleventh Edition, 2017.
- E.Balagurusamy, “Programming with Java” , McGraw-Hill, Fifth Edition, 2014.
- Kathy Sierra, “Head First Java”, Shroff publications, Second edition, 2005.
- Cay S. Horstmann and Gary Cornell, “Core Java, Volume I - Fundamentals”, Prentice Hall, Ninth Edition, 2013.
- Cay S. Horstmann and Gary Cornell, “Core Java, Volume II – Advanced Features : 2”, Prentice Hall, Eleventh Edition, 2018.

### Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours	Course Outcome
<b>1</b>	<b>Object Oriented Programming Concepts</b>		
1.1	Object oriented paradigm - Introduction	2	CO1
1.2	Methods, classes and instances		
1.3	Data types, arrays	1	
1.4	Control structures, looping statements, type conversion	2	
1.5	I/O – Reading and Writing Files	1	
1.6	Constructors, overloading constructors	1	CO2
1.7	Encapsulation	1	
1.8	Polymorphism	1	
1.9	Inheritance	2	
1.10	Dynamic Method Dispatch	1	
<b>2</b>	<b>Packages, Interfaces and Exception Handling</b>		
2.1	Create and Import packages	1	CO3
2.2	Interfaces, Extending interfaces	2	
2.3	Exception handling	1	
2.4	Exception hierarchy		
2.5	Clauses	1	
2.6	Built-in and User defined exceptions	1	
<b>3</b>	<b>Inter Thread Communication</b>		
3.1	Thread life cycle, creation & priority	2	CO4
3.2	Multiple threads	2	
3.3	Synchronization - Inter thread communication	2	
<b>4</b>	<b>Libraries</b>		
4.1	Collection classes & interfaces	2	CO5
4.2	Accessing collection via an Iterator	1	
4.3	User defined classes in Collections	1	
4.4	Logging	2	
<b>5</b>	<b>Software Development Framework</b>		
5.1	Event handling: Events, Event sources, Event classes	1	CO6
5.2	Event listeners interfaces (action listener, adjustment listener focus listener, item listener, key listener, mouse listener, text listener)		
5.3	Delegation event model: handling mouse and keyboard events	1	
5.4	The AWT class hierarchy, user interface components- labels, button, scrollbars, text components, check box, check box groups, choices, lists	1	
5.6	Layout manager types – boarder, grid, flow and card.	1	



	Framework for MVC	1	
5.7	Swing components, container, Simple Swing Application	1	
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

1. Dr.S.Sridevi sridevi@tce.edu
2. Mr.M.Manikandakumar mmrit@tce.edu

18IT330	SOFTWARE ENGINEERING	Category	L	T	P	Credit
		PC	3	0	0	3

### Preamble

This course presents methods, tools and procedures that enable to control the process of software development and provide the student with a foundation for building quality software in a productive manner. The course highlights the application of systematic, disciplined, quantifiable approach to the development, operation and maintenance of software. The course also enables the students to acquire analytical, critical, technical writing, team building and managerial skills through team project activities by using agile practices

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Compare traditional and agile software process models	17
CO2	Identify user stories, Story map, functional and non-functional requirements for any given problem	16
CO3	Prepare design documents with standards for the given requirements	23
CO4	Develop test cases using appropriate testing techniques for an application	30
CO5	Illustrate the use of version controlling and tracking mechanisms	6
CO6	Demonstrate DEVOPS life cycle processes	8

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.1.4, 3.1.5
CO3	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.2.3, 4.4.1, 4.4.2
CO4	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,4.4.1, 4.4.2 4.5.5
CO5	TPS2	Understand	Respond	Guided Response	1.2,4.3.4
CO6	TPS2	Understand	Respond	Guided Response	1.2,4.3.4, 4.5.3, 4.5.6

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L						M				S	L		L
CO2	S	M	L		M	M			S	S		S	M	M	M
CO3	S	M	L		M	M			S	S		S	M	L	M
CO4	S	M	L		M				S	S		S	M	L	M
CO5	M	L							S	S		S	L		M
CO6	M	L			L				S	S		S	L		M

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	30	20	20	-	-	-	20
Understand	40	40	40	-	-	-	30
Apply	30	40	40	100	100	100	50
Analyse	0	0	0	-	-	-	0
Evaluate	0	0	0	-	-	-	0
Create	0	0	0	-	-	-	0

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	50
Mechanism	50
Complex Overt Responses	-
Adaptation	-
Orignation	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1 (CO1):**

1. Identify the needs for software engineering.
2. Differentiate the various processing models highlighting their advantages and disadvantages.
3. As a Project Manager, you have been contracted to build the software for weather monitoring system. Choose a process model that best fits your project and justify your answer comparing with other process models. Explain your choice of process model in detail.
4. Using the example of safe home security function, justify how does Agile process model can be implemented in this project. Write advantages and disadvantages
5. Explain the roles and responsibilities of software project manager.

**Course Outcome 2 (CO2):**

1. Identify user stories and draw story map for Railway reservation system.
2. Explain the requirements analysis process.
3. Differentiate the requirements analysis process between various process models
4. Signing off contract is a major task in requirements analysis. Justify your answer for this for agile process model.
5. Identify functional requirements for Online shopping software
6. Identify functional and non-functional requirements for the given case study.

**Course Outcome 3 (CO3):**

1. Draw DFD for the given case study (online shopping software)
2. Select use case diagram for the given case study (online shopping software)
3. Draw class and sequential diagram for the given case study (online shopping software)
4. Construct activity diagram for the given case study (Library Management System)
5. Draw use case diagram for Hospital management.

**Course Outcome 4 (CO4):**

1. Explain different testing techniques
2. Explain cause-effect testing technique with suitable example
3. Design the black-box test suite for software that computes the square root of an input integer which can assume values in the range of 0 to 5000.
4. Identify test cases for Prime Number generation program using the cyclomatic complexity
5. Draw program dependence graph and write test cases for the given problem.

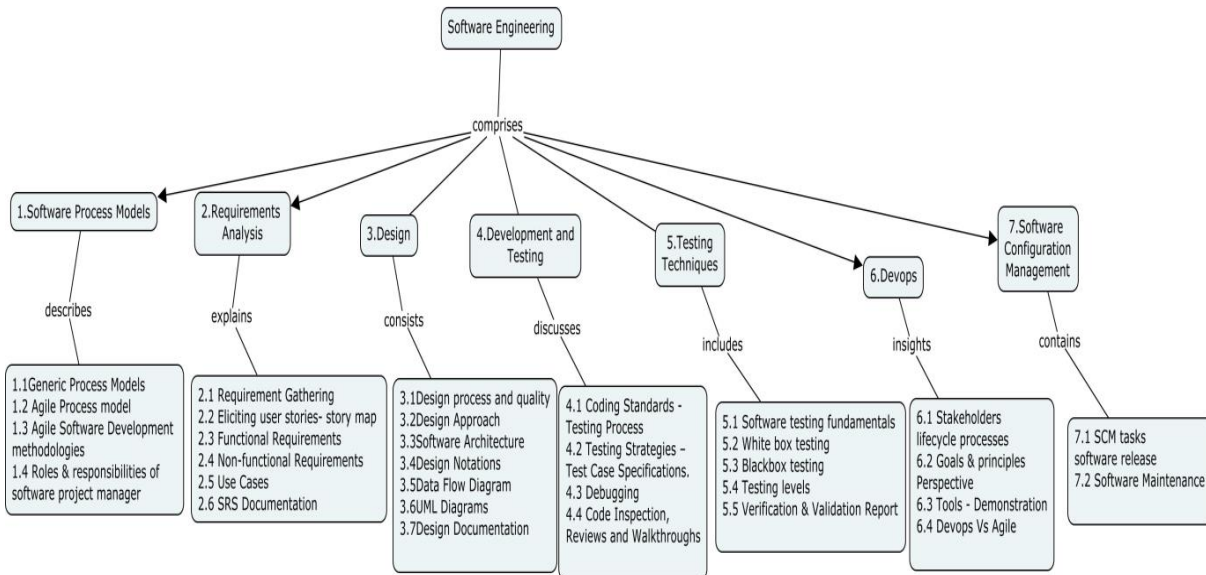
**Course Outcome 5 (CO5):**

1. List SCM tasks.
2. Explain version controlling and tracking
3. Identify the characteristics of software maintenance.
4. Define software release plan.
5. Discuss about software reviews

**Course Outcome 6 (CO6):**

1. List Devops stakeholders.
2. Identify Devops goals and principles.
3. Explain Devops life cycle processes
4. Compare Devops and Agile process models
5. Describe the advantages of using Devops

## Concept Map



## Syllabus

**Software Process Models:** Generic Process Models Vs Agile Process model. Agile Software Development methodologies -Extreme Programming (XP), Adaptive Software Development (ASD) - Dynamic Systems Development Method (DSDM) – Scrum – Crystal – Feature Driven Development (FDD) - Roles and responsibilities of software project manager

**Requirements Analysis:** Requirement Gathering – Eliciting user stories- story map - Functional Requirements - Non-functional Requirements. Use Cases – SRS Documentation

**Design:** Design process and quality - Design concepts – design guidelines – Design Approach - Structured approach – Object-oriented approach. Software Architecture- Data design – Architectural styles and patterns - User Interface Design. Design Notations – Data Flow Diagram – Context Diagram - UML Diagrams – Class Diagram - Sequential Diagram – User Interface Design - Design Documentation. Exploration of Design tools

**Development and Testing:** – Coding Standards –Testing Process – Testing Strategies – Test Case Specifications. Debugging - Code Inspection, Reviews and Walkthroughs

**Testing techniques:** – Software testing fundamentals – Black box and white box testing - White box testing - Basis path testing- Control structure testing – Program Dependence Graph. Black box testing –Equivalence Partitioning – Boundary Value Analysis – Cause effect graph Testing levels – Unit testing – Integration testing - System testing -Modular testing – Regression testing –User acceptance testing – Verification & Validation Report. Testing tools.

**Devops:** Stakeholders – Lifecycle processes – Goals & principles –Perspective –Tools - Demonstration of Devops. DevopsVs Agile.

**Software Configuration Management:** SCM tasks- version control- tracking- software release. Software Maintenance – characteristics, controlling factors, maintenance tasks

**Learning Resources**

1. Orit Hazzan, Yael Dubinsky, "Agile software engineering II", Springer, 2014
2. Roger S. Pressman, "Software Engineering A Practitioner's Approach", McGraw Hill, 8<sup>th</sup> edition, 2014.
3. Rajib Mall, "Fundamentals of Software Engineering", PHI, 4th edition, 2014.
4. Michael Duffy, "DevOps Automation Cookbook", Kindle editions, 2015
5. Adithya P. Mathur, "Foundations of Software Testing", Pearson Education, 2008..
6. <https://cloudacademy.com/blog/introduction-to-devops/>

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Software Process Models</b>		
1.1	Generic Process Models	1	CO1
1.2	Agile Process model	1	
1.3	Agile Software Development methodologies	1	
1.3.1	Extreme Programming (XP)		
1.3.2	Adaptive Software Development (ASD)	1	
1.3.3	Dynamic Systems Development Method (DSDM)	1	
1.3.4	Scrum	1	
1.3.5	Crystal		
1.3.6	Feature Driven Development (FDD)		
1.4	Roles and responsibilities of software project manager	1	
<b>2</b>	<b>Requirements Analysis</b>		
2.1	Requirement Gathering	1	CO2
2.2	Eliciting user stories- story map	1	
2.3	Functional Requirements	1	
2.4	Non-functional Requirements	1	
2.5	Use Cases	1	
2.6	SRS Documentation	1	
<b>3</b>	<b>Design</b>		
3.1	Design process and quality - Design concepts – Design guidelines	1	CO3
3.2	Design Approach - Structured approach – Object-oriented approach.	1	
3.3	Software Architecture - Data design –Architectural styles and patterns	1	
3.4	Design Notations	2	
3.5	Data Flow Diagram – Context Diagram		
3.6	UML Diagrams – Class Diagram - Sequential Diagram – User Interface Design	2	
3.7	Design Documentation	1	
<b>4</b>	<b>Development and Testing</b>		
4.1	Coding Standards –Testing Process -	1	CO4
4.2	Testing Strategies – Test Case Specifications.		
4.3	Debugging	1	
4.4	Code Inspection, Reviews and Walkthroughs	1	
<b>5</b>	<b>Testing techniques</b>		
5.1	Software testing fundamentals	1	
5.2	White box testing	2	

5.2.1	Basis path testing		CO4
5.2.2	Control structure testing		
5.2.3	Program Dependence Graph		
5.3	Black box testing	2	
5.3.1	Equivalence Partitioning		
5.3.2	Boundary Value Analysis		
5.3.3	Cause effect graph		
5.4	Testing levels – Unit testing – Integration testing - System testing -Modular testing – Regression testing –User acceptance testing	1	
5.5	Verification & Validation Report	1	
5.6	Testing tools	1	
<b>6</b>	<b>Devops</b>		CO6
6.1	Stakeholders – lifecycle processes	1	
6.2	Goals & principles – Perspective		
6.3	Tools - Demonstration	1	
6.4	DevopsVs Agile	1	
<b>7</b>	<b>Software Configuration Management</b>		CO5
7.1	SCM tasks- version control- tracking- software release.	1	
7.2	Software Maintenance – characteristics, controlling factors, maintenance tasks	1	
	Total Hours	36	

**Course Designers:**

1. R.Suganya rsuganya@tce.edu
2. S.Pudu Malar spmit@tce.edu

18IT340	DATA STRUCTURES	Category	L	T	P	Credit
		PC	3	0	0	3

**Preamble**

The course introduces the fundamental data structures and their operations. The course discusses the use of linear and non-linear data structures with real time applications. It strives to strengthen the programming ability of students to solve problems and write efficient algorithms using suitable data structures.

**Prerequisite**

Basic Programming Skills

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Use suitable linear ADT data structures and their operations for solving a given problem	25%
CO2	Use suitable non-linear ADT data structures and their operations for solving a given problem	30%
CO3	Illustrate hash table and sets data structure and their operations for simple applications	15%
CO4	Compute space and time complexity of a given problem	10%
CO5	Interpret computational efficiency of searching and sorting algorithms	10%
CO6	Formulate solutions by using suitable ADTs and write efficient procedures for implementing problems	10%

**CO Mapping with CDIO Curriculum Framework**

CO#	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.4.5, 2.4.6
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.4.5, 2.4.6
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.4.5, 2.4.6
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.4.5, 2.4.6
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.1.2, 3.2.3, 3.2.4, 4.1.1, 4.1.2, 4.5.1



**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			M				S	M	M	L
CO2	S	M	L		S			M				S	M	M	L
CO3	S	M	L		S			M				S	M	M	L
CO4	S	M	L		S			M				S	M	M	L
CO5	S	M	L		S			L				S	M	M	L
CO6	S	M	L		S	S	L	S	S	S	M	S	M	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	30	20	20	-	-	-	20
Understand	30	40	40	-	-	-	40
Apply	40	40	40	10	10	10	40
Analyze	0	0	0	-	-	-	0
Evaluate	0	0	0	-	-	-	0
Create	0	0	0	-	-	-	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini-project / Assignment / Practical Component
Perception	-
Set	10
Guided Response	30
Mechanism	60
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome 1 (CO1):**

1. Insert the elements into the Singly Linked list so that the list is sorted
2. Use Stack to check whether the given string is palindrome or not
3. Select the appropriate data structure to check the palindrome so as to minimize the traversal

**Course Outcome 2 (CO2):**

1. AVL tree is better than Binary Search Tree. Give reason.
2. Identify the suitable data structure so as to delete the minimum element from the list.
3. Insert the A to J into the suitable data structure, so that search always yields  $O(\log n)$  time.

**Course Outcome3 (CO3):**

1. Demonstrate the operations of Set ADT with suitable examples.
2. Suggest the suitable collision resolution strategies when the given keys are hashed into the hash table
3. List different collision resolving strategies in Hashing technique

**Course Outcome 4 (CO4):**

1. List few  $O(n^2)$  and  $O(n \log n)$  sorting algorithms
2. Describe the potential advantages of notations  $\Omega$ ,  $\theta$ ,  $O$
3. Find the space complexity and time complexity of matrix multiplication

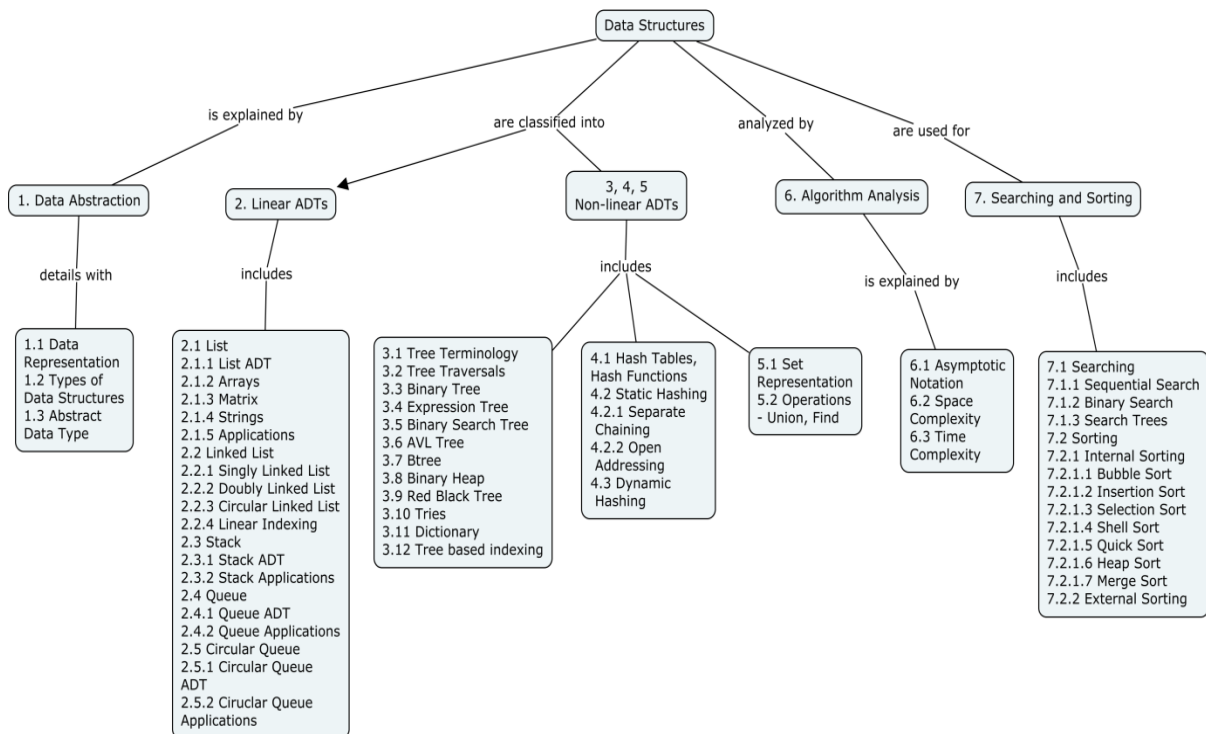
**Course Outcome 5 (CO5):**

1. Compare linear and binary search techniques
2. Write procedure and sort the elements using insertion sort
3. Demonstrate Merge sort for the set of numbers

**Course Outcome 6 (CO6):**

1. Convert infix expression to postfix using stack ADT
2. Solve polynomial equation using singly linked list ADT
3. Mini-project implementation

**Concept Map**



**Syllabus**

**Data Abstraction:** Data Representation - Types of Data Structures - Abstract Data Type (ADT)

**Linear ADTs:** List - Arrays - Matrix - String - Applications - Stack - Queue - Circular Queue - Linked List - Singly Linked List, Doubly Linked List, Circular Linked List, Applications -

Expression evaluation, Recursion, FCFS Algorithm, Round Robin Scheduling Algorithm, Linear Indexing

**Non-linear ADTs:** Tree Terminology - Tree traversals - Binary tree - Expression Tree - Binary Search Tree - AVL Tree - B-tree - Binary Heap (Priority Queue) - Red Black Tree, Tries, Applications - Dictionary - Tree-based indexing

**Tables:** Hash Tables - Hash Functions - Static Hashing - Separate Chaining, Open Addressing - Dynamic Hashing

**Sets:** Representation - Operations - Union, Find

**Algorithm Analysis:** Asymptotic Measures - Space Complexity - Time Complexity

**Searching and Sorting:** Sequential Search - Binary Search - Search trees - Internal Sorting - Bubble Sort, Insertion Sort, Selection Sort, Shell Sort, Quick Sort, Merge Sort - External Sorting

### Learning Resources

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2012.
2. Richard Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudo code Approach with C", Second edition, India Edition 2007.
3. S Sridhar, "Design and Analysis of Algorithms", 1<sup>st</sup> edition, Oxford University Press, 2014.
4. BasantAgarwal, BejaminBaka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2<sup>nd</sup> Edition, 2018
5. Aho, J.E. Hopcroft and J.D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
6. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", Galgotia Publications, 2010.
7. NPTEL's Course for Data Structures - [http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/data\\_str\\_algo/frameset.htm](http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/data_str_algo/frameset.htm)
8. Web Reference for Data Structures - <https://www.geeksforgeeks.org/data-structures>
9. Web Reference for Data Structures - <https://www.hackerrank.com/domains/data-structures>
10. Web Reference for Data Structures - [www.leetcode.com/](http://www.leetcode.com/)

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Data Abstraction</b>		CO1
1.1	Data Representation	1	
1.2	Types of Data Structures		
1.3	Abstract Data Type (ADT)		
<b>2</b>	<b>Linear ADTs</b>		CO1, CO6
2.1	List	1	
2.1.1	List ADT		
2.1.2	Arrays		
2.1.3	Matrix		
2.1.4	Strings	1	

2.1.5	Applications		
2.2	Linked List		
2.2.1	Singly Linked List ADT	2	
2.2.2	Doubly Linked List ADT	2	
2.2.3	Circular Linked List ADT		
2.2.4	Applications - Linear Indexing		
2.3	Stack		
2.3.1	Stack ADT	1	
2.3.2	Applications - Expression Evaluation	1	
2.3.3	Applications - Recursion	1	
2.4	Queue		
2.4.1	Queue ADT	1	
2.4.2	Applications - FCFS Algorithm		
2.5	Circular Queue		
2.5.1	Circular Queue ADT	1	
2.5.2	Applications - Round Robin Algorithm	1	
<b>3</b>	<b>Non-linear ADTs</b>		
3.1	Tree Terminology	1	
3.2	Tree Traversals		
3.3	Binary Tree	1	
3.4	Expression Tree	1	
3.5	Binary Search Tree	1	
3.6	AVL Tree	1	
3.7	B-tree	1	
3.8	Binary Heap (Priority Queue)	1	
3.9	Red Black Tree	1	
3.10	Tries		
3.11	Applications - Dictionary	1	
3.12	Applications - Tree-based indexing		
<b>4</b>	<b>Tables</b>		
4.1	Hash Tables, Hash Functions	1	CO3, CO6
4.2	Static Hashing	1	
4.2.1	Separate Chaining		
4.2.2	Open Addressing		
4.3	Dynamic Hashing	1	
<b>5</b>	<b>Sets</b>		
5.1	Representation	1	
5.2	Operations: Union and Find	1	
<b>6</b>	<b>Algorithm Analysis</b>		
6.1	Aysmptotic Measures	2	CO4, CO6
6.2	Space Complexity		
6.3	Time Complexity		
<b>7</b>	<b>Searching and Sorting</b>		
7.1	Searching Techniques	1	CO5,

7.1.1	Sequential Search		CO6
7.1.2	Binary Search		
7.1.3	Search Trees		
7.2	Sorting Techniques		
7.2.1	Internal Sorting		
7.2.1.1	Bubble Sort	1	
7.2.1.2	Insertion Sort		
7.2.1.3	Selection Sort		
7.2.1.4	Shell Sort		
7.2.1.5	Quick Sort	1	
7.2.1.6	Heap Sort	1	
7.2.1.7	Merge Sort	1	
7.2.2	External Sorting	1	
<b>Total Lecture Hours</b>		36	

**Course Designers:**

1. A.M. Abirami [abiramiam.@tce.edu](mailto:abiramiam.@tce.edu)
2. E. Ramanujam [erit@tce.edu](mailto:erit@tce.edu)

18IT380	DATA STRUCTURES LAB	Category	L	T	P	Credit
		PC	0	0	2	1

**Preamble**

The course is designed to develop programming skills for writing applications using linear and non-linear data structures. It strengthens the logical reasoning skills of students to solve problems and write efficient algorithms using suitable data structures.

**Prerequisite**

Basic Programming Skills

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Use suitable array-based linear data structures for a given problem	35%
CO2	Use suitable linked list data structures for a given problem	30%
CO3	Use suitable tree data structures for a given problem	15%
CO4	Use suitable hashing techniques and sets for a given problem	7%
CO5	Experiment with different searching and sorting algorithms using time complexity measures	7%
CO6	Develop solutions for real time applications using suitable linear or non-linear data structures and communication skills by involving in project teams	6%

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.5.1, 3.1.1, 3.2.3, 3.2.4, 4.1.1, 4.5.1,

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			S				S	M	M	L
CO2	S	M	L		S			S				S	M	M	L
CO3	S	M	L		S			S				S	M	M	L
CO4	S	M	L		S			S				S	M	M	L
CO5	S	M	L		S			S				S	M	M	L
CO6	S	M	L		S	S	L	S	S	S	M	S	M	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	10	-
Apply	90	100
Analyze	-	-
Evaluate	-	-
Create	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Practical Component/Observation
Perception	-
Set	10
Guided Response	40
Mechanism	50
Complex Overt Responses	-
Adaptation	-
Origination	-

**List of Experiments/Activities with CO Mapping**

S. No	Topic	No. of Sessions	COs Mapping
1	Implementation of List ADT using array and structures for simple applications	1	CO1
2	Implementation of Matrix ADT using array and pointers for simple applications	1	
3	Implementation of String Algorithms (eg. string matching) for simple applications	1	
4	Implementation of List ADT using Linked List and its applications	1	CO2
5	Implementation of Stack ADT for simple applications i. Two way stack ii. Stack Applications	1	CO1
6	Implementation of Queue ADT, Queue Applications	1	
7	Implementation of Circular Queue ADT, Circular Queue Applications		
8	Implementation of List ADT using Doubly Linked List, Applications	1	CO2
9	Implementation of List ADT using Circular linked list, Applications	1	
10	Implementation of Binary Search Tree ADT	1	CO3
11	Implementation of Binary Heap ADT	1	
12	Implementation of Hashing techniques	1	CO4
13	Performance analysis of searching and sorting algorithms	1	CO5
14	Mini-project Implementation and review		CO6
<b>Total Sessions</b>		<b>12</b>	

**Learning Resources**

1. GeeksforGeeks - [www.geeksforgeeks.org](http://www.geeksforgeeks.org)
2. HackerRank - [www.hackerrank.com](http://www.hackerrank.com)

**Course Designers:**

1. A.M. Abirami [abiramiam.@tce.edu](mailto:abiramiam.@tce.edu)
2. E. Ramanujam [erit@tce.edu](mailto:erit@tce.edu)



18IT361	IT OPERATIONS AND MANAGEMENT	Category	L	T	P	Credit
		ES	2	0	2	3

**Preamble**

This course intends to provide basic knowledge on system administration to administer Linux/Windows machines and further explores IT operations concepts such as server Management, Storage, Back-up and Business Continuity Planning

**Prerequisite**

NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Manage users and groups in a linux environment using appropriate commands and shell scripts	20
CO2	Use bash scripting for handling Files, directories and devices in a linux system	25
CO3	Use Active Directory Domain services to manage users, groups, devices and resources in a Windows environment	20
CO4	Make use of roles included in windows server core such as DNS server, DHCP server, HyperV for system administration purposes	20
CO5	Describe the functionalities, Configuration, monitoring and Power budget for different types of servers	5
CO6	Summarize various techniques and strategies of data storage and backup solutions for enterprises.	10

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1,2.1.5,3.1, 4.6.2
CO2	TPS3	Apply	Value	Mechanism	1.2,2.1.1,2.1.5,3.1, 4.6.2
CO3	TPS2	Apply	Value	Mechanism	1.2,2.3.3
CO4	TPS2	Apply	Value	Mechanism	1.2,2.2.2,2.3.2,
CO5	TPS2	Understand	Respond	Guided Response	1.2, 2.1.1,2.1.5,2,2.2,3.1
CO6	TPS2	Understand	Respond	Guided Response	1.2,2.1.5,2.2.2

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			M	M	M		M	M	M	L
CO2	S	M	L		S			M	M	M		M	M	M	L
CO3	S	M	L		S			M	M	M			M	M	
CO4	S	M	L		S			M	M	M			M	M	L
CO5	M	L					M						L		
CO6	M	L					M						L		L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Model Exam	Practical Component/ Observation	Terminal Exam
	1	2	3			
Remember	20	20	20	0	0	20
Understand	20	20	80	20	20	20
Apply	60	60	0	80	80	60
Analyse	0	0	0	0	0	0
Evaluate	0	0	0	0	0	0
Create	0	0	0	0	0	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	0
Set	0
Guided Response	20
Mechanism	80
Complex Overt Responses	0
Adaptation	0
Origination	0

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1 (CO1):**

- Use user management commands and options to write the shell script for the following scenario:
  - Create a directory "Office" and a file "employee.txt".
  - Create 3 users Clerk, Accountant, Manager and add all the 3 users in a group Sections.
  - Set user id and password for all the 3 users
- Find the appropriate commands to find the unique entries and Sort the /etc/group file using the field separator and starting position options

**Course Outcome 2 (CO2):**

- Use appropriate Linux commands in a bash script such that first 5 lines and last 2 lines of the file accesscontrol.txt would be displayed
- Perform the following using bash script
  - Create a new user with appropriate home directory and a new group
  - Assign the new user created to the new group

c) Create a new user with the UID 1230

### Course Outcome 3 (CO3):

1. Produce the correct Sequence of steps to administer active directory by managing and maintaining domain controller in windows server 2012
2. Explain the procedure for setting system password and account lockout policies in windows machine.

### Course Outcome 4 (CO4):

1. Identify the steps to manage file services in windows server 2012
2. Illustrate the steps to configure name resolution in windows server 2012

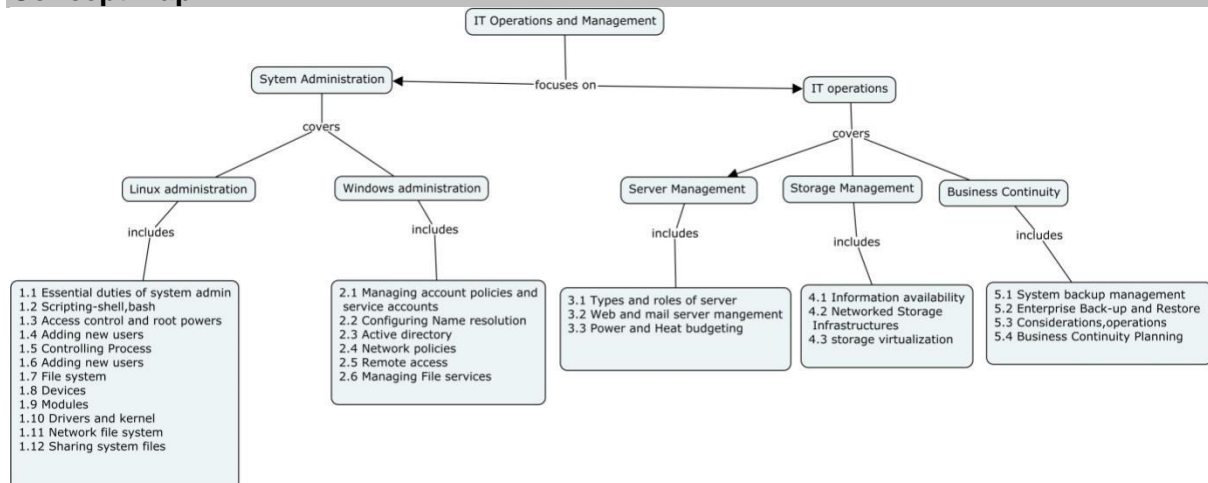
### Course Outcome 5 (CO5):

1. Explain the schemes of Power budgeting
2. Illustrate the architecture of Application Server
3. List the steps of configuring a Mail Server

### Course Outcome 6 (CO6):

1. State the purpose of performing operation backup, disaster recovery and archiving?
2. Explain the various business/technical considerations for implementing a backup solution?
3. Illustrate the components of bacula and sequence the steps to perform backup and restore of your system's root directory

## Concept Map



## Syllabus

**Linux Administration-** Essential duties of system admin-Scripting – Shell - Shell Configuration - Access control and Root powers- Adding new users- Controlling Process- File system- Devices- Modules- Drivers and kernel - Network file system - sharing system files

**Windows Administration** - Managing account policies and service accounts- Configuring Name resolution- Active directory- Network policies- Remote access- Managing File services

**Server Management** - Types of servers - Roles of Server - Web Server Management – Mail server Management - Setup - Monitoring - Optimization - Power and Heat budgeting

**Storage Management-** Information availability - Networked Storage Infrastructures (NAS, SAN) - RAID - Storage Virtualization

**Business Continuity** - System Backup management- Enterprise Back-up and Recovery: Considerations , Operations - Backup Granularity, Methods, Technologies - Replication - Business Continuity Planning

### Learning Resources

- Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, "UNIX and Linux System Administration Handbook", 5th edition, Pearson education,2017.
- Orin Thomas, "Administering Windows Server 2012 – Training guide", O'Reilly Media, 2014
- EMC Education Services," Information Storage and Management", Wiley, 2nd edition, 2012
- Gilbert Held, "Server Management (Best Practices Book 9)", Auerbach Publications, 1st edition.2000
- Nicholas Wells, "Guide to Linux Installation and Administration", Course Technology Inc; 2nd Revised edition, 2003
- Matthias KalleDalheimer, Matt Welsh, "Running Linux", Om books, Fifth Edition, 2006.
- Robert Spalding, "Storage Networks :The Complete Reference", Tata McGraw Hill,Osborne,2017
- Backup management-<https://www.baculasystems.com/training>
- System administration and engineering training - <https://www.cbtnuggets.com/it-training/systems-administration-engineering>
- System administration certification - <https://www.koenig-solutions.com/specialization/system-administration-training-courses.aspx>

### Course Contents and Lecture Schedule

Module No	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Basic Linux Administration</b>		CO1, CO2
1.1	Essential duties of system admin	3	
1.2	Shell scripting - Configuration		
1.3	Access control and Root powers	1	
1.3	Controlling Process	1	
1.4	Adding new users	2	
1.5	File system		
1.6	Devices	2	
1.7	Modules		
1.8	Drivers and kernel	1	
1.9	Network file system	1	
1.10	Sharing system files	1	
<b>2</b>	<b>Windows Administration</b>		CO3,CO4
2.1	Managing account policies and service accounts	1	
2.2	Configuring Name resolution	1	
2.3	Active directory	1	
2.4	Network policies	1	
2.5	Remote access	1	
2.6	Managing File services		
<b>3</b>	<b>Server Management</b>		CO5
3.1	Types of servers - Roles of Server	1	
3.2	Web Server Management - Setup - Monitoring - Optimization		

3.3	Mailserver Management - Setup - Monitoring - Optimization	1	CO6
3.4	Power and Heat budgeting		
<b>4</b>	<b>Storage Management</b>		
4.1	Information availability	1	
4.2	Networked Storage Infrastructures	1	
4.3	RAID	1	
4.4	Storage Virtualization		
<b>5</b>	<b>Business Continuity</b>		
5.1	System Backup - Replication	1	
5.2	Enterprise Back-up and Restore		
5.3	Business Continuity Planning	1	
	Total No. of Lecture Hours	24	

### List of Experiments

S. No	Description	No. of Hours	Course Outcome
	<b>Linux Administration</b>		
1	Shell scripting and Configuration	2	CO1
2	Access management	2	
3	User management	2	
4	File System Management	2	
5	Web server management	2	
6	Mail server management	2	
7	Backup	2	CO1
8	Network file system	1	CO1
9	Sharing system files	1	
	<b>Windows Administration</b>		
10	Managing account policies and service accounts	2	CO2
11	Configuring Name resolution	1	
12	Active directory	2	
13	Remote access	1	
14	Managing File services	2	
	Total Lectures	24	

### Course Designers

1. S.ThiruchadaiPandeewari eshwarimsp@tce.edu

18IT370	<b>OBJECT ORIENTED PROGRAMMING LAB</b>	Category	L	T	P	Credit
		PC	0	0	2	1

**Preamble**

This course provides knowledge and skills on object oriented concepts such as inheritance, polymorphism and also the concepts such as threading, packages, exceptions and collections. It also provides knowledge at analyze level on selecting java libraries to implement logging and swing for an application.

**Prerequisite**

Nil

**Course Outcomes**

On successful completion of the course, students will be able to

Course Outcomes		Weightage in %
CO1	Apply Basic Programming concepts like type casting, control structures, looping statements, I/O Operations etc.	16
CO2	Apply object oriented concepts like abstraction, encapsulation, polymorphism and inheritance to solve the given problem.	25
CO3	Develop applications that use packages, interfaces, exceptions, and threads for the given requirements.	25
CO4	Implement Collections and logging to solve the given problem.	17
CO5	Examine suitable Application Programming Interfaces (APIs) to incorporate swing concepts in the given application.	9
CO6	Develop applications for the given real time problems based on core and advanced OOP concepts.	8

**CO Mapping with CDIO Curriculum Framework**

CO	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 3.1.1, 3.2.1 3.2.6, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 3.1.1, 3.2.1 3.2.6, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 3.1.1, 3.2.1 3.2.6, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 3.1.1, 3.2.1 3.2.6, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 3.1.1, 3.2.1 3.2.6, 4.1.1, 4.3.1, 4.4.3, 4.5.3

CO6	TPS4	Analyze	Organize	Complex Overt Responses	1.2, 2.1.1, 2.1.5, 2.4.3, 2.4.6, 2.4.7, 2.5.1, 3.1.1, 3.2.1 - 3.2.6, 4.1.1, 4.3.1, 4.4.3, 4.5.3, 4.5.5
-----	------	---------	----------	-------------------------	--

### Mapping with Programme Outcomes / Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		L			L	M	M		M	M	L	M
CO2	S	M	L		L			L	M	M		M	M	L	M
CO3	S	M	L		M			M	S	S		S	M	M	M
CO4	S	M	L		M			M	S	S		S	M	M	M
CO5	S	M	L		M			M	S	S		S	M	M	M
CO6	S	S	M	L	M			M	S	S		S	S	M	M

S - Strong, M – Medium, L – Low

### Assessment Pattern: Cognitive Domain

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	20	20
Apply	60	60
Analyse	20	20
Evaluate	0	0
Create	0	0

### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Practical Component/Observation
Perception	-
Set	-
Guided Response	20
Mechanism	80
Complex Overt Responses	-
Adaptation	-
Orignation	-

### List of Experiments/Activities with CO Mapping

Exp No.	List of Experiments	No. of Hours	Course Outcome
1.	Use of data types, operators, scope and life time of variables, Type casting	2	CO1
2.	Practice Java I/O	2	
3.	Demonstrate Encapsulation	2	CO2
4.	Practice Inheritance	2	
5.	Practice Polymorphism	2	
6.	Practice Packages & Interfaces	2	CO3
7.	Demonstrate built-in Exceptions and User defined Exceptions	2	
8.	Practice Threading	2	
9.	Practice Collections with string methods	2	CO4
10.	Practice Logging with JAR	2	

11.	Practice Event Handling with Swing	2	CO5
12.	Case study on J2EE Concepts like Servlet/Spring frameworks/Struts	2	CO6
	<b>Total Hours</b>	24	

**Course Designers**

1. Dr.S.Sridevi                      sridevi@tce.edu
2. M. Manikandakumar          mmkit@tce.edu





18IT380	DATA STRUCTURES LAB	Category	L	T	P	Credit
		PC	0	0	2	1

**Preamble**

The course is designed to develop programming skills for writing applications using linear and non-linear data structures. It strengthens the logical reasoning skills of students to solve problems and write efficient algorithms using suitable data structures.

**Prerequisite**

Basic Programming Skills

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Use suitable array-based linear data structures for a given problem	35%
CO2	Use suitable linked list data structures for a given problem	30%
CO3	Use suitable tree data structures for a given problem	15%
CO4	Use suitable hashing techniques and sets for a given problem	7%
CO5	Experiment with different searching and sorting algorithms using time complexity measures	7%
CO6	Develop solutions for real time applications using suitable linear or non-linear data structures and communication skills by involving in project teams	6%

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.5, 2.5.1, 3.1.1, 3.2.3, 3.2.4, 4.1.1, 4.5.1,

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			S				S	M	M	L
CO2	S	M	L		S			S				S	M	M	L
CO3	S	M	L		S			S				S	M	M	L
CO4	S	M	L		S			S				S	M	M	L
CO5	S	M	L		S			S				S	M	M	L
CO6	S	M	L		S	S	L	S	S	S	M	S	M	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	10	-
Apply	90	100
Analyze	-	-
Evaluate	-	-
Create	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Practical Component/Observation
Perception	-
Set	10
Guided Response	40
Mechanism	50
Complex Overt Responses	-
Adaptation	-
Origination	-

**List of Experiments/Activities with CO Mapping**

S. No	Topic	No. of Sessions	COs Mapping
1	Implementation of List ADT using array and structures for simple applications	1	CO1
2	Implementation of Matrix ADT using array and pointers for simple applications	1	
3	Implementation of String Algorithms (eg. string matching) for simple applications	1	
4	Implementation of List ADT using Linked List and its applications	1	CO2
5	Implementation of Stack ADT for simple applications i. Two way stack ii. Stack Applications	1	CO1
6	Implementation of Queue ADT, Queue Applications	1	
7	Implementation of Circular Queue ADT, Circular Queue Applications		
8	Implementation of List ADT using Doubly Linked List, Applications	1	CO2
9	Implementation of List ADT using Circular linked list, Applications	1	
10	Implementation of Binary Search Tree ADT	1	CO3
11	Implementation of Binary Heap ADT	1	
12	Implementation of Hashing techniques	1	CO4
13	Performance analysis of searching and sorting algorithms	1	CO5
14	Mini-project Implementation and review		CO6
<b>Total Sessions</b>		<b>12</b>	

**Learning Resources**

1. GeeksforGeeks - [www.geeksforgeeks.org](http://www.geeksforgeeks.org)
2. HackerRank - [www.hackerrank.com](http://www.hackerrank.com)

**Course Designers:**

1. A.M. Abirami [abiramiam.@tce.edu](mailto:abiramiam.@tce.edu)
2. E. Ramanujam [erit@tce.edu](mailto:erit@tce.edu)

18ES390	DESIGN THINKING	Category	L	T	P	Credit
		ES	1	-	2	2

### Preamble

Design has been defined as a “systematic, intelligent process in which designers generate, evaluate, and specify concepts for devices, systems, or processes whose form and function achieve clients’ objectives or users’ needs while satisfying a specified set of constraints”. Human-centered design is defined as a process and a set of techniques used to create new solutions for the world. Solutions include products, services, environments, organizations, and modes of interaction. The reason this process is called “human-centered” is because it starts with the people we are designing for. This course facilitates the development of students’ professional skills through their team engagement in developing conceptual design for a local community problem.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Identify a specific social need to be addressed	20
CO2	Identify stakeholder’s requirements for the societal project	20
CO3	Develop measurable criteria in which design concepts can be evaluated	10
CO4	Develop prototypes of multiple concepts using user’s feedback	30
CO5	Select the best design solution among the potential solutions with its functional decomposition	20

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1.1, 3.1.2, 3.2.3, 3.2.6, 4.1.2
CO2	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1.2, 2.5.1, 2.5.2, 3.1.2, 3.2.3, 3.2.6, 4.1.2
CO3	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1.3, 3.1.2, 3.2.3, 3.2.6, 4.1.2, 4.3.1
CO4	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1.4, 3.1.2, 3.2.3, 3.2.6, 4.1.2, 4.4.1
CO5	TPS5	Evaluate	Organise	Adaptation	1.1, 1.2, 2.1.5, 3.1.2, 3.2.3, 3.2.6, 4.1.2, 4.4.1

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	-	-	M	M	M	L	M	M	S
CO2	S	M	L	-	-	M	M	M	L	M	M	S
CO3	S	M	L	-	-	M	M	M	L	M	M	S
CO4	S	M	L	-	M	M	M	M	L	M	M	S
CO5	S	S	M	L	M	M	M	M	L	M	M	S

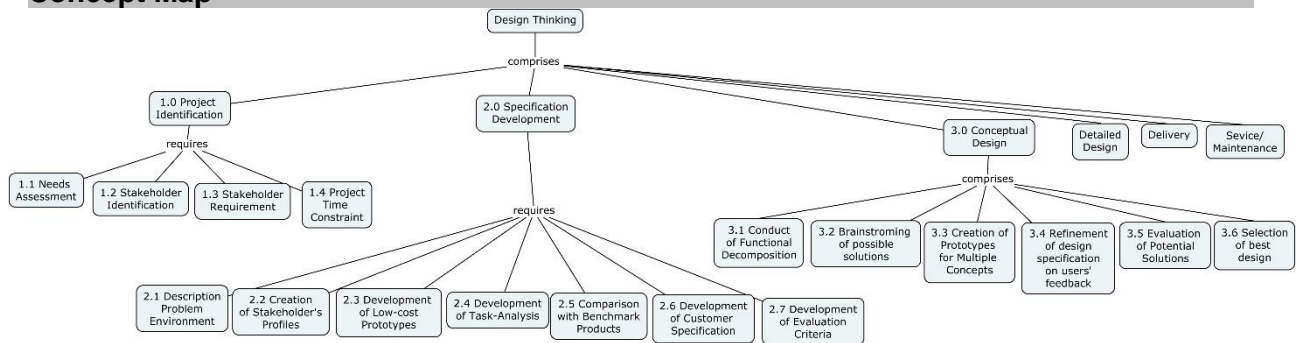
S- Strong; M-Medium; L-Low

## Assessment Pattern: Cognitive Domain

Phases	Deliverables	Marks	Course Outcomes
<b>Continuous Assessment</b>			
Review 1 – Problem Identification	Technical Report	10	CO1 and CO2
Review 2 – Specification Development	Technical Report	20	CO3
Review 3 -Conceptual Design	Technical Report	20	CO4 and CO5
<b>End-Semester Examination</b>			
Demonstration	Prototype	60	CO1, CO2, CO3, CO4 and CO5
Poster Presentation	Poster	40	

- Reports are to be submitted at each review. The report and presentation will be evaluated based on Rubrics
- Demonstration and Poster presentation will be evaluated by two faculty members nominated by their respective Head of the Department.

## Concept Map



## Syllabus

**1.0 Project Identification:** Needs Assessment, Stakeholder Identification, Stakeholder Requirement Project Time Constraint.

**2.0 Specification Development:** Description Problem Environment, Creation of Stakeholder's Profiles Development of Low-cost Prototypes, Development of Task-Analysis, Comparison with Benchmark Products, Development of Customer Specification, Development of Evaluation Criteria,

**3.0 Conceptual Design:** Conduct of Functional Decomposition, Brainstroming of possible solutions, Creation of Prototypes for Multiple Concepts, Refinement of Design Specification on users' feedback, Evaluation of Potential Solutions, Selection of best design

## Learning Resources

1. Learning Material prepared by TCE faculty members
2. <https://www.ideo.com/>
3. <https://engineering.purdue.edu/EPICS>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours		Course Outcome
		In-Class	Hands-on	
1.	<b>Project Identification:</b> Introduction to Human-Centered Design	1	-	CO1
1.1	Needs Assessment	1	2	CO1
1.2	Identification of Stakeholders	1	2	CO2
1.3	Identification of Stakeholder Requirements		2	CO2
1.4	Project Time Constraint	1	2	CO2
2.	<b>Specification Development</b>			
2.1	Description Problem Environment	1	2	CO3
2.2	Creation of Stakeholder's Profiles		2	CO3
2.3	Development of Low-cost Prototypes	1	2	CO3
2.4	Development of Task-Analysis	1	2	CO3
2.5	Comparison with Benchmark Products	1	2	CO3
2.6	Development of Customer Specification		2	CO3
2.7	Development of Evaluation Criteria	1	2	CO3
3.	<b>Conceptual Design</b>			
3.1	Conduct of Functional Decomposition	1	2	CO4
3.2	Brainstroming of possible solutions	1	2	CO5
3.3	Creation of Prototypes for Multiple Concepts	1	2	CO5
3.4	Refinement of design Specification on users' feedback		2	CO6
3.5	Evaluation of Potential Solutions	1	2	CO6
3.6	Selection of best design		2	CO6
	Total	12	34	

### Course Designers:

1. Dr.S.J.Thiruvengadam      sjtece@tce.edu
2. Dr.S.Saravana Perumaal      sspmech@tce.edu

**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.TECH. INFORMATION TECHNOLOGY DEGREE PROGRAMME**

**FOURTH SEMESTER**

**FOR THE STUDENTS ADMITTED IN THE  
ACADEMIC YEAR 2021-19 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A GOVERNMENT AIDED ISO 9001:2008 CERTIFIED  
AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)  
**MADURAI – 625 015, TAMILNADU**

PHONE: 0452 – 2482240, 41  
FAX: 0452 2483427  
WEB: [WWW.TCE.EDU](http://WWW.TCE.EDU)



**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**COURSES OF STUDY**  
 (For the candidates admitted from 2021)

**FOURTH SEMESTER**

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
<b>THEORY</b>						
21ITR10	Probability and Statistics	BS	3	-	-	3
21IT420	Algorithm Design Principles	PC	3	-	-	3
21IT430	Computer Networks	PC	3	-	-	3
21IT440	Database Management Systems	PC	3	-	-	3
21IT490	Project Management	HSS	3	-	-	3
21YYFX0	Foundation Elective I	FE	3	-	-	3
<b>THEORY CUM PRACTICAL</b>						
21EG460	Professional Communication	HSS	-	1	2	2
<b>PRACTICAL</b>						
21IT470	Computer Networks Lab.	PC	-	-	2	1
21IT480	Database Management Systems Lab	PC	-	-	2	1
<b>AUDIT COURSE</b>						
21CHAB0	Constitution of India	AC	1	-	-	-
<b>Total</b>			<b>19</b>	<b>1</b>	<b>6</b>	<b>22</b>

BS : Basic Science  
 HSS : Humanities and Social Science  
 ES : Engineering Science  
 PC : Program Core  
 PE : Program Elective  
 GE : General Elective

L : Lecture  
 T : Tutorial  
 P : Practical

**Note:**

1 Hour Lecture is equivalent to 1 credit  
 1 Hour Tutorial is equivalent to 1 credit  
 2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**Scheme of Examinations**  
(For the candidates admitted from 2021-19 onwards)

**FOURTH SEMESTER**

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
<b>THEORY</b>								
1	21ITR10	Probability and Statistics	3	40	60	100	27	50
2	21IT420	Algorithm Design Principles	3	40	60	100	27	50
3	21IT430	Computer Networks	3	40	60	100	27	50
4	21IT440	Database Management Systems	3	40	60	100	27	50
5	21IT490	Project Management	3	40	60	100	27	50
6	21YYFX0	Foundation Elective I	3	40	60	100	27	50
<b>THEORY CUM PRACTICAL</b>								
7	21EG460	Professional Communication	3	100			100	50
<b>PRACTICAL</b>								
8	21IT470	Computer Networks Lab.	3	60	40	100	18	50
9	21IT480	Database Management	3	60	40	100	18	50
<b>AUDIT COURSES</b>								

\* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

\*\* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

21ITR10	<b>PROBABILITY AND STATISTICS</b>	Category	L	T	P	Credit
		BS	3	0	0	3

### Preamble

The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modelling, climate prediction and computer networks etc.

Statistical methods are important tools which provide the engineers with both descriptive and analytical methods for dealing with the variability in observed data. It introduces students to cognitive learning in statistics and develops skills on analyzing the data by using different tests and designing the experiments with several factors.

### Prerequisite

Higher secondary level -probability theory.

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	<b>Understand</b> and interpret mathematical expectation, conditional probability and probability mass/density functions.	10
CO2	<b>Apply</b> the basic rules and theorems of probability theory to determine probabilities that help to solve engineering problems.	20
CO3	<b>Compute</b> and interpret the correlation and regression coefficients that arise in engineering problems	20
CO4	<b>Identify</b> the scopes of sampling theory in engineering problems	10
CO5	<b>Apply</b> the concepts of large/small sample tests into real life problems.	20
CO6	<b>Identify</b> the appropriate non parametric hypothesis testing procedure based on type of outcome variable and number of samples	20

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	-	1.1.1, 2.1.1
CO2	TPS3	Apply	Value	-	1.1.1, 2.1.1, 2.1.5
CO3	TPS3	Apply	Value	-	1.1.1, 1.2, 2.1.1, 2.1.5
CO4	TPS2	Understand	Respond	-	1.1.1, 2.1.1
CO5	TPS3	Apply	Value	-	1.1.1, 1.2, 2.1.1, 2.1.5
CO6	TPS3	Apply	Value	-	1.1.1, 1.2, 2.1.1, 2.1.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	-	-	-	-	M	-	-	M			S
CO2	S	S	S	S	-	-	-	-	M	-	-	M			S
CO3	S	S	S	S	-	-	-	-	-	-	-	M			S
CO4	S	S	S	S	-	-	-	-	-	-	-	M			S
CO5	S	S	S	S	-	-	-	-	-	-	-	M			S
CO6	S	S	S	S	-	-	-	-	-	-	-	M			S

S- Strong; M-Medium; L-Low

### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continous Assessment Tests		Assignment		Terminal Examinations
	1	2	1	2	
Remember	10	10	-	-	-
Understand	30	30	-	-	30
Apply	60	60	100	100	70
Analyse					
Evaluate					
Create					

### Sample Questions for Course Outcome Assessment\*\*

#### Course Outcome 1(CO1):

1. An individual has 3 different email accounts. Most of her messages, in fact 70%, come into account #1, whereas 20% come into account #2 and the remaining 10% into account #3. Of the messages into account #1, only 1% are spam, whereas the corresponding percentages for accounts #2 and #3 are 2% and 5%, respectively. What is the probability that a randomly selected message is spam?

2. A store carries flash drives with either 1 GB, 2 GB, 4 GB, 8 GB, or 16 GB of memory. The accompanying table gives the distribution of  $Y$  = the amount of memory in a purchased drive:

$y$	1	2	4	8	16
$p(y)$	.05	.10	.35	.40	.10

Determine the Cumulative Distribution function  $F(y)$ .

#### Course Outcome 2(CO2):

1. A particular telephone number is used to receive both voice calls and fax messages. Suppose that 25% of the incoming calls involve fax messages, and consider a sample of 25 incoming calls. What is the probability that

- At most 6 of the calls involve a fax message?
- Exactly 6 of the calls involve a fax message?
- At least 6 of the calls involve a fax message?
- More than 6 of the calls involve a fax message?

2. A soft-drink machine is regulated so that it discharges an average of 200 milliliters per cup. If the amount of drink is normally distributed with a standard deviation equal to 15 milliliters,

- (a) what fraction of the cups will contain more than 224 milliliters?
- (b) what is the probability that a cup contains between 191 and 209 milliliters?
- (c) how many cups will probably overflow if 230-milliliter cups are used for the next 1000 drinks?
- (d) below what value do we get the smallest 25% of the drinks?

**Course Outcome 3(CO3):**

1. Suppose we have a linear equation through the origin. Estimate the regression line passing through the origin for the following data.

<i>x</i>	0.5	1.5	3.2	4.2	5.1	6.5
<i>y</i>	1.3	3.4	6.7	8.0	10.0	13.2

Suppose it is not known whether the true regression should pass through the origin. Estimate the regression line.

2. A study was done on a diesel-powered light-duty pickup truck to see if humidity, air temperature, and barometric pressure influence emission of nitrous oxide (in ppm). Emission measurements were taken at different times, with varying experimental conditions. The data are given in Table 12.2. The model is  $y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \epsilon_i, i = 1, 2, \dots, 20$ . Fit this multiple linear regression model to the given data and then estimate the amount of nitrous oxide emitted for the conditions where humidity is 50%, temperature is 76°F, and barometric pressure is 29.30.

Nitrous Oxide, <i>y</i>	Humidity, <i>x</i> <sub>1</sub>	Temp., <i>x</i> <sub>2</sub>	Pressure, <i>x</i> <sub>3</sub>	Nitrous Oxide, <i>y</i>	Humidity, <i>x</i> <sub>1</sub>	Temp., <i>x</i> <sub>2</sub>	Pressure, <i>x</i> <sub>3</sub>
0.90	72.4	76.3	29.18	1.07	23.2	76.8	29.38
0.91	41.6	70.3	29.35	0.94	47.4	86.6	29.35
0.96	34.3	77.1	29.24	1.10	31.5	76.9	29.63
0.89	35.1	68.0	29.27	1.10	10.6	86.3	29.56
1.00	10.7	79.0	29.78	1.10	11.2	86.0	29.48
1.10	12.9	67.4	29.39	0.91	73.3	76.3	29.40
1.15	8.3	66.8	29.69	0.87	75.4	77.9	29.28
1.03	20.1	76.9	29.48	0.78	96.6	78.7	29.29
0.77	72.2	77.7	29.09	0.82	107.4	86.8	29.03
1.07	24.0	67.7	29.60	0.95	54.9	70.9	29.37

**Course Outcome 4 (CO4):**

1. Many older homes have electrical systems that use fuses rather than circuit breakers. A manufacturer of 40-amp fuses wants to make sure that the mean amperage at which its fuses burn out is in fact 40. If the mean amperage is lower than 40, customers will complain because the fuses require replacement too often. If the mean amperage is higher than 40, the manufacturer might be liable for damage to an electrical system due to fuse malfunction. To verify the amperage of the fuses, a sample of fuses is to be selected and inspected. If a hypothesis test were to be performed on the resulting data, what null and alternative hypotheses would be of interest to the manufacturer? Describe type I and type II errors in the context of this problem situation.

2. Water samples are taken from water used for cooling as it is being discharged from a power plant into a river. It has been determined that as long as the mean temperature of the discharged water is at most 150°F, there will be no negative effects on the river's ecosystem. To investigate whether the plant is in compliance with regulations that prohibit a mean discharge water temperature above 150°, 50 water samples will be taken at randomly selected times and the temperature of each sample recorded. The resulting data will be used to test the hypotheses that mean temperature is 150° versus mean temperature exceeds 150°. In the context of this situation, describe type I and type II errors. Which type of error would you consider more serious? Explain.

**Course Outcome 5 (CO5):**

1. Lightbulbs of a certain type are advertised as having an average lifetime of 750 hours. The price of these bulbs is very favorable, so a potential customer has decided to go ahead with a purchase arrangement unless it can be conclusively demonstrated that the true average lifetime is smaller than what is advertised. A random sample of 50 bulbs was selected, the lifetime of each bulb determined, and the appropriate hypotheses were tested using Minitab, resulting in the accompanying output.

Variable	N	Mean	StDev	SEMean	Z	P-Value
lifetime	50	738.44	38.20	5.40	-2.14	0.016

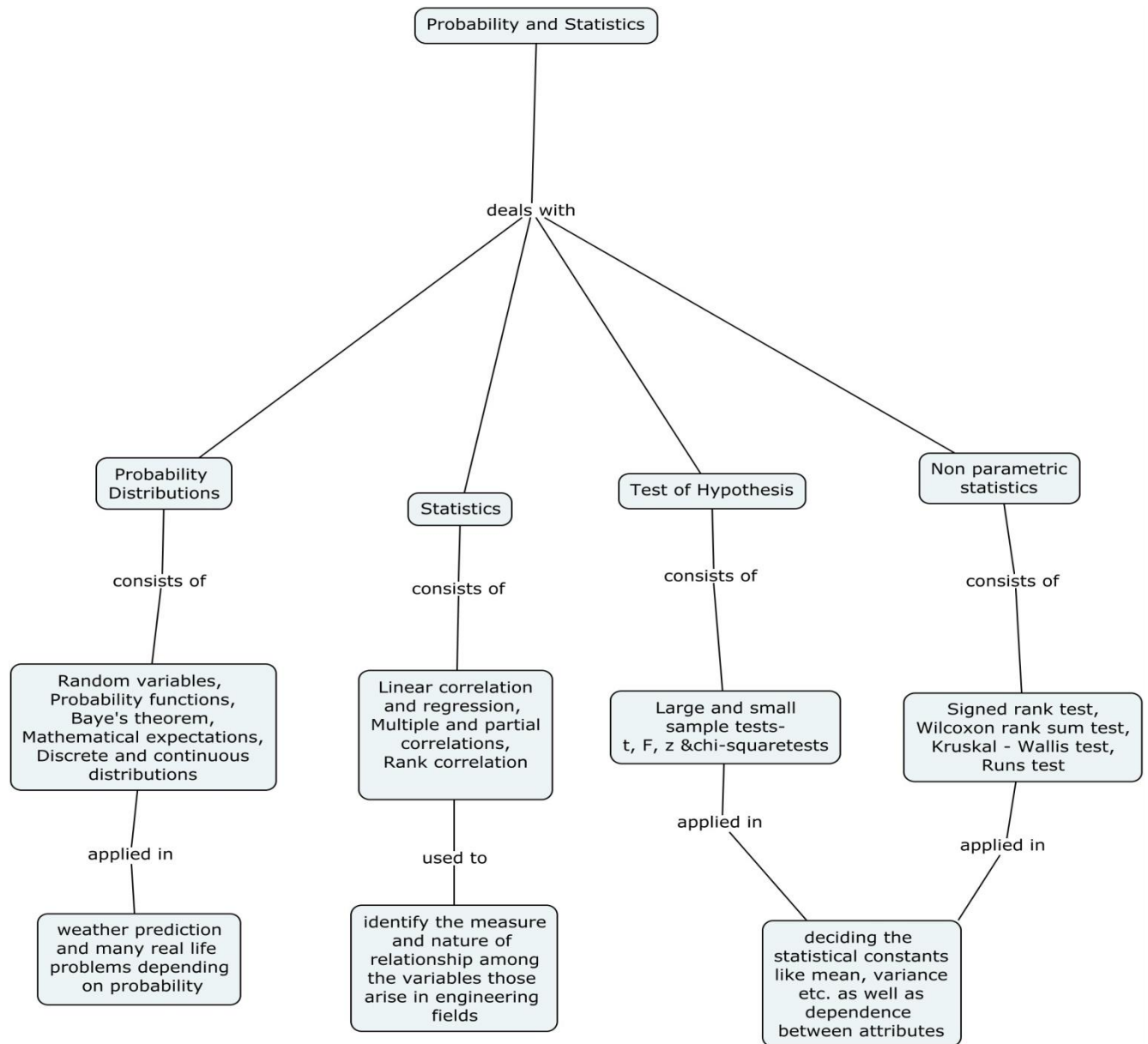
What conclusion would be appropriate for a significance level of .05? A significance level of .01? What significance level and conclusion would you recommend?

2. A random sample of 150 recent donations at a certain blood bank reveals that 82 were type A blood. Does this suggest that the actual percentage of type A donations differs from 40%, the percentage of the population having type A blood? Carry out a test of the appropriate hypotheses using a significance level of .01. Would your conclusion have been different if a significance level of .05 had been used?

**Course Outcome 6(CO6):**

1. A cigarette manufacturer claims that the tar content of brand B cigarettes is lower than that of brand A cigarettes. To test this claim, the following determinations of tar content, in milligrams, were recorded: Brand A 12 9 13 11 14 Brand B 8 10 7 Use the rank-sum test with  $\alpha = 0.05$  to test whether the claim is valid.
2. A machine dispenses acrylic paint thinner into containers. Would you say that the amount of paint thinner being dispensed by this machine varies randomly if the contents of the next 15 containers are measured and found to be 3.6, 3.9, 4.1, 3.6, 3.8, 3.7, 3.4, 4.0, 3.8, 4.1, 3.9, 4.0, 3.8, 4.2, and 4.1 liters? Use a 0.1 level of significance.

## Concept Map



## Syllabus

**PROBABILITY DISTRIBUTIONS** Conditional probability -Bayes' theorem- Random variables - discrete and continuous random variables - mathematical expectation - Probability mass and density functions - discrete distributions: Binomial, Poisson -continuous distributions: uniform, exponential, Weibull and normal

**STATISTICS** Linear correlation and regression-Rank correlation-Multiple and partial correlations-

**TEST OF HYPOTHESIS** Large and small sample tests, Test for (i) Proportion (ii) Mean (iii) Variance and (iv) Difference between two proportions, Means and variances in large and small samples, Tests of normality, Applications of chi-square, 't', 'F' distributions for test of hypothesis

**NON PARAMETRIC STATISTICS** Introduction- Signed rank test - Wilcoxon rank sum test - Kruskal Wallis test - Runs test

**Learning Resources**

1. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning India Pvt Ltd, New Delhi, 2012.
2. Ronald E. Walpole, Sharon L. Myers, Keying Ye, "Probability & Statistics for Engineers and Scientists", 9th Edition, Pearson Education, New Delhi, 2012.
3. Mendenhall William, "Introduction to Probability and Statistics", 14th Edition, Duxbury Press, New Delhi, 2012.
4. John A. Gubner, "Probability and Random Processes for Electrical and Computer Engineers, 1st edition, Cambridge University Press, UK, (1 June 2006)
5. Richard A. Johnson, Irwin Miller, John Freund, "Miller & Freund's Probability and Statistics for Engineers", 8th Edition, Pearson, 2015

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
<b>1.</b>	<b>PROBABILITY DISTRIBUTIONS</b>		
1.1	Conditional probability -Bayes' theorem	1	CO1
1.2	Random variables - discrete and continuous random variables	1	CO1
1.3.	mathematical expectation - Probability mass and density functions	2	CO1
1.4	discrete distributions: Binomial, Poisson	2	CO2
1.5	continuous distributions: uniform, exponential,	2	CO2
1.6	Weibull and normal distributions	2	CO2
<b>2.</b>	<b>STATISTICS</b>		
2.1	Linear correlation and regression	2	CO3
2.2	Rank correlation	2	CO3
2.3	Multiple correlation	2	CO3
2.4	Partial correlation	2	CO3
<b>3.</b>	<b>TEST OF HYPOTHESIS</b>		
3.1	Introduction to sampling theory	1	CO4
3.2	Large sample tests, Test for (i)Proportion (ii) Mean and (iii) Difference between two proportions and means	3	CO5
3.3	Small sample tests for mean, variance and Difference between means	3	CO5
3.4	Chi-square tests and applications of it	3	CO5
<b>4.</b>	<b>NON - PARAMETRIC STATISTICS</b>		
4.1	Introduction	1	CO6
4.2	Signed rank test	2	CO6
4.3	Wilcoxon rank sum test	2	CO6
4.4	Kruskal - Wallis test	2	CO6
4.5	Runs test	1	CO6
	Total Lecture Hours	36	

**Course Designers:**

1. Dr.M. Kameswari      mkmat@tce.edu
2. Dr.T. Lakshmi      tlakshmimdu@tce.edu
3. Mr.AR. Murugan      armmat@tce.edu



21IT420	Algorithm Design Principles	Category	L	T	P	Credit
		PC	3	-	-	3

### Preamble

This course aims at explaining how to identify, formulate and solve real world engineering problems that require usage of algorithms with emphasis on design and analysis based on asymptotic notations. Upon completion of this course, they will be able to constructing efficient algorithms for solving engineering problems by using various algorithm design paradigms and data structures.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Analyze the best case, worst case and average case running time of algorithms using Asymptotic notation.	11
CO2	Identify the appropriateness of brute force approach for the problems like sorting, searching etc.	11
CO3	Develop algorithms to solve computational problems using design paradigms like divide and conquer, greedy and dynamic programming.	42
CO4	Construct algorithms using design paradigms like Backtracking and branch and bound for a given problem.	17
CO5	Make use of the complexity classes like NP-Complete, NP-hard and develop polynomial reductions for the real world problems	11
CO6	Examine the appropriate design scenario and algorithmic design paradigms based on the application requirements.	8

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS4	Analyse	Organise	Complex Overt Responses	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.4.1, 4.5.1, 4.5.3, 4.5.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.3.1, 2.3.2
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO5	TPS4	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO6	TPS3	Analyse	Organise	Complex Overt Responses	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.4.1, 4.5.1, 4.5.3, 4.5.5

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	S	M	L								L	S		L
CO2	S	M	L									L	M		L
CO3	S	M	L									L	M		L
CO4	S	M	L					L	L	L	L	L	M		L
CO5	S	M	L					L	L	L	L	L	M		L
CO6	S	S	M	L	L			M	M	M	L	L	S	L	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination (100) - Retained the previous values
	1	2	1	2	
Remember	10	10	0	0	10
Understand	20	20	0	0	20
Apply	40	50	40	60	50
Analyse	30	20	60	40	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	
Guided Response	10
Mechanism	60
Complex Overt Responses	30
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\***

\*\* (2 to 3 at the cognitive level of course outcome)

**Course Outcome1(CO1):**

1. Illustrate the fundamental steps for analyzing the given problem in detail.
2. Evaluate  $1+2+3+\dots+n$ . Find out the basic operation and its efficiency.
3. Analyze the Selection sort in best, worst and average cases.
4. Apply the step-counting to compute the time-complexity of the given code snippet:

```

For ( j=2; j<n-1; j++)
{
    If mod(n,j)==0;
    Then output n is a prime;
}

```

```

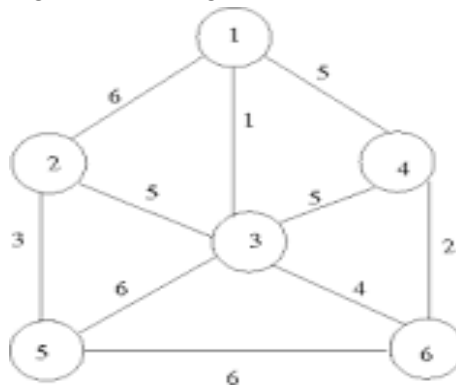
Else
    Output n is not a prime;
}
    
```

**Course Outcome2(CO2):**

1. Illustrate the fundamental steps for analyzing the given problem in detail.
2. Discuss in detail the empirical framework of analysis.
3. Analyze the Brute force approach for selection sort, Bubble sort and String Matching algorithms.

**Course Outcome3(CO3):**

1. Explain in detail the prim’s algorithm for a given example



2. Build the Huffman tree construction for the given scenario. Consider the five-character alphabet {A,B,C,D,\_} with the following occurrence probabilities

Character	A	B	C	D	_
Probability	0.35	0.1	0.2	0.2	0.15

3. Apply the working principle of Kruskal’s algorithm for constructing a minimum spanning tree for the above example and compute its complexity

**Course Outcome 4 (CO4):**

1. Solve the following instance of the knapsack problem by the branch-and-bound algorithm (Capacity of knapsack = 16)

Item	Weight	Value
<b>1</b>	10	\$100
<b>2</b>	7	\$63
<b>3</b>	8	\$56
<b>4</b>	4	\$12

2. Solve n-queens problem using appropriate algorithm design paradigms.
3. Find the solution for assignment problem using branch and bound technique

**Course Outcome 5 (CO5):**

1. Interpret the m-coloring graph from 3-SAT using NP-hard analysis.
2. Let X be an NPComplete problem. Consider a decision problem  $Z \in NP$  such that  $X \leq Z$ . Then defend that Z is also NPComplete

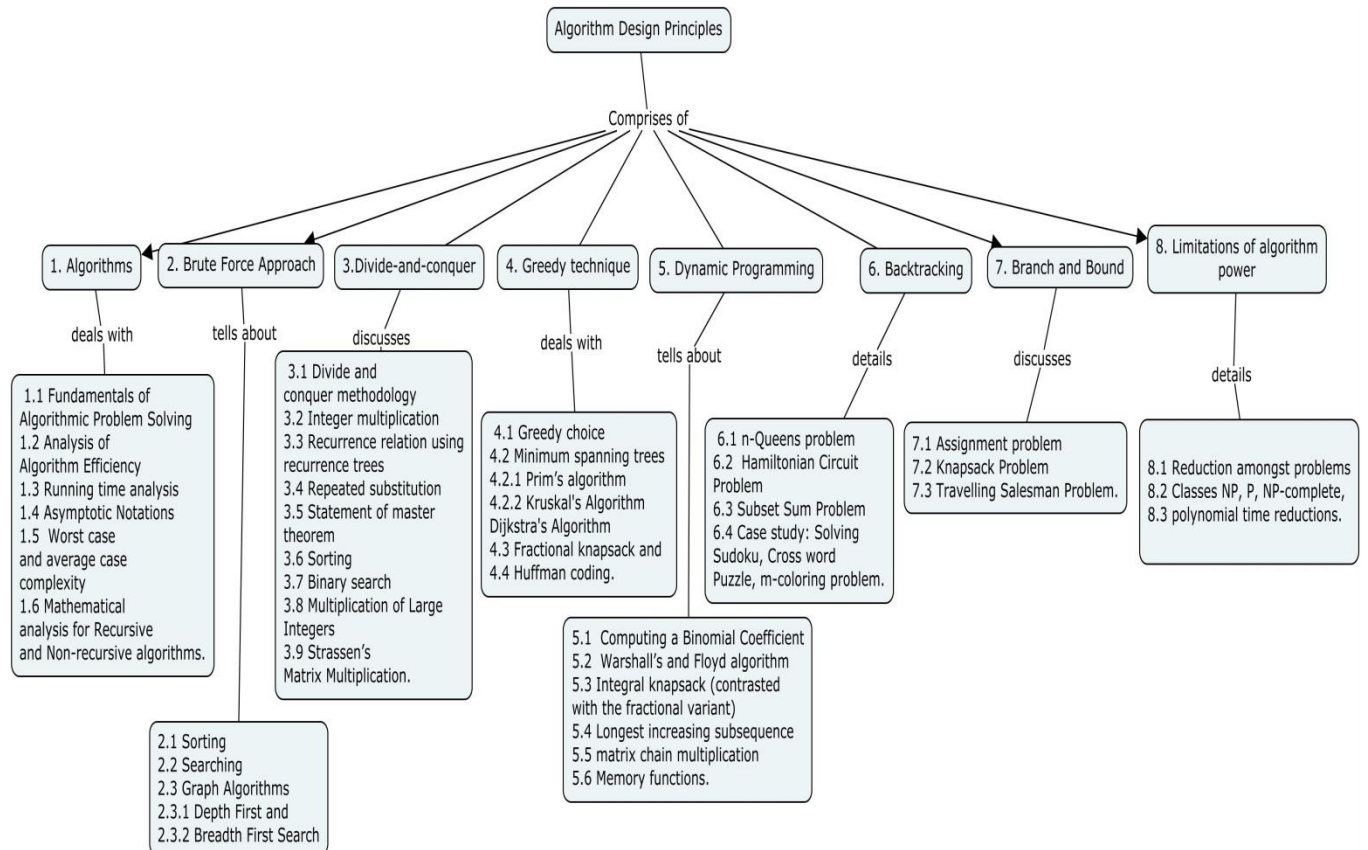
3. Let HAMD denote the problem of deciding whether a graph  $G = \langle N, A \rangle$  is Hamiltonian and let TSPD denote the problem of deciding whether or not there is a tour in the graph  $G$  that begins and ends at the same node; after having visited each of the other nodes exactly once and whose total cost does not exceed a given bound  $L$ . Translate a HAMD problem instance into a TSPD problem instance.

#### Course Outcome6(CO6):

**Extensive analysis on algorithms is done through assignments/Mini Project is a principal activity of this course. It is assessed using standard rubrics. These assignments will focus on developing skills that are immediately transferrable to building real-world systems. Some of the mini project problems are listed below [but not limited to]:**

1. Banks often record transactions on an account in order of the times of the transactions, but many people like to receive their bank statements with checks listed in order by check number. People usually write checks in order by check number, and merchants usually cash them with reasonable dispatch. The problem of converting time-of-transaction ordering to check -number ordering is therefore the problem of sorting almost -sorted input. Analyze whether the procedure Insertion- sort would tend to beat the procedure Quick – sort on this problem.
2. We have a set of  $n$  jobs to execute, each of which takes unit time. At any time  $T = 1, 2, \dots$  we can execute exactly one job. Job  $i$  earns us a profit  $g_i > 0$  if and only if it is executed no later than time  $d_i$ . Solve this scheduling problem and by identifying appropriate design paradigms.
3. A Jeroo starts at  $(0, 0)$  facing East with no flowers in its pouch. There is a flower at location  $(3, 0)$ . Write a program that directs the Jeroo to pick the flower and plant it at location  $(3, 2)$ . After planting the flower, the Jeroo should hop one space East and stop. There are no other nets, flowers, or Jeroos on the island.

## Concept Map



## Syllabus

**Algorithms:** Fundamentals of Algorithmic Problem Solving – Analysis of Algorithm Efficiency – Running time analysis - Asymptotic Notations - Worst case and average case complexity - Mathematical analysis for Recursive and Non-recursive algorithms.

**Bruteforce Approach:** Sorting – Searching - Graph Algorithms: Depth First and Breadth First Search

**Divide-and-conquer:** Divide and conquer methodology - Integer multiplication - Recurrence relation using recurrence trees - repeated substitution - statement of master theorem – Sorting– Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication.

**Greedy technique:** Greedy choice - minimum spanning trees - Prim's algorithm- Kruskal's Algorithm-Dijkstra's Algorithm- fractional knapsack and Huffman coding.

**Dynamic programming:** Computing a Binomial Coefficient – Warshall's and Floyd algorithm – Integral knapsack (contrasted with the fractional variant) - longest increasing subsequence - matrix chain multiplication- Memory functions.

**Backtracking:** n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem - Case study: Solving Sudoku, Cross word Puzzle, m-coloring problem.

**Branch and bound:** Assignment problem – Knapsack Problem – Travelling Salesman Problem.

**Limitations of algorithm power:** NP-completeness: reduction amongst problems, classes NP, P, NP-complete, and polynomial time reductions.

### **Learning Resources**

1. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition, 2012.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI Learning Private Limited, Third Edition, 2012.
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
4. Design And Analysis of Algorithms -<http://nptel.ac.in/courses/106101060/>
5. Design And Analysis of Algorithms -<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/>

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Algorithms (5)</b>		
1.1	Fundamentals of Algorithmic Problem Solving	1	CO1
1.2	Analysis of Algorithm Efficiency – Running time analysis	2	CO1,CO6
1.3	Asymptotic Notations - Worst case and average case complexity	1	CO1
1.4	Mathematical analysis for Recursive and Non-recursive algorithms	1	CO1
<b>2</b>	<b>Brute Force Approach(4)</b>		
2.1	Sorting	2	CO2
2.2	Searching		
2.3	Breadth First Search	1	
2.4	Depth First Search	1	
<b>3</b>	<b>Divide-and-conquer (6)</b>		
3.1	Recurrence relation using recurrence trees - repeated substitution	1	CO3
3.2	Master theorem	1	
3.3	Merge sort - Quick sort	1	
3.4	Binary search	1	
3.5	Multiplication of Large Integers	2	
3.6	Strassen's Matrix Multiplication.		
<b>4</b>	<b>Greedy technique(4)</b>		
4.1	Greedy choice	2	
4.2	Minimum spanning trees - Prim's algorithm, Kruskal's Algorithm		
4.3	Dijkstra's Algorithm	1	
4.4	Fractional knapsack and Huffman coding	1	
<b>5</b>	<b>Dynamic programming(6)</b>		
5.1	Computing a Binomial Coefficient	1	
5.2	Warshall's and Floyd algorithm	1	
5.3	Integral knapsack (contrasted with the fractional variant)	1	
5.4	Longest increasing subsequence	1	
5.5	Matrix chain multiplication, Memory functions	1	
	Case study on Greedy and Dynamic programming techniques	1	CO6
<b>6</b>	<b>Backtracking (4)</b>		
6.1	n-Queens problem	1	CO4
6.2	Hamiltonian Circuit Problem	1	
6.3	Subset Sum Problem	1	
6.4	Case study: Solving Sudoku, Cross word Puzzle, m-colouring problem	1	CO6

<b>7</b>	<b>Branch and bound (3)</b>		
7.1	Assignment problem	1	
7.2	Knapsack Problem	1	
7.3	Travelling Salesman Problem	1	
<b>8</b>	<b>Limitations of algorithm power (4)</b>		
8.1	NP-completeness: reduction amongst problems	1	CO5
8.2	Classes NP, P, NP-complete	2	
8.3	Polynomial time reductions	1	
	Total Lecture hours	36	

**Course Designers:**

1. Dr.S.Padmavathi    spmcse@tce.edu
2. Mrs.T.Manju        tmanju@tce.edu



21IT430	COMPUTER NETWORKS	Category	L	T	P	Credit
		PC	3	0	0	3

### Preamble

This course will help the students to gain knowledge in Networking concepts, Models, technologies and protocols. This course further provides introduction to Socket Programming, Network Simulation and packet analysis.

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Describe various Network components, topologies, reference models and technologies	20
CO2	Experiment Flow control, Error control and Access control techniques at layer 2	30
CO3	Apply Subnetting and routing mechanisms for a given network	30
CO4	Explain the working principle of End-to-End and application layer protocols	10
CO5	Compare the needs and implementation architectures of peer to peer, Client server and Cloud Networks	5
CO6	Examine the Performance metrics of a specific Network traffic using tools such as Wireshark	5

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2, 2.3.1
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.5, 2.2.2, 2.3.1, 2.3.4
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.5, 2.3.1
CO4	TPS2	Understand	Respond	Guided Response	1.2, 2.1.5, 2.3.1
CO5	TPS2	Understand	Respond	Guided Response	1.2, 2.2.2, 2.3.1
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.1.5, 2.2.3, 2.3.4, 3.1.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L								L			L		
CO2	S	M	L							L			M		
CO3	S	M	L							L			M		
CO4	M	L								L			L		
CO5	M	L								L			L		
CO6	S	M	L	L	S			L	L	L		L	S	M	L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

21IT430 Computer Networks						
Cognitive Levels	Continuous Assessment Tests			Assignment		Terminal Examination
		1	2	1	2	
Remember	20	10				10
Understand	20	30	20	20		30
Apply	60	60	80	80		60
Analyse	0	0	0	0		0
Evaluate	0	0	0	0		0
Create	0	0	0	0		0

CO6 may also be evaluated using practical exercises/assignments/mini-project.

Assignments may include exercises such as

- capturing network traffic using Wireshark
- inspecting the packet capture details
- Filtering packets using precise filter such as hostnames and protocols
- Capturing and inspecting streams
- Sniffing passwords

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	0
Set	20
Guided Response	60
Mechanism	20
Complex Overt Responses	0
Adaptation	0
Origination	0

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1(CO1):**

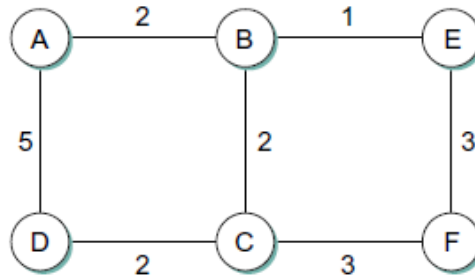
1. Mention the physical devices operating at various layers of TCP/IP protocol Suite.
2. Distinguish between LAN and WAN.
3. Recall the functionalities of all layers in OSI architecture

**Course Outcome 2(CO2):**

1. Explain the scheme prescribed in Ethernet for collision Detection
2. Suppose we want to transmit the message 11001001 and protect it from errors using the CRC polynomial  $x^3 + 1$ . Use polynomial long division to determine the message that should be transmitted
3. Draw a timeline diagram for the sliding window algorithm with SWS = RWS = 3 frames, for the following two situations. Use a timeout interval of about  $2 \times \text{RTT}$ .
  - (i) Frame 4 is lost.
  - (ii) Frames 4 to 6 are lost

**Course Outcome 3(CO3):**

1. For the network given in below demonstrate how the link-state algorithm builds routing table for node D.



2. An ISP is granted a block of addresses starting with 120.60.4.0/22. The ISP wants to distribute these blocks to 100 organizations with each organization receiving just eight addresses. Design the subblocks and give the slash notation for each subblock. Find out how many addresses are still available after these allocations.
3. Distinguish Classful Addressing and Classless Addressing

**Course Outcome 4 (CO4):**

1. Explain how the Network layer and Transport layer complements each other's functionalities. And bring out the dependencies between the two
2. Demonstrate a congestion avoidance technique based on queue length monitoring
3. Compare various email protocols like SMTP, IMAP and POP and Outline When it is appropriate each

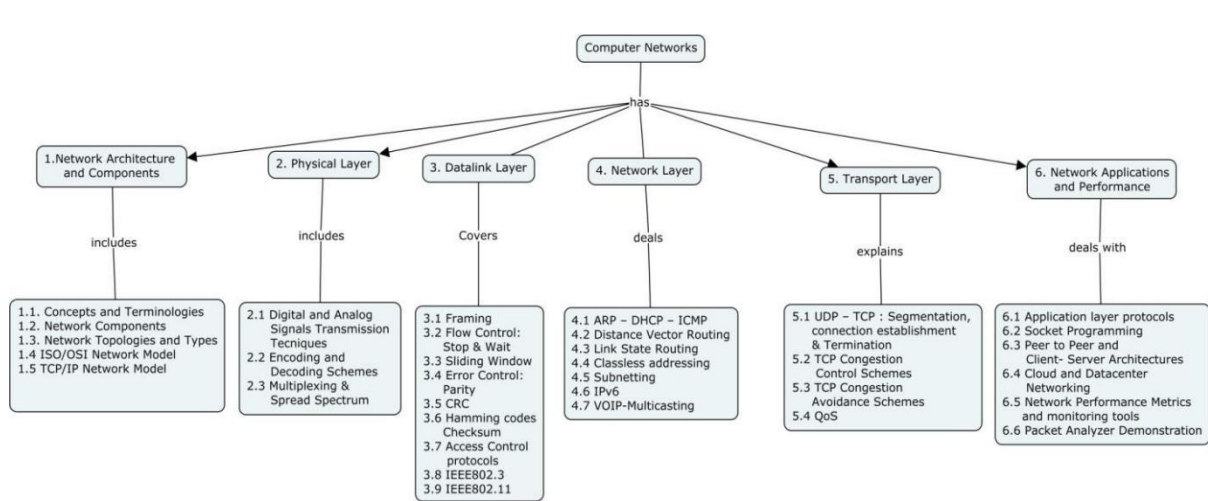
**Course Outcome 5 (CO5):**

1. Distinguish between Peer-to-peer and Client-Server application architectures
2. Illustrate the Network architecture for cloud
3. Describe Network virtualization

**Course Outcome 6(CO6):**

1. Write the procedure to perform password sniffing using Wireshark.
2. Enlist any four tools used for Network monitoring and network management.
3. Demonstrate the necessary steps to capture traffic directed to a specific host using wireshark

**Concept Map**



**Syllabus**

**Network Architecture and Components** – Terminologies-components: NIC, Switches, Routers, Bridges, Hub -Topologies-ISO/OSI Architecture – Internet Architecture

**Physical Layer** – Digital and Analog Signals, Encoding and Decoding, Analog and Digital data Transmission techniques , Multiplexing, Spread spectrum

**Datalink Layer** – Framing- Flow Control : Stop and Wait, Sliding Window – Error Control : Parity, Hamming codes, CRC, Access Control : ALOHA, CSMA, CSMA-CD, CSMA-CA, Reservation, Polling – IEEE 802.3 – IEEE 802.11

**Internetworking** – IPv4 – Global Addresses – ARP – DHCP – ICMP – Routing – Intra domain Routing algorithms (RIP, OSPF) – Subnetting – Classless Addressing – Interdomain routing – Ipv6 – Multicasting – VoIP

**Transport Layer** – UDP – TCP : Segmentation, connection establishment & Termination, Congestion control – Congestion Avoidance - QoS

**Network Performance and Applications** – HTTP,WWW, SMTP, IMAP,POP,DNS, FTP – Sockets – Peer to Peer and Client- Server Architectures - Cloud and Datacenter Networking –Network Performance Metrics and Analysis

**Learning Resources**

1. Larry L.Peterson and Bruce S. Davie, “Computer Networks – A systems Approach” Fifth Edition, Elsevier, 2011
2. BehrouzA.Foruzan, “Data Communication and Networking”, McGraw Hill Education, Fifth Edition, 2017
3. NPTEL Course on Computer Networks by IIT-Kharagpur - <http://nptel.ac.in/video.php?subjectId=106105081>
4. Cisco network fundamentals - <http://ptgmedia.pearsoncmg.com/images/9781587132087/samplepages/1587132087.pdf>

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lecture Hours	COs
1	<b>Network Architecture and Components</b>		
1.1	Network concepts and Terminologies	1	CO1
1.2	Components of Computer Networks	1	CO1

1.3	Network Types and Topologies	1	CO1
1.4	ISO/OSI Reference Model	1	CO1
1.5	TCP/IP Network Model	1	CO1
2	<b>Physical Layer</b>		
2.1	Digital and Analog signals, Transmission Techniques	1	CO1
2.2	Encoding and Decoding Schemes	1	CO1
2.3	Multiplexing and Spread spectrum	1	CO1
3	<b>Datalink Layer</b>		
3.1	Framing	1	CO2
3.2	Flow Control : Stop and Wait	1	CO2
3.3	Sliding Window technique	1	CO2
3.4	Error Control : Parity	1	CO2
3.5	Cyclic Redundancy Check	1	CO2
3.6	Hamming Codes, Checksum	1	CO2
3.7	Access Control Protocols	1	CO2
3.8	IEEE 802.3	1	CO2
3.9	IEEE 802.11	1	CO2
4	<b>Network Layer</b>		
4.1	ARP – DHCP – ICMP	1	CO3
4.2	Distance Vector Routing	1	CO3
4.3	Link State Routing	1	CO3
4.4	Classless addressing	1	CO3
4.5	Subnetting	1	CO3
4.6	IPv6	1	CO3
4.7	VOIP-Multicasting	1	CO3
5	<b>Transport Layer</b>		
5.1	UDP – TCP : Segmentation, connection establishment & Termination	1	CO4
5.2	TCP Congestion Control Schemes	1	CO4
5.3	TCP Congestion avoidance Schemes	1	CO4
5.4	QoS	1	CO4
6	<b>Network Performance and Applications</b>		
6.1	Application layer protocols	2	CO4
6.2	Socket Programming	1	CO5
6.3	Peer to Peer and Client- Server Architectures	1	CO5
6.4	Cloud and Datacenter Networking	2	CO5
6.5	Network Performance Metrics and monitoring tools	1	CO6
6.6	Packet Analyzer Demonstration	1	CO6
	<b>Total Hours</b>	<b>36</b>	

**Course Designers:**

- |    |                          |                    |
|----|--------------------------|--------------------|
| 1. | S.Muthuramalingam        | smrit@tce.edu      |
| 2. | S.Thiruchadaipandeeswari | eshwarimsp@tce.edu |

21IT440	DATABASE MANAGEMENT SYSTEMS	Category	L	T	P	Credit
		PC	3	0	0	3

### Preamble

This course facilitates the student to understand the various functionalities of DBMS and perform many operations related to creating, using and maintaining databases for real world applications and emerging technologies in Databases. It emphasizes the need for design of database systems and provides an in depth coverage of various principles of database systems.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain database architecture and its environment.	14
CO2	Use SQL and PL/SQL to perform various Query operations for a given database designed using different data models.	31
CO3	Design database with appropriate use of normalization techniques	14
CO4	Build database using NoSQL model.	14
CO5	Apply concurrency control and transaction processing techniques for the given scenario.	22
CO6	Explain Temporal and Spatial database.	5

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2,2.3.2,2.3.3
CO2	TPS3	Apply	Value	Mechanism	1.2,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO3	TPS3	Apply	Value	Mechanism	1.2,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO4	TPS3	Apply	Value	Mechanism	1.2,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO5	TPS3	Apply	Value	Mechanism	1.2,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO6	TPS2	Understand	Respond	Guided Response	1.2,2.4.6

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		S			M	M	M		L	M	S	M
CO3	S	M	L										M		
CO4	S	M	L		S			M	M	M		L	M	S	M
CO5	S	M	L									L	M		L
CO6	M	L											L		

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	10			10
Understand	20	30	20	20	40
Apply	60	60	80	80	50
Analyse					0
Evaluate					0
Create					0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	20
Guided Response	40
Mechanism	40
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome1(CO1):**

1. Describe database management systems.
2. State the need of a schema.
3. Recall the structure of a DBMS
4. Define a database model? Give any two types of data models with an example for each.
5. Describe the different components of a database systems environment

**Course Outcome2(CO2):**

1. Write the following queries on the database schema using the relational operators in Relational Algebra. Also show the result of each query as it would apply to the database of relational operations.
  - a. Retrieve the names of all employees in department 5 who work more than 10 hours per week on the ProductXproject.

- b. List the names of all employees who have a dependent with the same first name as themselves.
  - c. Find the names of all employees who are directly supervised by 'Franklin Wong'.
  - d. For each project, list the project name and the total hours per week (by all employees) spent on that project.
2. Consider the following relations: Employee (empID , FirstName, LastName, address, DOB,sex,position,deptNo),Department(dtptNo,deptName,mgr,empID),Project(projNo,projName,deptNo), Work on (empID, projNo, hours worked).
  3. Write the SQL statements for the following:
    - a. List the name and addresses of all employees who work for the IT department.
    - b. List the total hours worked by each employee, arranged in order of department number and within department, alphabetically by employee surname.
    - c. List the total number of employees in each department for those departments with more than 10 employees.
    - d. List the project number, project name and the number of employees who work on that project.
  4. A table Employee with the following fields: EmpNo, Name, Designation, salary are maintained in a computer. Write SQL queries for the following.
    - a. Display the details for all employees.
    - b. Find average salary paid to employees.
    - c. Display the details of all employees whose salary fall in the range of Rs.10,000 and Rs.50,000.
  5. Identify some of the character, number and date functions available in SQL. List the two functions that allow the user to transform column values regardless of the data type.
  6. Illustrate the creation of constraints and their enforcement on views.

### Course Outcome3(CO3):

1. Suppose that we have the following requirements for a university database that is used to keep track of students' transcripts:
  - a. The university keeps track of each student's name (SNAME); student number (SNUM); social security number (SSN); current address (SCADDR) and phone (SCPHONE); permanent address (SPADDR) and phone (SPPHONE); birth date (BDATE); sex (SEX); class (CLASS) (freshman, sophomore, ..., graduate); major department (MAJORCODE); minor department (MINORCODE) (if any); and degree program (PROG) (B.A., B.S., ..., PH.D.). Both SSN and student number have unique values for each student.
  - b. Each department is described by a name (DNAME), department code (DCODE), office number (DOFFICE), office phone (DPHONE), and college (DCOLLEGE). Both name and code have unique values for each department.
  - c. Each course has a course name (CNAME), description (CDESC), course number (CNUM), number of semester hours (CREDIT), level (LEVEL), and offering department (CDEPT). The course number is unique for each course.
  - d. Each section has an instructor (INAME), semester (SEMESTER), year (YEAR), course (SECCOURSE), and section number (SECNUM). The section number distinguishes different sections of the same course that are



taught during the same semester/year; its values are 1, 2, 3, .up to the total number of sections taught during each semester.

- e. A grade record refers to a student (SSN), a particular section, and a grade (GRADE).
2. Prepare a relational database schema for this database application.
3. Then. Specify the key attributes of each relation. Note any unspecified requirements, and make appropriate assumptions to render the specification complete.
4. For the above schema show all the functional dependencies that should hold among the attributes
5. Design relation schemas for the above mentioned database that are each in 3NF or BCNF.

**Course Outcome 4(CO4):**

1. Explain CAP theorem.
2. Use Cypher query language operation MATCH and RETURN clause to retrieve the locations for department number 5 in Employee database.
3. Apply MongoDB CRUD operations for the Student database.

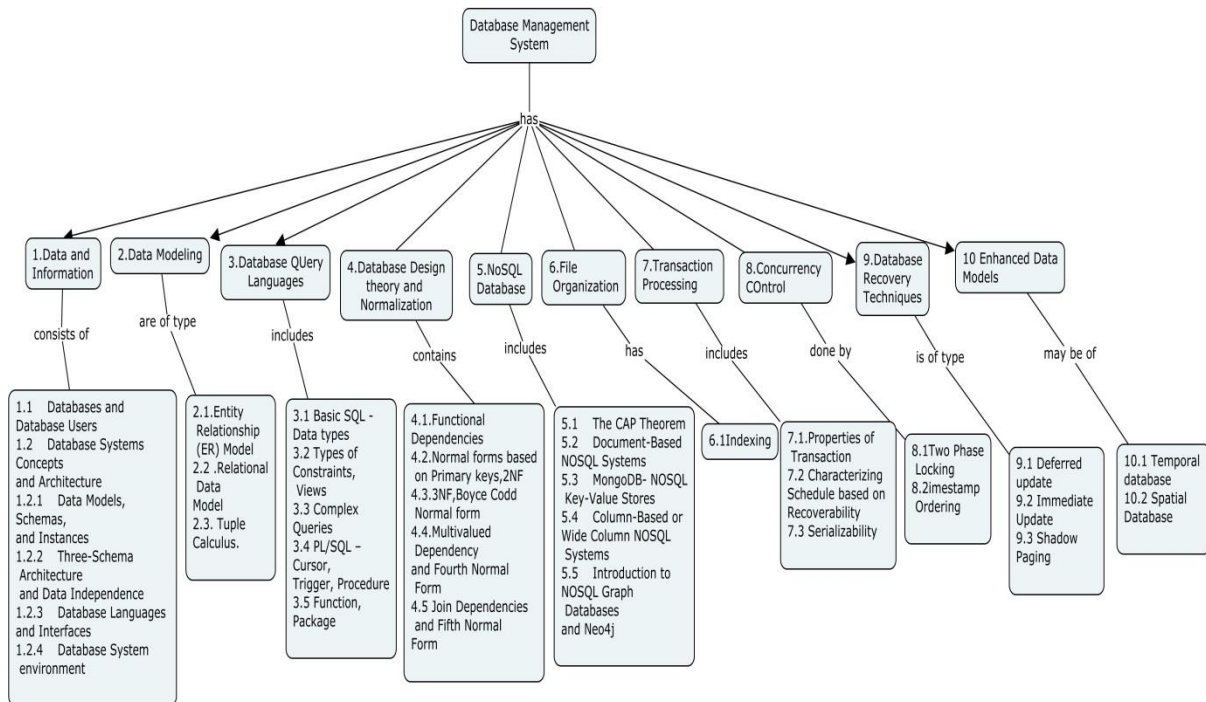
**Course Outcome5(CO5):**

1. Explain Lost update problem with an example.
2. List the different types of Transaction failures.
3. Describe ACID properties.
4. Expalin Serial, Non-serial, and Conflict-Serializable Schedules.

**Course Outcome6(CO6):**

1. Explain Spatial Database.
2. List the different data types in Spatial database.
- 3.Explain Temporal Database with an example.

**Concept Map**



## Syllabus

**Data and Information:** Databases and Database Users. **Database Systems Concepts and Architecture**-Data models, Schemas and Instances, -Three Schema Architecture and Data Independence-Database Languages and Interfaces-Database System environment

**Data Modeling:** Entity Relationship (ER) Model, Relational Data Model -The Relational Algebra and Relational Calculus. Tuple Calculus. **Database query language:** Basic SQL- Data types –Types of Constraints, Views Complex Queries. PL/SQL –Cursor, Trigger, Procedure, Function, Package

**Database Design Theory and Normalization:** Functional Dependencies-Normal forms based on Primary keys-2NF-3NF-Boyce Codd Normal form-Multivalued dependence and Fourth Normal form-Join dependencies and Fifth Normal Form

**NOSQL Database:** The CAP Theorem - Document-Based NOSQL Systems and MongoDB - NOSQL Key-Value Stores- Column-Based or Wide Column NOSQL Systems. Introduction to NOSQL Graph Databases and Neo4j.

**File Organization:** Indexing - B+tree

**Transaction Processing**-Properties of Transaction, Characterizing Schedule based on Recoverability, Serializability. **Concurrency Control** –Two Phase Locking, Timestamp Ordering. **Database Recovery Techniques**-Deferred update, Immediate Update, Shadow Paging.

**Enhanced Data Models** - Introduction to Temporal, Spatial Databases

## Learning Resources

1. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, Seventh Edition, 2016
2. C.J Date, A.Kannan, S.Swamynathan, "An Introduction to database systems", Pearson Education, Eighth Edition, 2006.
3. Abraham Silberschatz, Henry F.Korth and Sudarshan, "Database System Concepts", Tata Mcgraw-Hill, Sixth edition, 2010

4. Raghu Ramakrishnan, Johannes Gehrke, —Database Management SystemsII, McGraw Hill ,Fourth Edition, 2010
5. Pramod J. Sadalage,Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence,Pearson,2013.
6. Web Reference : <http://nptel.ac.in/courses/106106093/> Course Name:Database Design

### Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours	Course Outcomes
<b>1</b>	<b>Data and Information</b>		CO1
1.1	Databases and Database Users	1	
1.2	Database Systems Concepts and Architecture		
1.2.1	Data Models, Schemas, and Instances	1	
1.2.2	Three-Schema Architecture and Data Independence	1	
1.2.3	Database Languages and Interfaces	1	
1.2.4	Database System environment	1	
<b>2</b>	<b>Data Modeling</b>		CO2
2.1	Entity Relationship (ER) Model	1	
2.2	Relational Data Model		
2.2.1	The Relational Algebra and Relational Calculus	2	
2.3.	Tuple Calculus.	1	
<b>3</b>	<b>Database query languages</b>		
3.1	Basic SQL - Data types	1	
3.2	Types of Constraints, Views	1	
3.3	Complex Queries	2	
3.4	PL/SQL –Cursor, Trigger, Procedure	1	
3.5	Function, Package	2	
<b>4</b>	<b>Database Design Theory and Normalization</b>		CO3
4.1	Functional Dependencies	2	
4.2	Normal forms based on Primary keys,2NF		
4.3	3NF,Boyce Codd Normal form	1	
4.4	Multivalued Dependency and Fourth Normal Form	1	
4.5	Join Dependencies and Fifth Normal Form	1	
<b>5</b>	<b>NOSQL database</b>		CO4
5.1	The CAP Theorem	1	
5.2	Document-Based NOSQL Systems	1	
5.3	MongoDB- NOSQL Key-Value Stores	1	
5.4	Column-Based or Wide Column NOSQL Systems	1	
5.5	Introduction to NOSQL Graph Databases and Neo4j	1	
<b>6</b>	<b>File Organization</b>		CO5
6.1	Indexing - B+tree	1	
<b>7</b>	<b>Transaction Processing</b>		
7.1	Properties of Transaction	1	

7.2	Characterizing Schedule based on Recoverability	1	
7.3	Serializability	1	
<b>8</b>	<b>Concurrency Control</b>		
8.1	Two Phase Locking	1	
8.2	Timestamp Ordering		
<b>9</b>	<b>Database Recovery Techniques</b>		
9.1	Deferred update	1	
9.2	Immediate Update	1	
9.3	Shadow Paging	1	
<b>10</b>	<b>Enhanced Data Models</b>		
10.1	Temporal database	1	
10.2	Spatial Database	1	
	<b>Total Hours</b>	<b>36</b>	

**Course Designers:**

- |            |               |
|------------|---------------|
| 1. C.Deisy | cdcse@tce.edu |
| 2. K.V.Uma | kvuit@tce.edu |

21EG460	PROFESSIONAL COMMUNICATION	Category	L	T	P	Credit
		HSS	0	1	2	2

### Preamble

This course helps the students to achieve effective language proficiency for their professional, social and interpersonal communication skills, hence increasing their employability and career skills.

### Prerequisite

Basic English Knowledge

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Listen, watch, understand and respond to talks, conversations, etc by native and neutral speakers on science, general context, and from ETS test samples with confidence.	22%
CO2	Present ideas, express opinions/comments, practice presentation, and converse in discussions on a variety of technical and non-technical domains without fear	39%
CO3	Read and comprehend passages/texts from various topics – general and reasoning, to respond precisely through reading techniques, besides getting awareness on competitive exam lexicon/verbal exercises for career prospects	17%
CO4	Write journal abstracts/projects and business correspondences with clarity, accuracy, intelligibility, and precision.	22%

\*\*\* Weightage depends on Bloom's Level, number of contact hours

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	2.4.2, 2.4.6, 3.2.1, 3.2.2,
CO2	TPS3	Apply	Value	Mechanism	3.1.3, 3.1.2, 3.2.4, 3.2.5, 3.2.6
CO3	TPS2	Understand	Respond	Guided Response	2.4.6, 2.4.5, 3.2.1,
CO4	TPS3	Apply	Value	Mechanism	2.4.3, 3.2.1, 3.2.3, 3.2.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									L	S		M			
CO2									S	S		M			
CO3									M	S		M			
CO4									M	S		M			

S- Strong; M-Medium; L-Low

### Assessment Pattern:

**Internal:** No Continuous Assessment Test(CAT) will be conducted. Students' performance will be continuously assessed in various classroom activities in Listening, Speaking, Reading and Writing for 50 marks as detailed below:

Listening Test	- 10
Speaking Test (Group Discussion and Technical Presentation)	- 20
Written Test(Objective/Descriptive to be tested for 40 marks and converted to 20 marks)-	20

**External (Practical):**

Group Discussion	- 20
Personal Interview / Situational Conversation (BEC speaking based)	- 20
Listening Test	- 20
Reading / Writing – Computerised or Paper-based Test / General Aptitude Test – Objective type	- 40

**List of Experiments/Activities with CO Mapping**

S.No	Activities	Hours		CO Mapping			
		T	P				
1	Listening, Reading and Writing based on Extensive Reading	2		CO1		CO3	CO4
2	Listening exercises at lab - online resources		2	CO1			
3	Developing Listening skills (BEC / IELTS / TOEIC / TOEFL)		2	CO1			
4	GD/Mock interview/Presentation Intro at lab through online		2	CO1			
5	GD Practice at classroom in groups		4	CO1	CO2		
6	Presentation on Technical / general topics – from dailies &	1	4		CO2		
7	Mock interview practice at classroom	1	4	CO1	CO2		
8	Comprehension Descriptive and Reasoning	2	2			CO3	
9	General Aptitude Practice – Vocabulary Development / Sentence completion / Error spotting /Analogy / Reasoning	3	2			CO3	CO4
10	Business Correspondence - BEC Writing Task II	2					CO4
11	Basics of Technical Writing/ Project Reports		2		CO2		
12	Preparation of Resume	1					CO4

**Learning Resources****Reference Books:**

1. Cappel, Annette and Sharp, Wendy, Cambridge English: Objective First, 4<sup>th</sup> Ed., CUP, New Delhi, 2013.
2. Cusack, Barry. Improve Your IELTS Listening and Speaking Skills (With CD) Paperback, Mcmillan, 2007.
3. Bates, Susan TOEFL iBT Exam Paperback – Oxford, 2012.
4. Hart, Guy Brook. Cambridge English Business Benchmark: 2 Ed., CUP 2014

**Websites:**

1. <https://ielts-up.com> (IELTS – LSRW – Practice Tests)
2. [www.cambridgeenglish.org](http://www.cambridgeenglish.org) (BEC - LSRW)
3. [www.etsglobal.org](http://www.etsglobal.org) (TOEIC Preparation)
4. [www.examenglish.com](http://www.examenglish.com) (Online Exams for international ESL Exams)
5. [www.testpreppractice.net](http://www.testpreppractice.net) (GRE Tests -Vocabulary /Analogy / Sentence Completion / Reading)
6. <https://www.freshersworld.com> (Placement Papers)

**Extensive Reading:**

Coelho, Paulo. The Alchemist, Harper Publication, 2018.

**Course Designers:**

1. Dr.A.Tamilselvi , Convenor
2. Dr S.Rajaram
3. Mr.Vinoth.R
4. Dr.G.Jeya Jeevakani
5. Ms.R.Manibala

18IT490	PROJECT MANAGEMENT	Category	L	T	P	Credit
		HSS	3	0	0	3

### Preamble

This course provides students with a comprehensive overview of the principles, processes, and practices of Software project management. Insights into the techniques for planning, organizing, scheduling, and controlling software projects. The course aims to provide substantial focus on software cost estimation and software risk management. Students will obtain practical project management skills and competencies related to the definition of a software project, establishment of project communications, managing project changes and managing distributed software teams and projects based on the Project Management Body of Knowledge (PMBOK) as a framework.

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain the key components of a project plan	11
CO2	Apply appropriate project planning and tracking tools	19
CO3	Show the importance of a cost benefit analysis to the successful implementation of a project plan	11
CO4	Interpret how to identify the lessons learned in a project closeout and review session	11
CO5	Develop a project plan for the applications on Internet of Things, Society and Environment	15
CO6	Apply suitable software project management technique for the given software project scenario	33

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.1, 2.1.1, 2.3.1,2.4.1
CO2	TPS3	Apply	Value	Mechanism	1.1, 2.4.1, 2.4.7
CO3	TPS3	Apply	Value	Mechanism	1.1, 2.1.3
CO4	TPS2	Understand	Respond	Guided Response	1.1, 4.6.4
CO5	TPS3	Apply	Value	Mechanism	1.1, 3.1, 3.2, 4.1
CO6	TPS3	Apply	Value	Mechanism	1.1,2.3.1,2.4.7,

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		M						S		M	M	S
CO2	S	M	L		M						S		M	M	S
CO3	S	M	L		S						S		M	S	S
CO4	M	L									S	L	L		M
CO5	S	M	L		S	M	M	S	S	S	S	L	M	M	S
CO6	S	M	L		M				S	S	S		M	M	S

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests	Assignment		Terminal Examination
		1	2	
Remember	20	20		10
Understand	30	30	20	30
Apply	50	50	80	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	20
Mechanism	80
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1 (CO1):**

1. Identify the milestones in requirement engineering process
2. Explain the steps involved in project planning process.
3. Describe the concept of work break down structure in project planning.
4. Explain the process of project portfolio and project formulation.
5. List the key roles of a stakeholder and a project charter.

**Course Outcome 2 (CO2):**

1. Define the term direct cost in projects with examples
2. Differentiate between CPM and PERT
3. Estimate the cost associated with the project using bottom up technique
4. Elaborate the methods of project budgeting
5. What do you mean by budget uncertainty? How risk is managed in projects?

**Course Outcome 3 (CO3):**

1. List the benefits and limitations of latest tools in project management
2. Identify the reasons to terminate a project
3. A project consists of six activities with the following logical relationships. Draw a network for the project and determine the critical path using traditional method - A and B are initial activities and can be performed concurrently - C follows A but cannot start until B is over - D and E succeed B - C and D precede F - E and F are terminal activities



Activity	A	B	C	D	E	F
Duration (Days)	7	8	3	2	7	4

- Find the status of the project on the 10th day of its commencement.
- What are the steps needed in developing the Project Staffing Management Plan
- Draw a Gantt chart for tracking purpose and explain their use in scheduling

**Course Outcome 4 (CO4):**

- Summarize the key tools of project life cycle’s closing phase
- Illustrate the KICK-OFF meeting essentials for any project development.
- Write the need and meaning of fast tracking and estimation of projects
- Using any Software Planning and tracking tool, Plan a project systematically.

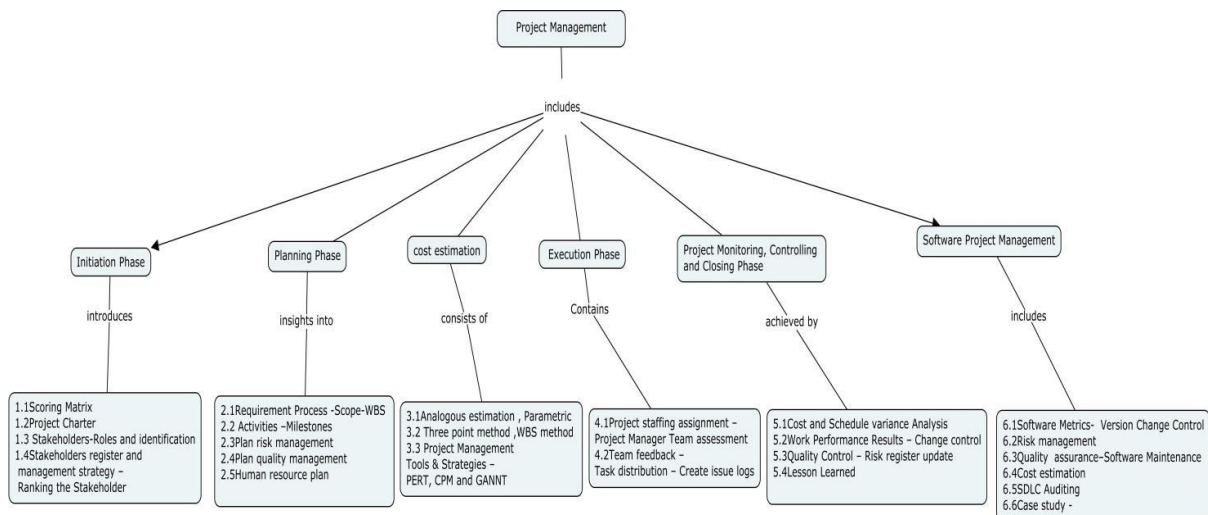
**Course Outcome 5 (CO5):**

- Explain why or why not LOC is an appropriate software size metric in your organization
- List the quality attributes that contribute to a quality software product. Discuss how it influences the software quality.
- What are baselines? Interpret how it contributes to version control.
- Illustrate COCOMO Estimation using your own example.
- Develop a plan for Smart Health Care project using appropriate tools.

**Course Outcome 6 (CO6):**

- Development of mini-project by using appropriate Software Engineering practices and Software Project Management techniques

**Concept Map**



**Syllabus**

**Project Initiation Phase** – Scoring Matrix – Project Charter – Role of charter – Creation of charter – Role of stakeholder – Identification of stakeholders– Stakeholders register and management strategy – Ranking the Stakeholder

**Project Planning Phase** - Requirement Process Collection – Project Scope – Work break down structure– Define activities –Milestones Estimate activity resources – Activity durations

– Plan risk management – Identify and rank risks –Risk response plan – Risk contingency plan – Plan quality management –Quality roles and responsibilities – Define project quality – Measure project quality – Quality control – Quality management plan – Human resource plan – Communication management plan

**Project cost estimation** - Analogous estimation – Parametric – Three point method – WBS method – Project Management Tools & Strategies – PERT, CPM and GANNT

**Project Execution Phase** – Project staffing assignment – Project Manager Team assessment – Team feedback – Task distribution – Create issue logs

**Project Monitoring, Controlling and Closing Phase** – Cost and Schedule variance Analysis –Work Performance Results – Change control – Quality Control – Risk register update – Lesson Learned

**Software Project Management** – Software Metrics-Metrics Analysis Report-Version Change Control- Risk management - Quality management and assurance–Software Maintenance-Cost estimation –COCOMO model – SDLC Auditing–Case study - Software management tools and techniques

### Learning Resources

1. Warburton. R & Kanabar. V, The Art and Science of Project Management, RW Press, RI, Second Edition, 2016.
2. Bob Hughes, Mike Cotterell, Software Project Management, Tata McGraw Hill, Third Edition, 2011.
3. Kanabar. V and Warburton, R, Fundamentals Project Management, Kaplan Press, New York, 2008.
4. Walker Royce, Software Project Management A Unified Framework, Pearson Education, 2004

### Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours	Course Outcomes
<b>1</b>	<b>Project Initiation Phase</b>		
1.1	Scoring Matrix	1	CO1
1.2	Project Charter – Role of charter – Creation of charter	1	
1.3	Role of stakeholder – Identification of stakeholders	1	
1.4	Stakeholders register and management strategy – Ranking the Stakeholder	1	
<b>2</b>	<b>Project Planning Phase</b>		
2.1	Requirement Process Collection – Project Scope – Work breakdown structure	1	CO2
2.2	Define activities –Milestones - Estimate activity resources – Activity durations	1	
2.3	Plan risk management – Identify and rank risks – Risk response plan – Risk contingency plan	2	
2.4	Plan quality management –Quality roles and responsibilities – Define project quality – Measure project quality – Quality control – Quality management plan	2	
2.5	Human resource plan – Communication management plan	1	
<b>3</b>	<b>Project cost estimation</b>		

3.1	Analogous estimation – Parametric	1	CO3
3.2	Three point method – WBS method	1	
3.3	Project Management Tools & Strategies – PERT, CPM and GANNT	3	
<b>4</b>	<b>Project Execution Phase</b>		
4.1	Project staffing assignment – Project Manager Team assessment	1	
4.2	Team feedback – Task distribution – Create issue logs	2	CO4
<b>5</b>	<b>Project Monitoring, Controlling and Closing Phase</b>		
5.1	Cost and Schedule variance Analysis	1	CO5
5.2	Work Performance Results – Change control	1	CO5
5.3	Quality Control – Risk register update	1	CO5
5.4	Lesson Learned	1	CO5
<b>6</b>	<b>Software Project Management</b>		
6.1	Software Metrics- Metrics Analysis Report - Version Change Control	2	CO6
6.2	Risk management	2	CO6
6.3	Quality management and assurance–Software Maintenance	2	CO6
6.4	Cost estimation – COCOMO model	2	CO6
6.5	SDLC Auditing	2	CO6
6.6	Case study - Software management tools and techniques	2	CO6
	<b>Total</b>	<b>36</b>	

**Course Designers:**

1. P.Karthikeyan karthikit@tce.edu
2. S.Pudu Malar spmit@tce.edu

21IT470	COMPUTER NETWORKS LAB	Category	L	T	P	Credit
		PC	0	0	2	1

### Preamble

This laboratory course helps the students to explore Networking concepts by simulating various scenarios using simulation tools and develop simple networking applications using Java based Socket programming. This course also includes hands-on exercises on Packet capture and analysis.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Simulate various Network topologies using Network simulation tools and examine their performance	20
CO2	Implement Routing algorithms for the given piece of network	20
CO3	Demonstrate the working of Layer 2 and Layer 3 protocols	20
CO4	Develop Simple Network applications with socket programming	20
CO5	Analyze the given network traffic using network packet analyzer tools	10
CO6	Demonstrate the configuration of web servers and DNS servers	10

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2,3.1.5,2.3.3,2.3.4,3.2.3,2.2.3
CO2	TPS3	Apply	Value	Mechanism	1.2,3.2.3,2.3.4, 2.2.3
CO3	TPS3	Apply	Value	Mechanism	1.2, 3.2.3, 2.2.3
CO4	TPS3	Apply	Value	Mechanism	1.2, 3.2.3, 2.2.3
CO5	TPS3	Analyze	Organize	Complex overt Response	1..2,3.1.5, 3.2.3, 2.2.3
CO6	TPS3	Apply	Value	Mechanism	1.2, 3.1.5, 3.2.3, 2.2.3

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			S	S	S			M	S	S
CO2	S	M	L		L								M	L	
CO3	S	M	L		L								M	L	
CO4	S	M	L		L			M	M	M			M	L	M
CO5	S	M	L		S			S	S	S			M	S	S
CO6	S	M	L		L								M	L	

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	0	0
Understand	20	20
Apply	70	70
Analyse	10	10
Evaluate	0	0
Create	0	0

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Miniproject/Practical Component/Observation
Perception	0
Set	10
Guided Response	20
Mechanism	70
Complex Overt Responses	0
Adaptation	0
Origination	0

**Guidelines for carrying out exercises:**

- Students may do pair programming for the Socket programming exercises
- Students may form teams of size 3, to complete Simulation and packet analysis exercises

**List of Experiments/Activities with CO Mapping**

Exp No	List of Experiments	COs	No. of Lab Hours
	Socket Programming and Configuration Exercises		
1	Develop a simple single client-server chatting application using (i) Connection-oriented and (ii) Connectionless sockets (Use Stream Mode Socket API and Datagram Socket API respectively)	CO4	2
2	Develop a concurrent server that spawns several threads, one for each client requesting a specific service	CO4	2
3	Extend the single client – single server chatting application developed using connection-oriented sockets to a multiple client – single server chatting application using threads	CO4	2
4	Develop a multicast chatting tool that will be used to communicate among a multicast group	CO4	1
5	Implement a simple file transfer protocol (FTP) using connection-oriented and connectionless sockets		1
6	Implement sliding window and stop and wait techniques to establish flow control between a sender and receiver	CO3	2
7	Develop a remote service request-response application using RMI	CO4	2
8	Install and configure DNS Server with forward and reverse lookups	CO6	2
9	Develop an simple interactive web-based application using LAMP/WAMP servers	CO6	2
	Simulation Exercises		
10	Simulate a LAN based on Ethernet with a minimum of ten nodes and examine the performance under different load scenarios	CO1	2

11	Simulate switched LAN and compare the performances with different Network topologies	CO1	
12	Simulate Distance vector routing with and without Node failure scenarios	CO2	2
13	Simulate Link State routing with and without Node failure scenarios	CO2	
14	Simulate Address Resolution and reverse address resolution	CO3	
	Packet Analysis Exercises		
15	Install and configure Network Packet Analyzer like Wireshark, to capture and analyze Packet Data Unit for HTTP, TCP and DNS	CO5	2
	Total Hours		24

- Socket Programming exercises may be carried out using networking capabilities of Java platform.
- Simulation Experiments may be carried out using GNS3 or Riverbed Modeler Academic edition
- Packet Analysis experiments may be carried out using Wireshark, Fiddler or Network Miner

### Learning Resources

1. Harold, Elliotte Rusty. *Java network programming*. " O'Reilly Media, Inc.", 2004.
2. Kurose, James F. *Computer networking: A top-down approach featuring the internet, 3/E*. Pearson Education India, 2005.
3. Sanders, Chris. *Practical packet analysis: Using Wireshark to solve real-world network problems*. No Starch Press, 2017.

### Course Designers:

- |    |                          |                    |
|----|--------------------------|--------------------|
| 1  | S.Muthuramalingam        | smrit@tce.edu      |
| 2. | S.Thiruchadaipandeeswari | eshwarimsp@tce.edu |

21IT480	DATABASE MANAGEMENT SYSTEMS LAB	Category	L	T	P	Credit
		PC	0	0	2	1

### Preamble

This course aims to provide a strong foundation in database design concepts and to give adequate exposure to the SQL and PL/SQL programming with the help of the Oracle RDBMS environment. It also deals with connecting the database to a programming language and thereby creating web application for real world scenarios.

### Prerequisite

- None

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Design database with integrity constraints and appropriate normal forms	12
CO2	Implement SQL data model for a given application	25
CO3	Use PL/SQL constructs to add programming extension to SQL	10
CO4	Implement Procedures, Functions, Triggers, Cursors and Packages for the given application.	25
CO5	Implement NoSQL data model for a given application.	20
CO6	Develop projects by incorporating database concepts with PHP connectivity.	8

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2,2.1.1,2.1.2,2.3.1,3.1.1.3.2.6
CO2	TPS3	Apply	Value	Mechanism	1.2,2.1.2,2.2.3
CO3	TPS3	Apply	Value	Mechanism	1.2,4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.2,4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.2,2.1.2,2.2.3
CO6	TPS3	Apply	Value	Mechanism	1.2,2.1.1,2.1.2,2.2.3,2.3.1,3.1.1,3.2.6

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			S	S	S	L		M	S	M
CO2	S	M	L		S			S	S	S	L	L	M	S	M
CO3	S	M	L		S			S	S	S	L		M	S	M
CO4	S	M	L		S			S	S	S	L		M	S	M
CO5	S	M	L		S			S	S	S	L	L	M	S	M
CO6	S	M	L		S			S	S	S	L	L	M	S	M

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	-	-
Apply	100	100
Analyse	0	0
Evaluate	0	0
Create	0	0

\*CO6 will be assessed through Mini Project.

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Miniproject/Practical Component/Observation
Perception	-
Set	-
Guided Response	30
Mechanism	70
Complex Overt Responses	
Adaptation	-
Origination	-

**List of Experiments/Activities with CO Mapping**

Exp No.	List of Experiments	No. of Hours	Course Outcome
1	Identification of Mini Project	1	CO1
2	Creation and Modification of relations	2	CO2
3	Integrity constraint enforcement and simple SQL queries	2	CO1
4	Creation and updation of views	2	CO2
5	Complex SQL Queries	2	CO2
6	Query Tuning	2	CO2
7	PL/SQL block creation and usage of various composite data types	2	CO3
8	Cursor management and Creation of Triggers in SQL	2	CO4
9	Procedures, functions and packages in PL/SQL	2	CO4
10	Installation of MongoDB and creation of Collections	1	CO5
11	Simple and Join Queries in MongoDB	2	CO5
12	Perform MongoDB Query and Projection operation	2	CO5
13	Demonstrate Mini-Project as Web application	2	CO6
<b>Total Hours</b>		<b>24</b>	

**Learning Resources**

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems, McGraw Hill Publications, 3rd Edition, 2014
2. Nilesh Shah, "DATABASE SYSTEMS USING ORACLE –", 2nd edition, PHI.
3. NPTEL Online Course on "Database Management System" - <https://nptel.ac.in/courses/106105175/2>

**Course Designers**

1. C.Deisy                      cdcse@tce.edu
2. K.V.Uma                    kvuit@tce.edu
3. S.Pudumalar                spmit@tce.edu



**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.TECH. INFORMATION TECHNOLOGY DEGREE PROGRAMME**

**FIFTH SEMESTER**

**FOR THE STUDENTS ADMITTED IN THE**

**ACADEMIC YEAR 2021 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A GOVERNMENT AIDED ISO 9001:2008 CERTIFIED  
AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)  
**MADURAI – 625 015, TAMILNADU**

PHONE: 0452 – 2482240, 41

FAX: 0452 2483427

WEB: [WWW.TCE.EDU](http://WWW.TCE.EDU)

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**COURSES OF STUDY**

(For the candidates admitted from 2019 onwards)

**FIFTH SEMESTER**

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
<b>THEORY</b>						
21IT511	Web Technologies	PC	3	-	-	3
21IT520	Information Security	PC	3	-	-	3
21IT530	Data Mining	PC	3	-	-	3
21IT540	Accounting and Finance	HSS	3	-	-	3
21ITPX0	Programme Elective	PE	3	-	-	3
21XXGX0	General Elective	GE	3	-	-	3
<b>PRACTICAL</b>						
21IT571	Web Technologies Lab	PC	-	-	2	1
21IT580	Information Security Lab	PC	-	-	2	1
21ES590	System Thinking	ES	-	-	6	2
<b>AUDIT COURSES</b>						
21CHAC0	Essence of Indian Knowledge	AC	1	-	1	-
<b>Total</b>			<b>19</b>	<b>-</b>	<b>11</b>	<b>22</b>

Capstone Design Project

BS : Basic Science

HSS : Humanities and Social Science

ES : Engineering Science

PC : Program Core

PE : Program Elective

GE : General Elective

AC : Audit Course

L : Lecture

T : Tutorial

P : Practical

**Note:**

1 Hour Lecture is equivalent to 1 credit

2 Hours Tutorial is equivalent to 1 credit

2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**Scheme of Examinations**  
 (For the candidates admitted from 2019 onwards)

**FIFTH SEMESTER**

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
<b>THEORY</b>								
1	21IT511	Web Technologies	3	50	50	100	25	50
2	21IT520	Information Security	3	50	50	100	25	50
3	21IT530	Data Mining	3	50	50	100	25	50
4	21IT540	Accounting and Finance	3	50	50	100	25	50
5	21ITPX0	Programme Elective	3	50	50	100	25	50
6	21XXGX0	General Elective	3	50	50	100	25	50
<b>PRACTICAL</b>								
7	21IT571	Web Technologies Lab	3	50	50	100	25	50
8	21IT580	Information Security Lab	3	100	0	100	0	50
9	21ES590	System Thinking	-	50	50	100	25	50
<b>AUDIT COURSES</b>								
10		Essence of Indian Knowledge	-	50	50	100	25	50

\* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

\*\* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

<b>21IT511</b>	<b>WEB TECHNOLOGIES</b>	Category	L	T	P	Credit
		PC	3	0	0	3

**Preamble**

This course covers the design and implementation of web-based applications including related software, database and interfaces. The students will learn about mark-up languages, scripting languages, interactive graphics and databases with current trends. It also covers social, ethical and security issues arising from the web and social software. The concepts will be illustrated with appropriate examples and tools.

**Prerequisite**

- 18IT320 Object Oriented Programming

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Demonstrate essential software tools for web application development	14
CO2	Design web applications using Angular JS based on the requirements	30
CO3	Develop simple server side applications using Node JS with DB	20
CO4	Build applications using XML and JSON	14
CO5	Summarize the vulnerable techniques of web technologies	10
CO6	Build a web service based on the application requirement	12

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Set	1.2,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,4.4.1, 4.4.2,4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.2.3, 4.4.1, 4.4.2
CO4	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.1.4, 3.1.5
CO5	TPS2	Understand	Respond	Set	1.2,4.3.4, 4.5.3, 4.5.6
CO6	TPS3	Apply	Value	Mechanism	1.2,4.3.4

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L			L			L	L	L		L	L	L	L
CO2	S	M	L		S			S	S	S		S	M	S	S
CO3	S	M	L		S			S	S	S		S	M	S	S
CO4	S	M	L		S			S	S	S		S	M	S	S
CO5	M	L			L			L	L	L		L	L	L	L
CO6	S	M	L		S			S	S	S		S	M	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	20
Understand	40	40	20	20	40
Apply	40	40	80	80	40
Analyse	0	0	0	0	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	-
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\***

\*\* (2 to 3 at the cognitive level of course outcome)

**Course Outcome 1(CO1):**

1. List the essential tools for Web development.
2. How can we add series to MVC charts?
3. Before users even look at the wireframe or prototype, what would they expect to be able to do with it?

**Course Outcome 2(CO2):**

1. Create a web page for TCE. Write HTML5 code snippets to divide your web page into three parts A, B and C. The frame A contains an image and some rolling text. The frame B has links like Home, Courses offered, Feedback form and ContactUs. When these are links clicked they have to be opened in the Frame C, but for Feedback form link, the page has to be opened in the new window. Your XHTML document should contain a form with text boxes for a name, address and e-mail. Provide check boxes that allow prospective students to indicate what they liked most about the campus. Also, provide radio buttons that ask the student how they became interested in the university. In addition, provide a text area for additional comments, a submit button and a reset button.
2. Design a web page for the following using Angular JS.

The screenshot shows a web form with the following fields and values:

- Title: Programming in Scala
- Author(s): Odersky, Martin. Lex Spoon. E
- Year: 2008
- Publisher: Artima Press (dropdown menu)
- Price: 45.05
- In Stock: 1511
- Description: This book is a thorough introduction to the Scala programming language.
- Save changes button

3. Develop an employee based web application and show the steps of integrating Angular JS with HTML.

**Course Outcome 3(CO3):**

1. Perform server side validation for the following

2. Design a webpage using MongoDB for implementing marks sheet based system in which it is generated with 6 theory subjects, 2 lab subjects with Grading point system for 10 students and generate report in table format with XML. Check whether the maximum marks exceeds, generate exceptions.
3. Design a webpage for payroll application with empname, empid, salary, month using Node JS and perform basic operations like insert, update and delete.

**Course Outcome 4 (CO4):**

1. Develop XSLT code to retrieve the Student roll no and name whose names starts with "s", display the details in the tabular form. (Note: Assume the student details are stored in the xml document).
2. Build a data file for employee details and convert the data into JSON structure.
3. a. Create a XML file for food menu list of a restaurant and design DTD for the following table.
  - b. Apply xml schema for the given table of contents with the following condition  
The price should start from at least 5 and should not be a string

Food name	Description	Price
Belgian Waffles	Maple	\$5.95
Strawberry Belgian Waffles	Whipped cream	\$7.95
French Toast	sourdough bread	\$4.5

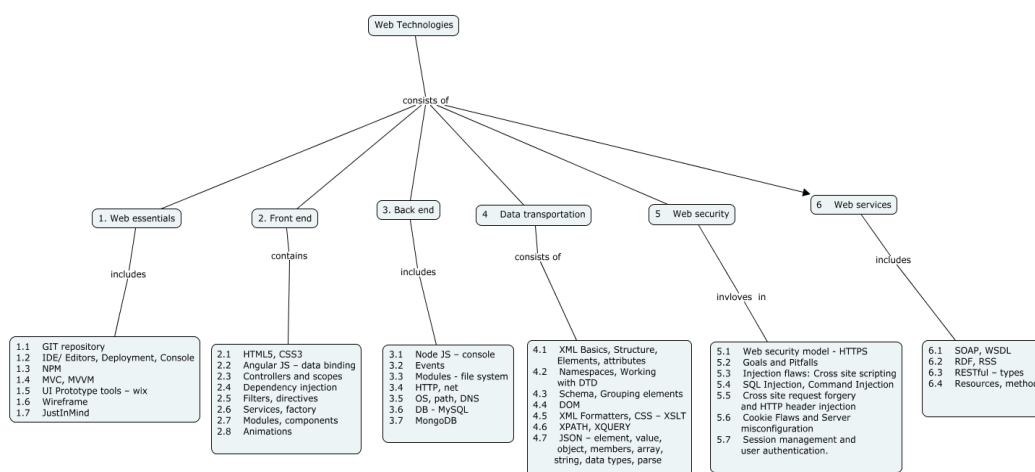
**Course Outcome 5 (CO5):**

1. Create a Cookie and build the following
  - a. Construct four user id's and passwords and write these to cookies.
  - b. Read the user id and passwords entered in the Login form and authenticate with the values (user id and passwords) available in the cookies. If he is a valid user (i.e., user-name and password match) you should welcome him by name (user-name) else you should display "You are not an authenticated user".
2. Identify the adequacy of Web Security.
3. Develop a web application to describe how source code disclosure can be effectively used to safeguard against the vulnerabilities in applications.
4. Design an own Web application. Set Cookies and Sessions for visiting that page.

**Course Outcome 6(CO6):**

1. Demonstrate the SOAP structure and a SOAP request, response messages for getting the employee's details.
2. Experiment with the following web service standards
  - a. Soap binding with an example
  - b. Structure of web service architecture
3. Using web service technology of your choice, create a web service which behaves like a text editor.

## Concept Map



## Syllabus

**Web essentials:** GIT repository, IDE/ Editors, Deployment, Console, NPM, MVC, MVVM, UI Prototype tools – wix, wireframe.

**Front end:** HTML5, CSS3, Angular JS – data binding, controllers, scopes, dependency injection, filters, directives, services, factory, modules, components, animations.

**Back end:** Node JS – console, events, modules - file system, HTTP, net, OS, path, DNS, DB - MySQL, MongoDB.

**Data transportation:** XML Basics, Structure, Elements, attributes, Namespaces, Working with DTD, Schema, Grouping elements, writing and Parsing XML Document, DOM, XML Formatters, CSS – XSLT, XPATH, XQUERY, JSON – element, value, object, members, array, string, data types, parse

**Web security:** Web security model - HTTPS: Goals and Pitfalls - Injection flaws: Cross site scripting, SQL Injection, Command Injection, Cross site request forgery and HTTP header injection - Cookie Flaws and Server misconfiguration - Session management and user authentication.

**Web services:** SOAP, WSDL, RDF, RSS, REST – types, resources, methods

## Learning Resources

1. Mastering HTML, CSS & Javascript Web Publishing by Laura Lernay, Rafe Colburn, Jennifer Kyrnir, BPB Publications, 2016
2. Pro AngularJS, Adam Freeman, Apress; 1st ed. edition, 2014
3. *Beginning Node.js*, Basarat Ali Syed, Apress; 1st ed. edition, 2014
4. <https://www.comp.nus.edu.sg/~prateeks/teaching/sp16/cs5331-sp16.html>
5. <https://www.coursera.org/learn/single-page-web-apps-with-angularjs>
6. <https://www.coursera.org/learn/server-side-nodejs>
7. <https://angularjs.org/>
8. <https://nodejs.org/en/>
9. <https://www.npmjs.com/>
10. <https://restfulapi.net/>

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1	<b>Web essentials</b>		
1.1	GIT repository	1	
1.2	IDE/ Editors, Deployment, Console	1	
1.3	NPM	1	

1.4	MVC, MVVM		
1.5	UI Prototype tools – wix	2	
1.6	Wireframe		
1.7	JustInMind		
2	<b>Front end</b>		
2.1	HTML5, CSS3	1	
2.2	Angular JS – data binding	1	
2.3	Controllers and scopes	1	
2.4	Dependency injection	1	
2.5	Filters, directives	2	
2.6	Services, factory	2	
2.7	Modules, components	1	
2.8	Animations	2	
3	<b>Back end</b>		
3.1	Node JS – console	1	
3.2	Events	1	
3.3	Modules - file system	1	
3.4	HTTP, net	1	
3.5	OS, path, DNS	1	
3.6	DB - MySQL	2	
3.7	MongoDB		
4	<b>Data transportation</b>		
4.1	XML Basics, Structure, Elements, attributes	1	
4.2	Namespaces, Working with DTD	1	
4.3	Schema, Grouping elements		
4.4	DOM	1	
4.5	XML Formatters, CSS – XSLT	1	
4.6	XPATH, XQUERY		
4.7	JSON – element, value, object, members, array, string, data types, parse	2	
5	<b>Web security</b>		
5.1	Web security model - HTTPS	1	
5.2	Goals and Pitfalls		
5.3	Injection flaws: Cross site scripting	1	
5.4	SQL Injection, Command Injection		
5.5	Cross site request forgery and HTTP header injection	1	
5.6	Cookie Flaws and Server misconfiguration		
5.7	Session management and user authentication.		
6	<b>Web services</b>		
6.1	SOAP, WSDL	1	
6.2	RDF, RSS	1	
6.3	RESTful – types	1	
6.4	Resources, methods	1	
<b>Total Lecture Hours</b>		<b>36</b>	

**Course Designers:**

1. Dr.P.Karthikeyan [karthikit@tce.edu](mailto:karthikit@tce.edu)
2. S. Karthiga [skait@tce.edu](mailto:skait@tce.edu)
3. C.Santhiya [csit@tce.edu](mailto:csit@tce.edu)



<b>21IT520</b>	<b>INFORMATION SECURITY</b>	Category	L	T	P	C
		PC	3	0	0	3

### Preamble

The objective of the course on Information Security is to provide exposure on cryptography and secure communication protocols. This course develops a basic understanding of the algorithms used for data protection and few design choices behind these algorithms. The course emphasizes the understanding of previous attacks on the networks with the aim of preventing future attacks.

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Perform Encryption/ Decryption of text using symmetric and asymmetric crypto algorithms to provide confidentiality.	25
CO2	Compute hash and digital signature for the given message to provide integrity and non-repudiation.	11
CO3	Examine the strength of any cryptographic algorithm by crypt analysis.	12
CO4	Explain different types of authentication and key agreement protocols.	19
CO5	Use security protocols such as SSL, IP Sec etc., at different layers of TCP/IP stack to develop security solutions.	11
CO6	Identify security attacks and vulnerabilities in any information system and provide preventive measures and solutions in adherence with security standards.	22

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.5.1
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.5.1
CO3	TPS4	Analyze	Organize	Complex Overt Response	1.2, 2.1.1, 2.1.2, 2.1.5, , 2.4.4, 2.5.1
CO4	TPS2	Understand	Respond	Guided Response	1.2
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, , 2.5.1
CO6	TPS4	Analyze	Organize	Complex Overt Response	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3.1, 2.5.1, 2.4.4, 2.4.6, 3.1.1, 3.2.2, 3.2.3

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	S	M	L										M		
CO2	S	M	L										M		
CO3	S	S	M	L									S		
CO4	M	L											M		
CO5	S	M	L										M		
CO6	S	S	M	L	M			S	M	M		M	S	M	M

S- Strong; M-Medium; L-Low

### Assessment Pattern: Cognitive Domain

21IT520 Information Security					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	10
Understand	20	20	0	0	20
Apply	40	40	70	70	50
Analyse	20	20	30	30	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

### Assessment Pattern: Psychomotor

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	
Set	
Guided Response	30
Mechanism	50
Complex Overt Responses	20
Adaptation	
Origination	

### Sample Questions for Course Outcome Assessment

#### Course Outcome 1 (CO1):

- Alice Wishes to send the message (24, 26) to Bob using Elliptic curve encryption. If the Cryptosystem parameters are  $E_{67}(2,3)$ ,  $G=(2,22)$  and the private key of Alice is 4, find the public key of Alice and the encrypted message if the random value is  $r=2$ . Show the steps by which Bob recovers the plaintext from the cipher text.
- Encrypt the message "CS" using RSA algorithm with  $n=18923$  and  $e=79$ . Break the code by factorizing  $n$  and compute the deciphering key.
- Consider a Diffie Hellman scheme with a common prime  $q=19$  and a primitive root 13. (i) If User A has a public key 10, what is his private key? (ii) If User B has a private key 6, what is his public key? (iii) What is the shared secret key?

**Course Outcome 2 (CO2):**

1. Apply SHA-1 message digest to message  $M=THIAGARAJARCOLLEGE\dots$  for one step. Make assumptions of initial buffer values in big endian form.  $F(t,b,c,d)=bc+b'd$ . Draw the flow diagram for the scheme and then compute all other relevant parameters required for the calculation.
2. Generate the digital signature for a message with hash value  $h(m) = 25$  using Digital Signature Standard Scheme if  $p=709, q=59, d=14, r=4, e_0=3$ . Verify the signature at the receiving end.
3. Differentiate strong and weak collision resistance with reference to hash functions.

**Course Outcome 3 (CO3):**

1. Intercept the message 'FBRTLWUGATEPHBNXSW' which was encoded using a Hill Cipher System with a  $3 \times 3$  key matrix in a 26 letter alphabetic system. The last nine letters are the sender's signature 'JAMESBOND'. Find the enciphering matrix, deciphering matrix and read the message.
2. Can the following matrix be used as key in Hill cipher? Justify your answer.  
{1,2,3; 4,5,6; 7,8,9}
3. John is reading a mystery book involving cryptography. In one part of the book, the author gives a cipher text "CIW" and two paragraphs later the author tells the reader that this is a Caesar cipher and the plain text is "yes", In the next chapter the hero found a tablet in a cave with "XVIEWYWI" engraved on it. John immediately found the actual meaning of the cipher text, what type of attack did John launch here? What is the plain text?

**Course Outcome 4 (CO4):**

1. Compare and contrast biometric authentication vs. cryptographic authentication.
2. Explore the various ways of distribution of public keys.
3. Enlist the various parameters present in a digital certificate.

**Course Outcome 5 (CO5):**

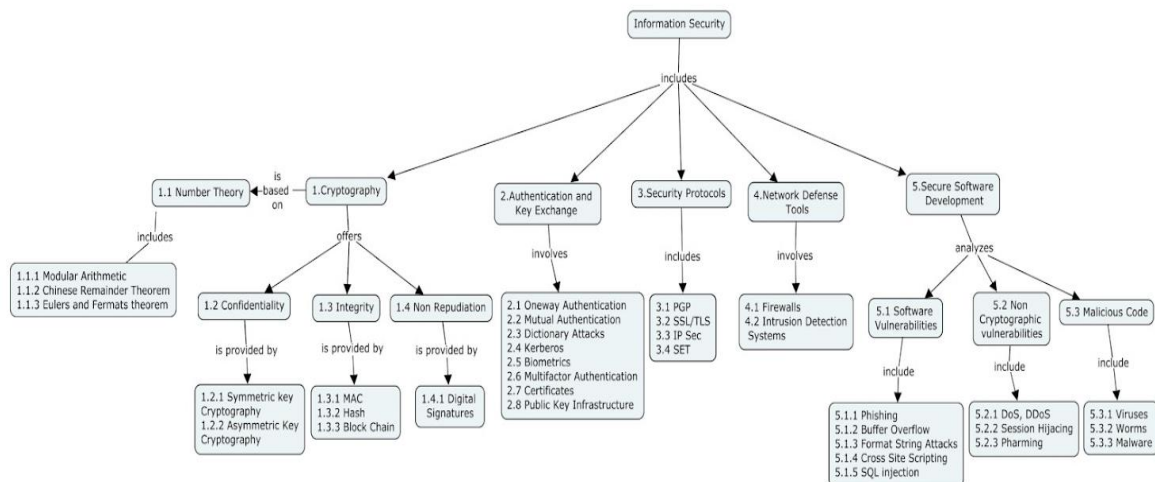
1. An organization allows its employees a remote login facility through an IPsec based VPN. With the help of neat sketches, show different possible placements of VPN terminator with respect to organization firewalls. Discuss the pros and cons of each placement.
2. Compare the packet marking versus packet logging schemes for IP trace back in respect to the probability of success, cost, and ease of deployment and performance overheads.
3. How are the following supported in electronic passport? (i) Detection of fake passports, (ii) Detection of stolen passports, (iii) Prevention of passport skimming attacks, (iv) Prevention of eaves dropping on passport to reader communications.

**Course Outcome 6 (CO6):**

1. Is it possible to design a protocol that accomplishes both authentication and session key exchange with only two messages and without timestamps? Consider each of the following two cases separately.  
The two parties share a long term secret.  
Both communicating parties have a public key – private key pair. Each party knows other's public key.

2. Prepare a security analysis report on the threats and vulnerabilities involved in an online examination system.
3. Examine the feasibility of launching an offline dictionary attack on the electronic passport with the goal of obtaining certain fields in it such as the Date of Birth. Let S represent the concatenation of three fields –DOB, expiry date and passport number. Assuming each character is possible and equally likely, calculate the total number of possible values of S. Recalculate the total number of possible values of S under the following assumptions: (i) The holder of the passport being targeted is less than 80 years old. (ii) The passport validity period is 5 years. (iii) The passport number uses numeric characters only. (iv) About 1million passports have been issued in India and the passport numbers are aligned in sequence.

### Concept Map



### Syllabus

**Basics of Information Security** – Perspectives and Impact, Threats and vulnerabilities, Attacks, Security Services -CIA Triad and Security Models, Internet Law and Cyber Crimes

**Cryptography** - Mathematics for Cryptography – Number Theory - Modulo Arithmetic - Euclidean and extended Euclidean Theorem - Chinese Remainder Theorem - Euler and Fermat theorem , Symmetric Key Cryptosystems –Hill Cipher, Data Encryption Standard and Advanced Encryption Standard, Public Key Cryptography - RSA , Elliptic Curve Cryptosystems , Integrity – Message Authentication Code and Hash, Block Chain Technology, Digital Signatures.

**Authentication of Key Exchange** – One way Authentication- Mutual Authentication- Dictionary Attacks- Kerberos- Biometrics- Multifactor Authentication. Key management – Digital certificates- Public Key Infrastructure.

**Security Protocols** Security at Application Layer – PGP, Security at Transport Layer –SSL and TLS, Security at Network layer –IP Sec, Electronic Payments – SET

**Network Defense Tools** -Firewalls, Intrusion Prevention and Detection Systems

**Secure Software Development** -Software Vulnerabilities – Phishing, Buffer Overflows, Format String Attacks, Cross Site Scripting, SQL injection.

**Non cryptographic Protocol Vulnerabilities** –DoS, DDoS, Session Hijacking and Pharming Attacks. Viruses, Worms and Malware Analysis- Case Studies

### Learning Resources

- Behrouz. A. Foruzan and Debdeep Mukhopadhyay, “Cryptography and Network Security”, Tata McGraw Hill , Third Edition, 2016.
- William Stallings, “Cryptography and Network Security: Principles and Practice”, Prentice Hall, Seventh Edition, 2017.
- Bernard L Menezes, and Ravinder Kumar “Cryptography, Network Security and Cyber Laws”, Cengage Learning India Pvt Limited, 2018.
- Charlie Kaufman and Radia Perlman, Mike Speciner, “Network Security, Private Communication in Public World”, Prentice Hall India, Second Edition, 2002.
- William Stallings, "Network Security Essentials: Applications and Standards", Prentice Hall, Sixth Edition, 2016.
- Man Young Rhee, "Internet Security Cryptographic Principles, Algorithms and Protocols", Wiley, First Edition, 2003.
- Douglas R. Stinson, “Cryptography Theory and Practice”, Third Edition, Chapman & Hall/CRC, 2006.
- [http://cse.iitkgp.ac.in/~debdeep/courses\\_iitkgp/Crypto/index.htm](http://cse.iitkgp.ac.in/~debdeep/courses_iitkgp/Crypto/index.htm)
- <http://nptel.ac.in/courses/106105031/>
- <https://canvas.uw.edu/courses/1064488>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	COs
0	<b>BASICS OF INFORMATION SECURITY</b>		
0.1	Perspectives and Impact, Attacks, Threats and vulnerabilities	1	CO1
0.2	Security Services -CIA Triad and Security Models		
0.3	Internet Law and Cyber Crimes	1	CO1
1	<b>CRYPTOGRAPHY</b>		
1.1	<b>Mathematics for Cryptography- Number Theory</b>	1	CO1
1.1.1.	Modulo Arithmetic - Euclidean and extended Euclidean Theorem		
1.1.2	Chinese Remainder Theorem	1	CO1
1.1.3	Euler and Fermat theorem		
1.2.1	<b>Symmetric Key Cryptography</b>	1	CO1/CO3
1.2.1.1	Hill Cipher		
1.2.1.2	Data Encryption Standard	2	CO1/CO3
1.2.1.2	Advanced Encryption Standard	2	CO1/CO3
1.2.2	<b>Public Key Cryptography</b>	2	CO1/CO3
1.2.2.1	RSA		
1.2.2.2	Elliptic Curve Cryptosystems		

1.3	<b>Integrity</b>	1	CO2
1.3.1	Message Authentication Code and Hash		
1.3.2	SHA -512	1	CO2/CO3
1.3.3	Block Chain Technology	1	CO2
1.4	<b>Digital Signatures</b>	1	CO2/CO3
1.4.1	Digital Signature Standard		
2	<b>AUTHENTICATION AND KEY EXCHANGE</b>		
2.1	One way Authentication	1	CO4
2.2	Mutual Authentication		
2.3	Dictionary Attacks	1	CO4
2.4	Kerberos	1	CO4
2.5	Biometrics	1	CO4
2.6	Multifactor Authentication.	1	CO4
2.7	Key management –Digital certificates	1	CO4
2.8	Public Key Infrastructure	1	CO4
3	<b>SECURITY PROTOCOLS</b>		
3.1	Security at Application Layer – PGP	1	CO5
3.2	Security at Transport Layer –SSL and TLS	1	CO5
3.3	Security at Network layer –IP Sec	1	CO5
3.4	Electronic Payments – SET	1	CO5
4	<b>NETWORK DEFENSE TOOLS:</b>		
4.1	Firewalls	1	CO6
4.2	Intrusion Prevention and Detection Systems	1	CO6
5	<b>SECURE SOFTWARE DEVELOPMENT</b>		
5.1	<b>Software Vulnerabilities</b>	1	CO6
5.1.1	Phishing		
5.1.2	Buffer Overflows		
5.1.3	Format String Attacks	1	CO6
5.1.4	Cross Site Scripting		
5.1.5	SQL injection.		
5.2	<b>Non cryptographic Protocol Vulnerabilities</b>	1	CO6
5.2.1	DoS, DDoS		
5.2.2	Session Hijacking	1	CO6
5.2.3	Pharming Attacks		
5.3	<b>Malicious Code</b>	2	CO6
	Viruses, Worms and Malware Analysis - Case Studies		

**Course Designers:**

- |               |                   |
|---------------|-------------------|
| 1. C.Jeyamala | jeyamala@tce.edu  |
| 2. S.Sujitha  | sujithait@tce.edu |

21IT530	DATA MINING	Category	L	T	P	Credit
		PC	3	0	0	3

**Preamble**

The course on data mining provides an emphasis on data processing techniques, rule mining, classification, clustering and in the development of prediction models. It also facilitates the student by interpreting the real world problems by examining with appropriate mining tools.

**Prerequisite**

Nil

**Course Outcomes**

On successful completion of the course, students will be able to

Course Outcomes		Weightage in %
CO1	Describe the fundamental concepts of data mining.	11
CO2	Apply appropriate data pre-processing techniques for the given dataset.	22
CO3	Produce Association rules using algorithms like Apriori and Frequent Pattern tree for the given problem.	16
CO4	Demonstrate the performance of different Classification algorithms (decision tree algorithms, naïve bayes., support vector machines and Neural Networks ) and prediction algorithms (Linear Models and Logistic Regression) to solve the real world problem.	24
CO5	Illustrate various clustering and outlier techniques for grouping the given data.	17
CO6	Experiment various data pre-processing and mining techniques for the given application using Python, R, Weka and Rapid Miner etc.	10

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond		1.2,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.2, 2.3.1, 2.3.2, 3.1.4, 3.1.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.2, 2.3.1, 2.3.2, 3.1.4, 3.1.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.3.1, 2.3.2, 2.3.3, 4.4.1, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 4.3.4, 4.6.1
CO6	TPS4	Analyse	Organise	Complex Overt Responses	1.2,2.3.1, 2.3.2, 2.5.1, 3.1, 3.2.5, 4.1.2, 4.3.4, 4.4.1,4.4.2, 4.5.3, 4.5.6, 4.6.1

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L										M		
CO3	S	M	L		L							L	M	L	L
CO4	S	M	L		L							L	M	L	L
CO5	S	M	L		L							L	M	L	L
CO6	S	S	M	L	S	M		L	M			S	S	S	L

S- Strong; M-Medium; L-Low

\*CO6 will be assessed through Mini Project / Assignment

#### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	10			20
Understand	20	20	20	20	20
Apply	60	70	80	80	60
Analyse					0
Evaluate					0
Create					0

#### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	60
Complex Overt Responses	40
Adaptation	-
Origination	-

#### Sample Questions for Course Outcome Assessment

##### Course Outcome 1 (CO1):

1. Discuss the Issues and challenges in Data Mining.
2. Describe different types of data and give an example for each.
3. Explain various stages of KDD.

##### Course Outcome 2 (CO2):



1. Predict min – max normalization for the variable call duration and transform it to the range between [0.0 ,0.1]

User Id	Calls Duration	SMS	Data Counter
1	25000	24	4
2	49000	27	5
3	55000	32	7
4	27000	25	6
5	53000	30	5

2. Suppose that the data for analysis includes the attribute age. The age values for the data tuples are 75, 63, 55, 47, 77, 48, 63, 54, 60, 38, and 54.
- Find the mean, median and mid-range of the data.
  - Can you find (roughly) the first quartile (Q1) and the third quartile (Q3) of the data?
  - What is the mode of the data? Comment on the data's modality (i.e., bimodal, trimodal, etc.).
  - Show a boxplot of the data.
  - How is a quantile-quantile plot different from a quantile plot?
3. In a certain town, there are about one million eligible voters. A simple random sample of 10000 eligible voters was chosen to study the relationship between sex and participation in the last election. The results are summarized in the following 2 x 2 (read two by two) contingency table: check whether a man or a woman (columns) is independent of having voted in the last election (rows). In other words is "sex and voting independent"?

	Men	Women
Voted	2792	3591
Didn't Vote	1486	2131

### Course Outcome 3 (CO3):

1. Take a look at the following table, where  $T1$ ,  $T2$ ,  $T3$ ,  $T4$ ,  $T5$ , and  $T6$  are the transaction ID's, and  $A$ ,  $B$ ,  $C$ ,  $D$ , and  $E$  are the item ID's. Let the min\_support = 20% and min\_conf = 60%. Find all frequent item set using Apriori Algorithm and List all the strong association rules.

<b>Transaction ID</b>	<b>List of Item ID's</b>

<i>T1</i>	<i>A, B, E</i>
<i>T2</i>	<i>B, C, D</i>
<i>T3</i>	<i>B, D, E</i>
<i>T4</i>	<i>C, D, E</i>
<i>T5</i>	<i>B, C, D, E</i>
<i>T6</i>	<i>B, C, E</i>

2. A Database has seven transactions. Let *min\_sup*=30% and *min\_conf*=80%. Find all the frequent itemset using FP tree algorithm. Also list all the strong association rules.

- T1: Beef, Chicken, Milk
- T2: Beef, Cheese
- T3: Cheese, Boots
- T4: Beef, Chicken, Cheese
- T5: Beef, Chicken, Clothes, Cheese, Milk
- T6: Chicken, Clothes, Milk
- T7: Chicken, Milk, Clothes

3. Illustrate how minimum support thresholds are defined at each level of abstraction, such as uniform support, reduced support, and group-based support. Explain multi dimensional and cluster based association rule mining.

**Course Outcome 4 (CO4):**

1. Consider the following phone purchasing database, let's phone\_category is the class label. Construct the Decision Tree Using 'Gain Ratio' attribute selection Measures.

Screen	SIM	Camera	RAM	Class: Phone_Category	Screen	SIM	Camera	RAM	Class : Phone_Category
5.2 inch	Single	12 MP	2GB	Cheap	5.1 inch	Dual	12 MP	4 GB	Costly
5.7 inch	Single	16 MP	4GB	Costly	5.1 inch	Dual	16 MP	3GB	Costly
5.7 inch	Single	12MP	2GB	Cheap	5.7 inch	Single	16 MP	3GB	Costly
5.5 inch	Single	12 MP	4 GB	Cheap	5.5 inch	Dual	16 MP	4GB	Costly

2. Compute the value of 'Profit' attribute for the following test tuple using Naïve bayes Classification.  $X = (\text{Age} = \text{Middle-aged}, \text{Competition} = \text{Yes}, \text{Type} = \text{Hardware}, \text{Profit} = ?)$

Age	Competition	Type	Profit
Senior	Yes	Software	Down
Senior	No	Software	Down
Senior	No	Hardware	Down
Middle-aged	Yes	Software	Down
Middle-aged	Yes	Hardware	Down
Middle-aged	No	Hardware	Up
Middle-aged	No	Software	Up
Youth	Yes	Software	Up
Youth	No	Hardware	Up

3. Let  $x_i$  indicates Height and  $y_i$  indicates weight. What linear regression equation best predicts Weight based on Height?

$X_i = \text{Height (in cm)} : 160, 151, 174, 138, 186, 136, 179, 163, 152, 170$

$Y_i = \text{Weight (in kg)} : 55, 63, 81, 56, 91, 57, 76, 72, 62, 73$

If a person has i) 155cm height ii) 139cm height iii) 190cm height, what weight would we expect? Also recall when linear regression and logistic regressions are used?

**Course Outcome 5 (CO5):**

1. Cluster the following flower data set into 3 clusters. The distance function is Euclidean distance. Use K-Means algorithm to show the final three clusters

Flower No	Sepal Length	Sepal Width	Petal Length	Petal Width
1.	5.1	3.5	1.3	0.2
2.	4.6	3.1	1.4	0.2
3.	4.5	2.3	1.5	0.2
4.	7.0	3.2	1.7	0.4
5.	5.2	2.7	1.4	0.1
6.	5.7	2.8	1.5	0.3
7.	6.5	3.0	1.7	0.2
8.	6.9	3.1	1.4	0.3

2. Consider  $\epsilon = 3$  units and  $\text{Minpts} = 4$ . Apply the DBSCAN algorithm to cluster the following points: A(2,2), B(3,1), C(3,4), D(5,3), E(9,8), F(10,7), G(10,10), H(12,8), I(3,14), J(10,14), K(11,13), L(12,15), M(14,15).
3. Apply COBWEB Algorithm to cluster the following dataset. Also Analyze in what way, the working of COBWEB algorithm is differed from Partition and Hierarchical Clustering Algorithms.

Object Identifier	Gender	Fever	Cough
A	Male	Y	N
B	Female	N	N
C	Male	Y	Y
D	Female	Y	N

### Course Outcome 6 (CO6):

\*CO6 will be assessed through Mini Project / Assignment

### Guidelines for the Mini-Project:

Group formation: Students are split into project groups with around 3 members in each group. A team can execute the project using appropriate data mining algorithms and improve the efficiency of the algorithm by pre-processing methods using any of the data mining software like R tool, Rapid Miner and python etc.

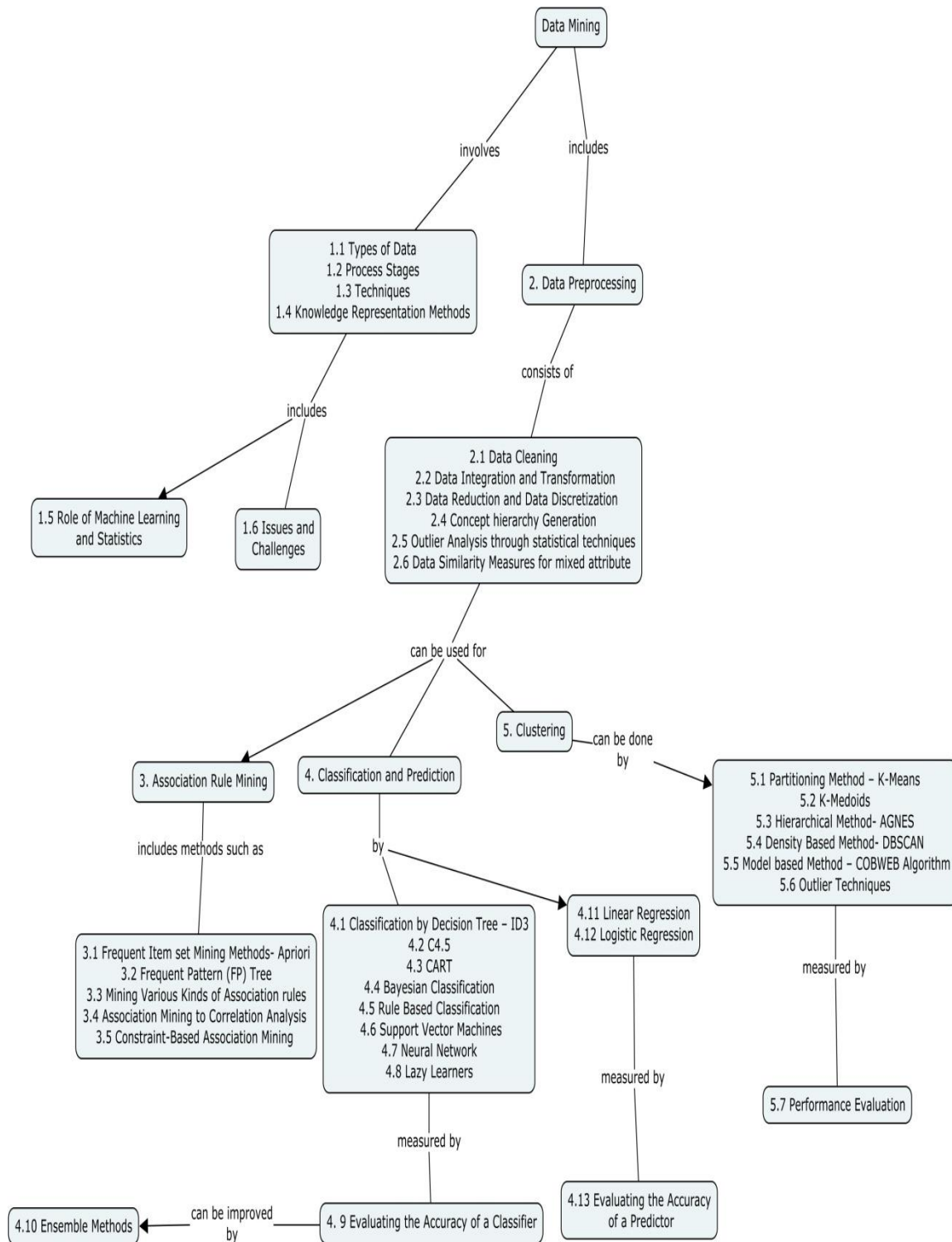
At the end of the semester, the team members have to present their project, submit their report and share their lessons learnt/best practices with other teams. Some of the activities may include: (but not limited to)

- ✓Application identification and data set collection
- ✓Selecting relevant data mining algorithm to extract knowledge from the data set
- ✓Design diagram / Data Modeling
- ✓Results and performance analysis for the chosen data mining technique
- ✓Documentation

Some of the Mini-project titles may include: (but not limited to)

- Financial Data Analysis
- Retail Industry
- Telecommunication Industry
- Biological Data Analysis
- Other Scientific Applications
- Intrusion Detection
- Healthcare
- Market Basket Analysis
- Education
- CRM- Customer Relationship Management

**Concept Map**



## Syllabus

Module No	Topic	No. of Lecture Hours	Course Outcome
-----------	-------	----------------------	----------------

**Data Mining:** Types of Data - Process Stages – Techniques - Knowledge Representation Methods - Role of machine learning and statistics - Issues and challenges in Data Mining.

**Data Pre-processing:** Data Cleaning - Data Integration and Transformation - Data Reduction and Data Discretization - Concept hierarchy Generation - Outlier Analysis through statistical techniques - Data Similarity Measures for mixed attribute - Case Study.

**Association Rule Mining:** Frequent Item set Mining Methods- Apriori, Frequent Pattern (FP) Tree - Mining Various Kinds of Association rules - Association Mining to Correlation Analysis - Constraint-Based Association Mining—Case Study.

**Classification:** Classification by Decision Tree – ID3, C4.5, CART - Bayesian Classification, Laplacian Correction in Bayesian algorithm - Rule Based Classification - Support Vector Machines - Neural Network - Lazy learners - Evaluating the Accuracy of a Classifier- Ensemble Methods- Case Study.

**Prediction:** Linear Regression - Logistic Regression model - Evaluating the Accuracy of a Predictor -Case Study.

**Clustering:** Partitioning Method – K-Means, K-Medoids - Hierarchical Method- AGNES, Density Based Method- DBSCAN - Model based Method – COBWEB Algorithm - Outlier Techniques - Performance Evaluation - Case Study.

## Learning Resources

- Jiawei Han, Micheline Kamper, Jian Pei, “Data Mining: Concepts and Techniques”, Morgan Kaufman, Third Edition, 2011.
- Parteek Bhatia , “Data Mining and Data Warehousing: Principles and Practical Techniques”, Cambridge University Press, First Edition, 2019.
- ArunK.Pujari, “Data Mining Techniques”, Universities Press, Third Edition, 2013.
- Ian H.Witten, Eibe Frank, Mark.A. Hall, “Data Mining Practical Machine Learning Tools and Techniques”, Elsevier, Fourth Edition, 2016.
- AdelchiAzzalini, Bruno Scarpa, “Data Analysis and Data Mining: An Introduction”, Oxford University Press, Third Edition, 2012.
- G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall India Learning Private Limited, Second edition, 2011.
- <https://nptel.ac.in/courses/106/105/106105174/> - Data Mining by Prof. Pabitra Mitra, IIT Kharagpur.

## Course Contents and Lecture Schedule

<b>1</b>	<b>DATA MINING</b>		
1.1	Types of Data	1	CO1
1.2	Process Stages		
1.3	Data Mining Techniques	1	
1.4	Knowledge Representation Methods	1	
1.5	Role of machine learning and statistics		
1.6	Issues and challenges in Data Mining	1	
<b>2</b>	<b>DATA PREPROCESSING</b>		
2.1	Data Cleaning	1	CO2
2.2	Data Integration and Transformation	2	
2.3	Data Reduction and Data Discretization	1	
2.4	Concept hierarchy Generation	1	
2.5	Outlier Analysis through statistical techniques	1	
2.6	Data Similarity Measures for mixed attribute	2	
<b>3</b>	<b>ASSOCIATION RULE MINING</b>		
3.1	Frequent Item set Mining Methods- Apriori	2	CO3
3.2	Frequent Pattern (FP) Tree	2	
3.3	Mining Various Kinds of Association rules	1	
3.4	Association Mining to Correlation Analysis	2	
3.5	Constraint-Based Association Mining		
<b>4</b>	<b>CLASSIFICATION AND PREDICTION</b>		
4.1	Classification by Decision Tree – ID3	1	CO4
4.2	C 4 .5	1	
4.3	CART	1	
4.4	Bayesian Classification, Laplacian Correction in Bayesian algorithm	1	
4.5	Rule Based Classification	1	
4.6	Support Vector Machines		
4.7	Neural Network	1	
4.8	Lazy learners	1	
4.9	Evaluating the Accuracy of a Classifier	1	CO6
4.10	Ensemble Methods		
4.11	Linear Regression	2	CO4
4.12	Logistic Regression model		
4.13	Evaluating the Accuracy of a Predictor		CO6
<b>5</b>	<b>CLUSTERING</b>		
5.1	Partitioning Method – K-Means	1	CO5
5.2	K-Medoids	1	
5.3	Hierarchical Method- AGNES	1	
5.4	Density Based Method- DBSCAN		
5.5	Model based Method – COBWEB Algorithm	1	
5.6	Outlier Techniques	2	
5.7	Performance Evaluation	1	CO6

	<b>Total Lectures</b>	<b>36</b>	
--	-----------------------	-----------	--

**Course Designers:**

1. S. Sridevi [sridevi@tce.edu](mailto:sridevi@tce.edu)
2. A. Sheik Abdullah [asait@tce.edu](mailto:asait@tce.edu)
3. E. Ramanujam [erit@tce.edu](mailto:erit@tce.edu)



<b>21IT540</b>	<b>ACCOUNTING AND FINANCE</b>
----------------	-------------------------------

Category	L	T	P	Credit
HSS	3	0	0	3

**Preamble**

Engineering profession involves lots of decision making. The decisions may range from operation to non-operation. For taking decisions of these kinds, an engineer needs among other data about the organization routine operations and non-routine operations. Accounting is a science which provides all the data by recording, classifying, summarizing and interpreting the various transactions taking place in an organization and thereby helps an engineer in taking vital decisions in an effective manner. Finance is an allied but a separate field relying on accounting and enables engineers in taking useful financial and cost related decisions by providing well defined concepts, tools and techniques

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Prepare financial statements, common size statements and comparative statements.	20
CO2	Perform cost sheet, depreciation and its applications in business.	15
CO3	Compute various types of budgets in an organization	15
CO4	Practice break even analysis and activity based costing systems for a business applications.	15
CO5	Compute working capital requirements and long term investment decisions.	20
CO6	Apply the appropriate sources of finance and mobilize the right quantum of finance and use them in most profitable investment avenues	15

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1,3.2, 4.1.1, 4.1.2, 4.4.5, 4.6.5
CO2	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1,3.2, 4.1.1, 4.1.2, 4.4.5, 4.6.5
CO3	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1,3.2, 4.1.1, 4.1.2, 4.4.5, 4.6.5
CO4	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1,3.2, 4.1.1, 4.1.2, 4.4.5, 4.6.5
CO5	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1,3.2, 4.1.1, 4.1.2, 4.4.5, 4.6.5
CO6	TPS3	Apply	Value	Mechanism	1.1, 1.2, 2.1,3.2, 4.1.1, 4.1.2, 4.4.5, 4.6.5

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	-	-	M	S	M	S	S	S	S	M	M
CO2	S	M	L	-	-	-	M	M	S	S	S	M	M	M
CO3	S	M	L	-	-	-	-	S	S	S	S	S	M	M
CO4	M	M	L	-	M	M	L	S	S	S	S	M	-	S
CO5	M	M	L	-	S	M	M	S	S	S	M	M	-	-
CO6	L	M	L	-	-	M	M	S	M	M	M	S	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	-	-	20
Understand	30	30	-	-	20
Apply	50	50	100	100	60
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini project/Assignment/Practical Component
Perception	
Set	
Guided Response	
Mechanism	Assignment
Complex Overt Responses	
Adaptation	
Origination	

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1(CO1):**

1. Prepare Trading Account, Profit and Loss Account and Balance Sheet from the following

S.NO	PARTICULARS	Debit balances (in Rs)	Credit balances(in Rs)
1	Capital		300000
2	Bank	15000	
3	Plant and machinery	40000	
4	Land and building	60000	
5	Debtors	20000	
6	Creditors		40000
7	Cash	70000	
8	Purchases and sales	35000	50000
9	Purchase returns and	7000	4000

	sales returns		
10	Bills receivable	3000	
11	Bills payable		5000
12	Wages	40000	
13	Salaries	30000	
14	Discount		4000
15	Stock on Jan 2017	10000	
16	Furniture	7000	
17	Carriage inwards	5000	
18	Carriage outwards	6000	
19	Advertising	10000	
20	Travelling expense	3000	
21	Loans		60000
22	Vans	100000	
23	Telephone	2000	
	<b>Total</b>	<b>463000</b>	<b>463000</b>

2. From the following particulars, prepare comparative balance sheet of Malar Ltd as on 31<sup>st</sup> March 2017 and 31<sup>st</sup> March 2018.

Particulars	31 <sup>st</sup> March 2017	31 <sup>st</sup> March 2018
<b>I EQUITY AND LIABILITIES</b>		
1. Shareholders' fund		
a) Share capital		
b) Reserves and surplus	2,00,000	2,50,000
2. Non-current liabilities	50,000	50,000
Long-term borrowings		
3. Current liabilities	30,000	60,000
Trade payables	20,000	60,000
<b>Total</b>	<b>3,00,000</b>	<b>4,20,000</b>
<b>II ASSETS</b>		
1. Non-current assets		
a) Fixed assets	1,00,000	1,50,000
b) Non-current investments	50,000	75,000
2. Current assets		
a) Inventories	75,000	1,50,000
b) Cash and cash equivalents	75,000	45,000
<b>Total</b>	<b>3,00,000</b>	<b>4,20,000</b>

### Course Outcome 2(CO2):

- Classify the cost according to function.
- Prepare cost sheet in the book of Vimi from the following particulars.

Opening stock: - Raw material	=	Rs 5,000
Finished goods	=	Rs 4,000
Closing stock: Raw material	=	Rs 4,000
Finished goods	=	Rs 5,000

Raw material purchased	=	Rs 50,000
Wages paid to laboures	=	Rs 20,000
Chargeable expenses	=	Rs 2,000
Rent and Taxes	=	Rs 7,400
Power	=	Rs 3,000
Experimental expenses	=	Rs 600
Sale of wastage of material	=	Rs 200

Office management salary	=	Rs 4,000
Office printing & stationery	=	Rs 200
Salaries to salesman	=	Rs 2,000
Commission to traveling agents	=	Rs 1,000
Sales	=	Rs 1, 00,000

**Course Outcome 3(CO3):**

1. Explain the advantages and applications of budgetary control.
2. From the forecast of income and expenditure prepare a cash budget for the months from April to June 2019.

Month	Sales Rs	Purchases Rs	Wages Rs	Office expenses Rs	Selling expenses Rs
Feb	70,000	45,000	4,500	2,700	1,800
Mar	72,000	43,000	4,700	3,000	2,000
Apr	75,000	44,000	4,900	2,900	2,200
May	71,000	40,000	5,000	3,000	2,100
Jun	70,000	42,000	5,000	2,800	1,900

- Plant worth Rs25, 000 purchased in June. 40% payable immediately and the remaining in two equal instalments in subsequent months.
- Advance tax payable in April Rs 4500
- Period of credit allowed
  - By suppliers 2 months
  - To customer 1 month
- Dividend payable Rs 7000 in June
- Delay in payment of wages and office expenses 1 month and selling expenses 1 month. Expected cash balance on 1<sup>st</sup> April Rs 30,000

Machinery expected to sell on May is Rs 20,000

**Course Outcome 4 (CO4):**

1. From the following information calculate the Breakeven point in terms of units and breakeven point in terms of sales. Sales....Rs.10,000, Variable costs Rs.6,000, fixed costs Rs.2000; profit Rs.2,000; No. Of units produced 1,000 units.
2. Calculate the breakeven point and margin of safety from the following information Fixed cost .Rs.10,000, sales in Rs.25,000, selling price per unit Rs.30; variable cost per unit Rs.10.

**Course Outcome 5(CO5):**

1. From the following information extracted from the books of a manufacturing company, compute the operating cycle in days and the amount of working capital required:
 

Period Covered	365 days
Average period of credit allowed by suppliers	16 days
Average Total of Debtors Outstanding	480
Raw Material Consumption	4,400
Total Production Cost	10,000

Total Cost of Sales	10,500
Sales for the year	16,000
<b>Value of Average Stock maintained:</b>	
Raw Material	320
Work-in-progress	350
Finished Goods	260

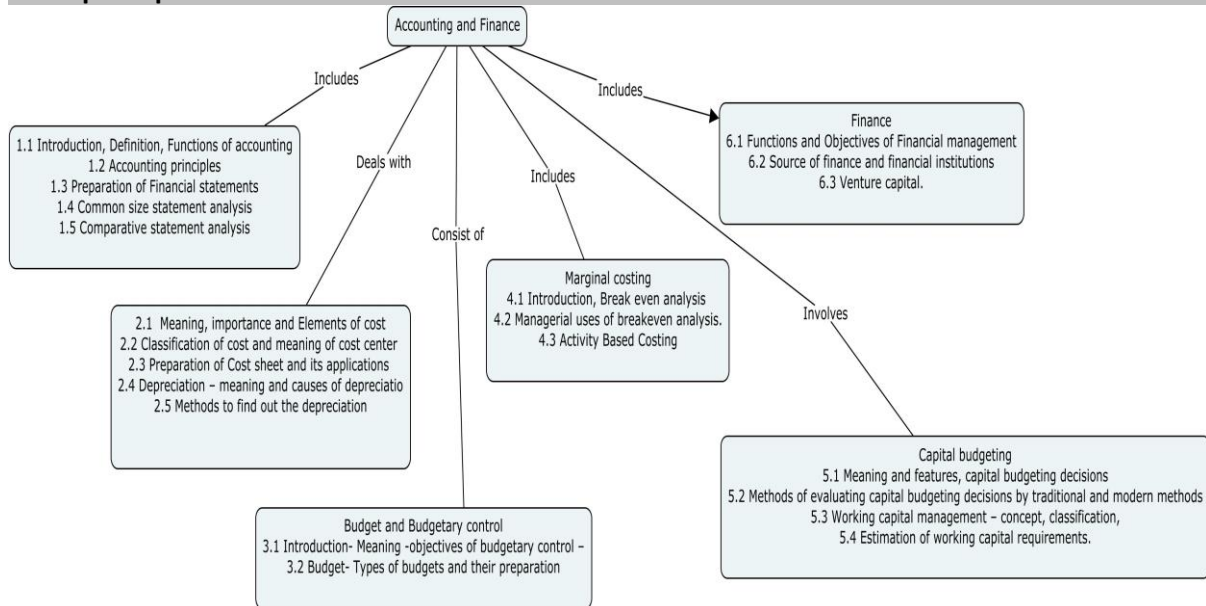
2. From the following data of a project, Calculate IRR and suggest whether the project is to be undertaken or not if the cut off rate is 9%.

<b>Cash Out flow (Rs.)</b>		1,50,000
<b>Cash Inflow(Rs.)</b>	<b>Year 1</b>	41,000
	<b>Year 2</b>	50,000
	<b>Year 3</b>	50,000
	<b>Year 4</b>	42,000

**Course Outcome 6(CO6):**

1. Analyse the sources of finance to start small scale business.
2. Suggest suitable sources of finance to start a business with a capital of 60 crores.

**Concept Map**



**Syllabus**

**Accounting** Introduction definition, functions of accounting, accounting principles. Preparation of financial statements and study them with common size and comparative statements.

**Cost Accounting** - Meaning and importance -Elements of cost- classification of cost- Cost centre, Preparation of cost sheet and its applications .Depreciation – meaning and causes of depreciation, Methods to find out the depreciation

**Budget and Budgetary control**- Introduction-Meaning -objectives of budgetary control – Budget-Types of budgets and their preparation.

**Marginal costing**- Introduction, Break even analysis –Managerial of breakeven analysis. Activity based Costing.

**Capital budgeting**- Meaning and features, capital budgeting decisions, Methods of evaluating capital budgeting decisions by traditional and modern methods. Working capital

management - concept, classification, and Estimation of working capital requirements.

**Finance:** Functions, Objectives of financial management and Sources of finance and financial institutions, Venture capital.

Module No	Topic	No. of Lectures	Cos
1	<b>Accounting</b>		
1.1	Introduction, Definition, Functions of accounting	1	CO1
1.2	Accounting principles	1	
1.3	Preparation of Financial statements	3	
1.4	Common size statement analysis	1	
1.5	Comparative statement analysis	1	
2	<b>Cost Accounting</b>		
2.1	Meaning, importance and Elements of cost	1	CO2
2.2	classification of cost and meaning of Cost centre,	1	
2.3	Preparation of Cost sheet and its applications	3	
2.4	Depreciation – meaning and causes of depreciation	1	
2.5	Methods to find out the depreciation	2	
3	<b>Budget and Budgetary control</b>		
3.1	Introduction- Meaning -objectives of budgetary control –	1	CO3
3.2	Budget- Types of budgets and their preparation	4	
4	<b>Marginal costing</b>		
4.1	Introduction, Break even analysis	2	CO4
4.2	Managerial uses of breakeven analysis.	1	
4.3	Activity Based Costing	2	
5	<b>Capital budgeting</b>		
5.1	Meaning and features, capital budgeting decisions	1	CO5
5.2	Methods of evaluating capital budgeting decisions by traditional and modern methods	4	
5.3	Working capital management – concept, classification,	1	
5.4	Estimation of working capital requirements.	1	
6	<b>Finance</b>		
6.1	Functions and Objectives of Financial management	1	CO6
6.2	Sources of finance and financial institutions	3	
6.3	Venture capital.	1	
	<b>Total</b>	<b>36 hrs</b>	

### Learning Resources

1. M.C.Shukla, T.S.Grewal, "Advanced Accounts-Volume-I, 2010 Reprint, S. Chand & company Ltd., 2010.
2. Prasanna Chandra, "Financial Management-Theory and practice" seventh Reprint, Tata McGraw-Hill publishing company Limited, 2010.
3. P.S.BoopathiManickam "Financial and Management Accounting" PSG publications 2009.
4. Don R. Hansen and Maryanne M. Mowen "Cost Management: Accounting and Control, Fifth Edition" Thomson, 2006.
5. Michael C . Ehrhardt and Eugene F . Brigham, "Financial Management: Theory and Practice -thirteenth edition" South-Western cengage learning, 2011
6. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 2007
7. Paramasivan.C, Subramanian.T, "Financial management" New Age international Publishers, 2014.

8. <https://nptel.ac.in/courses/110/106/110106135/>: Decision making using financial accounting, Prof. G Arun Kumar, IIT Madras
9. <https://nptel.ac.in/courses/110/101/110101131/> : Financial Accounting, Dr. Varadraj Bapat, IIT Bombay.
10. <https://nptel.ac.in/courses/110/107/110107127/>: Management Accounting, Prof. Anil K. Sharma, IIT Roorkee.
11. <https://www.youtube.com/watch?v=P9JIBbZas3w>: Introduction to accounting, Dr.S.Vaidhyasubramanian, Adjunct professor, Sastra University.

**Course Designers:**

- |                      |                 |
|----------------------|-----------------|
| 1. Mr.B.Brucelee     | bbmech@tce.edu  |
| 2. Dr.R.Sivasankaran | rssmech@tce.edu |
| 3. Mr.S.Rajkumar     | srmech@tce.edu  |

18IT571	WEB TECHNOLOGIES LAB	Category	L	T	P	Credit
		PC	0	0	2	1

**Preamble**

The objective of this laboratory is to motivate the students to learn how to choose their communication approach by considering platform, dynamically updating the web contents based on the client requirements. It provides strong foundation in scripting languages, XML and web developer tools.

**Prerequisite**

- 18IT370 Object Oriented Programming Lab

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Build a web application using PHP with database for the given requirements	17
CO2	Design an UI prototype for the given problem	8
CO3	Develop the client side part of the web application for the business need	17
CO4	Develop the server side part of the web application for the business need	24
CO5	Perform functional, integration, usability testing for the web application	17
CO6	Analyze the existing web application codes for finding the errors, issues, and scope for improvement	17

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO6	TPS4	Analyse	Organise	Complex Overt Responses	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			S	S	S		S	M	S	S
CO2	S	M	L		S			S	S	S		S	M	S	S
CO3	S	M	L		S			S	S	S		S	M	S	S
CO4	S	M	L		S			S	S	S		S	M	S	S
CO5	S	M	L		S			S	S	S		S	M	S	S
CO6	S	S	M	L	S			S	S	S		S	M	S	S

S- Strong; M-Medium; L-Low



**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	-	-
Apply	80	80
Analyse	20	20
Evaluate	-	-
Create	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Practical Component/Observation
Perception	-
Set	-
Guided Response	20
Mechanism	60
Complex Overt Responses	20
Adaptation	-
Orignation	-

**List of Experiments/Activities with CO Mapping**

S. No	List of Experiments	COs	Total lecture hours
1.	Design a web application front-end using HTML, CSS, JS	CO1	2
2.	Develop the web application back-end using PHP with DB	CO1	2
	Form a team of 2/3 students, identify a business problem, collect the requirements and draft the system requirement specifications (SRS)		
3.	Prepare the UI Prototype using wix/ wireframe/ JustInMind	CO2	2
4.	Design the front-end part of the application	CO3	4
5.	Develop the Back-end part of the application	CO4	4
6.	Perform various testing such as functional, usability, interface using testing tools such as selenium	CO5	4
7.	Improvement in the web application code after testing and customer feedback	CO3	2
8.	Prepare an analysis report of the existing web application codes considered from online repository like GitHub Report must include errors, issues and scope for improvement Modify/Update/Add suitable functionality	CO6	4
	Total Hours		24

**Learning Resources**

1. Mastering HTML, CSS & Javascript Web Publishing by Laura Lernay, Rafe Colburn, Jennifer Kyrnir, BPB Publications, 2016
2. Pro AngularJS, Adam Freeman, Apress; 1st ed. edition, 2014
3. Beginning Node.js, Basarat Ali Syed, Apress; 1st ed. edition, 2014
4. <https://angularjs.org/>
5. <https://nodejs.org/en/>
6. <https://www.npmjs.com/>
7. <https://restfulapi.net/>

**Course Designers:**

1. Dr.P.Karthikeyan [karthikit@tce.edu](mailto:karthikit@tce.edu)
2. S. Karthiga [skait@tce.edu](mailto:skait@tce.edu)
3. C.Santhiya [csit@tce.edu](mailto:csit@tce.edu)

21IT580	INFORMATION SECURITY LAB	Category	L	T	P	C
		PC	0	0	2	1

### Preamble

The laboratory course on Information security aims to provide hands on experience in using various crypto libraries for securing computer applications. Practical exposure on usage of various network security tools for analyzing security vulnerabilities and protection is provided.

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Utilize symmetric and public key cryptography to offer confidentiality in simple application development	21
CO2	Perform message and entity authentication using hashing and digital signatures	13
CO3	Use standard crypto libraries for crypt analysis	12
CO4	Configure and manage network defense tools like Firewalls and Intrusion Detection Systems	21
CO5	Identify software vulnerabilities such as SQL injection and provide solutions for prevention and detection	12
CO6	Analyze the network attacks and identify the malwares in the network	21

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3.1, 2.5.1, 3.1.1, 3.2.2, 3.2.3
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3.1, 2.5.1, 3.1.1, 3.2.2, 3.2.3
CO3	TPS4	Analyze	Organize	Complex Overt Response	1.2, 2.1.1, 2.1.2, 2.1.5, 2.1.3, 2.4.4, 2.5.1, 3.1.1, 3.2.2, 3.2.3
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3, 4.1.1, 4.2.2, 4.5.5
CO5	TPS4	Analyze	Organize	Complex Overt Response	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3.1, 2.4.4, 2.5.1, 3.1.1, 3.2.2, 3.2.3
CO6	TPS4	Analyze	Organize	Complex Overt Response	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3.1, 2.4.4, 2.5.1, 3.1.1, 3.2.2, 3.2.3

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 0	PO1 1	PO1 2	PO1 3	PSO 1	PSO 2	PSO 3
-----	------	------	------	------	------	------	------	------	------	------	-------	-------	-------	-------	-------	-------

CO 1	S	M	L		M			M	L			M	M	M	L
CO 2	S	M	L		M			M	L			M	M	M	L
CO 3	S	S	M	L	M			M	L			M	S	M	L
CO 4	S	M	L		M			M	L			M	M	M	L
CO 5	S	S	M	L	M			M	L	L		M	S	M	L
CO 6	S	S	M	L	M			M	L	L		M	S	M	L

S- Strong; M-Medium; L-Low

#### Assessment Pattern: Cognitive Domain

Cognitive Levels	Model Examination	Terminal Examination
Remember		
Understand		
Apply	60	60
Analyse	40	40
Evaluate		
Create		

#### Assessment Pattern: Psychomotor

Psychomotor Skill	Miniproject /Practical Component/Observation
Perception	
Set	
Guided Response	
Mechanism	50
Complex Overt Responses	50
Adaptation	
Origination	

#### List of Experiments/Activities with CO Mapping

Exp No.	Topic	No. of Lab Hours	COs
1	Implementation and Crypt analysis of Hill Cipher	2	CO1/ CO3
2	Develop a secure client server communication using symmetric key algorithms (Use Standard crypto Libraries)	2	CO1/C O3
3	Implement RSA cryptosystem with key management	2	CO1/ CO3
4	Verify integrity of client server communication using Hashing techniques	3	CO2
5	Perform Man in the middle attack in Diffie Hellman Key Exchange protocol	2	CO1
6	Perform password extraction, cracking and recovery from target system	1	CO4
7	Simulation of SQL Injection attack - Testing Web applications for SQL injection vulnerabilities, Scanning web servers, analyzing logs, Securing web application	3	CO5
8	Configuration of Firewalls in system environment / using OPNET or	1	CO4

	equivalent tool.		
9	Simulation of Virtual Private Network using OPNET or equivalent tool.	1	CO4
10	Security analysis of network traffic using Wireshark or equivalent tool.	1	CO4
11	Configure Intrusion Detection System tool for monitoring events in a host to detect malicious activities.	1	CO4
12	Creation, Detection and Prevention of Buffer overflow attack	1	CO6
13	Post attack analysis as Incidence Response	1	CO6
14	Study on detection and analyzes of Malwares	1	CO6
15	Study on software tool used to validate Internet Security Protocols and Applications (AVISPA or equivalent tools)	2	CO6
<b>Total Lab Hours</b>		<b>24</b>	

### Learning Resources

1. Michael Gregg, "The Network Security Test Lab", Wiley Publication, 2015.
2. Randall Boyle, Jeffery G.Proudfoot, "Applied Information Security", Second Edition, Pearson Publication, 2013.

### Course Designers

- |    |             |                   |
|----|-------------|-------------------|
| 1. | C.Jeyamala  | jeyamala@tce.edu  |
| 2. | M.Thangavel | mtit@tce.edu      |
| 3. | S.Sujitha   | sujithait@tce.edu |

**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.TECH. INFORMATION TECHNOLOGY DEGREE PROGRAMME**

**SIXTH SEMESTER**

**FOR THE STUDENTS ADMITTED IN THE**

**ACADEMIC YEAR 2021 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A GOVERNMENT AIDED ISO 9001:2008 CERTIFIED  
AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)  
**MADURAI – 625 015, TAMILNADU**

PHONE: 0452 – 2482240, 41

FAX: 0452 2483427

WEB: [WWW.TCE.EDU](http://WWW.TCE.EDU)

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**COURSES OF STUDY**

(For the candidates admitted from 2021-19 onwards)

**SIXTH SEMESTER**

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
<b>THEORY</b>						
21IT610	Cloud Computing	PC	3	-	-	3
21YYEX0	Engineering Science Elective	ES	3	-	-	3
21ITPX0	Programme Elective	PE	3	-	-	3
21XXGX0	Open Elective	FE/GE	3	-	-	3
<b>THEORY CUM PRACTICAL</b>						
21IT630	Programming for Internet of Things	ES	2	-	2	3
21IT660	Mobile Application Development	PC	2	-	2	3
<b>PRACTICAL</b>						
21IT670	Cloud Computing Lab.	PC	-	-	2	1
21ES690	Engineering Design Project	Project	-	-	6	3
<b>Total</b>			<b>16</b>	<b>-</b>	<b>12</b>	<b>22</b>

BS : Basic Science  
HSS : Humanities and Social Science  
ES : Engineering Science  
PC : Program Core  
PE : Program Elective  
GE : General Elective  
AC : Audit Course

L : Lecture  
T : Tutorial  
P : Practical

**Note:**

1 Hour Lecture is equivalent to 1 credit  
2 Hours Tutorial is equivalent to 1 credit  
2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**Scheme of Examinations**

(For the candidates admitted from 2021-19 onwards)

**SIXTH SEMESTER**

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
<b>THEORY</b>								
1	21IT610	Cloud Computing	3	40	60	100	27	50
2	21IT620	Data Analytics	3	40	60	100	27	50
3	21ITPX0	Programme Elective	3	40	60	100	27	50
4	21XXGX0	Open Elective	3	40	60	100	27	50
<b>THEORY CUM PRACTICAL</b>								
5	21IT630	Programming for Internet of	3	50	50	100	25	50
6	21IT660	Mobile Application Development	3	50	50	100	25	50
<b>PRACTICAL</b>								
7	21IT670	Cloud Computing Lab.	3	60	40	100	18	50
8	21ES690	Engineering Design Project	-	50	50	100	25	50

\* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

\*\* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

21IT610	CLOUD COMPUTING	Category	L	T	P	Credit
		PC	3	0	0	3

### Preamble

Cloud computing paradigm covers a range of distributed computing, hosting and access solutions, including service-based computing. The objective of the course is to provide comprehensive view of cloud computing concepts, technologies, architecture, security breaches, corrective measures, deploying applications and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications and deployments

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain the key technologies, strengths, limitations and applications of cloud computing	11
CO2	Apply suitable virtualization concept for the given scenario	17
CO3	Categorize the cloud service types, architecture, contract negotiations needed for cloud service delivery and cloud software development	25
CO4	Identify the necessity, appropriate cloud architecture/model for deploying an application in a cloud environment based on the given requirements	22
CO5	Develop a cloud application with a user interface and diagnose the suitable data components	17
CO6	Outline the emerging technologies in cloud computing platforms	8

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2, 2.3.1, 2.4.6
CO2	TPS2	Apply	Value	Mechanism	1.2, 2.3.1, 2.3.2, 2.3.4
CO3	TPS4	Analyze	Organize	Complex Overt Response	1.2, 2.4.5, 2.4.6, 3.2.1 -3.2.6, 4.3.1, 4.3.2
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO6	TPS3	Understand	Respond	Guided Response	1.2, 2.3.1, 2.4.6



**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO1	M	L											L		
CO2	S	M	L		S	L			S	S			M	M	L
CO3	S	S	M	L					S	S		M	M		M
CO4	S	M	L			L			S	S	L	M	M	L	S
CO5	S	M	L		S	M	L	L	S	S	M	S	M	S	S
CO6	M	L											L		

S- Strong; M-Medium; L-Low

- CO4 and CO5 partially evaluated through assignments/min projects

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	10	10			10
Understand	30	20	20	20	20
Apply	60	60	80	70	60
Analyse		10		10	10
Evaluate					0
Create					0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	
Set	
Guided Response	
Mechanism	80
Complex Overt Responses	20
Adaptation	
Origination	

**Sample Questions for Course Outcome Assessment\*\***

\*\* (2 to 3 at the cognitive level of course outcome)

**Course Outcome 1(CO1):**

1. Define Cloud computing and explain essential characteristics of cloud computing.
2. What is self service provisioning?
3. Discuss the benefits of cloud computing with respect to conventional computing.

**Course Outcome 2(CO2):**

1. Explain some of the common pitfalls that come with virtualization.
2. Show the difference between process virtual machines, host VMMs and native VMMs.

3. Contrast the virtual machine as perceived by a traditional operating system processes and a system VM.

**Course Outcome 3(CO3):**

1. Explain the services provided by the Amazon infrastructure cloud from a user perspective.
2. What is cloud computing? Enlist and explain three service models, and four deployment models of cloud computing.
3. How to deploy a web application in a Google App Engine? Explain

**Course Outcome 4 (CO4):**

1. Identify when to use cloud application and explain how architecture affects the performance
2. Compare the differences between an internal application and a cloud application.
3. Propose several samples of risk/benefit assessments when selecting applications

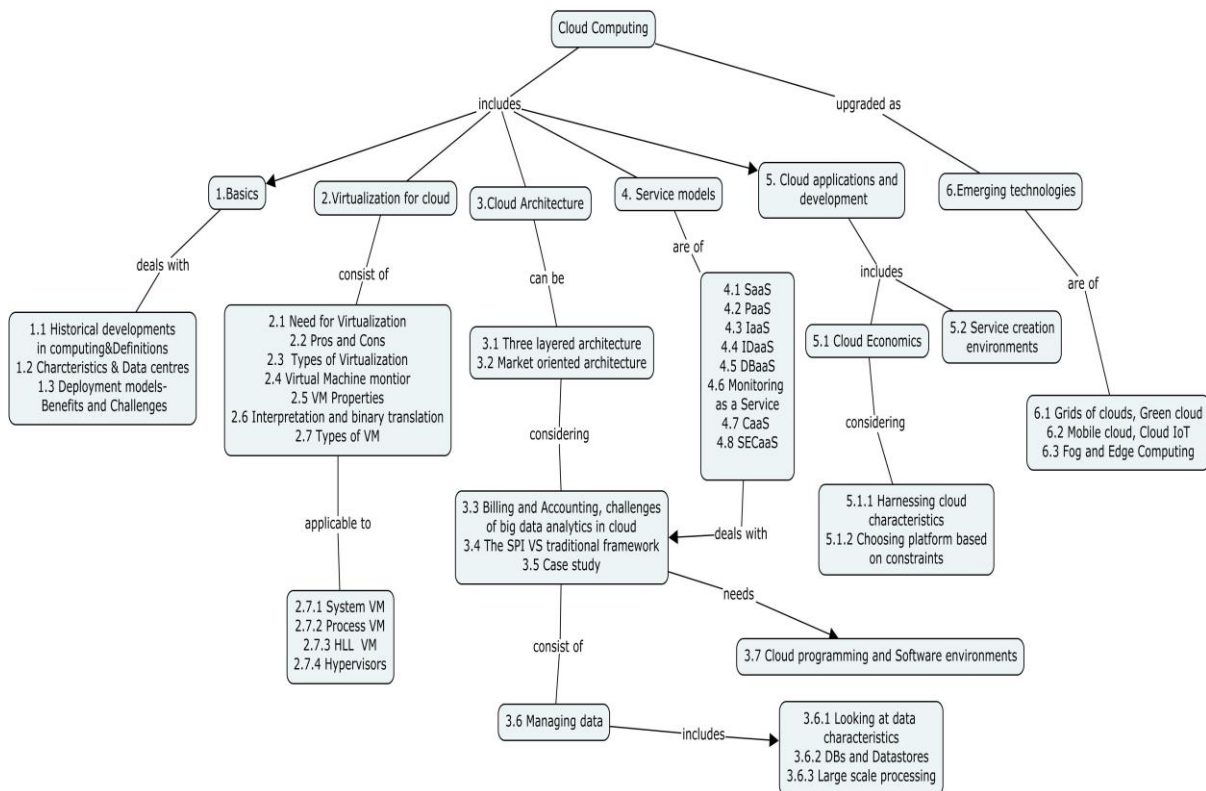
**Course Outcome 5 (CO5):**

1. Deploy cloud application with user interface that to be used on a smart phone
2. Adapt suitable data component for E-Governance applications
3. Design an interface for rural development system using suitable cloud platform

**Course Outcome 6(CO6):**

1. Compare the difference between fog and edge computing
2. Outline the benefits of cloud in IoT applications
3. Explain the key characteristics of mobile cloud computing
4. Infer the role of using green cloud in IT services

**Concept Map**



**Syllabus**

**Basics of Cloud:** Historical developments in computing- Definition of Cloud Computing, Essential Characteristics- Data centres-Cloud deployment models-benefits and challenges

### **Virtualization for cloud**

Need for Virtualization, Pros and cons of Virtualization, Types of Virtualization, Virtual Machine monitor, Virtual machine properties, Interpretation and binary translation, Types of VM: System VM, Process VM, , HLL VM, Hypervisors : Xen, KVM , VMWare, Virtual Box, Hyper-V.

### **Cloud architecture**

Three layer cloud architecture-market oriented cloud architecture ,SLA-billing and Accounting, challenges of big data analytics in cloud-The SPI Framework vs. the Traditional IT Model-Case study : Openstack, Nimbus, Microsoft Azure-Managing Data: Looking at Data, Scalability & Cloud Services-Database & Data Stores in Cloud-Large Scale Data Processing- cloud programming and software environments- Hadoop, GFS, Spark, map reduce, Big Table, Hbase, Libvirt ,openVswitch-.

### **Service Models**

SaaS – Multi-tenant, OpenSaaS, SOA. PaaS – IT Evolution, Benefits, Disadvantages. IaaS – Improving performance, System and storage redundancy, Cloud based NAS devices, Advantages, Server types. IDaaS – Single Sign-on, OpenID. Database as a Service, Monitoring as a Service, Communication as services- Security as a Service (SECaaS)- ISO/IEC Standards

### **Cloud applications and development**

Cloud Economics-Harnessing cloud characteristics in application design- Cloud Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs-Service creation environments to develop cloud based application-Case study: Meghdoot, Amazon, Azure, Google App, Docker, IBM, Sales force.

### **Emerging technologies**

Grid of Clouds, Green Cloud- Mobile cloud Computing, Cloud in IoT applications, Fog and Edge computing

### **Learning Resources**

- John Rittinghouse& James Ransome, “Cloud Computing, Implementation, Management and Strategy”, CRC Press, 2010.
- Cloud Computing Principles and Paradigms, RajkumarBuyya,JamesBroberg, AndrzejGoscinski, Wiley Publishers,2011
- Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, SubraKumaraswamy, ShahedLatif,O’Reill,2010.
- RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering cloud computing”, Morgan Kaufman, 2013.
- Dr. Kris Jamsa, “Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More”, Jones and Bartlett learning, First edition, 2013.
- ArshdeepBahga, Vijay Madiseti, “Cloud Computing: A Hands-On Approach”, CreateSpace Independent Publishing Platform, 1st edition, 2013.
- Massimo Cafaro (Editor), Giovanni Aloisio (Editor), “Grids, Clouds and Virtualization” Springer; edition, 2011.
- GautamShroff, “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1 edition, 2010.
- Barrie Sosinsky, “ Cloud Computing Bible” John Wiley & Sons, 2010
- Cloud Security Alliance, “Security Guidance for Critical Areas of Focus in Cloud Computing” 2011

- Cloud Security Alliance, “Top Threats to Cloud Computing”, 2013.
- <http://nptel.ac.in/courses/106105167/>

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
1.	Basics of Cloud		
1.1	Historical developments in Computing, Definition of Cloud Computing	1	CO1
1.2	Essential Characteristics, Data centres	1	
1.3	Deployment models -Benefits, Challenges	2	
2.	Virtualization for cloud		CO2
2.1	Need for Virtualization	1	
2.2	Pros and cons of Virtualization		
2.3	Types of Virtualization	1	
2.4	Virtual Machine monitor		
2.5	Virtual machine properties	2	
2.6	Interpretation and binary translation		
2.7	Types of VM		
2.7.1	System VM	1	
2.7.2	Process VM		
2.7.3	HLL VM		
2.7.4	Hypervisors :Xen, KVM , VMWare, Virtual Box, Hyper-V.	1	
3.	Cloud architecture		CO4
3.1	Three layer cloud architecture	2	
3.2	Market oriented cloud architecture, SLA		
3.3	Billing and Accounting, Challenges of big data analytics in cloud	1	
3.4	The SPI Framework vs. the Traditional IT Model	2	
3.5	Case study : Eucalyptus, Nimbus, Microsoft Azure		
3.6	Managing Data		
3.6.1	Looking at Data, Scalability & Cloud Services	1	
3.6.2	Database & Data Stores in Cloud	1	
3.6.3	Large Scale Data Processing	1	
3.7	Cloud programming and software environments		
4.	Service models		CO3
4.1	SaaS – Multitenant, OpenSaaS, SOA	1	
4.2	PaaS – IT Evolution, Benefits, Disadvantages	2	
4.3	IaaS – Improving performance, System and storage redundancy, Cloud based NAS devices, Advantages, Server types	2	
4.4	IDaaS – Single Sign-on, OpenID.	1	
4.5	Database as a Service	1	
4.6	Monitoring as a Service	1	
4.7	Communication as services	1	
4.8	SECaaS-ISO/IEC Standards		
5.	Cloud applications and development		CO5
5.1	Cloud Economics	2	
5.1.1	Harnessing cloud characteristics in application design		
5.1.2	Cloud Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs	2	
5.2	Service creation environments to develop cloud based applications—Meghdoot, Amazon, Azure, Google App,	2	

	Docker, IBM, Sales force		
6.	Emerging technologies		CO6
6.1	Grid of Clouds, Green Cloud	1	
6.2	Mobile cloud Computing, Cloud in IoT	1	
6.3	Fog and Edge computing	1	
	Total Lectures	36	

**Course Designers:**

1. Dr.S.Padmavathi      spmcse@tce.edu

21ITEA0	DATA ANALYTICS	Category	L	T	P	Credit
		ES	3	0	0	3

### Preamble

This course provides an in-depth knowledge on managing, handling and analysing structured or unstructured data. The course focuses on concepts, methods, principles, techniques, tools applicable to any technology environment and establishes a baseline that can be enhanced by practice and additional real-world experience.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain the analytic process model and perform suitable statistical test for the processed data.	20
CO2	Implement statistical modelling and make inferences for real time applications.	20
CO3	Apply predictive modelling using regression analysis and ensemble methods for any data.	15
CO4	Examine the type of unstructured data, content analysis, frequency analysis with lexical relations and sentiment analysis.	15
CO5	Illustrate the use of survival analytics models, measurements and its evaluation to real time applications.	10
CO6	Demonstrate big data analytics platform such as Hadoop, No SQL with a key understanding on quality, standards and ethical guidelines.	10
CO7	Develop simple applications using big data analytic platform, data modelling methods and data analytic tools.	10

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3
CO2	TPS3	Apply	Value	Mechanism	1.3,2.1.2,2.1.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.2,
CO4	TPS4	Analyse	Organise	Complex Overt Responses	1.3,2.2.3,2.2.4
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.1.2,2.1.3
CO6	TPS2	Understand	Respond	Guided Response	1.3,2.2.3
CO7	TPS6	Apply	Value	Mechanism	1.3, 2.1.2,2.2.3, 2.2.4,3.1.2, 4.1, 4.2, 4.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		S	M		M				M	M	S	L
CO3	S	M	L		S	M		M				M	M	S	L
CO4	S	S	M	L	S	S		M	M			M	M	S	L
CO5	S	M	L		L	L		L				M	M	L	L
CO6	M	L			L	M		L				L	L	M	
CO7	S	M	L		S	S		S	S	S		S	M	S	M

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Mini Project			Terminal Examination
	1	2		Ass 1	Mini		
Remember	20	20		-	-		10
Understand	20	20		-	-		30
Apply	60	50		100	50		50
Analyse	-	10		-	50		10
Evaluate	-	-		-	-		-
Create	-	-		-	-		-

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Mini project/Assignment/Practical Component
Perception	-
Set	20
Guided Response	20
Mechanism	60
Complex Overt Responses	-
Adaptation	-
Origionation	

**Sample Questions for Course Outcome Assessment\*\***

**Course Outcome1 (CO1):**

1. Explain Analytics Process Model with suitable examples.
2. Describe about analytical model requirements.
3. Prepare about the methods of scaling a variable and clearly justify with your reasons why scaling is important and Infer the concepts related to coarse classification. Give an example.

**Course Outcome2 (CO2):**

1. Two samples are drawn from two normal populations. compute whether the two samples have same variance at 5% level.

I	60	65	71	74	76	82	85	87	-	-
II	64	66	67	85	78	88	86	85	63	91

- Organize null and alternate hypothesis and compute the degrees of freedom.
  - Solve for F Test-Statistic
  - Use the following critical value of F at 0.05 for various degrees of freedom.
2. Lin Xiang, a young banker, has moved from Saskatoon, Saskatchewan, to Winnipeg, Manitoba, where she has recently been promoted and made the manager of City Bank, a newly established bank in Winnipeg with branches across the Prairies. After a few weeks,

she has discovered that maintaining the correct number of tellers seems to be more difficult than it was when she was a branch assistant manager in Saskatoon. Some days, the lines are very long, but on other days, the tellers seem to have little to do. She wonders if the number of customers at her new branch is simply more variable than the number of customers at the branch where she used to work. Because tellers work for a whole day or half a day (morning or afternoon), she collects the following data on the number of transactions in a half day from her branch and the branch where she used to work:

Winnipeg branch: 156, 278, 134, 202, 236, 198, 187, 199, 143, 165, 223

Saskatoon branch: 345, 332, 309, 367, 388, 312, 355, 363, 381

Consider the scenario, Perform F-Test statistic and also test whether the two Winnipeg and Saskatoon attributes have same variance.

3. For the above given scenario, organize null and alternate hypothesis and compute the degrees of freedom.

### Course Outcome 3 (CO3):

Consider the assumptions of linearity for a curvature using various plots.

- Scatter plot of residuals versus the fitted values
- Scatter plot for residuals versus each predictor

The plot for residuals versus the predictor suggests that there is a non-linear relationship.

1. Identify the type of regression analysis model that suits best for the above problem
2. Elaborate the algorithmic steps of the regression model.
3. Consider there are about 1000 tuples of record with binary class labels. Out of 1000 data tuples 580 belongs to class A and 420 data tuples belongs to class B. The data records have been trained and tested over Neural Network algorithm. The confusion matrix shows that out of 1000 tuples of records only 620 records has been correctly classified by the classifier which then corresponds 341 of class A and 279 of class B.

Calculate the following:

- Classification Accuracy
- Error Rate
- Sensitivity
- Specificity
- Precision

### Course Outcome 4 (CO4):

1. Consider a set of unstructured textual data given for analysis. Summarize the sub tasks and components in which a text analysis process must contain. Make use of tagging and annotation for the textual data analysis process.
2. Consider the logical view of a document from a full text to a set of index terms and compute the following for text processing:
  - (a) Parts of speech tagging
  - (b) Tokenization
  - (c) Stemming

3. Produce the pseudo code for computing tokenization, stemming using any text processing language for the below.

*I love this movie! It's sweet, but with satirical humor. The dialogue is great and the adventure scenes are fun... It manages to be whimsical and romantic while laughing at the conventions of the fairy tale genre. I would recommend it to just about anyone. I've seen it several times, and I'm always happy to see it again whenever I have a friend who hasn't seen it yet!*

### Course Outcome 5 (CO5):

1. Consider 200 subjects of certain types were tracked over a period of time to determine how many survived for one year, two years, and so forth. If all the subjects remained accessible throughout the entire length of the study, the estimation of survival



probabilities for subjects would be easy. Calculate the Kaplan Meier Survival probability estimate for the data provided and find the total number of subjects at risk during the end of sixth year.

Time period	At Risk	Become Unavailable (censored)	Died	Survived
Year 1	200	6	10	?
Year 2	?	6	20	?
Year 3	?	6	30	?
Year 4	?	6	40	?
Year 5	?	6	50	?
Year 6	?	6	60	?

2. Apply the following data for non-parametric maximum likelihood estimator for the variable  $S(t)$ . Incorporate the concepts of censoring and no censoring with respect to the total number of individuals  $d_j$ , for an event to occur.

Suppose there are 10 customers of a certain type who were tracked over a a period of time to determine how many have churned, censored and at risk  $t(n_t)$ . out of 10 customers at the beginning of the study, the following conditions holds with respect to the time of the event  $S(t)$ :

Time	Customers at risk $t(n_t)$	Customers churned $t(d_t)$	Customers censored at $t$
0	10	0	0
3	?	1	1
6	?	1	0
9	?	0	1
12	?	3	0
15	?	1	1
18	?	0	1

- (i) Derive the KM estimator for  $S(t)$ .
- (ii) Find the total number of customers who are at risk at the end of the time period, say 18.

3. Relate the concept of product limit estimator for  $s(t)$  with censoring for churn prediction with 10 individuals and compute the following for the data provided:

- (i) Examine when the customers churn.
- (ii) Interpret the data when customers make next purchase.
- (iii) Solve for  $s(t)$  when customers are in default state.

Customer	Time of churn	Churn or censored
C1	6	Churn
C2	3	Censored
C3	12	Churn
C4	15	Censored
C5	18	Censored
C6	12	Churn
C7	3	Churn
C8	12	Churn
C9	9	Censored
C10	15	Churn

**Course Outcome 6 (CO6):**

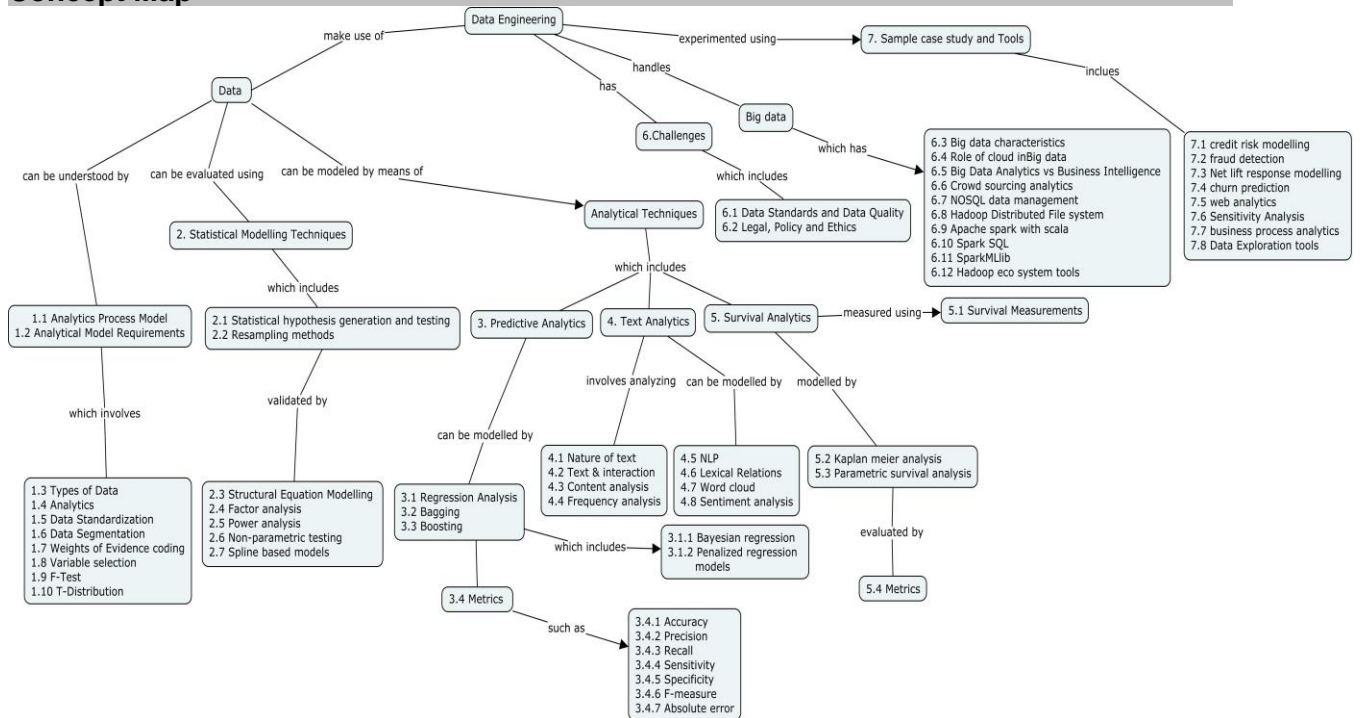
1. Describe data replication for HDFS with replica selection and placement.
2. Illustrate the working paradigm of map reduce programming for a simple word count program. Clearly state the map, shuffle and reduce phase with an example.
3. Illustrate the concept of anatomy of map reduce with the code determining the execution of map and reduce jobs separately. Mention the steps corresponding to each map phase during execution. The execution workflow must contain the following:
  - What does the user gives?
  - How many map and reduce task?
  - How to launch map task?
  - Mention the flow of execution timeline.

**Course Outcome 7 (CO7):**

CO7 would be evaluated through Mini-project implementation using tools and case study presentation that may include but not limited to the following topics:

1. Credit risk Prediction
2. Fraud detection
3. Churn prediction

**Concept Map**



**Syllabus**

**Data Analytics** – Analytics Process Model – Analytical Model Requirements - Types of Data - Analytics – Standardizing and categorizing - Data Segmentation – weights of evidence coding – variable selection - F-Test –T-Distribution.

**Statistical modelling** – Statistical hypothesis generation and testing - Resampling methods – Structural Equation Modelling – Factor analysis – Power analysis – Non-parametric testing – Spline based models.

**Predictive Analytics** – Target definition – Regression Analysis –Bayesian regression – Penalized regression models – Improvisation methods- Evaluating Predictive Models

**Text Analytics** –Nature of text – text & interaction – content analysis – frequency analysis - NLP - lexical relations and topics – word cloud – sentiment analysis.

**Survival Analytics** – survival analysis measurements – Kaplan meier analysis – parametric survival analysis – evaluating survival analysis models.

**Data Engineering and its challenges:** Data Standards and Data Quality - Legal, Policy and Ethics. Big data characteristics – Role of cloud inBig data – Big Data Analytics vs Business Intelligence -crowd sourcing analytics – NOSQL data management – Hadoop Distributed File system – Apache spark with scala - Spark SQL – SparkMLlib - Hadoop eco system tools.

**Case Study and Tools:**– Credit risk modelling – Fraud detection – Net lift response modelling – churn prediction – web analytics – Sensitivity Analysis - business process analytics-Data exploration Tools: Hadoop and its platforms -R tool-Rapid miner-Mongo DB- POS taggers.

#### Learning Resources

1. Bart Baesens, "Analytics in a Big Data World", The Essential Guide to Data Science and its Applications, Wiley, First edition, 2014.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", Massachusetts Institute of Technology, 2012.
3. Trevor Hastie and Robert Tibshirani and Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition", Secon edition, Springer, 2017.
4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
6. Thomas H. Davenport, Jeanne G. Harris, "Competing on Analytics: The New Science of Winning", Harvard Business Review Press ,First edition,2007
7. Paul C. Zikopoulos, Chris Eaton, "Understanding Big Data", McGraw-Hill, 2012 (eBook from IBM).
8. <https://www.edx.org/learn/data-analysis>
9. <https://www.coursera.org/browse/data-science/data-analysis>
10. <https://www.udemy.com/courses/business/data-and-analytics/>
11. <https://online-learning.harvard.edu/subject/data-analysis>

#### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>Data Analytics</b>		
1.1	Analytics Process Model		<b>CO1</b>
1.2	Analytical Model Requirements	1	
1.3	Types of Data	1	
1.4	Analytics		
1.5	Standardizing and categorizing	1	
1.6	Data Segmentation		

1.7	weights of evidence coding		
1.8	variable selection	1	
1.9	F-Test	1	
1.10	T-Distribution.	1	
2.	<b>Statistical modelling</b>		
2.1	Statistical hypothesis generation and testing	1	<b>CO2</b>
2.2	Resampling methods	1	
2.3	Structural Equation Modelling	1	
2.4	Factor analysis	1	
2.5	Power analysis		
2.6	Non-parametric testing	1	
2.7	Spline based models	1	
3.	<b>Predictive Analytics</b>		
3.1	Target definition	1	<b>CO3</b>
3.2	Regression Analysis – Bayesian regression, Penalized regression analysis.	2	
3.3	Improvisation Methods	1	
3.4	Evaluating Predictive Models	1	
4.	<b>Text Analytics</b>		
4.1	Nature of text	1	<b>CO4</b>
4.2	Text & interaction		
4.3	Content analysis		
4.4	Frequency analysis	1	
4.5	NLP		
4.6	Lexical relations	1	
4.7	Word cloud		
4.8	Sentiment analysis	1	
5.	<b>Survival Analytics</b>		
5.1	Survival analysis measurements	1	<b>CO5</b>
5.2	Kaplan meier analysis	1	
5.3	Parametric survival analysis	1	
5.4	Evaluating survival analysis models.	1	
6	<b>Data Engineering and its challenges</b>		
6.1	Data Standards and Data Quality	1	<b>CO6</b>
6.2	Legal, Policy and Ethics		
6.3	Big data characteristics	1	
6.4	Role of cloud in Big data		
6.5	Big Data Analytics vs Business Intelligence	1	
6.6	Crowd sourcing analytics		
6.7	NOSQL data management	1	
6.8	Hadoop Distributed File system		
6.9	Apache spark with scala	1	
6.10	Spark SQL		
6.11	SparkMLlib		
6.12	Hadoop eco system tools.	1	
7	<b>Case Study and Tools:</b>		
7.1	Credit risk modelling	3	<b>CO7</b>
7.2	Fraud detection		
7.3	Net lift response modelling		
7.4	churn prediction		
7.5	web analytics		
7.6	Sensitivity Analysis		
7.7	business process analytics		

7.8	Data Exploration Tools: Hadoop and its platforms –R tool-Rapid miner-Mongo DB-POS taggers.	2	
	Total no. of contact hrs.	36	

**Course Designers:**

1. A.Sheik Abdullah      asait@tce.edu
2. S.Pudumalar          spmit@tce.edu

21IT630	PROGRAMMING FOR INTERNET OF THINGS	Category	L	T	P	Credit
		ES	2	0	2	3

### Preamble

This course aims at providing basic knowledge and skills to engage in innovative design and development of IoT solutions. The IoT encompasses broader spectrum of technologies, It is not only to identify the things, rather than they participate in computations, connections and also sense the environment to react with the real world. It also aims at giving the students a view, connect and actuate the sensor through powerful interfaces and programs.

### Prerequisite

- 18IT430 Computer Networks
- Any Programming Language

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Examine the evolution of IoT, its architecture and their protocols.	10%
CO2	Identify the domain-specific building blocks of IoT enabling technologies and characteristics and similarities.	10%
CO3	Exemplify IoT design methodology and System management.	20%
CO4	Apply logical design using pragmatic techniques for designing an IoT System	20%
CO5	Recommend cloud offerings and data analytics on IoT using case studies	20%
CO6	Build state of the art IoT architecture to solve the real world constraints.	20%

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2
CO2	TPS2	Understand	Respond	Guided Response	1.2
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1,2.1.2,2.1.5
CO4	TPS3	Apply	Value	Mechanism	1.2,2.1.1,2.1.2,2.1.5
CO5	TPS4	Analyse	Organise	Complex Overt Responses	1.2, 2.4, 2.5, 3.1.1, 3.1.2, 3.2, 4.1.1, 4.2.1, 4.3.1, 4.3.2, 4.4.1 – 4.4.3, 4.5.1, 4.5.3, 4.5.5
CO6	TPS5	Create	Characterize	Origination	1.2, 2.4, 2.5, 3.1.1, 3.1.2, 3.2, 4.1.1, 4.2.1, 4.3.1, 4.3.2, 4.4.1 – 4.4.3, 4.5.1, 4.5.3, 4.5.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	M	L											L		
CO3	S	M	M	M	S								M	S	
CO4	S	M	M	M	S								M	S	
CO5	S	S	M	L	M	S	S	S	S	S	S	S	M	L	M
CO6	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

#### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Practical component/Observation	Model Exam	Terminal Examination
	CAT 1	Lab Test 2			
Remember	20	-			20
Understand	20	20	20	20	30
Apply	60	80	80	80	50
Analyse					0
Evaluate					0
Create					0

#### Assessment Pattern: Psychomotor

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	40
Mechanism	40
Complex Overt Responses	10
Adaptation	-
Origination	10

Course Level Assessment Questions CO5 & CO6 are assessed through Mini -Project.

#### Mini Project Details

- Team formation (Team size: 3)
- Problem identification on various IT, societal, business and environmental needs
- Identify the appropriate components needed to build the microcontroller board.
- Assemble the components and program the board.
- Test the board with sample input.

#### Course Level Assessment Questions

##### Course Outcome 1 (CO1):

1. Discuss the Evolution of IoT.
2. Label the architecture of IoT with a neat diagram
3. List the some of the protocols involved in IoT.

**Course Outcome 2 (CO2):**

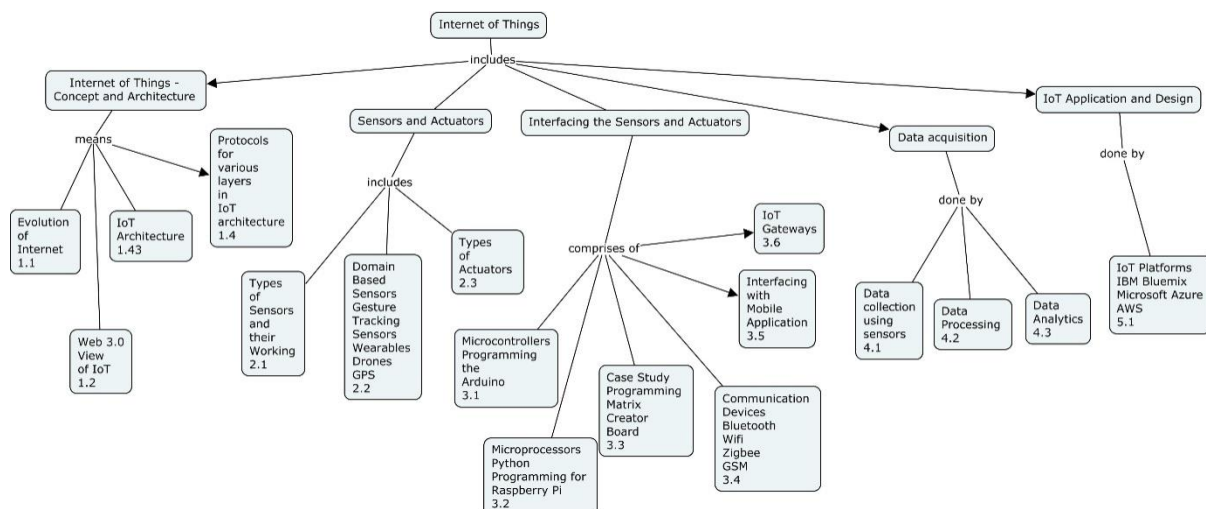
1. Use Appropriate sensors to code for Motion Detection
2. Experiment various sensors and Actuators
3. Illustrate the usage of Drones for any specific problem
4. Demonstrate the Anatomy of Sensors and Actuators

**Course Outcome 3 (CO3):**

1. Write a program for glowing an LED.
2. Write a program to automate electric appliances in a room using a microcontroller.
3. Simulate water overflow detection using a suitable microprocessor of your choice
4. Explain the interfacing of sensors and actuators to the controllers.

**Course Outcome 4 (CO4):**

1. Develop an IoT application to solve anomaly detection issue
2. Experiment various IoT platforms
3. Construct an IoT application for a societal problem of your choice
4. Show the connectivity of microcontroller with Bluetooth and USB

**Concept Map****Syllabus**

**Internet of Things - Concept and Architecture:** Evolution of Internet, Web 3.0 View of IoT, IoT Architecture, Protocols for various layers in IoT architecture

**Sensors and Actuators:** Types of Sensors and their Working, Domain Based Sensor: Gesture Tracking Sensors, Wearables, Drones, GPS, Types of Actuators

**Interfacing the Sensors and Actuators:** Microcontrollers : Programming the Arduino, Microprocessors : Python Programming for Raspberry Pi, Case Study: Programming Matrix Creator Board, Communication Devices : Bluetooth, Wifi, Zigbee, GSM, Interfacing with Mobile Application, IoT Gateways.



**Data acquisition:** Data collection using sensors, Data Processing, Data Analytics

**IoT Application and Design:** IoT Platforms: IBM Bluemix, Microsoft Azure, AWS, Case Studies :Industrial Revolution 4, Smart Energy Systems, Digital Food , Smart Entertainment, Smart Manufacturing, Mini Project

### Text Books

- Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things Principles and Paradigms", Elsevier , First edition , 2016
- Arshdeep Bahga, Vijay Madiseti, "Internet of Things, A Hands-on Approach", Universities Press, First Edition, 2015

### References

- <https://www.edx.org/course/introduction-to-the-internet-of-things-iot>
- <http://www.instructables.com/technology/>
- <https://aws.amazon.com/iot/>
- <https://azure.microsoft.com/en-in/services/iot-hub/>
- <https://www.ibm.com/cloud/internet-of-things>

### Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours
<b>1</b>	<b>Internet of Things - Concept and Architecture</b>	
1.1	Evolution of Internet	
1.2	Web 3.0 View of IoT	1
1.3	IoT Architecture	1
1.4	Protocols for various layers in IoT architecture	2
<b>2</b>	<b>Sensors and Actuators</b>	
2.1	Types of Sensors and their Working	2
2.2	Domain Based Sensors: Gesture Tracking Sensors , Wearables , Drones, GPS	2
2.3	Types of Actuators	1
<b>3</b>	<b>Interfacing the Sensors and Actuators</b>	
3.1	Microcontrollers : Programming the Arduino	2
3.2	Microprocessors : Python Programming for Raspberry Pi	2
3.3	Case Study: Programming Matrix Creator Board	1
3.4	Communication Devices : Bluetooth, Wifi , Zigbee , GSM	2
3.5	Interfacing with Mobile Application	2
3.6	IoT Gateways	1
<b>4</b>	<b>Data acquisition</b>	
4.1	Data collection using sensors	1
4.2	Data Processing	1
4.3	Data Analytics	1
<b>5</b>	<b>IoT Application and Design</b>	
5.1	IoT Platforms: IBM Bluemix, Microsoft Azure, AWS	1
5.2	Case Study : Industrial Revolution 4, Smart Energy systems, Digital Food , Smart Entertainment, Smart Manufacturing	1

<b>Total Lectures</b>	<b>24</b>
-----------------------	-----------

### List of Experiments

Exp. No.	Topic	No of Practical Hours
1	Installation of Arduino Ide and Environment Setup	2
2	Implement simple programs using Arduino	
3	Data Collection and storage from PIR Sensor, Temperature Sensor	2
4	Data Collection and storage from Ultrasonic sensor, Moisture sensor and Water level sensor	2
4	Experiment with GPS,RFID	2
5	Practice Interfacing of GSM and Bluetooth with Mobile Application	2
6	Practice Interfacing with Zigbee Shield	2
7	Installation of OS in Raspberry pi	2
8	Implement simple programs using Raspberry Pi	
9	Interfacing sensor with Raspberry Pi	2
10	Interfacing Communication Device with Raspberry Pi	2
11	Storing and Retrieving Data From Cloud(Wifi)	2
12	Mini Project Review I,II,III	4
<b>Total Lectures</b>		<b>24</b>

### Course Designers

1. Ms.C.V.Nisha Angeline [cvnait@tce.edu](mailto:cvnait@tce.edu)
2. Mr.M.Manikanda Kumar [mmrit@tce.edu](mailto:mmrit@tce.edu)

21IT660	<b>MOBILE APPLICATION DEVELOPMENT</b>	Category	L	T	P	Credit
		PC	2	0	2	3

### Preamble

This course provides knowledge and skill on recent technologies in mobile application development. It includes APIs for UI design, location based services, storage mechanism, multimedia, camera, Bluetooth, WiFi, sensor and Gesture support.

### Prerequisite

- 18IT320 Object Oriented Programming

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Apply the UI components and location based services for the given problem	40
CO2	Choose the suitable storage mechanisms such as shared preferences, files, SQLite database for the given requirements	12
CO3	Apply multimedia, graphics and animation Application Programming Interfaces (APIs) for the suitable problems	10
CO4	Produce applications with the support of Camera, Bluetooth, WiFi and Sensor	10
CO5	Examine the usage of XML parsing, JSON parsing, Web services, Kotlin, React Native, Material Design and RSSFeedReader in application development	12
CO6	Develop a mobile application with appropriate API based on the societal or business requirements	16

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3
CO2	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3
CO3	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3
CO4	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3
CO5	TPS4	Analyse	Organise	Complex Overt Responses	1.2, 2.4, 2.5, 3.1.1, 3.1.2, 3.2, 4.1.1, 4.2.1, 4.3.1, 4.3.2, 4.4.1 – 4.4.3, 4.5.1, 4.5.3, 4.5.5
CO6	TPS6	Create	Characterize	Origination	1.2, 2.4, 2.5, 3.1.1, 3.1.2, 3.2, 4.1.1, 4.2.1, 4.3.1, 4.3.2, 4.4.1 – 4.4.3, 4.5.1, 4.5.3, 4.5.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	S	M	L		M			L	L	L		L	M	L	L
CO 2	S	M	L		M			L	L	L		L	M	L	L
CO 3	S	M	L		M			L	L	L		L	M	L	L

CO 4	S	M	L		M			L	L	L		L	M	L	L
CO 5	S	S	M	L	M			M	M	M		S	M	L	M
CO 6	S	S	S	M	M			S	S	S		S	S	S	S

S- Strong; M-Medium; L-Low

#### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Practical component/Observation	Model Exam	Terminal Examination
	CAT 1	Lab Test 2			
Remember	20	-	-	-	-
Understand	20	20	20	20	20
Apply	60	80	80	80	80
Analyse					
Evaluate					
Create					

CO6 will be assessed only through Mini Project.

#### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project/ Assignment/ Practical Component
Perception	-
Set	-
Guided Response	20
Mechanism	50
Complex Overt Responses	10
Adaptation	10
Origination	10

#### Sample Questions for Course Outcome Assessment

##### Course Outcome 1 (CO1):

1. Write an android code for generate a notification when the particular location reached.
2. Design a Feedback form of an event and perform validation. Write code.
3. Design two activities to with proper navigation mechanisms such as link, button, menu etc. Write code.

##### Course Outcome 2 (CO2):

1. Design an app to enter the Name of the book and ISBN number and click on Add Book. Write code.
2. Design an app to click on Show Books to view the contents added so far.
3. Design an app to search for a book from querying author details.

##### Course Outcome 3 (CO3):

1. Design an app with music player.

2. Design an app to play, stop, and pause a video.
3. Design an animated app for demonstrating the working principle of an algorithm.

**Course Outcome 4 (CO4):**

1. Implement a camera enabled application for capturing video or image.
2. Implement a Bluetooth enabled application for controlling a system.
3. Design an app with WiFi support API for transmitting signals to a system.

**Course Outcome 5 (CO5):**

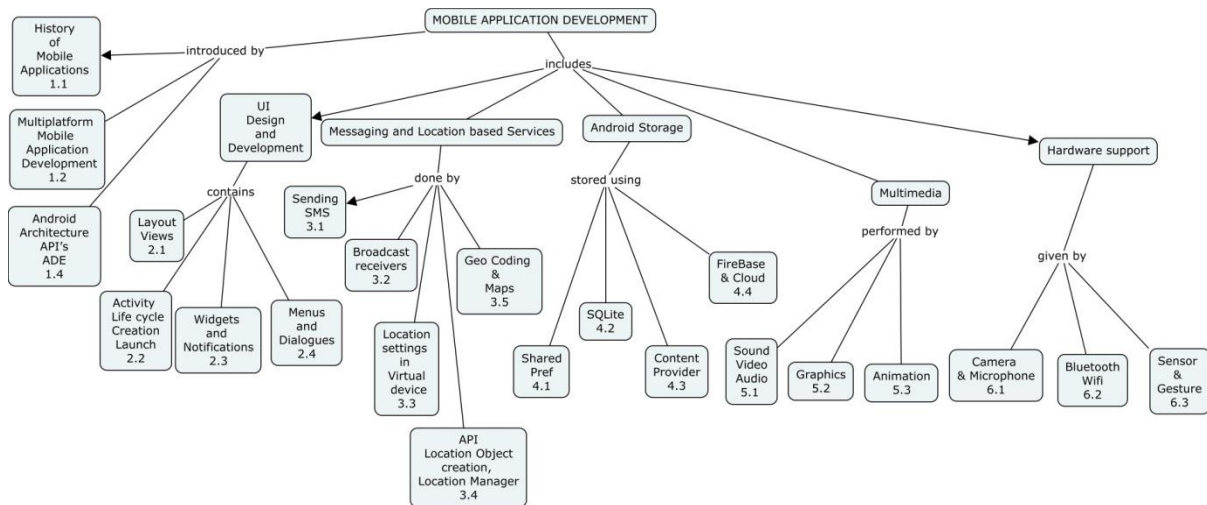
1. Outline a web service for providing a hall booking service in a company.
2. Illustrate JSON parsing of a book store application.
3. Experiment XML parsing for a bus reservation application.

**Course Outcome 6 (CO6):**

Mini-Project

- Form a team of 2/3 persons
- Pick-up a societal, business problem
- As per the design thinking process, develop a design
- Implement and test the problem
- Upload the basic version of the application in playstore

**Concept Map**



**Syllabus**

**Introduction** - History of Mobile Applications - Multipatform Mobile Application Development  
Android Architecture, API's, ADE

**UI Design and Development** - Layout, Views – Activity – Lifecycle, creation, launch -  
Widgets & Notifications, Menus & Dialogues

**Messaging and Location based Services** - Sending SMS – Broad cast receivers- Location  
settings in virtual devices – API – Location Object creation, Location manager -Geo Coding  
& Maps

**Android Storage** - Shared Pref – SQLite – Content provider - FireBase& Cloud

**Multimedia** - Sound - Video – Audio– Graphics - Animation

**Hardware Support** - Camera & Microphone – Bluetooth – Wifi - Sensor – Gesture

**Case Study** –Xml Parsing, JSON Parsing,RSSFeedReader,Web Services, Kotlin, React  
Native, Material Design, Android Game Development

**Learning Resources**

1. RetoMeier, "Professional Android Application Development 4", Wrox, 2012.
2. Dawn Griffiths, David Griffiths, "Head First Android Development", Shroff/O'Reilly 2<sup>nd</sup> Edition, 2017.
3. <https://developer.android.com>

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lecture Hours	Course Outcome
<b>1</b>	<b>Introduction</b>		CO1
1.1	History of Mobile Applications	1	
1.2	Multiplatform Mobile Application Development	1	
1.3	Android Architecture , API's , ADE	1	
<b>2</b>	<b>UI Design and Development</b>		
2.1	Layout, Views	1	
2.2	Activity - Life cycle, Creation, Launch		
2.3	Widgets and Notifications	2	
2.4	Menus and Dialogues	2	
<b>3</b>	<b>Messaging and Location based Services</b>		
3.1	Sending SMS	1	
3.2	Broad cast receivers	1	
3.3	Location settings in Virtual device	1	
3.4	API - Location Object creation, Location Manager	1	
3.5	Geo Coding & Maps	1	
<b>4</b>	<b>Android Storage</b>		CO2
4.1	Shared Preferences	1	
4.2	SQLite	1	
4.3	Content Provider	1	
4.4	FireBase& Cloud	1	
<b>5</b>	<b>Multimedia</b>		CO3
5.1	Sound, Video, Audio	1	
5.2	Graphics	1	
5.3	Animation		
<b>6</b>	<b>Hardware support</b>		CO4
6.1	Camera & Microphone	1	
6.2	Bluetooth, Wifi	1	
6.3	Sensor & Gesture	1	
<b>7</b>	<b>Case Study</b>		CO5
7.1	Xml Parsing, JSON Parsing	1	
7.2	RSS FeedReader, Web Services		
7.3	Kotlin, React Native	1	
7.4	Material Design, Android Game Development		
	<b>Total Hours</b>	<b>24</b>	

Exp No	Topic	No. of Practical Hours	Course Outcome
	<b>Problem and requirements identification in team</b>	2	CO6
1	UI Design with Layout, Activity and Widgets	2	CO1

<b>Mini project Review 1</b>			CO6
2	Notifications, Menu and Dialogues	2	CO1
3	Location based services	2	CO1
4	Data storage	2	CO2
5	Multimedia	2	CO3
<b>Mini project Review 2</b>		2	CO6
6	Graphics and Animation	2	CO3
7	Hardware support Camera/Bluetooth/WiFi/Sensor	2	CO4
8	Case Study – XML Parsing, JSON Parsing	2	CO5
9	Case Study – RSS FeedReader, Web Services etc	2	CO5
<b>Mini project Review 3 - Complete project demonstration</b>		2	CO6
<b>Total Hours</b>		<b>24</b>	

**Course Designers:**

1. Dr.P.Karthikeyan
2. Mrs.C.V.Nisha Angeline

karthikit@tce.edu  
cvnait@gmail.com

21IT670	CLOUD COMPUTING LAB	Category	L	T	P	Credit
		PC	0	0	2	1

### Preamble

This laboratory course will make the students to experience the key techniques and concepts of cloud computing such as live migration, configuring the Virtual machines on different platforms and container technology. The students will be competent with the design, programming and application of cloud computing systems through hands-on experience.

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Examine system requirements for the cloud deployment and application development.	29
CO2	Implement virtualization techniques for the data intensive computing applications	25
CO3	Develop and Implement applications using Dockers Containers	8
CO4	Develop and Deploy cloud applications on mobile devices	9
CO5	Design and Deploy a web application in PaaS environment	17
CO6	Simulate a cloud environment to implement new schedulers by analyzing the parameters affecting performance	12

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS4	Analyze	Organise	Complex Overt Response	1.2, 2.1.1, 2.1.2, 2.1.3, 2.1.5, 2.2.3, 2.3.3, 2.3.4, 3.2.3, 3.2.6
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.5, 2.3.4, 2.2.3, 3.2.3, 3.2.6
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3, 3.2.6
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3, 3.2.6
CO5	TPS3	Create	Characterize	Origination	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3, 3.2.6
CO6	TPS3	Analyze	Organise	Complex Overt response	1.2, 3.1.5, 2.3.3, 2.3.4, 3.2.3, 2.2.3, 3.2.6



**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PS O1	PSO 2	PS O3
CO1	S	S	M	L					S	S		M	S		M
CO2	S	M	L		S	L			S	S			M	M	L
CO3	S	M	L			M			S	S	M	M	M	L	M
CO4	S	M	L		S	M			S	S	L	L	M	S	M
CO5	S	S	S	S	S	M	L	L	S	S	M	M	S	S	M
CO6	S	S	M	L	S				S	S	L	L	S	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	
Understand	-	
Apply	50	50
Analyse	30	30
Evaluate		
Create	20	20

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Practical Component/Observation
Perception	
Set	
Guided Response	
Mechanism	50
Complex Overt Responses	30
Adaptation	
Origination	20

**List of Experiments/Activities with CO Mapping**

S.No	List of experiments	Course Outcomes	Total lecture hours
1.	Virtual Machine Management using Hypervisor i. VM-VM Ping ii. VM-External Host Ping iii. VM migration	CO2	2
2.	Implementation of Para Virtualization using virtualization tools i. Windows over Linux Platforms ii. Linux over windows platform	CO2	2
3.	Creating Azure Cloud Virtual Machines	CO1	2

4.	Launch a web application in PaaS environment such as IBM Bluemix, Google App Engine	CO5 ( Upto Apply level)	2
5.	Open stack Installation and VM Configuration	CO1,CO2	2
6	Cloud Stack Installation and VM Configuration	CO1,CO2	2
7	Hadoop Installation and Configuration and Implementing a simple Program using Map Reduce Framework.	CO1	3
8	Develop any one cloud application using smartphones.	CO4	2
9	Deploy an application in a Docker container	CO3	2
10	Simulate a cloud scenario using CloudSim and run a new scheduling algorithm	CO6	2
11	Case Study based on the real time applications using Amazon Web Services, IBM Blue mix etc..	CO1-CO6	1
12	Mini project	CO5	2
	Total lab hours		24

The project/ Case study (on the topic of choice of the student) will require possibly the implementation of a real/simulated system, a writer report, and an oral presentation. Projects/ Case study can fall in a number of different areas, which are related to data intensive distributed computing.

Some of the data intensive computing applications like (not limited to),

- Distributed file system
- Data ware scheduling algorithms
- Distributed Job management systems
- Distributed Monitoring systems

Some of the real time applications like (not limited to)

- E-Health care management system
- Library Management system
- Ticket booking system
- Online survey consolidation system
- E-Learning
- Tracking system

Software's that need to be considered for the specific project area are (not limited to),

- Operating systems: Linux, Windows
- Programming models: MapReduce (Hadoop)
- Cloud Middleware: Nimbus, OpenStack, Owncloud, Cloudstack
- Virtualization: VMWare, KVM, Zen

### Learning Resources

1. ArshdeepBahga, Vijay Madiseti, "Cloud Computing: A Hands-On Approach", CreateSpace Independent Publishing Platform, 1st edition, 2013

2. John Rittinghouse & James Ransome, "Cloud Computing, Implementation, Management and Strategy", CRC Press, 2010.
3. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010

**Course Designers:**

1. Dr.S.Padmavathi      spmcse@tce.edu

**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.TECH. INFORMATION TECHNOLOGY DEGREE PROGRAMME**

**SEVENTH SEMESTER**

**FOR THE STUDENTS ADMITTED IN THE**

**ACADEMIC YEAR 2021-19 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A GOVERNMENT AIDED ISO 9001:2008 CERTIFIED  
AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY)  
**MADURAI – 625 015, TAMILNADU**

PHONE: 0452 – 2482240, 41

FAX: 0452 2483427

WEB: [WWW.TCE.EDU](http://WWW.TCE.EDU)

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**COURSES OF STUDY**

(For the candidates admitted from 2021 onwards)

**SEVENTH SEMESTER**

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
<b>THEORY</b>						
21IT710	Human Computer Interaction	PC	3	-	-	3
21ITPX0	Programme Elective	PE	3	-	-	3
21ITPX0	Programme Elective	PE	3	-	-	3
21ITPX0	Programme Elective	PE	3	-	-	3
21ITPX0	Programme Elective	PE	3	-	-	3
<b>PRACTICAL</b>						
21IT770	Multimedia Lab.	PC	-	-	2	1
21IT780	Human Computer Interaction Lab	PC	-	-	2	1
21ES790	Capstone Design Project	ES	-	-	4	2
<b>Total</b>			<b>15</b>	<b>-</b>	<b>8</b>	<b>19</b>

BS : Basic Science  
HSS : Humanities and Social Science  
ES : Engineering Science  
PC : Program Core  
PE : Program Elective  
GE : General Elective  
AC : Audit Course

L : Lecture  
T : Tutorial  
P : Practical

**Note:**

1 Hour Lecture is equivalent to 1 credit  
2 Hours Tutorial is equivalent to 1 credit  
2 Hours Practical is equivalent to 1 credit

**THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015**  
**B.Tech. Information Technology Degree Programme**

**Scheme of Examinations**

(For the candidates admitted from 2021-19 onwards)

**SIXTH SEMESTER**

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
<b>THEORY</b>								
1	21IT710	Human Computer Interaction	3	40	60	100	27	50
2	21ITPX0	Programme Elective	3	40	60	100	27	50
3	21ITPX0	Programme Elective	3	40	60	100	27	50
4	21ITPX0	Programme Elective	3	40	60	100	27	50
5	21ITPX0	Programme Elective						
<b>PRACTICAL</b>								
7	21IT770	Multimedia Lab.	3	60	40	100	18	50
8	21IT780	Human Computer Interaction Lab	3	60	40	100	18	50
9	21ES790	Capstone Design Project	-	50	50	100	25	50

\* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

\*\* Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

<b>21IT710</b>	<b>Human Computer Interaction</b>	Category	L	T	P	Credit
		PC	3	0	0	3

### Preamble

This course gives an introduction to contemporary user interfaces, including the basics of human-computer interaction, the user interface design/evaluation process, and the architectures within which user interfaces are developed. The hands on exposure to this course will be implemented with the design of how user interfaces are implemented for various real time projects.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the fundamental concepts and needs for human computer interaction, User interface design, understanding human psychology and applications of HCI in various fields	14
CO2	Explain Human Physiology, perceptual, sensing, motor, memory characteristics and Modelling with GOMS	22
CO3	Illustrate the interface with interaction model considering the context, ergonomics, experience and engagement	17
CO4	Apply the Universal design principles with standards Norman, Seeheim model and DOET Principles with tools	19
CO5	Analyse the design issues with Nielsen's principles, experts, controlled psychological experiments and errors	17
CO6	Demonstrate the working of devices for normal, physical and cognitive impaired people along with case studies	11

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TSP2	Understand	Respond		1.2,2.3.1,2.3.2
CO2	TSP2	Understand	Respond		1.2, 2.2, 2.3.1,2.3.2,3.1.4, 3.1.5
CO3	TSP3	Apply	Value		1.2, 2.2, 2.3.1,2.3.2,3.1.4, 3.1.5
CO4	TSP3	Apply	Value		1.2,2.3.1, 2.3.2, 2.3.3, 4.4.1, 4.5.3, 4.5.5
CO5	TSP4	Analyse	Organise		1.2,4.3.4, 4.6.1
CO6	TSP3	Apply	Value		1.2,4.3.4, 4.5.3, 4.5.6, 4.6.1

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	M	L											L		
CO3	S	M	L			L		L				M	M	L	L
CO4	S	M	L		L	L		L				S	M	L	L
CO5	S	S	M	L	S	L		L	M	M	M	S	S	M	M
CO6	S	M	L		M	L	L	M	M	M	M	S	M	M	M

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests(60)		Assignment(40)		Terminal Examination(100)
	1	2	1	2	
Remember	10	10			10
Understand	20	10			20
Apply	40	50	50	50	40
Analyse	30	30	50	50	30
Evaluate	0				
Create	0				

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Miniproject/Practical Component/Observation
Perception	-
Set	-
Guided Response	-
Mechanism	-
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1(CO1):**

1. Describe the taxonomy of HCI with an example
2. Summarise requirements of User Interface Design
3. Discuss the Success stories of HCI Design in Medical Field

**Course Outcome 2(CO2):**

1. Explain the ways in which the information is sensed, processed in human being
2. Describe the processing of optical illusion in human eye and its role for UI Design
3. Discuss about sensory memory

**Course Outcome 3(CO3):**

1. Draw the seven stages of Donald Norman Model for mobile device
2. Apply the Ergonomics for mobile for the left hand side user
3. Illustrate the look and feel effect in Mac OS and Windows OS

**Course Outcome 4(CO4):**

1. Apply Shneiderman's golden rule for designing the spectacles
2. Use MVC (Model View Controller) and PAC(Presentation Abstraction Control) for



- mouse design
3. Apply the story board for the game console you are developing

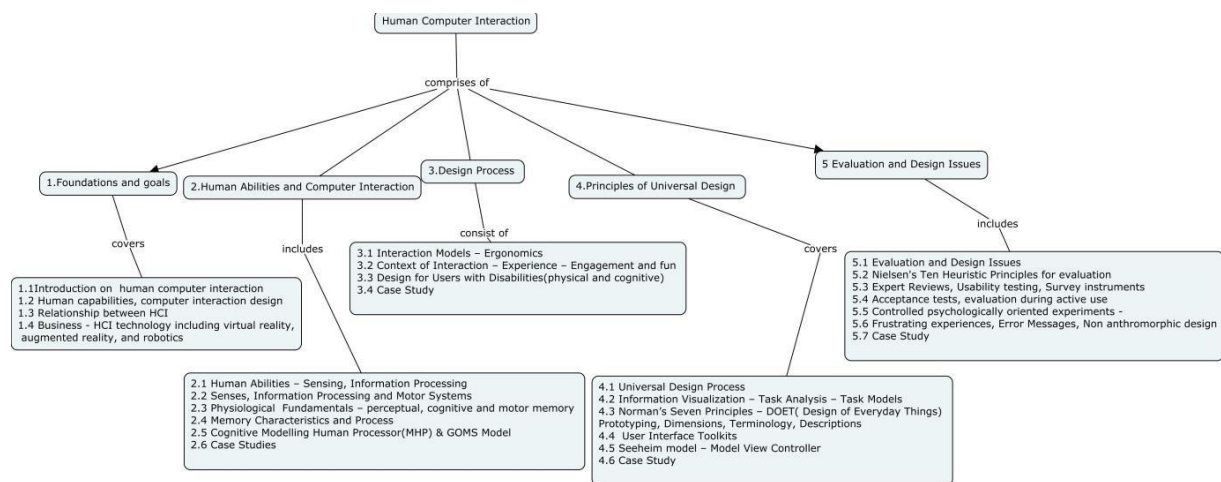
**Course Outcome 5(CO5):**

1. Analyse the cognitive walkthrough for the wheel chair desinged for the challenging people
2. Examine the importance of Heuristic Evaluation for OS development
3. Experiment the frsutrating experiences and error messages for the devices you have discussed and list the ways to improvise it for customer need

**Course Outcome 6(CO6):**

1. Design a User Interface for hand gestures as a mode of interaction for children with cognitive challenges
2. Illustrate the Speech Based Mobile Interface for the Textually Low Literate
3. Practice Interactive Information Platform for Remote Health Care

**Concept Map**



**Syllabus**

**Foundations and goals of human computer interaction** – human capabilities – computer interaction design - Relationship between HCI, User Experience design, human factors engineering, and psychology - Relevance of HCI to domains like healthcare, education, and Business - HCI technology including virtual reality, augmented reality, and robotics

**Human Abilities and Computer Interaction** – Senses, Information Processing and Motor Systems – Physiological Fundamentals – perceptual, cognitive and motor memory - Memory Characteristics and Process –Cognitive Modelling Human Processor(MHP) & GOMS Model

**Design Process** - Interaction Models – Ergonomics – Context of Interaction – Experience – Engagement and fun - Design for Users with Disabilities(physical and cognitive) – Software Engineering aspects of HCI

**Principles of Universal Design** – Design Process – - Information Visualization – Task Analysis – Task Models –Norman’s Seven Principles – DOET( Design of Everyday Things) - Prototyping – Dimensions – Terminology – Descriptions – storyboarding –User Interface Toolkits – Seeheim model – Model View Controller

**Evaluation and Design Issues**– Nielsen's Ten Heuristic Principles for evaluation- Expert Reviews – Usability testing – Survey instruments – acceptance tests – evaluation during active use – controlled psychologically oriented experiments - Frustrating experiences–Error Messages - Non anthropomorphic design – Evaluation of spastic devices interaction panels

### Learning Resources

1. Don Norman, “ The Design of Everyday Things” First Edition, Basic Books, 2013.
2. Alan Dix, Janet E.Finlay, Gregory D.Abowd, Russell Beale , “ Human-Computer Interaction” (3rd Edition) , Prentice-Hall, Inc, 2009, ISBN : 0130461091
3. B. Shneiderman; Designing the User Interface, Addison Wesley, 5<sup>th</sup> Edition, 2014.
4. <https://www.cc.gatech.edu/~stasko/6750>
5. <http://iitg.ac.in/uelab/courses.html>

### Course Content & Lecture Schedule

Module No.	Topic	No. of Lecture Hours	CO
1	<b>Foundations and goals</b>		
1.1	Introduction on human computer interaction	1	CO1
1.2	Human capabilities, computer interaction design	1	
1.3	Relationship between HCI, User Experience design, human factors engineering, and psychology	1	
1.4	Relevance of HCI to domains like healthcare, education	1	
1.4.1	Business - HCI technology including virtual reality, augmented reality, and robotics	1	
2	<b>Human Abilities and Computer Interaction</b>		
2.1	Human Abilities – Sensing, Information Processing	1	CO2
2.2	Senses, Information Processing and Motor Systems	2	
2.3	Physiological Fundamentals – perceptual, cognitive and motor memory	2	
2.4	Memory Characteristics and Process	1	
2.5	Cognitive Modelling Human Processor(MHP) & GOMS Model	2	
2.6	Case Studies	1	CO6
3	<b>Design Process</b>		
3.1	Interaction Models – Ergonomics	2	CO3
3.2	Context of Interaction – Experience – Engagement and fun	2	
3.3	Design for Users with Disabilities(physical and cognitive)	2	
3.4	Case Study	1	CO6
4	<b>Principles of Universal Design</b>		
4.1	Universal Design Process	1	CO4
4.2	Information Visualization – Task Analysis – Task Models	1	
4.3	Norman’s Seven Principles – DOET( Design of Everyday	2	

	Things)		
4.4	Prototyping, Dimensions, Terminology, Descriptions	1	
4.5	Storyboarding, User Interface Toolkits	1	
4.6	Seeheim model – Model View Controller	1	
4.7	Case Study	1	CO6
5	<b>Evaluation and Design Issues</b>		
5.1	Evaluation and Design Issues	1	CO5
5.2	Nielsen's Ten Heuristic Principles for evaluation	1	
5.3	Expert Reviews, Usability testing, Survey instruments	1	
5.4	Acceptance tests, evaluation during active use	1	
5.5	Controlled psychologically oriented experiments -	1	
5.6	Frustrating experiences, Error Messages, Non anthropomorphic design	1	
5.7	Case Study	1	CO6
	Total Hours	36	

### Course Designers

Dr.D.Tamilselvi  
Mrs.T.Manju

[dtamilselvi@tce.edu](mailto:dtamilselvi@tce.edu)  
tmanju@tce.edu

21IT770	MULTIMEDIA LAB	Category	L	T	P	Credit
		PC	0	0	2	1

**Preamble**

The objective of this laboratory is to motivate the students to acquire knowledge and skills in various photo editing features, 2D, 3D animation techniques, AR with HTML5 and demonstrate proficiency in developing multimedia presentation. This course emphasizes the students to implement their own ideas with more creativity for real time applications

**Prerequisite**

- NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Demonstrate the knowledge of fundamental requirements of multimedia systems and various file formats	10
CO2	Demonstrate photo editing techniques using Image manipulation tools	15
CO3	Apply various visual effects using audio editing tools for any application	15
CO4	Apply 2D and 3D animation tools for any application	20
CO5	Create short films / advertisement using AR animations	20
CO6	Design any applications (Web/ Mobile/ Gaming) using AR with HTML 5	20

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 1.3, 2.1.1, 2.1.2, 2.1.3, 2.1.5, 2.2.3, 2.3.3, 2.3.4, 3.2.3
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.5, 2.3.4, 2.3.3, 3.2.3
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3
CO6	TPS4	Analyze	Organize	Complex Overt Responses	1.2, 3.1.5, 2.3.3, 2.3.4, 3.2.3, 2.2.3, 3.2.6

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S	L			S	S			M	M	L
CO2	S	M	L			M			S	M			M	M	L
CO3	S	M	L		S	M			S	M	L	M	M	L	L
CO4	S	M	L		M			M		M		M	M	L	L
CO5	S	M	L		M			M		M		S	M	L	L
CO6	S	S	M	L	S	M		S	S	S		S	M	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	-
Understand	-	-
Apply	50	50
Analyze	20	20
Evaluate	-	-
Create	30	30

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini project/Assignment/Practical Component
Perception	-
Set	-
Guided Response	10
Mechanism	50
Complex Overt Responses	20
Adaptation	10
Origination	10

**Lab Content and Schedule**

S.No	List of Experiments	Course Outcomes	No. Of Sessions
1	Study about basics of multimedia and its applications	CO1	2
2	Implementation of Image manipulation using Photoshop /GIMP / Inkscape	CO2	2
3	Implementation of audio editing/ mixing of sound files by Wave surfer	CO3	2
4	Study about various 2D animation tools like Ajax Animator, Toon Boom, Adobe Flash Professional and 3D and 3D animation tools like Blender, Art of illusion, Maya.	CO4	2
5	Use of 2D animation tool to create animations for web applications, mobile applications, gaming applications etc	CO4	4
6	Create a short film / Game development using any 3D	CO4	4

	tool - Blender		
7	Design an advertisement using AR animation	CO5	4
8	Design any web applications or mobile applications or gaming applications using AR with HTML5.	CO6	4
			<b>24</b>

### Learning Resources

1. Steve Roberts, "Character Animation: 2D Skills for better 3D", Focal Press, Second Edition, 2007.
2. Rick Parent, "Computer Animation: Algorithm and Techniques", Elsevier, Third Edition, 2012
3. Park, John Edgar, "Understanding 3D Animation using Maya", Springer Publications, Eighth Edition, 2005
4. Issac Kerlow, "The Art of 3D Computer Animation and Effects", Wiley Publications, 4<sup>th</sup> Edition, 2009.

### Course Designers:

1. Dr.R.Suganya [rsuganya@tce.edu](mailto:rsuganya@tce.edu)
2. Ms. S.Karthiga [skait@tce.edu](mailto:skait@tce.edu)

21IT780	Human Computer Interaction Lab	Category	L	T	P	Credit
		PC	0	0	2	1

**Preamble**

This laboratory course will make the students to design the user interface with required ethical standards and principles. The students will be competent in storyboarding the design and doing usability testing. They can also visualize the data acquired during research visit in the specific real world domains.

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Design the interface with story boarding and interaction model considering the context, ergonomics, experience and engagement	25
CO2	Develop the prototype for the chosen problem	12.5
CO3	Visualize the Information using Information visualization tool.	12.5
CO4	Examine the societal, economic influences for the given problem	12.5
CO5	Analyse the design issues with user experience and usability testing	25
CO6	Report all the research findings with genuine design and development.	12.5

**CO Mapping with CDIO Curriculum Framework**

#	Proficiency Scale	Cognitive	Affective	Psychomotor	CDIO Curricular Components (X.Y.Z)
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.3, 2.1.5, 2.2.3, 2.3.3, 2.3.4, 3.2.3, 3.2.6
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.5, 2.3.4, 2.2.3, 3.2.3, 3.2.6
CO3	TPS4	Analyze	Organize	Complex Overt Responses	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3, 3.2.6
CO4	TPS4	Analyze	Organize	Complex Overt Responses	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3, 3.2.6
CO5	TPS5	Evaluate	Organize	Adaptation	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3, 3.2.6
CO6	TPS6	Create	Characterize	Origination	1.2, 2.1.1, 2.1.2, 2.2.3, 2.3.1, 3.1.1, 3.2.3, 3.2.6

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		M			M	L			M	M	L	L
CO2	S	M	L		M			M	L			M	M	L	L
CO3	S	S	M	L	M			M	L			M	M	L	L
CO4	S	S	M	L	M			M	L			M	M	L	L
CO5	S	S	M	L	M			M	L			M	L	L	L
CO6	S	S	M	L	M			M	L			M	L	L	L



S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Model Examination	Terminal Examination
Remember	-	
Understand	-	
Apply	20	20
Analyse	20	20
Evaluate	30	30
Create	30	30

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Practical Component/Observation
Perception	-
Set	-
Guided Response	-
Mechanism	20
Complex Overt Responses	20
Adaptation	30
Origination	30

**List of Experiments/Activities with CO Mapping**

S.No.	List of Experiments	No. of Lecture Hours	Course Outcomes
1	Gather useful information about users and activities through asking, looking, learning, and trying	2	CO1
2	Organize information about users into useful summaries with affinity diagrams – Chart , Software	2	
3	User research findings with personas and scenarios	2	
4	Sketching as a process for user experience design – Chart, Software	2	CO2
5	Give and accept critiques of design ideas in a constructive manner – Peer Review	1	
6	Visualize the data gathered through any information visualization tool.	3	CO3
7	Demonstrate skills for low-fidelity prototyping and describe the strengths and weaknesses of a variety of prototyping methods – Software	2	CO4
8	Appreciate the process of user experience design as a-cyclical, iterative process	1	
9	Understand the differences between usability and user experience.	2	CO5
10	Analyze an interaction design problem and propose a user-centred process, justifying the process and identifying the trade-offs	2	
11	Development of accessible, Gesture and user-adapted interfaces for people with sensory, motor/physical and	2	

B.Tech Information Technology 2018-19-Programme Core

	cognitive/language impairments.		
12	Prepare high quality, professional documentation and artifacts relating to the design process for preparation for a professional portfolio	3	CO6
	Total Hours	24	

**Course Designers**

Dr.D.Tamilselvi  
Mrs.T.Manju

[dtamilselvi@tce.edu](mailto:dtamilselvi@tce.edu)  
tmanju@tce.edu

<b>21ES790</b>	<b>CAPSTONE DESIGN PROJECT</b> (COMMON TO B.E./B.TECH PROGRAMMES)
----------------	--

Category	L	T	P	Credit
Project	0	0	6	3

### Preamble

Capstone Design Project is a culminating course where students work in teams to design, build, and test prototypes with real world applications. The Capstone Design course provides students an opportunity to work with real-world, open-ended, interdisciplinary challenges proposed by industrial and research project sponsors. They learn and apply the engineering design process: defining functional requirements, conceptualization, analysis, identifying risks and countermeasures, selection, and physical prototyping. Student teams design and build working, physical prototypes to validate their solutions. The course reemphasizes teamwork, project management, research and development.

### Prerequisite

NIL

### Course

### Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement
CO1	Apply prior knowledge, independent research, published information, patents, and original ideas in addressing complex engineering problems and generating solutions.
CO2	Make design decisions based on product design requirements, product lifecycle considerations, resource availability, and associated risks
CO3	Develop design solutions in addressing performance requirements while satisfying relevant societal/industrial and professional constraints.
CO4	Demonstrate effective use of contemporary tools for engineering analysis, fabrication, testing, and design communication.
CO5	Plan, monitor, and manage project schedule, resources, and work assignments to ensure timely and within-budget completion.
CO6	Test and defend performance of a design product with respect to at least one primary design requirement.
CO7	Perform professionally—exhibiting integrity, accepting responsibility, taking initiative, and providing leadership necessary to ensure project success.
CO8	Use formal and informal communications with team, advisor, and clients to document and facilitate progress

\* *Weightage needs to be assigned based on the customized domain-specific rubrics*

CO		Mapping with CDIO Curriculum Framework			
CO#	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	

CO1	TPS3	Apply	Value	Mechanism	1.1, 1.2,1.3, 2.1, 2.2, 2.4, 3.1, 3.2, 4.1, 4.2, 4.3, 4.4, 4.5
CO2	TPS5	Evaluate	Organise	Adaptation	4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.5, 4.1.6, 4.2.1, 4.2.2, 4.2.3, 4.2.4
CO3	TPS3	Apply	Value	Mechanism	4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5
CO4	TPS4	Analyse	Organise	Complex Overt Response	4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.5.5
CO5	TPS4	Analyse	Organise	Complex Overt Response	4.3.1, 4.3.2, 4.3.3, 4.3.4
CO6	TPS4	Analyse	Organise	Complex Overt Response	4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.5.5
CO7	TPS3	Apply	Value	Mechanism	2.5.1, 2.5.2
CO8	TPS3	Apply	Value	Mechanism	3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	-	-	M	M	S	S	M	M	S
CO2	S	S	M	L	S	M	M	M	S	M	M	S
CO3	S	M	L	-	-	M	M	M	S	M	M	S
CO4	S	S	M	L	M	M	M	M	S	M	M	S
CO5	S	S	M	L	M	M	M	M	S	M	S	S
CO6	S	S	M	L	M	M	M	M	S	M	M	S
CO7	S	M	L	-	-	M	M	S	S	S	M	S
CO8	S	M	L	-	-	M	M	S	S	S	M	S

S- Strong; M-Medium; L-Low

### Assessment Pattern: Cognitive Domain

Phases	Deliverables	Marks	Course Outcomes
<b>Continuous Assessment</b>			
Comprehensive Test on disciplinary knowledge*	MCQ format	20	CO1
Review 1 – Capstone Project Selection, functional decomposition and Technical Specification	Technical Report & Presentation	25	CO1, CO2, CO7, CO8
Review 2 – Evaluation of Design Approaches, Project planning and modern tool usage	Technical Report & Presentation	30	CO3, CO4, CO5, CO7, CO8
Review 3 – Evaluation of Testing and Validation, Documentation	Technical Report & Presentation	25	CO5, CO6, CO7, CO8
<b>End-Semester Examination</b>			
Demonstration of the product	Presentation & Viva -voce	60	CO1, CO2, CO3, CO4 CO5, CO6, CO7, CO8
Poster Presentation	Poster	40	
<ul style="list-style-type: none"> <li>• Reports are to be submitted at each review. The report and presentation will be evaluated based on customized domain-specific rubrics for periodic reviews.</li> <li>• Demonstration and Poster presentation will be evaluated by two faculty members nominated by their respective Head of the Department.</li> </ul>			

\* The content for comprehensive test on disciplinary knowledge shall be decided by the committee at department level.

**Course Designers:**

- Dr.S.J. Thiruvengadam [sjtece@tce.edu](mailto:sjtece@tce.edu)
- Dr.S.Saravana Perumaal [sspmech@tce.edu](mailto:sspmech@tce.edu)
- Dr. C.Jeyamala [jeyamala@tce.edu](mailto:jeyamala@tce.edu)

21ITPA0	MACHINE LEARNING	Category	L	T	P	Credit
		PE	3	0	0	3

**Preamble**

The course on machine learning provides an emphasis on data dimensionality reduction techniques, supervised, unsupervised and reinforcement learning models. It also facilitates the student by interpreting the real world problems by examining with appropriate machine learning tools.

**Prerequisite**

18IT530 - Data Mining

**Course Outcomes**

On successful completion of the course, students will be able to

Course Outcomes		Weightage in %
CO1	Describe theory underlying machine learning concepts and techniques.	11
CO2	Apply suitable dimensionality reduction techniques to select the features from the given dataset.	17
CO3	Construct algorithms to learn linear and non-linear classification and Regression models.	26
CO4	Implement data clustering algorithms such as Hierarchical Clustering, Gaussian Mixture Models, Expected Maximization and Hidden Markov Model to cluster the given dataset and hence identify the outliers.	15
CO5	Apply reinforcement learning techniques for real life problems especially medical data set.	17
CO6	Analyze the performance of various classifiers, regression models, clustering and reinforcement algorithms in terms of time and space complexity.	14

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond		1.3,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.3.1, 2.3.2, 3.1.2,4.4.1,4.5.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.3.1, 2.3.2, 3.1.2,4.4.1,4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.3.1, 2.3.2, 3.1.2, 4.4.1, 4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.3.1,2.3.2, 3.1.2, 4.4.1,4.5.3
CO6	TPS4	Analyse	Organise	Complex Overt Responses	1.3, 2.2.1, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4, 2.5, 3.1, 3.2, 4.1.1,4.1.2,4.1.3, 4.3, 4.4, 4.5.3, 4.5.5, 4.5.6

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		M							M	M	L	L
CO3	S	M	L		M							M	M	L	L
CO4	S	M	L		M							M	M	L	L
CO5	S	M	L		M							M	M	L	L
CO6	S	S	M	L	S	M		M	M	M		S	S	S	M

S- Strong; M-Medium; L-Low

\*CO6 will be assessed through Mini Project / Assignment

### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	30	20	0	0	20
Understand	20	20	0	0	20
Apply	50	60	70	60	60
Analyze	0	0	30	40	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	60
Complex Overt Responses	40
Adaptation	-
Orignation	-

### Sample Questions for Course Outcome Assessment

#### Course Outcome 1 (CO1):

1. Describe different types of Learning Models.
2. Differentiate supervised, unsupervised and Reinforcement Learning.
3. Explain about PAC Framework.

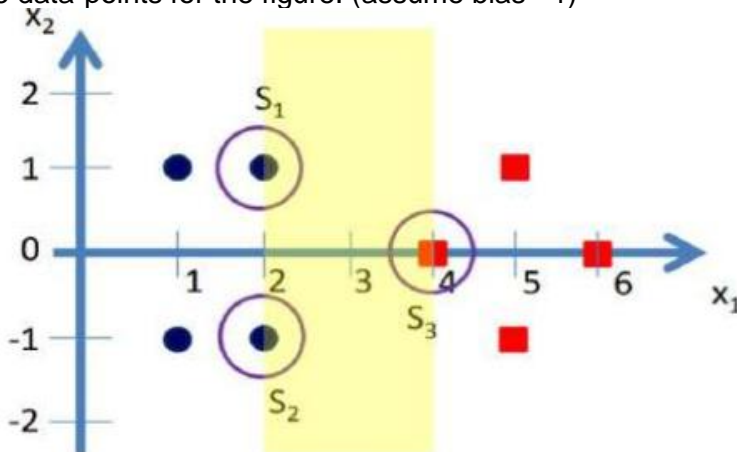
#### Course Outcome 2 (CO2):

1. Compute the Linear Discriminant projection for the following two dimensional dataset.  
 Samples for class  $\omega_1$  :  $X_1=(x_1,x_2)=\{(4,2),(2,4),(2,3),(3,6),(4,4)\}$   
 Sample for class  $\omega_2$  :  $X_2=(x_1,x_2)=\{(9,10),(6,8),(9,5),(8,7),(10,8)\}$
2. Determine the Principal Components for the given 3-Dimensional dataset.  
 (1, 2,4), (2, 4,6), (3, 6,8) (4,8,10) (5,10,12) (6,12,14)
3. Apply Partial Least Squares in the following data and write the findings. Let us assume that dependent variables are J1 to J6, Explanatory variables are: Glucose, Fructose, Saccharose and Observation label is: Name of the Orange Juice.

Orange juice	Glucose	Fructose	Saccharose	J1	J2	J3	J4	J5	J6
pampryl amb.	25.32	27.36	36.45	2	1	2	4	2	2
tropicana amb.	17.33	20	44.15	2	3	3	4	3	4
fruvita fr.	23.65	25.65	52.12	3	3	4	4	2	5
joker amb.	32.42	34.54	22.92	2	2	2	2	2	3
tropicana fr.	22.7	25.32	45.8	4	4	3	4	3	3
pampryl fr.	27.16	29.48	38.94	3	1	1	2	2	3

**Course Outcome 3 (CO3):**

1. Apply SVM algorithm for the data-points and find dimension of hyper plane to classify the data-points for the figure. (assume bias =1)



2. Apply KNN classifier to classify the following Breast Cancer Dataset by considering 7 features in to account. Let diagnosis is the class label. Also compute the following
  - a. Leave one cut cross validation error of 1NN
  - b. 3 – folded cross validation error of 4NN

diagnosis	radius_ mean	texture_ mean	perimeter_ mean	area_ mean	smoothness_ mean	Concavity_ mean
M	17.99	10.38	122.8	1001	0.1184	0.3001
M	20.57	17.77	132.9	1326	0.08474	0.0869
M	19.69	21.25	130	1203	0.1096	0.1974
M	11.42	20.38	77.58	386.1	0.1425	0.2414
M	20.29	14.34	135.1	1297	0.1003	0.198
B	13.54	14.36	87.46	566.3	0.09779	0.06664



B	13.08	15.71	85.63	520	0.1075	0.04568
B	9.504	12.44	60.34	273.9	0.1024	0.02956

3. Apply Ridge and Lasso Regression in the 'Motor Trend US magazine – mtcars' dataset and analyze their performance. The variable mpg - miles per gallon (or fuel efficiency) is the response variable.

model	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
<b>Mazda RX4</b>	21	6	160	110	3.9	2.62	16.46	0	1	4	4
<b>Mazda RX4 Wag</b>	21	6	160	110	3.9	2.875	17.02	0	1	4	4
<b>Datsun 710</b>	22.8	4	108	93	3.85	2.32	18.61	1	1	4	1
<b>Hornet 4 Drive</b>	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
<b>Hornet Sportabout</b>	18.7	8	360	175	3.15	3.44	17.02	0	0	3	2
<b>Valiant</b>	18.1	6	225	105	2.76	3.46	20.22	1	0	3	1
<b>Duster 360</b>	14.3	8	360	245	3.21	3.57	15.84	0	0	3	4
<b>Merc 240D</b>	24.4	4	146.7	62	3.69	3.19	20	1	0	4	2

**Course Outcome 4 (CO4):**

1. Consider the following matrix and apply the hidden markov model. Class label is Climate A(hot,cold),Temperature is hidden node for climate- B(low,medium,high)

$$\Pi = [0.55, 0.45] \quad A = \begin{bmatrix} 0.1 & 0.9 \\ 0.4 & 0.6 \end{bmatrix} \quad B = \begin{bmatrix} 0.2 & 0.5 & 0.3 \\ 0.4 & 0.3 & 0.2 \end{bmatrix}$$

Find the probability of the 4 years sequence of [hot, cold, hot, hot] for [low, medium, high, medium]

2. Show the hierarchy of clustering created by the single-link clustering and complete-link clustering algorithms.

	P1	P2	P3	P4	P5	P6
P1	1.00	0.70	0.65	0.40	0.20	0.05
P2	0.70	1.00	0.95	0.70	0.50	0.35
P3	0.65	0.95	1.00	0.75	0.55	0.40

<b>P4</b>	0.40	0.70	0.75	1.00	0.80	0.65
<b>P5</b>	0.20	0.50	0.55	0.80	1.00	0.85
<b>P6</b>	0.05	0.35	0.40	0.65	0.85	1.00

3. Apply LOF (Local Outlier Factor) algorithm in the following dataset to detect the anomaly data.

<b>user_id</b>	<b>load_video</b>	<b>pause_video</b>	<b>play_video</b>	<b>seek_video</b>	<b>speed_change_video</b>	<b>stop_video</b>
0	2	1	4	1	0	1
1	6	14	14	0	0	1
2	1	0	0	0	0	0
3	2	2	2	0	0	1
4	1	3	22	18	0	0
5	4	1	5	9	0	1
6	1	5	9	6	1	1
7	2	1	18	16	0	0
8	3	7	9	2	0	1

#### Course Outcome 5 (CO5):

1. Apply temporal difference learning approach to the tic-tac-toe problem. Suppose that the probability of winning at a particular state is 0.6, the max probability value in the next set of states is 0.8, and based on our exploration policy, we choose a next state which has probability value 0.4. Should you backup the current state's probability value based on this choice of next state (i.e., move probability value 0.6 closer to 0.4) or not, given that the agent never stops exploring (i.e., the agent always makes an explanatory move some fraction of the time)? Justify your answer.

2. Suppose we want an RL agent to learn to play the game of golf. For training purposes, we make use of a golf simulator program. Assume that the original reward distribution gives a reward of +10 when the golf ball is hit into the hole and -1 for all other transitions. To aid the agents learning process, we propose to give an additional reward of +3 whenever the ball is within a 1 metre radius of the hole. Is this additional reward a good idea or not? Justify.

3. Implement Q- Learning and SARSA algorithm for developing the game called "cliff". The cliff is a 2D world where a player (blue) has to reach the goal (green) by walking through the world while avoid to fall into the cliff (red).

#### Course Outcome 6 (CO6):

\*CO6 will be assessed through Mini Project / Assignment

Group formation: Students are split into project groups with around 2 or 3 members in each group. A team can execute the project using appropriate Data dimension reduction and

Learning algorithms. Students can use the software like R tool, Rapid Miner and python etc.

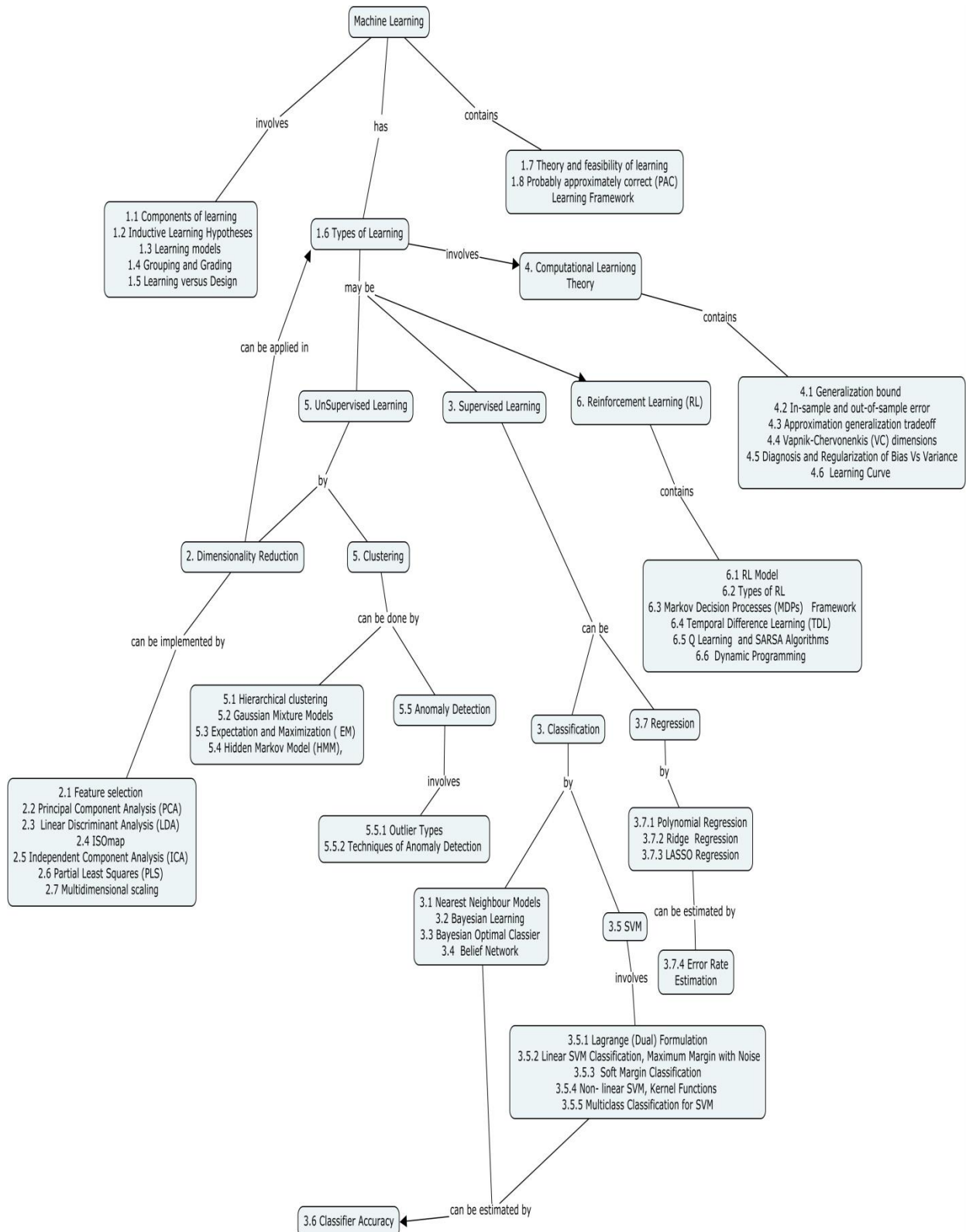
At the end of the semester, the team members have to present their project, submit their report and share their lessons learnt/best practices with other teams. Some of the activities may include: (but not limited to)

- Application identification and data set collection ( Collect the real time dataset from Kaggle / UCI Repository / github etc )
- Design diagram or Data Modeling Diagram
- Applying Data dimensionality reduction algorithms
- Selecting relevant Learning algorithm to extract knowledge from the data set
- Execution of the algorithm
- Results and performance analysis
- Documentation

Some of the Mini-project titles may include: (but not limited to)

- Speech Recognition
- Automatic Recognition of Handwritten documents
- Healthcare Dataset
- Biological Data Analysis
- Intrusion Detection
- Internet of Things (IoT),
- Security Applications
- Financial Data Analysis
- Retail Industry
- Telecommunication Industry
- Education
- CRM- Customer Relationship Management

## Concept Map



**Syllabus**

**Machine Learning** : Components of learning – Inductive Learning Hypotheses- Learning models – geometric models, probabilistic models, logic models – Grouping and Grading – Learning versus Design – Types of learning – supervised , unsupervised , reinforcement –

Theory and feasibility of learning - Probably approximately correct (PAC) Learning Framework

**Dimensionality Reduction:** Feature selection - Principal Component Analysis (PCA) - Linear Discriminant Analysis (LDA) – ISomap - Independent Component Analysis (ICA) - Partial Least Squares (PLS) - Multidimensional scaling – Case Study

**Supervised learning** – Nearest Neighbour Models - Bayesian Learning - Bayesian Optimal Classifier - Belief Network - SVM – Lagrange (Dual) Formulation, Linear SVM Classification, Maximum Margin with Noise, Soft Margin Classification, Non-linear SVM, Kernel Functions - Multiclass Classification for SVM - Classifier Accuracy Estimation - Case Study

**Regression** – Types - Polynomial Regression - Ridge and LASSO (Least Absolute Shrinkage and Selection Operator) Regression - Error Rate Estimation - Case Study

**Computational Learning Theory:** Generalization bound - In-sample and out-of-sample error - Approximation generalization tradeoff - Vapnik-Chervonenkis (VC) dimensions - Diagnosis and Regularization of Bias Vs Variance - Learning Curve - Case Study

**UnSupervised Learning:** Hierarchical clustering - Divisive and Agglomerative – Gaussian Mixture Models – Expectation Maximization (EM) algorithm – Hidden Markov Model (HMM), Anomaly Detection – Outlier Types, Techniques of Anomaly Detection - Case Study

**Reinforcement Learning (RL):** RL Model, Types of RL, Markov Decision Processes (MDPs) Framework, — Temporal Difference Learning (TDL) –Q Learning – SARSA (State-Action-Reward-State-Action) Algorithms – Dynamic Programming - Case Study

The following **use cases** will be applied during the discussion of the different Learning Models:

Speech Recognition, Automatic Recognition of Handwritten documents, Healthcare Dataset, Biological Data Analysis, Intrusion Detection, Internet of Things (IoT), Security Applications. Gaming etc.

### Learning Resources

- Tom M Mitchell, “Machine Learning”, McGraw-Hill, Indian Edition, 2017.
- Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning using Python”, Wiley, First Edition, 2019.
- Y. S. Abu-Mostafa, M. Magdon-Ismael, and H.-T. Lin, “Learning from Data”, AML Book Publishers, First Edition, 2012.
- P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, First Edition, 2012.
- K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, First Edition, 2012
- M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, First Edition, 2012.
- C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, First Edition, 2007.
- <https://nptel.ac.in/courses/106105152/> - Introduction to Machine Learning by Prof. Sudeshna Sarkar, IIT Kharagpur
- <https://www.coursera.org/learn/machine-learning> - Machine Learning by Prof. Andrew Ng, Standford University

<b>Course Contents and Lecture Schedule</b>			
<b>Module No</b>	<b>Topic</b>	<b>No. of Lecture Hours</b>	<b>Course Outcome</b>
<b>1</b>	<b>Machine Learning</b>		
1.1	Components of learning	1	CO1
1.2	Inductive Learning Hypotheses		
1.3	Learning models – geometric models , probabilistic models, logic models	1	
1.4	Grouping and Grading	1	
1.5	Learning Versus Design	1	
1.6	Types of learning – supervised, unsupervised and reinforcement		
1.7	Theory and feasibility of learning		
1.8	Probably approximately correct (PAC) Learning Framework		
<b>2</b>	<b>Dimensionality Reduction</b>		
2.1	Feature selection	1	CO2
2.2	Principal Component Analysis (PCA)	1	
2.3	Linear Discriminant Analysis (LDA)	1	
2.4	ISomap	1	
2.5	Independent Component Analysis (ICA)	1	
2.6	Partial Least Squares (PLS)		
2.7	Multidimensional Scaling	1	
<b>3</b>	<b>Supervised Learning</b>		
3.1	Nearest Neighbour Models	1	CO3
3.2	Bayesian Learning	1	
3.3	Bayesian Optimal Classifier		
3.4	Belief Network	1	
<b>3.5</b>	<b>SVM</b>		
3.5.1	Lagrange (Dual) Formulation	1	CO3
3.5.2	Linear SVM Classification ,Maximum Margin with Noise	1	
3.5.3	Non- linear SVM	1	
3.5.4	Kernel Functions		
3.5.5	Multiclass Classification for SVM	1	
3.6	Classifier Accuracy Estimation	1	CO6
<b>3.7</b>	<b>Regression</b>		
3.7.1	Types, Polynomial Regression	1	CO3
3.7.2	Ridge Regression	1	
3.7.3	LASSO (Least Absolute Shrinkage and Selection Operator) Regression		
3.7.4	Error Rate Estimation		CO6
<b>4</b>	<b>Computational Learning Theory</b>		

4.1	Generalization bound	1	CO6
4.2	In-sample and out-of-sample error		
4.3	Approximation generalization tradeoff	1	
4.4	Vapnik-Chervonenkis (VC) dimensions	1	
4.5	Diagnosis and Regularization of Bias Vs Variance	1	
4.6	Learning Curve		
5	UnSupervised Learning		
5.1	Hierarchical clustering - Divisive and Agglomerative	1	CO4
5.2	Gaussian Mixture Models	1	
5.3	Expectation - Maximization (EM) Algorithm	1	
5.4	Hidden Markov Model (HMM)	1	
5.5	Anomaly Detection		
5.5.1	Outlier Types	1	CO4
5.5.2	Techniques of Anomaly Detection	1	
6	Reinforcement Learning (RL)		
6.1	RL Model	1	CO5
6.2	Types of RL		
6.3	Markov Decision Processes (MDPs) Framework	1	
6.4	Temporal Difference Learning (TDL)	1	
6.5	Q Learning and SARSA (State-Action-Reward-State-Action) Algorithms	1	
6.6	Dynamic Programming	2	
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

- |    |            |                 |
|----|------------|-----------------|
| 1. | C.Deisy    | cdcse@tce.edu   |
| 2. | S. Sridevi | sridevi@tce.edu |

21ITPD0	DISTRIBUTED APPLICATION DEVELOPMENT	Category	L	T	P	Credit
		PE	3	0	0	3

### Preamble

This course helps the students to understand various aspects that must be considered while designing and developing a distributed application. This course also provides necessary insights into various design patterns, frameworks, tools and technologies that could be leveraged for the development of Distributed applications

### Prerequisite

- Basic knowledge in Application development

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain the concepts, components and key features of multi tier application architectures	10
CO2	Review various design patterns available for developing distributed applications	10
CO3	Solve challenges in co-ordinating distributed transactions using appropriate techniques and algorithms.	20
CO4	Use appropriate patterns for the design of distributed systems subject to specific design and performance constraints.	20
CO5	Perform Serverless application development with distributed databases such as Cassandra, DynamoDB at the backend	20
CO6	Develop and deploy applications using distributed frameworks such as Apache Zookeeper, Consul and Openwhisk	20

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3, 2.3.1, 4.3.2
CO2	TPS2	Understand	Respond	Guided Response	1.3, 2.2.2
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.5, 3.1.2, 4.4.1, 4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 3.1.2, 4.3.3, 4.4.1, 4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.1, 3.1.2, 4.3.2, 4.5.3
CO6	TPS3	Apply	Value	Mechanism	1.3, 2.4.6, 3.1.2, 3.2.3, 4.5.3

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	M	L											L		
CO3	S	M	L										M		
CO4	S	M	L		S			S	S	S		L	M	M	M
CO5	S	M	L		S			S	S	S		L	M	M	M
CO6	S	M	L		S			S	S	S		L	M	M	M

S- Strong; M-Medium; L-Low



AssessmentPattern: Cognitive Domain					
Cognitive Levels	Continuous Assessment Tests(60)		Assignment(40)		Terminal Examination(100)
	1	2	1	2	
Remember	10	10			10
Understand	30	30	20	20	30
Apply	60	60	80	80	60
Analyse					
Evaluate					
Create					

Assignments may be used to evaluate CO3, CO4, CO5 and CO6

AssessmentPattern: Psychomotor	
Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	20
Mechanism	80
Complex Overt Responses	-
Adaptation	-
Orignation	-

### Sample Questions for Course Outcome Assessment\*\*

#### Course Outcome1(CO1):

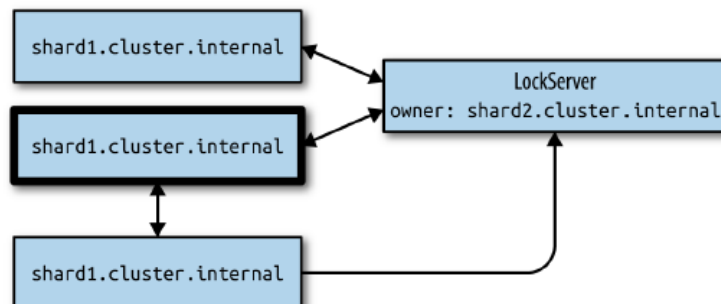
1. Review the differences and similarities between Cluster, Grid and Cloud
2. List the advantages of Serverless and Microservices architecture
3. Summarize the cluster and cloud computing concepts.

#### Course Outcome2(CO2):

1. Identify the differences between Single Node Patterns and Serving Patterns
2. Describe the use of Ambassadors and Adapters
3. Explain sharding a service using ambassadors

#### Course Outcome3(CO3):

1. Demonstrate implementation of synchronization and ownership in an distributed application
2. Consider the sharding scenario as in the below diagram, Predict the Ownership complications that may arise. Present atleast two cases



3. Show that Byzantine agreement can be reached for three generals, with one of them faulty, if the generals digitally sign their messages.

**Course Outcome 4 (CO4):**

1. how the steps for building simple PaaS application using Side car Patterns
2. demonstrate creation of replicated services and load balancer using Kubernetes
3. present the steps for deploying an Ambassador and Memcache for a Sharded Cache

S  
D  
P

**Course Outcome 5 (CO5):**

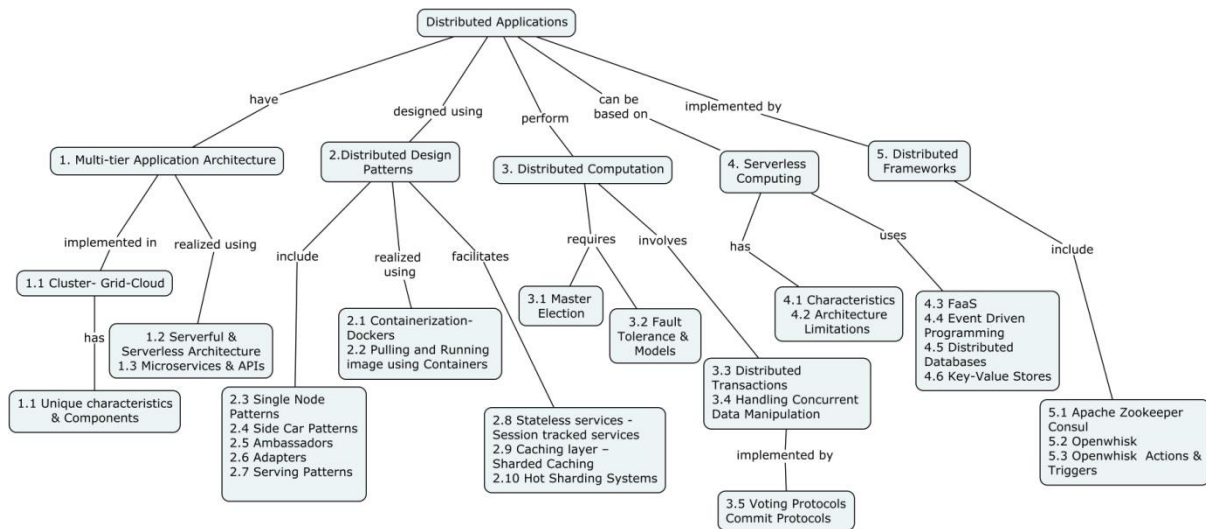
1. Demonstrate Function-as-a-Service(FaaS) model with suitable example
2. Present the steps to configure Openwhisk functions and trigger the same using events.
3. Consider that there is an application requirement to implement set of actions based on voice commands. Illustrate the design and basic components of the design in both Serverful and Serverless computing paradigms

**Course Outcome 6 (CO6):**

Course Outcome 6 may be evaluated through assignment which may be based on – but not limited to - the following areas

1. Implementing concurrency in a distributed application using Apache Zookeeper
2. Creating Static Web pages using S3
3. Moving existing web applications to Serverless framework

**Concept Map**



**Syllabus**

**Multi-Tier Application Architectures** - Characteristics – Components – Cloud Computing– Cluster Computing – Grid Computing - Serverful Application Architectures – Serverless Application Architectures – Microservices – APIs

**Distributed Design Patterns** - Containerization - Docker - Pulling and Running image using Containers - Single Node Patterns – Sidecar Patterns – Ambassadors -Sharding Services – Service Brokering – Adapters - **Serving Patterns** – Stateless services – Session tracked services – Caching layer – Sharded Caching – Hot Sharding systems

**Distributed Computation** – Master Election – Fault Tolerance - Fault Models – Distributed database concepts: Distributed Transactions-Handling Concurrent Data Manipulation - Commit Protocols – Voting Protocols

**Serverless Computing** - Serverful vs Serverless Computing - Serverless Platform Architecture – Characteristics – Event driven Programming – Function-as-a-Service – Limitations – Challenges – Serverless Databases – Key-Value Store Overview – Case Study on AWS Lambda – S3.

**Deployment Frameworks:** Apache Zookeeper – Consul - Openwhisk Architecture – Programming Model – Actions – Triggers and Rules – Sample Applications

**Learning Resources**

1. Brendon Burns, “Designing Distributed Systems”, OReilly Publication, First Edition, 2018
2. Andrew S. Tanenbaum, Maarten Van Steen, “Distributed Systems : Principles and Paradigms”, Pearson Education, Third Edition, 2017
3. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair , "Distributed Systems: Concepts and Design", Pearson Education, Fifth Edition, 2017
4. Maddie Staggler – “Beginning Serverless Computing: Developing with Amazon Web Services, Microsoft Azure and Google Cloud – Apress, 2018
5. Creating Serverless Application in Openwhisk - <https://thenewstack.io/hands-guide-creating-first-serverless-application-apache-openwhisk/>
6. Openwhisk Tutorial – <https://github.com/apache/openwhisk-tutorial/blob/master/README.md>
7. Openwhisk Documentation – <https://openwhisk.apache.org/documentation.html>

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lectures	Course Outcomes
<b>1</b>	<b>Multi-Tier Application Architectures</b>		
1.1	Cloud- Cluster- Grid – Characteristics and Components	2	CO1
1.2	Serverful and Serverless Application Architectures	1	CO1
1.3	Microservices and APIs	1	CO1
<b>2</b>	<b>Distributed Design Patterns</b>		
2.1	Containerization – Dockers	1	CO4
2.2	Pulling and Running image using Containers	1	CO4
2.3	Single Node Patterns	1	CO2
2.4	Sidecar Patterns	1	CO2
2.5	Ambassadors	1	CO2
2.6	Adapters	1	CO2
2.7	Serving Patterns	1	CO2
2.8	Stateless services - Session tracked services	1	CO4
2.9	Caching layer – Sharded Caching	1	CO4
2.10	Hot Sharding systems	1	CO4
<b>3</b>	<b>Distributed Computation</b>		
3.1	Master Election	2	CO3

3.2	Fault Tolerance - Fault Models	2	CO4
3.3	Distributed database concepts: Distributed Transactions	1	CO3
3.4	Handling Concurrent Data Manipulation	1	CO3
3.5	Commit Protocols – Voting Protocols	2	CO3
<b>4</b>	<b>Serverless Computing</b>		
4.1	ServerfulvsServerless Computing – Characteristics	1	CO5
4.2	Serverless Platform Architecture – Characteristics – Limitations	1	CO5
4.3	Function-as-a-service	2	CO5
4.4	Event Driven programming		CO5
4.5	Distributed Serverless Databases	1	CO5
4.6	Key- Value stores	1	CO5
4.7	Case Study on AWS Lambda – S3	2	CO5
<b>5</b>	<b>Deployment Frameworks</b>		
5.1	Apache Zookeeper, Consul	2	CO6
5.2	Openwhisk Architecture – Programming Model	2	CO6
5.3	Actions ,Triggers and Rules, Sample Applications	2	CO6
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

1. Dr.S.Padmavathi [spmcs@tce.edu](mailto:spmcs@tce.edu)
2. Mrs.S.Thiruchadai Pandeewari [eshwarimsp@tce.edu](mailto:eshwarimsp@tce.edu)

<b>21ITPE0</b>	<b>FOG COMPUTING</b>	Category	L	T	P	Credit
		PE	3	0	0	3

**Preamble**

This course aims at providing students with the necessary fundamental concepts and knowledge on technologies that will enable them to explore the fog computing paradigm and apply the same in their prospective projects in the domains of IoT, 5G, Industry 4.0 and Stream Analytics.

**Prerequisite**

- 18IT430-Computer Networks
- 18IT610 - Cloud Computing

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain the concepts, characteristics and architecture of Fog Computing paradigm.	8
CO2	Recognize the enabling technologies of fog computing such as Software Defined Networking, Network function virtualization and Containerization.	6
CO3	Demonstrate the application of software definition in the networking for fog computing.	19
CO4	Select the appropriate Orchestration framework for a fog based application	28
CO5	Identify the suitable communication technologies and execution management functions of fog computing middleware based on the given design goal.	22
CO6	Experiment with the use cases of fog computing in IoT and 5G systems	17

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3
CO2	TPS2	Understand	Respond	Guided Response	1.3,2.3.1,3.1.1,3.2.4
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO4	TPS4	Analyse	Organise	Complex Overt Response	1.3, 2.4.5, 2.4.6, 3.2.1 -3.2.6, 4.3.1, 4.3.2
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO6	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PS O3
CO1	M	L											L		
CO2	M	L											L		
CO3	S	M	L		L				L	L		L	M	L	L
CO4	S	S	M	L					S	M		L	S		L
CO5	S	M	L		M	L	L	S	S	M	L	M	M	M	M
CO6	S	M	L		S	L	L	S	S	M	L	M	M	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination(100)
	1	2	1	2	
Remember	20	10			20
Understand	20	30			20
Apply	40	40	100	40	50
Analyse	20	20		60	10
Evaluate					
Create					

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	30
Mechanism	50
Complex Overt Responses	20
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome 1(CO1):**

1. Describe the main characteristics of fog nodes.
2. Explain the fog reference architecture.
3. Discuss the significance of fog computing compared to cloud computing

**Course Outcome 2(CO2):**

1. How exactly containers are different from Hypervisor Virtualization (vsphere)? What Are The Benefits?
2. How Cloud Automation Overtake Containerization?
3. Discuss the problems that NFV (Network Functions Virtualization) addresses

**Course Outcome 3(CO3):**

1. Assume a chain of community colleges are linked by a MAN. A single campus might use a CAN (Campus Area Network), but the entire academic institution use a MAN to track students' progress across different classrooms and majors. Show what are the shortcomings the network is expected to suffer from? Select some SDN features you will adapt to rectify the identified problem.
2. An enterprise wants to set up a Data Center for its global operation, Provide a solution to implement it using SDN. Judge the effects of virtualization and its adaptability in Data Center Innovation and related issues.
3. Choose the best routing algorithm that can be exploited for topology abstraction and Point out a suitable example.

**Course Outcome 4 (CO4):**

1. Categorize the design patterns in orchestration.
2. Differentiate typed message and un-typed message in orchestration.
3. Select a suitable fog based Orchestration framework for health care application.

**Course Outcome 5 (CO5):**

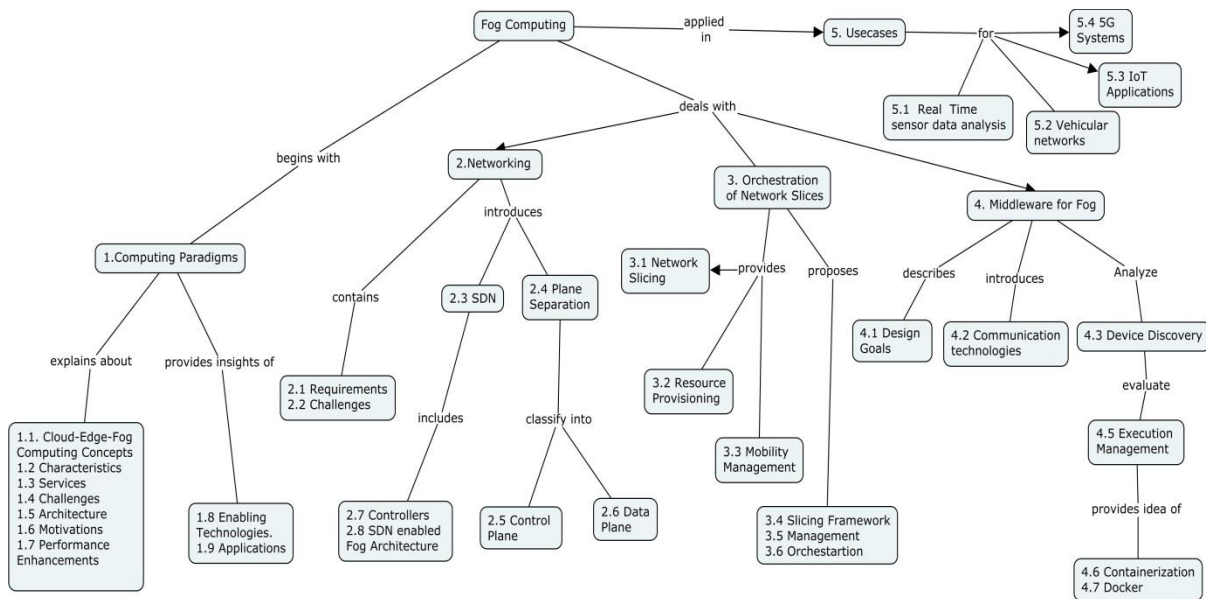
1. Sketch the taxonomy of network-aware VM/VNF Management in software-defined Clouds.
2. Show the network slice management in Fog computing architecture.
3. Prepare a system model with edge and fog devices for vehicular network.

**Course Outcome 6(CO6):**

CO6 would be evaluated through Assignments and Miniproject that may include but not limited to the following topics

1. Smart Nutrition monitoring system
2. Fog as a Data Analytics Engine
3. Fog in Health Monitoring
4. Smart City Applications
5. Fog in Vehicular Networks
6. Smart Surveillance systems
7. Intelligent Transportation systems

**Concept Map**



## Syllabus

**Computing Paradigms:** Cloud vs Fog vs Edge computing Concepts - Characteristics- Services - Challenges - Fog Computing Architecture - Motivations - Performance Enhancements - Enabling Technologies - Fog based applications.

**Networking for Fog:** Fog networking requirements - Challenges - Software Definition of Networks - Plane Separation - Control Plane - Data Plane - SDN Controllers - SDN Enabled Fog Architecture - Case Study

**Orchestration of Network Slices:** Network Slicing - Resource provisioning- Mobility Management - Generic Slicing framework - Slicing Data Management and Orchestration - State of the art Orchestration frameworks

**Middleware for Fog:** Design Goals - Communication Technologies - Device Discovery - Context Monitoring - Execution Management - Containerization - Docker Container Orchestration

**Fog - Use cases:** Fog based real time sensor data analysis - Vehicular Networks - IoT Applications - 5G systems

## Learning Resources

1. Buyya, Rajkumar, and SatishNarayanaSrirama, eds. Fog and edge computing: principles and paradigms. Wiley, 2019.
2. Mahmood, Zaigham, ed. Fog Computing: Concepts, Frameworks and Technologies. Springer, 2018.
3. Rahmani, Amir M., et al., eds. Fog computing in the internet of things: Intelligence at the edge. Springer, 2017.
4. Alenezi, Mamdouh, KhaledAlmustafa, and KhalimAmjadMeerja. "Cloud based SDN and NFV architectures for IoT infrastructure." Egyptian Informatics Journal 20.1 (2019): 1-10.
5. Manzalini, Antonio, CagatayBuyukkoc, Prosper Chemouil, SlawomirKuklinski, Franco Callegati, Alex Galis, Marie-PauleO dini et al. "Towards 5g software-defined ecosystems." IEEE, Software Defined Networks Whitepaper, 2016.
6. Chiang, Mung, and Tao Zhang. "Fog and IoT: An overview of research opportunities." IEEE Internet of Things Journal 3, no. 6: 854-864, 2016.



7. <https://www.openfogconsortium.org/resources/>**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
1	<b>Computing Paradigms</b>		
1.1	Cloud vs Fog vs Edge computing Concepts	1	CO1
1.2	Characteristics		
1.3	Services		
1.4	Challenges	1	CO1
1.5	Fog Computing Architecture		
1.6	Motivations		
1.7	Performance Enhancements	1	CO2
1.8	Enabling Technologies		
1.9	Fog based applications		
2	<b>Networking for Fog</b>		
2.1	Fog Networking requirements	1	CO2
2.2	Challenges		
2.3	Software Definition of Networks	1	CO3
2.4	Plane Separation	1	
2.5	Control Plane	1	
2.6	Data Plane	1	
2.7	SDN Controllers	1	
2.8	SDN Enabled Fog Architecture	1	
2.9	Case Study	1	CO3
3	<b>Orchestration of Network Slices</b>		
3.1	Network Slicing	1	CO4
3.2	Resource provisioning	2	
3.3	Mobility Management	2	
3.4	Generic Slicing framework	2	CO4
3.5	Slicing Management and Orchestration	2	
3.6	State of the art Orchestration frameworks	1	
4	<b>Middleware for Fog</b>		
4.1	Design Goals	1	CO5
4.2	Communication Technologies	1	
4.3	Device Discovery	1	
4.4	Context Monitoring	1	
4.5	Execution Management	2	
4.6	Containerization	1	
4.7	Docker Container Orchestration	1	
5	<b>Fog - Use cases</b>		
5.1	Fog based real time sensor data analysis	1	CO6
5.2	Vehicular Networks	2	
5.3	IoT Applications	2	
5.4	5G systems	1	
	<b>Total Lectures</b>		<b>36</b>

**Course Designers:**

- Dr.S.Padmavathi [spmcs@tce.edu](mailto:spmcs@tce.edu)
- Mrs. C.Santhiya [csit@tce.edu](mailto:csit@tce.edu)

21ITPF0	SOFTWARE DEFINED NETWORKS	Category	L	T	P	Credit
		PE	3	0	0	3

**Preamble**

This course presents the architecture, fundamental mechanisms and technical challenges of the emerging software-defined networking (SDN) paradigm. Also, this course introduces necessary tools and technologies required to develop SDN based applications.

**Prerequisite**

18IT430 – Computer Networks

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Recognize the need for SDN in Cloud, Fog, IOT and Big Data Applications	10
CO2	Summarize plane separation and implementation approaches	20
CO3	Examine traditional and SDN based Network topological information abstraction approaches	20
CO4	Implement Controller- Switch Communication using OpenFlow	10
CO5	Use Controller and Switch Implementations for realizing SDN based applications	20
CO6	Enhance Datacenter Networks, Campus Networks, Hospitality Networks, Mobile Networks using SDN Concepts	20

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3, 2.3.1, 2.1.1
CO2	TPS2	Understand	Respond	Guided Response	1.3, 2.3.1, 2.1.5
CO3	TPS3	Analyze	Organize	Complex Overt Response	1.3, 2.2.2, 4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.3.1, 4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.3.1 3.1.2, 4.3.2
CO6	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.5, 3.1.2, 3.2.3,4.3.2, 4.5.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	M	L											L		
CO3	S	S	M	L									S		
CO4	S	M	L		S			S	S	S			M		
CO5	S	M	L		S			S	S	S			M	M	M
CO6	S	M	L		S			S	S	S		L	M		S

S- Strong; M-Medium; L-Low

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	10			10
Understand	40	20	20	20	30
Apply	40	60	80	60	40
Analyse		10		20	20
Evaluate					
Create					

CO3, CO5 and CO6 may be evaluated using Miniproject/Assignments

#### Assessment Pattern: Psychomotor

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	-
Guided Response	20
Mechanism	80
Complex Overt Responses	-
Adaptation	-
Orignation	-

#### Sample Questions for Course Outcome Assessment\*\*

##### Course Outcome 1(CO1):

1. Describe the role of SDN in facilitating VM Mobility
2. Outline the various motivations for Software definition of Networks
3. Identify the shortcomings of traditional Networks in the context of Modern technologies such as Big data and IoT.

##### Course Outcome 2(CO2):

1. Identify the differences between traditional Networks and Software Defined Networks
2. Review the fundamental traits of Software Defined Networks
3. Recognize the control functions of traditional switches and SDN Controller

##### Course Outcome 3(CO3):

1. Employ Ping/trace route commands and devise a suitable algorithm Network topology abstraction given that you have access to a DNS Server's database
2. How an routing algorithm can be exploited for topology abstraction and Point out a suitable example
3. Relate the abstract idea of Traffic Engineering Databases presented in ALTO into an application offering routing information as a service using SDN concepts

##### Course Outcome 4 (CO4):

1. Present the treatment meted out to data packets in Openflow switches with detailed flow of messages in three different cases
  - a) Matching flow is found
  - b) Matching flow entry not found
  - c) The packet has to be dropped
2. Show the initiation of communication between Controller and Switch

- Use appropriate Openflow messages and demonstrate modification of an existing flow entry

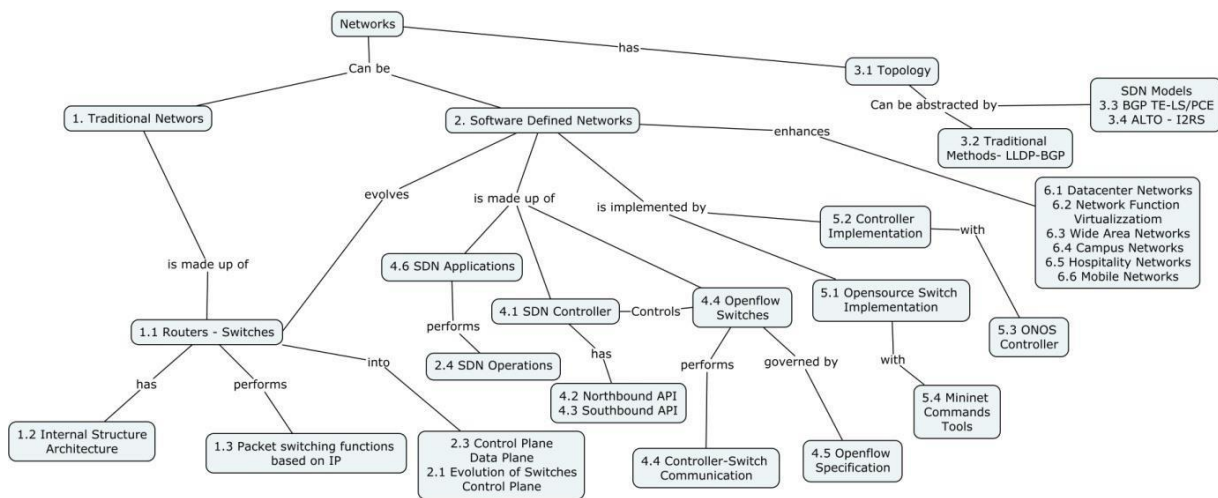
**Course Outcome 5 (CO5):**

- Demonstrate the unique characteristics of OpenFlow 1.0, 1.1, 1.2 and 1.3?
- Experiment with messaging between controller and switch using OpenFlow.
- Illustrate the Controller Programming Flow Table for the given network.

**Course Outcome 6(CO6):**

- Implement Network Captive portals in campus Networks
- Demonstrate traffic suppression in Hospitality Networks with SDN
- An online retail company wants to set up a Data center for its global operation, Provide a solution to implement it using SDN. Illustrate the concept of virtualization and its adaptability in Data Center Innovation and related issues

**Concept Map**



**Syllabus**

**Fundamentals of Traditional Networks -** Routers – Switches - Internal Structure and Architecture- Packet Switching Functions - IP

**Fundamentals of SDN -** Evolution of Switches and Control planes – Motivations and Challenges of SDN –Plane Separation - Control Plane Functions-Data Plane Functions – SDN Operation and Devices

**Network Topology and Topological Information Abstraction -** Network Topology - Traditional Methods-LLDP-BGP-TE/LS- PCE- ALTO-I2RS

**SDN APIs -** SDN Controller – Northbound APIs – Southbound APIs – Openflow Switches - Controller Switch Communication: OpenFlow - Overview, Basics and Limitations – SDN Applications

**SDN Implementations–** SDN Open source switch Implementation– Controller Implementations – ONOS Controller – Mininet – Mininet Commands - Tools.

**SDN Usecases –**SDN in Data Center Networks, NFV vs SDN, Wide Area Networks, Campus Networks, Hospitality Networks, Mobile Networks

**Learning Resources**

- Paul Goransson and Chuck Black – Software Defined Networks-A Comprehensive Approach – Morgan Kaufmann.- 2016 – Second Edition

2. Thomas D Nadeau and ken Gray- "SDN"- O'Reilly publication- First Edition- 2014
3. Road to SDN - <http://queue.acm.org/detail.cfm?id=2560327>
4. Routing Control - <http://www.cs.princeton.edu/~jrex/papers/rcp-nsdi.pdf>
5. ONOS - <https://onosproject.org/>
6. Open Networking - <https://www.opennetworking.org/onos/>

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lectures	Course outcome
<b>1</b>	<b>Fundamentals of Traditional Networks</b>		
1.1	Routers – Switches	2	CO1
1.2	Internal Structure and architecture	1	
1.3	Packet Switching Functions - IP	1	
<b>2</b>	<b>Fundamentals of SDN</b>		
2.1	Evolution of Switches and Control planes	1	CO2
2.2	Motivations and Challenges of SDN	1	
2.3	Plane Separation Control Plane Functions Data Plane Functions	2	
2.4	SDN Operation and Devices	1	
<b>3</b>	<b>Network Topology and Topological Information Abstraction</b>		CO3
3.1	Network Topology	2	
3.2	Traditional Methods- LLDP	2	
3.3	BGP - TE/LS- PCE	1	
3.4	ALTO - I2RS Topology	1	
<b>4</b>	<b>SDN APIs</b>		
4.1	SDN Controller	1	CO4
4.2	Northbound APIs	1	
4.3	Southbound APIs	1	
4.4	Openflow Switches Controller Switch Communication	2	
4.5	OpenFlow Specification	2	
4.6	SDN Applications	1	
<b>5</b>	<b>SDN Implementation</b>		
5.1	SDN Open source switch Implementation	1	CO5
5.2	Controller Implementations	2	
5.3	ONOS Controller	2	
5.4	Mininet – Mininet Commands - Tools	2	
<b>6</b>	<b>SDN Use cases</b>		CO6
6.1	SDN in Data Center Networks	1	
6.2	NFV vs SDN	1	
6.3	Wide Area Networks	1	
6.4	Campus Networks	1	
6.5	Hospitality Networks	1	

6.6	Mobile Networks	1	
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

- |                             |                    |
|-----------------------------|--------------------|
| 1. S.Thiruchadai Pandeewari | eshwarimsp@tce.edu |
| 2. K. Indira                | kiit@tce.edu       |



21ITPJ0	<b>WIRELESS AND MOBILE COMMUNICATION</b>	Category	L	T	P	Credit
		PE	3	0	0	3

**Preamble**

The course aims at exploring the concepts of wireless and mobile communications in Physical, MAC, Network and Transport layer level. It also explores the WLAN, GSM telecommunication system and Ad Hoc routing schemes. This course induces research practice through paper presentation in recent trends and technologies with simulation tools.

**Prerequisite**

- 18IT430 -Computer Networks

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Experiment with the wireless multiplexing, modulation and spread spectrum techniques for the given scenario	20
CO2	Choose the suitable wireless MAC mechanisms - SDMA, TDMA, FDMA and CDMA for solving the given problem	10
CO3	Outline the working principle of Mobile IP and Mobile TCP	15
CO4	Demonstrate the various functions of Wireless LAN and GSM telecommunication system	15
CO5	Solve the given wireless ad hoc network routing problem with suitable routing schemes	20
CO6	Analyze the performance of various wireless and mobile communication schemes through simulation tools such as NS3	10

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.3
CO2	TPS3	Apply	Value	Mechanism	1.3
CO3	TPS2	Understand	Respond	Guided Response	1.3
CO4	TPS2	Understand	Respond	Guided Response	1.3
CO5	TPS3	Apply	Value	Mechanism	1.3
CO6	TPS4	Analyse	Organise	Complex Overt Responses	1.3, 2.2, 2.4.5, 2.4.6, 2.4.7, 2.5.1, 3.1.1, 3.2

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L										M		
CO2	S	M	L										M		
CO3	M	L											L		
CO4	M	L											L		
CO5	S	M	L										M		
CO6	S	S	M	L	M			S	S	S		S	M	L	M

S- Strong; M-Medium; L-Low



**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	20
Understand	30	40	60	40	40
Apply	50	40	40	50	40
Analyse	0	0	0	10	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

CO6 will be assessed only through Paper Presentation.

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Mini project/Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	-
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome 1 (CO1):**

1. Implement the slow hopping and fast hopping for the data 1010101.
2. Apply MSK for the data 1011001.
3. Experiment DSSS with the data 110011.

**Course Outcome 2 (CO2):**

1. Consider two senders  $X_s$  and  $Y_s$ . Both senders are transmitting signal at the same time, same place with same frequency. Use the following table and apply the CDMA. Show how the two receivers  $X_r$  and  $Y_r$  received the signal and extract the data?

	$X_s$	$Y_s$
Digital Data	110	011
Sequence Keys	101101, 110100, 010100	111000, 101010, 000111

2. Consider the following scenario. Apply aloha. Explain with proper diagrams. Discuss your findings.
  - Assume there are three stations (X, Y and Z) using the medium for transmission
  - Assume that the transmission time for a single bit is 3 ms

	Station X	Station Y	Station Z
Digital Data	11011101	01101100	10110111
Starting time for each data transmission (ms)	0,1,4,7,8,9,12,14	1,2,5,8,10,11,13,15	0,3,4,6,10,12,17,18

3. Consider the following scenario. Apply slotted aloha. Explain with proper diagrams. Discuss your findings.
- Assume there are two stations (X, Y) using the medium for transmission
  - Assume that the transmission time for a single bit is 3 ms
  - Assume your own time slice for slotted aloha

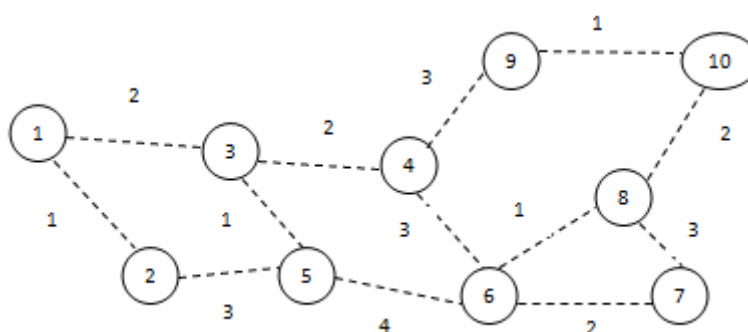
	Station X	Station Y
Digital Data	11011101	01101100
Starting time for each data transmission (ms)	0,1,4,7,8,9,12,14	1,2,5,8,10,11,13,15

**Course Outcome 3 (CO3):**

1. Explain the packet forwarding in Mobile IP.
2. Discuss in detail about agent registration and reply procedure.
3. Explain the Mobile TCP functionalities.

**Course Outcome 4 (CO4):**

1. Explain the GSM architecture.
2. Demonstrate how the handover scheme is working in GSM.
3. Explain in detail about various MAC schemes of IEEE 802.11.

**Course Outcome 5 (CO5):**

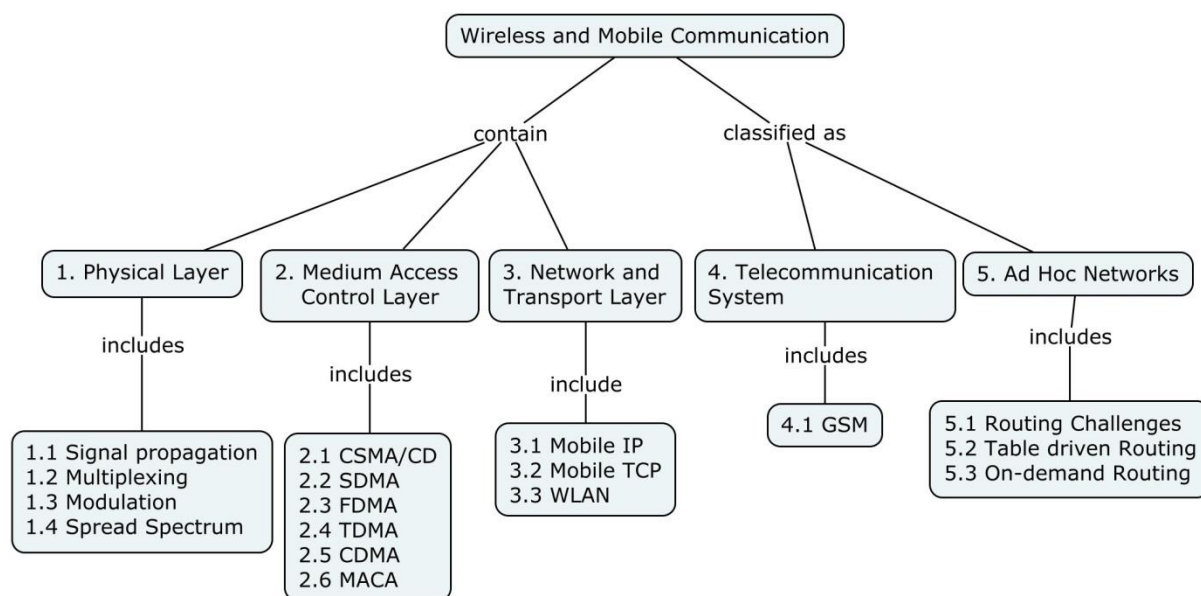
1. Consider the above graph. Find the routing path between node '1' and node '8' of the given network using WRP. Construct the routing table for the node '8' and node '9'.
2. Consider the above graph. Apply DSR for finding the path between node '2' and node '7' of the above network. Consider the node '6' is leaving the network after a data transmission between the nodes '2' and '7'. Now, demonstrate how the nodes '1' and '10' are transmitting data using DSR.
3. Consider the above graph. Build the routing table for node '4' using DSDV for the above ad hoc network

**Course Outcome 6 (CO6):**

## Paper Presentation

- Analyse the various ad hoc routing scheme with the respect to the delay, throughput.
- Analyse the performance of various mobility scheme of wireless ad hoc networks.
- Interpret the simulated results by changing the various wireless protocols with NS3.

## Concept Map



## Syllabus

**Physical Layer:** Signal propagation - Multiplexing - SDM, TDM, FDM, CDM – Modulation – ASK, PSK, FSK, MSK - Spread spectrum – DSSS, FHSS

**MAC Layer:** CSMA/CD - SDMA, FDMA, TDMA – Aloha, Slotted Aloha – CDMA - MACA

**Network and Transport Layer:** Mobile IP – Packet Delivery, Agent Registration, Reply, Triangular Routing - Mobile TCP - Snooping TCP

**Wireless LAN:** Transmission Technologies – System Architecture - Physical Layer – IR, FHSS, DSSS - DFWMAC

**Telecommunication Systems:** GSM - Services – Architecture – Protocol Stack – Call Routing - Handover

**Wireless Ad Hoc Networks – Routing:** Challenges - Table driven, On-demand, Power aware Routing schemes, QoS

### Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours	Course Outcomes
<b>1</b>	<b>Physical Layer</b>		<b>CO1</b>
1.1	Signal propagation	1	
1.2	Multiplexing – SDM, TDM, FDM, CDM	2	
1.3	Modulation – ASK, PSK, FSK, MSK	2	
1.4	Spread Spectrum – DSSS, FHSS	2	
<b>2</b>	<b>Medium Access Control Layer</b>		<b>CO2</b>
2.1	CSMA/CD	1	
2.2	SDMA		
2.3	FDMA		
2.4	TDMA – Aloha, Slotted Aloha	2	
2.5	CDMA	1	
2.6	MACA		
	Paper Presentation - Review – 1	1	
<b>3</b>	<b>Network and Transport Layer</b>		<b>CO3</b>
3.1	Mobile IP – Introduction	2	
3.1.1	Packet Delivery		
3.1.2	Agent Registration, Reply, Triangular Routing	2	
3.2	Mobile TCP – Snooping TCP	1	
3.3	Wireless LAN		
3.3.1	Transmission Technologies, System Architecture	1	
3.3.2	Physical Layer – IR, FHSS, DSSS	2	
3.3.3	DFWMAC	2	
<b>4</b>	<b>Telecommunication System</b>		<b>CO4</b>
4.1	GSM – Introduction	1	
4.1.1	Services, Architecture, Protocol Stack	1	
4.1.2	Call Routing, Handover	2	
	Paper Presentation - Review – 2	1	
<b>5</b>	<b>Wireless Ad Hoc Networks</b>		<b>CO5</b>
5.1	Routing Challenges	1	
5.2	Table Driven routing schemes	3	
5.3	On-demand routing schemes	3	
	Paper Presentation - Review – 3	2	
	<b>Total</b>	<b>36</b>	

### Learning Resources

1. T.S.Rappaport, “Wireless Communications Principles and Practices”, Pearson Education, Asia, NewDelhi, 2<sup>nd</sup> Edition, 2010.
2. Jochen.H.Schiller, “Mobile Communications” Addison- Wesley, 2<sup>nd</sup> Edition 2009.
3. C.Siva Ram Murthy and B.S. Manoj, “Ad Hoc Wireless Networks- Architectures and Protocols”, 2nd Edition, 2004.
4. William Stallings, “Wireless Communications and Networks”, Pearson Education, 2<sup>nd</sup> Edition, 2013.
5. 2. W.C.Y.Lee., “Mobile Communication Engineering”, Tata McGraw Hill, 2<sup>nd</sup> Edition, 2008.

### Course Designers:

1. Dr.S.Muthuramalingam

smrit@tce.edu

2. Dr.P.Karthikeyan

karthikit@tce.edu

21ITPM0	ETHICAL HACKING	Category	L	T	P	Credit
		PE	3	0	0	3

### Preamble

New worms, malware, viruses, and ransomware are multiplying every day and are creating a need for ethical hacking services to safeguard the networks of businesses, government agencies or defense. The course on Ethical hacking enables the students to learn and perform hacking in a professional manner, and to prepare an analysis report highlighting the overall risk and vulnerabilities in an information system. The learners will be able to select and apply the best solution to protect against the vulnerabilities. The course provides the necessary fundamentals to earn certification in Ethical Hacking (CEH) from EC Council.

### Prerequisite

- 18IT430 Computer Networks

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Explain the terminologies associated with Penetration testing, vulnerability assessment and various information security standards such as HIPAA, PCI- DSS, SOX, FISMA.	16
CO2	Use network scanning, enumeration and footprinting for gathering information about host, network and people related to an organization, search engines, web servers, DNS and social networking sites.	25
CO3	Deploy measures for protecting computer systems against password cracking, keyloggers, Spywares and Rootkits.	16
CO4	Use appropriate tools and techniques to identify various vulnerabilities in webserver and deploy counter measures.	15
CO5	Perform web application testing for prevention against OWASP application risks.	12
CO6	Provide security solutions for protection against evading of firewalls and Intrusion Detection Systems	16

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3, 2.1.1
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3, 4.1.1, 4.2.2, 4.5.5
CO3	TPS4	Analyze	Organize	Complex Overt Response	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3, 4.1.1, 4.2.2, 4.5.5

CO4	TPS4	Analyze	Organize	Complex Overt Response	1.3 , 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3, 4.1.1, 4.2.2, 4.5.5
CO5	TPS4	Analyze	Organize	Complex Overt Response	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3, 4.1.1, 4.2.2, 4.5.5
CO6	TPS4	Analyze	Organize	Complex Overt Response	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3, 4.1.1, 4.2.2, 4.5.5

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L											M		
CO2	S	M	L		M			M	L	L		L	M	M	L
CO3	S	S	M	L	M			M	L	L		L	S	M	L
CO4	S	S	M	L	M			M	L	L		L	S	M	L
CO5	S	S	M	L	M			M	L	L		L	S	M	L
CO6	S	S	M	L	M			M	L	L		L	S	M	L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	10				10
Understand	20	10			20
Apply	40	50	60	60	40
Analyse	30	40	40	40	30
Evaluate					
Create					

CAT3 is evaluated through practical test.

Assignments involve experimentation with hacking tools like NMAP, OSSEC, PFLOGSUM, DVWA, Maltego etc.,

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	
Set	
Guided Response	
Mechanism	60
Complex Overt Responses	40

Adaptation	
Origination	

### Sample Questions for Course Outcome Assessment

#### Course Outcome1(CO1):

1. Differentiate Penetration testing and vulnerability analysis.
2. Enlist the tools to determine organization's publicly available information on the Internet such as network architecture, operating systems, applications, and users.
3. Discuss briefly about the methodologies to collect information from websites, Regional Internet Registries databases and Networks.

#### Course Outcome 2(CO2):

1. Explain the different types of techniques used to identify the open ports on a targeted server or host.
2. Explain the various sources for gathering information through footprinting techniques.
3. "For attackers to build a hacking strategy, they need to gather information about the target organization's network, so that they can find the easiest way to break into the organization's security perimeter" – Justify the requirement.

#### Course Outcome 3(CO3):

1. Differentiate password attack and brute force attack.
2. Demonstrate how salting of passwords can resist dictionary attack.
3. Enlist the various options to check the existence of spywares in mobile phone.

#### Course Outcome 4 (CO4):

1. Enlist the various ways to check whether a website has been hacked.
2. Demonstrate footprinting on a Webserver using the httprecon tool.
3. State the differences between Denial of Service (DoS) and Distributed Denial of Service (DDoS) attacks.

#### Course Outcome 5 (CO5):

1. A company's security states that all web browsers must automatically delete their HTTP browser cookies upon terminating. What sort of security breach is this policy attempting to mitigate? Comment on the merits and demerits of the security policy.
2. Consider a University website that permits its students to view their registration status and grade information provided they login with their correct username and password. The inputs entered by the user (login credentials) are passed to the server as form parameters using HTTP POST request when the user clicks submit button as follows: `Select s_ID, gpa from students where s_ID = '14IT10' and password = 'BTECHIT'`. Launch SQL injection attack to
  - a. Return the tuple of the student with ID = '14IT12'.
  - b. Drop table students.
  - c. View all the records in the table
3. Demonstrate the steps involved in checking the vulnerability for cross site scripting.

#### Course Outcome6(CO6):

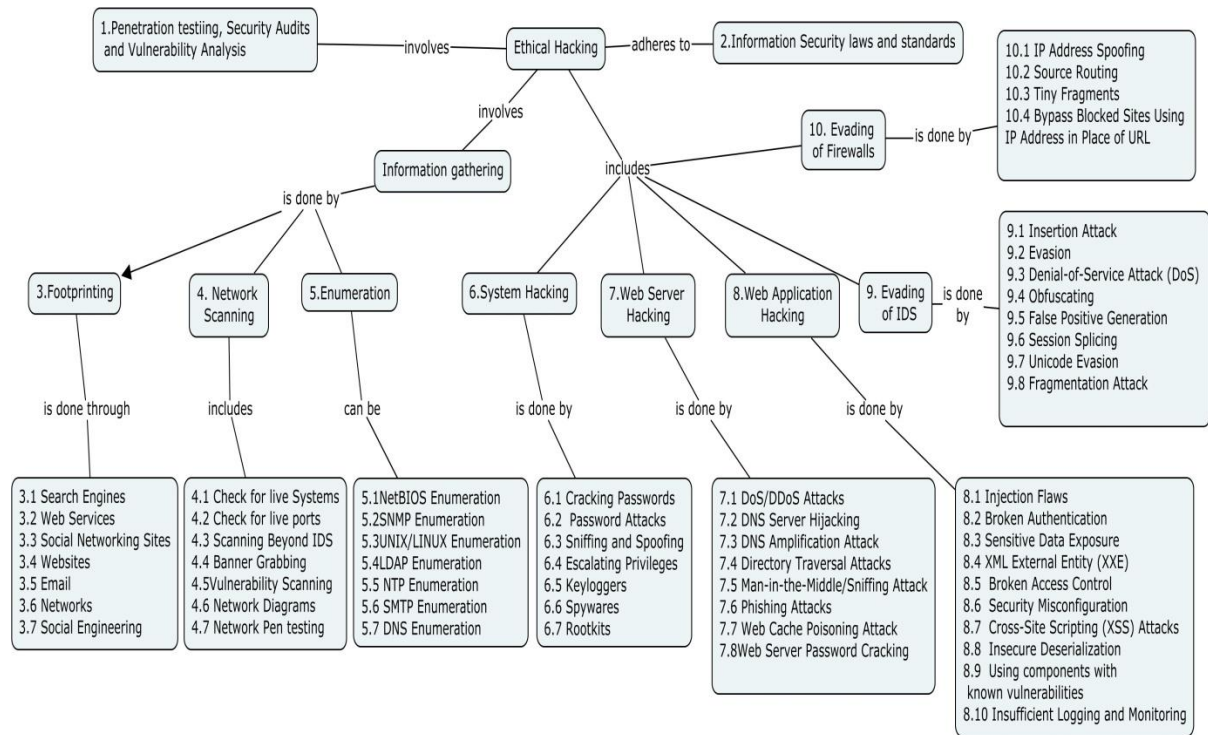
1. Develop rules for the following cases in a packet filtering firewall:
  - a. Allow inbound mails excepting a particular external host SPIGOT.
  - b. Any inside host can send mail to outside
  - c. Allow IP packets where the source IP address is one of a list of designated Internal hosts and the destination TCP port number is 25.
  - d. In handling ftp connections, allow
    - i. Packets that originate internally.



- ii. Reply packets to a connection initiated by an internal machine.
  - iii. Packets destined for a high numbered port on an internal machine.
2. A Certkiller security System Administrator is reviewing the network system log files. He notes the following:
- a. - Network log files are at 5 MB at 12:00 noon.
  - b. - At 14:00 hours, the log files at 3 MB.
- What should he assume has happened and what should he do about the situation?
3. List the types of intrusion detection systems and evasion techniques.

L

### Concept Map



### Syllabus

**Ethical Hacking -** Scope and Limitations of Ethical Hacking, Skills of an Ethical Hacker, Types of Penetration Testing, Phases of Penetration Testing, Security Testing Methodology, Comparing Security Audit, Vulnerability Assessment, and Penetration Testing, Case Studies on recent cyber security attacks -Dunkin' Donuts Reports Credential Stuffing Attack, Ransomware attack, The Phishy Wipro Breach, Privacy and security breaches in social media

**Information Security Laws and Standards -**Payment Card Industry Data Security Standard (PCI-DSS), ISO/IEC 27001:2013, Health Insurance Portability and Accountability Act (HIPAA), Sarbanes Oxley Act (SOX), The Digital Millennium Copyright Act (DMCA), Federal Information Security Management Act (FISMA), Cyber Law in Different Countries, State Actors and Non State Actors in Cyber attacks

**Footprinting** - Objectives of Footprinting, Footprinting through Search Engines, Footprinting through Web Services, Footprinting through Social Networking Sites, Website Footprinting, Email Footprinting, Network Footprinting, Footprinting through Social Engineering

**Scanning Networks:** Check for live systems, Check for live ports, Scanning beyond IDS, Banner Grabbing, Scan for vulnerability, network diagrams, Scanning Pen Testing.

**Enumeration:** Concepts, NetBIOS Enumeration, SNMP Enumeration, UNIX/LINUX Enumeration, LDAP Enumeration, NTP Enumeration, SMTP Enumeration, DNS Enumeration, Enumeration countermeasures

**System Hacking** -Cracking Passwords , Types of Password Attacks, Sniffing and Spoofing, Escalating Privileges, Executing Applications- Keyloggers, Spywares, Rootkits, Anti Keyloggers, AntiSpywares, Anti Rootkits

**Web Server Hacking**- Web Server Operations, IIS Web Server Architecture, Impact of Web Server Attacks, Web Server Attacks- DoS/DDoS Attacks, DNS Server Hijacking, DNS Amplification Attack, Directory Traversal Attacks, Man-in-the-Middle/Sniffing Attack, Phishing Attacks, Web Cache Poisoning Attack, Web Server Password Cracking, Web Server Penetration Testing.

**Web Application Hacking** - OWASP Top 10 Application Security Risks –Injection Flaws, Broken Authentication, Sensitive Data Exposure, XML External Entity (XXE), Broken Access Control, Security Misconfiguration, Cross-Site Scripting (XSS) Attacks, Insecure Deserialization, Using components with known vulnerabilities , Insufficient Logging and Monitoring

**IDS Evasion Techniques** - Insertion Attack, Evasion, Denial-of-Service Attack (DoS), Obfuscating, False Positive Generation, Session Splicing, Unicode Evasion, Fragmentation Attack, Overlapping Fragments, Time-To-Live Attacks, Invalid RST Packets, Urgency Flag, Polymorphic Shellcode, Protection against IDS Evasion

**Firewall Evasion Techniques** - IP Address Spoofing, Source Routing, Tiny Fragments, Bypass Blocked Sites Using IP Address in Place of URL, Bypass Blocked Sites Using Anonymous Website Surfing Sites, Bypass a Firewall - Proxy Server, ICMP Tunneling Method, ACK Tunneling Method, HTTP Tunneling Method, SSH Tunneling Method, Protection against Firewall Evasion

### Learning Resources

1. EC-Council Certified Ethical Hacking Review Guide, Wiley India Edition, 2012.
2. RafayBaloch , Ethical Hacking and Penetration Testing Guidell, CRC Press, 2015
3. Patrick Engebretson, The Basics of Hacking and Penetration Testing, Elsevier, 2013.
4. <https://www.darkwiki.in/certified-ethical-hacker-v10-course-free-download/>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>Ethical Hacking</b>		

1.1	Ethical Hacking	1	CO1
1.2	Scope and Limitations of Ethical Hacking		
1.3	Skills of an Ethical Hacker		
1.4	Types of Penetration Testing	1	CO1
1.5	Phases of Penetration Testing		
1.6	Security Testing Methodology	1	CO1
1.7	Comparing Security Audit, Vulnerability Assessment, and Penetration Testing,		
1.8	Case Studies	1	CO1
2.	<b>Information Security Laws and Standards</b>		
2.1	Payment Card Industry Data Security Standard (PCI-DSS),	1	CO1
2.2	ISO/IEC 27001:2013,		
2.2	Health Insurance Portability and Accountability Act (HIPAA)	1	CO1
2.3	Sarbanes Oxley Act (SOX)		
2.3	The Digital Millennium Copyright Act (DMCA)	1	CO1
2.4	Federal Information Security Management Act (FISMA)		
2.5	Cyber Law in Different Countries		
2.6	State actors and Non state actors in Cyber attacks		
3.	<b>Footprinting - Objectives</b>		
3.1	Footprinting through Search Engines	1	CO2
3.2	Footprinting through Web Services		
3.3	Footprinting through Social Networking Sites		
3.4	Website Footprinting	1	CO2
3.5	Email Footprinting		
3.6	Network Footprinting		
3.7	Footprinting through Social Engineering		
4.	<b>Scanning Networks</b>		CO2
4.1	Check for live systems	1	CO2
4.2	Check for live ports	1	
4.3	Scanning beyond IDS		
4.4	Banner Grabbing		
4.5	Scan for vulnerability	1	CO2
4.6	Network diagrams		
4.7	Scanning Pen Testing.	1	CO2
5.	<b>Enumeration</b>		CO2
5.1	NetBIOS Enumeration	1	CO2
5.2	SNMP Enumeration		
5.3	UNIX/LINUX Enumeration		
5.4	LDAP Enumeration	1	CO2
5.5	NTP Enumeration		
5.6	SMTP Enumeration		
5.7	DNS Enumeration	1	CO2
5.8	Enumeration countermeasures		
6	<b>System Hacking</b>		
6.1	Cracking Passwords	1	CO3
6.2	Types of Password Attacks		
6.3	Sniffing and Spoofing	1	CO3
6.4	Escalating Privileges	1	CO3
6.5	Keyloggers and Anti Keyloggers	1	CO3

6.6	Spywares and Anti Spywares	1	CO3
6.7	Rootkits and Anti Rootkits	1	CO3
7	<b>Web Server Hacking</b>		
7.0	Web Server Operations, IIS Web Server Architecture Impact of Web Server Attacks	1	CO4
7.1	DoS/DDoS Attacks	1	CO4
7.2	DNS Server Hijacking		
7.3	DNS Amplification Attack		
7.4	Directory Traversal Attacks	1	CO4
7.5	Man-in-the-Middle/Sniffing Attack		
7.6	Phishing Attacks	1	CO4
7.7	Web Cache Poisoning Attack		
7.8	Web Server Password Cracking		
7.9	Web Server Penetration Testing.	1	CO4
8	<b>Web Application Hacking</b>		
8.1	Injection Flaws	1	CO5
8.2	Broken Authentication		
8.3	Sensitive Data Exposure		
8.4	XML External Entity (XXE)		
8.5	Broken Access Control	1	CO5
8.6	Security Misconfiguration		
8.7	Cross-Site Scripting (XSS) Attacks	1	CO5
8.8	Insecure Deserialization	1	CO5
8.9	Using components with known vulnerabilities		
8.10	Insufficient Logging and Monitoring		
9	<b>IDS Evasion Techniques</b>		
9.1	Insertion Attack	1	CO6
9.2	Evasion		
9.3	Denial-of-Service Attack (DoS)		
9.4	Obfuscating		
9.5	False Positive Generation		
9.6	Session Splicing	1	CO6
9.7	Unicode Evasion		
9.8	Fragmentation Attack		
10	<b>Firewall Evasion Techniques</b>		CO6
10.1	IP Address Spoofing	1	CO6
10.2	Source Routing		
10.3	Tiny Fragments		
10.4	Bypass Blocked Sites Using IP Address in Place of URL		
10.5	Bypass a Firewall	1	CO6
10.5.1	Using Proxy Server		
10.5.2	ICMP Tunneling Method		
10.5.3	ACK Tunneling Method		
10.5.4	HTTP Tunneling Method	1	CO6
10.5.5	SSH Tunneling Method		
10.6	Protection against Firewall Evasion	1	CO6
<b>Total Hours</b>		<b>36</b>	

**Course Designers:**

1. C.Jeyamala                      jeyamala@tce.edu

2. M.Thangavel      mtit@tce.edu

21ITPP0	BLOCKCHAIN TECHNOLOGIES	Category	L	T	P	Credit
		PE	3	0	0	3

### Preamble

Blockchain is an emerging technology platform for developing decentralized applications and data storage, over and beyond its role as the technology underlying the crypto currencies. The basic tenet of this platform is that it allows one to create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability. After successful completion of this course, students can build their own application with blockchain and crypto currency concepts.

### Prerequisite

- 18IT520 Information Security

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Demonstrate the need and usage of cryptographic algorithms in blockchain technology.	11
CO2	Explain the significance of blocks, proof-of-work, and consensus building in blockchain technology	27
CO3	Explain the functional/operational aspects of trading and mining using crypto currencies.	12
CO4	Demonstrate verifiability and correctness of smart contracts in Blockchain.	16
CO5	Develop blockchain applications and write smart contracts in Hyperledger platform.	14
CO6	Analyze the impact and challenges of Blockchain implementation in various domains like finance, Health care etc.	20

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3
CO2	TPS2	Understand	Respond	Guided Response	1.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3
CO6	TPS4	Analyze	Organize	Complex Overt Response	1.3, 2.1.1, 2.2.3, 2.3.1, 2.4.1, 2.5.1, 2.5.2, 3.1.1, 3.1.2, 3.2.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	M	L										M		
CO2	M	L											L		
CO3	S	M	L										M		
CO4	S	M	L		S				M			M	M	S	M
CO5	S	M	L		S				M			M	M	S	M
CO6	S	S	M	L					M				S		

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	10
Understand	30	20	0	0	20
Apply	50	40	60	60	50
Analyse	0	20	40	40	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

Assignment 3 involves case study on applications of blockchain technology in various domains

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	
Set	
Guided Response	30
Mechanism	40
Complex Overt Responses	30
Adaptation	
Origination	

**Sample Questions for Course Outcome Assessment**

**Course Outcome1(CO1):**

- Enumerate four points of the elliptic curve  $Y^2 = X^3 + 9X + 5$  over  $F_{13}$ .
- Differentiate strong and weak collision resistance.
- Find two distinct inputs such that the corresponding SHA-256 hash function outputs coincide in the initial 28 bits.

**Course Outcome2(CO2):**

- What are Merkle trees? How important are Merkle trees in Blockchains?
- The Merkle Patricia trie corresponding to the key-value pairs { 646f : 'verb', 646f67 : 'puppy', 646f6765 : 'coin', 686f727365 : 'stallion' } is given below. Suppose the last key-value pair (corresponding to the value 'stallion') is deleted from the trie. Write down the modified trie.

- rootHash [ <16>, hashA ]
  - hashA [ <>, <>, <>, <>, hashB, <>, <>, <>, hashC, <>, <>, <>, <>, <>, <>, <> ]
  - hashC [ <20 6f 72 73 65>, 'stallion' ]
  - hashB [ <00 6f>, hashD ]
  - hashD [ <>, <>, <>, <>, <>, <>, hashE, <>, <>, <>, <>, <>, <>, <>, <>, 'verb' ]
  - hashE [ <17>, hashF ]
  - hashF [ <>, <>, <>, <>, <>, <>, hashG, <>, <>, <>, <>, <>, <>, <>, <>, <>, 'puppy' ]
  - hashG [ <35>, 'coin' ].
3. Explain PoW (Proof of Work) in blockchain.

**Course Outcome3(CO3):**

1. Alice wants to buy a book from Bob. He emails his Bitcoin P2PKH address to Alice. But a single character is missing from the address. Bob made a mistake while typing it. How can Alice find the location and value of the missing character in the address without contacting Bob?
2. The merchant Bob wants to create a vanity P2PKH address to share with this customers. He wants it to start with the characters 1bob.... How can he generate such an address?
3. Suppose a merchant waits for six confirmations on a Bitcoin payment before transferring some goods to a customer. Describe how a 51% attacker can execute a double spend attack on such a merchant.

**Course Outcome 4 (CO4):**

1. Explain transaction malleability in smart contracts.
2. Write the procedure with reference to micropayments contracts:
  - Creating refund transaction
  - Getting paid for first page edits
3. Write pseudocodes for smart contract creation and currency allocation.

**Course Outcome 5 (CO5):**

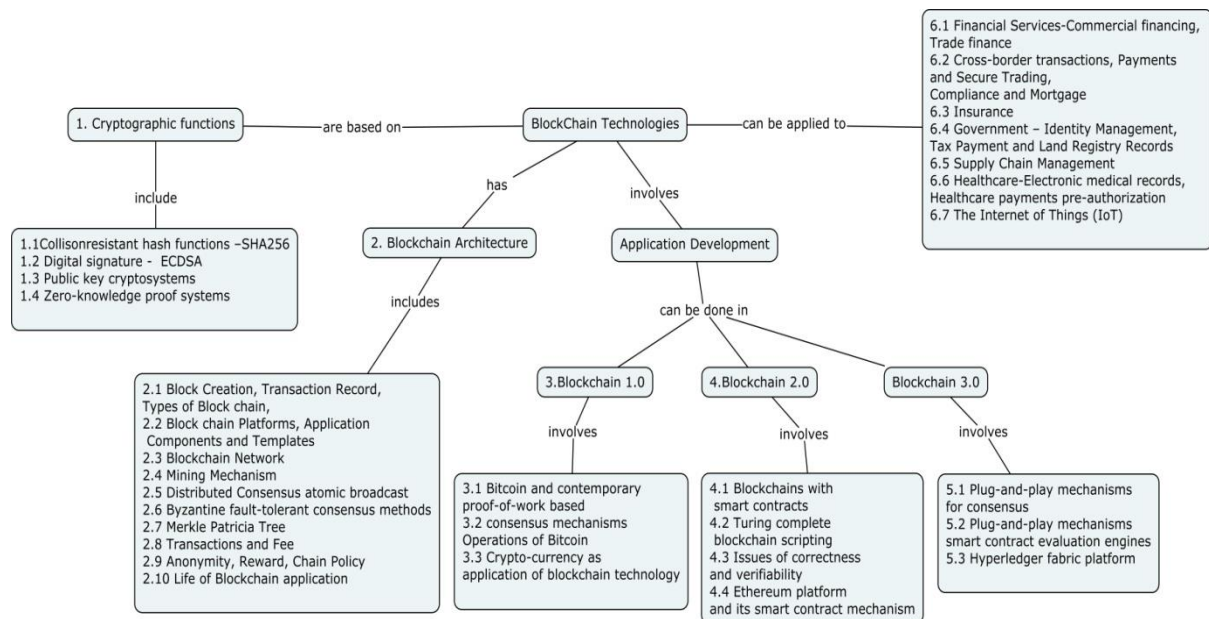
1. Suppose a Hyperledger Fabric network requires an application to get three endorsements before a transaction proposed by it is added to the blockchain. Explain the steps involved starting from the transaction proposal by the application to the addition of the transaction in the blockchain. Assume there are four peers P1, P2, P3, P4 connected by the same channel who can endorse a transaction.
2. Explain the salient features of Hyperledger fabric.
3. Describe the process of ensuring multitenancy in Hyperledger.

**Course Outcome6(CO6):**

1. Analyze the impact of blockchain technologies other than cryptocurrency.
2. Explain how blockchain technology can be applied in manufacturing industry.
3. Present a detailed report on the application of blockchain technology in electronic records of patients in healthcare industry



## Concept Map



## Syllabus

### Cryptographic primitives in Blockchain

Applications of Collision-resistant hash functions – SHA 256, Digital signature -ECDSA, public key cryptosystems, zero-knowledge proof systems

### Blockchain – Architecture

Block Creation, Transaction Record, Types of Block chain, Block chain Platforms, Application Components and Templates, Blockchain Network, Distributed Consensus atomic broadcast, Byzantine fault-tolerant consensus methods, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Mining Mechanism – Energy efficiency, Reward, Chain Policy, Life of Blockchain application, Limitations of Blockchain Technology

### Blockchain 1.0

Bitcoin and contemporary proof-of-work based consensus mechanisms, operations of Bitcoin, Crypto-currency as application of blockchain technology

### Blockchain 2.0

Blockchains with smart contracts and Turing complete blockchain scripting – issues of correctness and verifiability, Ethereum platform and its smart contract mechanism

**Blockchain 3.0** – Plug-and-play mechanisms for consensus and smart contract evaluation engines, Hyperledger fabric platform

### Blockchain – Use cases

Financial Services-Commercial financing, Trade finance, Cross-border transactions, Payments and Secure Trading, Compliance and Mortgage, Insurance, Government – Identity Management, Tax Payment and Land Registry Records, Supply Chain Management, Healthcare-Electronic medical records, Healthcare payments pre-authorization, The Internet of Things (IoT)

### Learning Resources

- Melanie Swa, “Blockchain – Blueprint for New Economy”, O’Reilly, First Edition 2015
- Andreas Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, Second Edition, 2018.
- S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, ‘Blockchain Technology: Cryptocurrency and Applications’, Oxford University Press, 2019.
- Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.
- Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits  
<https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>
- [https://swayam.gov.in/nd1\\_noc19\\_cs63/](https://swayam.gov.in/nd1_noc19_cs63/)
- Hyperledger Fabric - <https://www.hyperledger.org/projects/fabric>
- <https://www.packtpub.com/big-data-and-business-intelligence/hands-blockchain-hyperledger>
- Public github repository with code samples:  
<https://github.com/HyperledgerHandsOn/trade-finance-logistics>
- <https://www.ee.iitb.ac.in/~sarva/courses/EE465/Autumn2019.html>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>Cryptographic primitives in Blockchain</b>		CO1
1.1	Collision-resistant hash functions –SHA256	1	CO1
1.2	Digital signature - ECDSA	1	CO1
1.3	Public key cryptosystems	1	CO1
1.4	Zero-knowledge proof systems	1	CO1
2	<b>Block Chain – Architecture</b>		CO2
2.1	Block Creation, Transaction Record, Types of Block chain,	1	CO2
2.2	Block chain Platforms, Application Components and Templates	1	CO2
2.3	Blockchain Network	1	CO2
2.4	Mining Mechanism	2	CO2
2.5	Distributed Consensus atomic broadcast	1	CO2

2.6	Byzantine fault-tolerant consensus methods	1	CO2
2.7	Merkle Patricia Tree	2	CO2
2.8	Transactions and Fee	1	CO2
2.9	Anonymity, Reward, Chain Policy	1	
2.10	Life of Blockchain application	1	CO2
3	<b>Blockchain 1.0</b>		CO3
3.1	Bitcoin and contemporary proof-of-work based consensus mechanisms	1	CO3
3.2	Operations of Bitcoin	2	CO3
3.3	Crypto-currency as application of blockchain technology	1	CO3
4	<b>Blockchain 2.0</b>		CO4
4.1	Blockchains with smart contracts	1	CO4
4.2	Turing complete blockchain scripting	2	CO4
4.3	Issues of correctness and verifiability	1	CO4
4.4	Ethereum platform and its smart contract mechanism	2	CO4
5	<b>Blockchain 3.0</b>		CO5
5.1	Plug-and-play mechanisms for consensus	1	CO5
5.2	Plug-and-play mechanisms smart contract evaluation engines	1	CO5
5.3	Hyperledger fabric platform	2	CO5
6	<b>Blockchain – Use cases</b>		CO6
6.1	Financial Services-Commercial financing, Trade finance	1	CO6
6.2	Cross-border transactions, Payments and Secure	1	CO6
6.3	Trading, Compliance and Mortgage Insurance		CO6
6.4	Government – Identity Management, Tax Payment and Land Registry Records	1	CO6
6.5	Supply Chain Management	1	CO6
6.6	Healthcare-Electronic medical records, Healthcare payments pre-authorization	1	CO6
6.7	The Internet of Things (IoT)	1	CO6
Total Lecture Hours		36	

**Course Designers:**

1. C.Jeyamala      jeyamala@tce.edu
2. R.Parkavi      parkaviravi@gmail.com

21ITPQ0	SOFTWARE TESTING	Category	L	T	P	Credit
		PE	3	0	0	3

### Preamble

The course presents a comprehensive study of software testing concepts, principles, methodologies, management strategies. The purpose of this course is to build the skills necessary to perform software testing at the function, class and application level.

### Prerequisite

- Basic knowledge in Software Engineering

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Describe test management activities like strategies development, planning and progress monitoring	19%
CO2	Demonstrate agile testing practices in the project team	20%
CO3	Develop test cases and test scripts using appropriate testing tools and techniques	22%
CO4	Determine test adequacy state for test enhancement	14%
CO5	Practice defect management process using suitable tools	11%
CO6	Use software testing tools for performing application testing	14%

### CO Mapping with CDIO Curriculum Framework

CO#	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3, 2.4.1, 2.4.7, 2.5.1, 2.5.2, 3.2
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.4.3, 2.4.4, 2.4.7, 2.5, 3.1, 3.2
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.4.3, 2.4.4, 2.4.7, 3.2, 4.5.4, 4.5.5,
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.4.3, 2.4.4, 2.4.7, 3.2, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.4.6, 3.2, 4.5.5,
CO6	TPS3	Apply	Value	Mechanism	1.3, 2.4.3, 2.4.4, 2.4.6, 2.4.7, 3.1.2, 3.2,

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	M	L						S			M		L		L
CO 2	S	M	L		S			S	S	S		M	M	M	M
CO	S	M	L		S			S				S	M	M	L

3															
CO 4	S	M	L				S					M	M		L
CO 5	S	M	L		S		S						M	M	L
CO 6	S	M	L		S		S	S	S	S		M	M	M	S

S- Strong; M-Medium; L-Low

#### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	20
Understand	40	40	20	20	30
Apply	40	40	80	80	50
Analyse	0	0	0	0	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

#### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini-project / Assignment/Practical Component
Perception	-
Set	-
Guided Response	30
Mechanism	70
Complex Overt Responses	-
Adaptation	-
Origination	-

#### Sample Questions for Course Outcome Assessment

##### Course Outcome1 (CO1):

- List and explain the different types of test reports that are generated in test progress monitoring and control.
- Outline the Software Testing Principles.
- Rewrite the benefits of detecting defects earlier in SDLC.

##### Course Outcome2 (CO2):

- Agile and Scrum methodologies are used to complete a project at earliest. Implementing agile principles results in customer satisfaction where as scrum is known for its flexible feature as per the requirements. How will you choose the number of resources required to your scrum team? Justify your answer.
- As a tester what should be your approach when requirements change continuously? How can you implement scrum in an easy way to your project?

3. For the following requirements of a simple String calculator with a method `int Add(string numbers)`, check whether the input is ok: "1\n2,3" will produce result as 6. Also check the program using Test Driven Development if the method can take 0, 1 or 2 numbers, and will return their sum, for an empty string it will return 0, for example "" or "1" or "1,2". Allow the Add method to handle an unknown amount of numbers. Allow the Add method to handle new lines between numbers instead of commas.

### Course Outcome3 (CO3):

1. Airbnb, founded in 2008, is now well known around the world. The online market place allows people to rent their homes (or private and shared rooms) to travellers, who can book them. It has recently expanded to also offer bookable “Experiences” – for example, a coffee shop tour in a city with a local who knows the best spots. In addition, it offers guides to major cities and lists events available in some of them. For the given scenario what kind of Testing to be done in the Airbnb website and justify your answer.

2. A 70kb page would not take more than 15 seconds to load for the worst connection of 28.8kbps modem (latency=1000 milliseconds), while the page of the same size would appear within 5 seconds for the average connection of 256kbps DSL (latency=100 milliseconds). A 1.5mbps T1 connection (latency=50 milliseconds) would have the performance benchmark set as 1 second to achieve this target. Performance/Load/Stress Testing which will be preferred and why?

3. The following example illustrates the definition of (valid and invalid) equivalence classes and the corresponding test case values. The software module in question calculates entrance ticket prices for the Golden Splash Swimming Centre. The Centre’s ticket price depends on four variables: day (weekday, weekend), visitor’s status (OT = one time, M = member), entry hour (6.00–19.00, 19.01–24.00) and visitor’s age (up to 16, 16.01–60, 60.01–120). Identify the valid and invalid EC’s for the above.

### Course Outcome 4 (CO4):

1. Outline the Test Enhancement Procedure used in assessing the test adequacy with neat diagram.

2. Consider the following function `foo` that is required to return the sum of two integers.

```
int foo(int x, y)
{return (x-y);}
```

Create different mutants and detect the errors in the given piece of code.

3. Consider the program to find the roots of quadratic equation and assess the test adequacy using Statement Coverage and Block Coverage using your own test data.

### Course Outcome 5 (CO5):

1. Consider the following scenarios,s

- If the user tries to do online shopping and the application does not load or server unavailable message pops up.
- The user performs adding an item to the cart, the number of quantities added is incorrect/wrong product gets added.
- The user makes the payment and after the payment, the order stays in the cart as reserved instead confirmed.

- The system accepts the order but finally, cancels the order after half an hour due to any issues.
- The system accepts the “Add to Cart” on double click only instead on a single click.
- The Add To Cart button is spelt as Add To Cart.

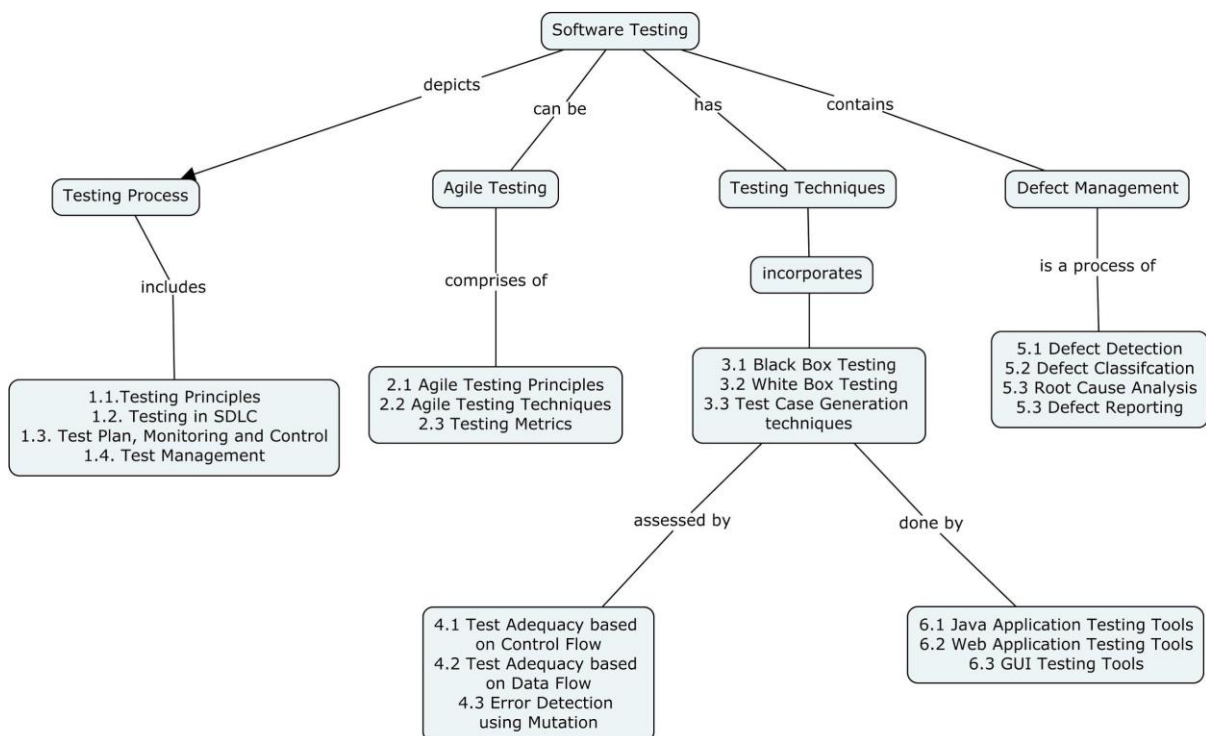
Identify the Defect Priority and Severity Levels of each scenario.

2. In the email service provider like Yahoo or Gmail, after typing the correct Username and the password, instead of logging in, the system crashes or throws the error message; this defect is classified as critical as this defect makes the whole application unusable. Develop the Defect Report.

3. Construct Fish Bone Diagram and derive test cases from it through decision table for the following specifications.

User must input the string length (upto 80) and the character to search for. If the string length is out-of-range, an error message will appear. If the character appears in the string, its position will be reported. If the character is not in the string, error message “Not found” will be the output.

### Concept Map



### Syllabus

#### Testing Process

Principles of Software Testing - Testing in Software Development Life Cycle –Test Planning, Monitoring and Control- Test Analysis- Test Design- Test Implementation- Test Execution- Evaluating exit criteria and Reporting- Test Closure Activities - Test Analyst’s task

**Agile Testing**

Agile Testing Lifecycle – Testing skills – Role of testers - Testing Methods – Test Driven Development – Acceptance Test-Driven Development – Behaviour-driven Development — Agile Testing Practices and Techniques – Agile Testing Quadrants – Agile Testing in SCRUM - Work products – Testing Metrics

**Testing Techniques and Tests Generation**

Black Box testing – White Box testing - Regression Testing – Specification-based techniques Equivalence Partitioning- Boundary Value Analysis- Decision Tables- Cause Effect Graph- Use case testing- State Transition Testing- Combinatorial Testing- User Story Testing- Domain Analysis- Applying techniques to Requirements – Defect-based Techniques- Experience-based techniques

**Test Adequacy Assessment and Enhancement** – Basics- Adequacy criteria based on Control Flow- Adequacy criteria based on data flow- Mutation and Mutants- Fault Detection using Mutation

**Defect Management**

Defect detection - Defect Classification - Root Cause Analysis - Defect Reporting  
Case Study- NASA Metrics DATA SET for Defect Prediction

**Testing tools**

Testing tools - Test Automation – Java Application Testing tools like JUnit, JMeter, Maven - Web Application Testing tools like Selenium – GUI testing tools

**Learning Resources**

1. Dorothy Graham, Rex Black, Erik Van, "Foundations of Software Testing", Cengage Learning EMEA; 4th edition edition (August 9, 2019)
2. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers", Addison-Wesley Professional, 2009
3. Srinivasan Desikan ,Gopalasamy Ramesh, "Software Testing – principles and practices", Pearson Education , First Edition, 2009
4. AdityaP.Mathur "Foundations of Software Testing ", Pearson education, First Edition, 2008.
5. Rex Black, "Advanced Software Testing", Cengage Learning EMEA, 2<sup>nd</sup> edition, a Guide to ISTQB Certification course, Dec 2015.
6. Lisa Crispin, Janet Gregory, "Agile Testing Condensed", Library and Archives Canada, 2019.
7. Krishna Rungta, "Selenium Learn in one day", published on Amazon digital services, 2017.

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>Testing Process</b>	1	CO1
1.1	Principles of Software Testing		
1.2	Testing in Software Development Life Cycle	1	



1.3	Test Planning, Monitoring and Control	1	
1.4	Test Analysis	1	
1.5	Test Design		
1.6	Test Implementation	1	
1.7	Test Execution		
1.8	Evaluating exit criteria and Reporting	1	
1.9	Test Closure Activities		
1.10	Test Analyst's task	1	
<b>2.</b>	<b>Agile Testing</b>		
2.1	Agile Testing Lifecycle	1	
2.2	Testing skills , Role of testers		
2.3	Testing Methods		
2.3.1	Test Driven Development	2	
2.3.2	Acceptance Test-Driven Development		
2.3.3	Behaviour-driven Development	1	
2.3.4	Agile Testing in SCRUM	2	
2.4	Agile Testing Practices and Techniques		
2.5	Agile Testing Quadrants , Work products, Testing Metrics	1	
Case Study: Test Automation		2	CO6
<b>3.</b>	<b>Testing Techniques and Tests Generation</b>		CO3
3.1	Black Box testing	1	
3.2	White Box testing	1	
3.3	Regression Testing		
3.4	Specification-based techniques		
3.4.1	Equivalence Partitioning		
3.4.2	Boundary Value Analysis	2	
3.4.3	Decision Tables		
3.4.4	Cause Effect Graph		
3.5	Use case testing		
3.6	State Transition Testing	2	
3.7	Combinatorial Testing		
3.8	User Story Testing		
3.9	Domain Analysis	2	
3.10	Defect-based Techniques		
3.11	Experience-based techniques		
Case Study: Web Application Testing Tools, Java Application Testing Tools, GUI Testing Tools		3	CO6
<b>4.</b>	<b>Test Adequacy Assessment and Enhancement</b>		CO4
4.1	Basics	1	
4.2	Adequacy criteria based on Control Flow	1	
4.3	Adequacy criteria based on data flow	1	
4.4	Mutation and Mutants	2	

4.5	Fault Detection using Mutation		
<b>5.</b>	<b>Defect Management</b>	1	CO5
5.1	Defect Detection		
5.2	Defect Classification		
5.3	Root Cause Analysis		
5.4	Defect Reporting		
Case Study: NASA Metrics Dataset			
<b>Total Lecture Hours</b>		<b>36</b>	

**Course Designers:**

1. A.M. Abirami                      abiramiam@tce.edu
2. S.Sujitha                              sujithait@tce.edu

21ITPR0	<b>C# AND .NET FRAMEWORK</b>	Category	L	T	P	Credit
		PE	3	0	0	3

### Preamble

This subject will enable students to understand the .Net Framework as a whole and technologies that constitute the framework. The student will gain programming skills in C# both in basic and advanced levels. It will help them to develop applications (windows based application, web based application and web services) using C#.

### Prerequisite

- 18IT320-Object Oriented Programming

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain the .Net framework components of CLR, CTS and JIT	17
CO2	Implement the basic concepts of OOP and delegates-events using C# programming language and apply Framework Base Classes for different applications	22
CO3	Develop a components in assemblies and implement the reflection class in any applications	13
CO4	Construct the different types of applications like windows based application, web based applications and able to retrieve data using ADO.Net	22
CO5	Make use of Windows Communication Foundation, Windows Presentation Foundation, Windows Workflow Foundation	13
CO6	Examine a simple project that incorporates all important features of NET Framework.	13

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS1	Understand	Respond	Guided Response	1.2,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO6	TPS3	Analyse	Organise	Complex Overt Responses	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1, 3.2, 4.1, 4.5.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	M	L											L	L		
CO2	S	M	L		S	S	L	L					c	M	S	L
CO3	S	M	L		S	S	L	L					S	M	S	L
CO4	S	M	L		S	S	L	L					S	M	S	L
CO5	S	M	L		S	S	L	L					S	M	S	L
CO6	S	S	M	L	S	S	L	S	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	0	0	0	0	0
Understand	50	30	0	0	30
Apply	50	70	80	80	60
Analyse	0	0	20	20	10
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

**CAT 2 is evaluated by Lab exams and Assignment 1,2,3 is also evaluated by Lab experiment.**

CO2, CO3, CO4 and CO6 are evaluated by laboratory sessions/assignments  
Attainment of course outcome 6 is evaluated through mini project which involves design and development of simple applications in .NET framework.

Assignments are evaluated through rubrics. Some of the assignment problems include: (but not limited to)

1. Implement delegates and events to solve the complex programming areas.
2. Create a DLL component that may be used by another application
3. Implement crystal report in any application
4. Include different database for your application
5. Prepare the best Desktop framework for any application

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	20
Mechanism	60
Complex Overt Responses	20
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\***

\*\* (2 to 3 at the cognitive level of course outcome)

**Course Outcome1 (CO1):**

1. List .Net framework components like a CLR, CTS, and CLS.
2. Recall the features of Managed Code.
3. List any of different types of compilation.
4. Retrieve the use of delegates and events
5. List the types of assemblies.
6. Describe the namespace in which .Net have the data functionality classes.
7. Describe are the two fundamental objects in ADO.NET.
8. List difference between dataset and data reader.
9. Recall the major difference between classic ADO and ADO.NET

**Course Outcome2 (CO2):**

1. Summarize .Net framework with core components.
2. Summarize various Base classes in the .Net Framework.
3. Explain jagged array and its use with simple example.
4. Explain the Lambda Expression with examples.
5. Explain various types of Assemblies with necessary examples.
6. How will you handle the Language Integrated Query for Relational Data in the applications?
7. Classify the Basic components of ADO.NET environment for different data providers.
8. How do you access the different web service from various web applications?
9. Interpret the need of windows workflow foundation in the application.

**Course Outcome3 (CO3):**

1. Implement a program for System.IO namespace.
2. Implement a program to connect the database using System.Data.OleDb.
3. Carryout C# program to implement the string manipulation.
4. Implement a C# program for the following concepts.
  - a. Delegates
  - b. Event handling
5. Implement the LIQRD operation for the following
  - a. Select
  - b. Count
  - c. Min, Max
  - d. Distinct
  - e. Intersect
6. Implement a window based application for Employee payroll management.
7. Using C# implement the following assemblies:
  - a) Private
  - b) Shared
  - c) Single file
  - d) Multi file.

**Course Outcome4 (CO4):**

1. Compare and contrast the characteristic of the following Namespace
  - System.Data
  - System.Collection
  - System.Drawing
  - System.Text

2. Explain the difference between an ADO.NET Dataset and an ADO Record set? If a table contains 20000 records in a page at each time 100 records to be displayed. What is the steps you will take to improve performance? Will you use dataset or data reader?
3. Compare the different ways to get the assembly (System.Reflection.Assembly.) for a given type in .Net4. Compare the different types of assemblies and justify usage.
4. Compare and contract LINQ to SQL attribute-based approach to mapping a LINQ to SQL object model to a SQL Server database.

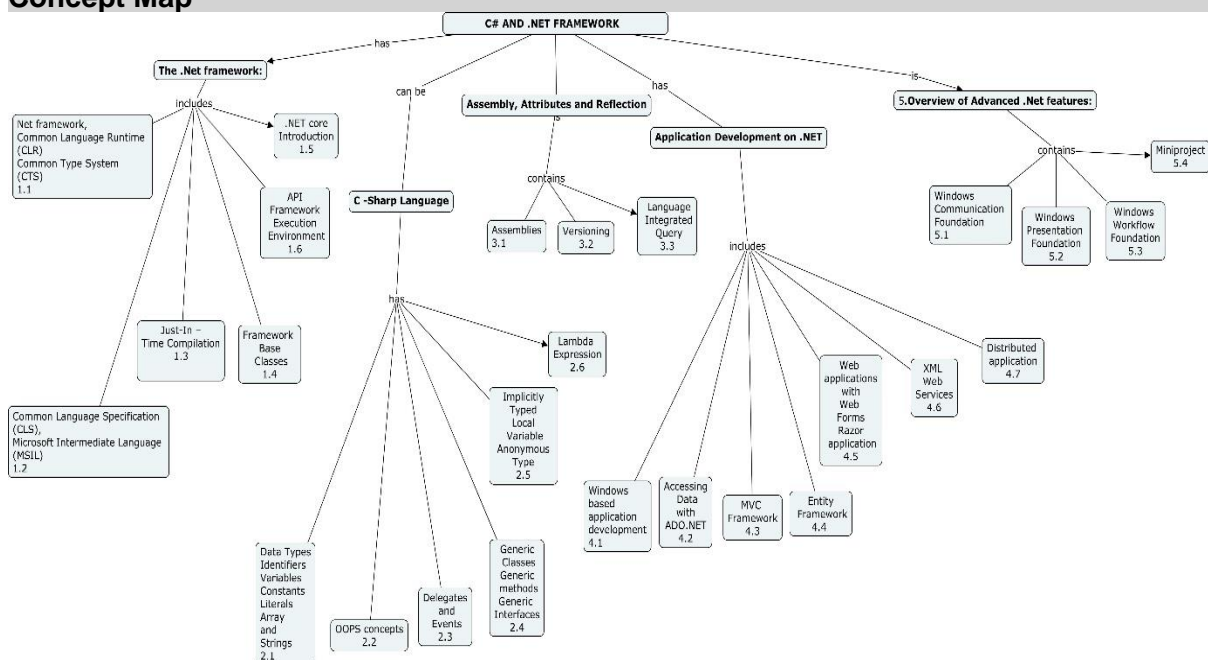
**Course Outcome 5 (CO5):**

- 1.Create WCF application to implement any webservice..
2. Create a Windows Workflow foundation for flight booking system which includes the following condition1.Ask for passenger name.2.Ask for city from where passenger wants to fly.3.Ask for destination city.4.Project will have list of cities in a dictionary. It will search city names in same.5.If it finds both cities in dictionary, it will display 'Booking confirmed'. (Assuming there is unlimited space in airplane and everyone can get a window seat!)6. Otherwise, apologize with passenger

**Course Outcome 6 (CO6):**

1. Design and implement a C# Program for making Student mark list using Delegates and event
2. Design and implement a C# Program for Online Bus Reservation system using Generic classes, methods and interfaces.
3. Design a service oriented architecture to provide weather services. Implement the same using C#
4. Design and implement a C# program using ADO.NET to perform operations of a library
5. Design a calculator web-service. Test this program using a client program.
6. Create a program structure that can connect with multiple databases seamlessly to display the details of student table in a data grid control

**Concept Map**



### Syllabus

**The .Net framework:** Introduction, .Net framework, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS), Microsoft Intermediate Language (MSIL), Just-In –Time Compilation, Framework Base Classes. **.NET core:** Introduction-API-Framework-Execution Environment.

**C -Sharp Language:** Introduction-Data Types, Identifiers, Variables, Constants, Literals, Array and Strings, -**OOPS** concepts-Delegates and Events- -Generic Classes-Generic methods-Generic Interface-Implicitly Typed Local Variable-Anonymous Type-Lambda Expression.

**Assembly, Attributes and Reflection:** Assemblies- Versioning- Attributes- Reflection. Language Integrated Query (Language Integrated Query for Relational Data

**Application Development on .NET:** Windows based Applications, - Accessing Data with ADO.NET, MVC Framework, and Entity Framework -Web applications with Web Forms-Razor application-XML Web Services- Distributed application- Implementing .NET Remoting-Develop peer-to-peer applications.

**Overview of Advanced .Net features:** Windows Communication Foundation- Windows Presentation Foundation- Windows Workflow Foundation.-Case study Synchronous and Asynchronous Programming

### Learning Resources

1. Andrew Troelsen, —Pro C#5 and the .NET 4.5 Frameworkll, AndrewTroelsen, Apress, Sixth Edition 2012
2. Herbert Schildt, —C# 4.0 The Complete Referencell, McGraw-Hill, 2010.
3. Karli Watson, Christian Nagel, etal, Professional C# 4.0 and .NET 4, Wrox, 2010
4. <https://msdn.microsoft.com>

### Course Contents and Lecture Schedule

Module No	Topic	Number of Lecturers	Course outcome
1	<b>The .Net framework:</b>		
1.1	Introduction, The Origin of .Net Technology, Common Language Runtime (CLR), Common Type System (CTS)	2	<b>CO1</b>
1.2	Common Language Specification (CLS), Microsoft Intermediate Language (MSIL)	1	
1.3	Just-In –Time Compilation	1	
1.4	Framework Base Classes	1	
1.5	<b>.NET core:</b> Introduction-	1	
1.6	API-Framework-Execution Environment.	1	
2	<b>C –Sharp Language</b>		

2.1	Introduction – Data Types, Identifiers, Variables, Constants, Literals, Array and Strings	2	<b>CO2</b>
2.2	OOP concepts	1	
2.3	Delegates and Events	1	
2.4	Generic Classes – Generic methods – Generic Interface	1	
2.5	Implicitly Typed Local Variable- Anonymous Type	2	
2.6	Lambda Expression	1	
3	<b>Assembly, Attributes and Reflection</b>		<b>CO3</b>
3.1	Assemblies-Reflection	2	
3.2	Versioning	1	
3.3	Language Integrated Query (Language Integrated Query for Relational Data).	2	
4	<b>Application Development on .NET</b>		<b>CO4</b>
4.1	Windows based application development	1	
4.2	Accessing Data with ADO.NET	1	
4.3	MVC Framework	1	
4.4	Entity Framework	1	
4.5	Web applications with Web Forms-Razor application	2	
4.6	XML Web Services	1	
4.7	Distributed application	1	
5	<b>Overview of Advanced .Net features</b>		
5.1	Windows Communication Foundation	2	<b>CO5</b>
5.2	Windows Presentation Foundation	2	
5.3	Windows Workflow Foundation	1	
5.4	Case study Synchronous and Asynchronous Programming-Mini project	5	<b>CO6</b>
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

- |                       |                |
|-----------------------|----------------|
| 1. K.Indira           | kiit@tce.edu   |
| 2. C.V Nisha Angeline | cvnait@tce.edu |





<b>21ITRE0</b>	<b>FULL STACK TECHNOLOGIES</b>
----------------	--------------------------------

Category	L	T	P	Credit
PE	3	0	0	3

**Preamble**

This course covers the Front-end Development Environment for handling view layer, Component Management, Life Cycle Handling, State Management of the web application. It covers the application architecture and navigation controls and emphasizes the deployment environment with a backend as a service. The concepts will be illustrated with appropriate examples and tools.

**Prerequisite**

- NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the Front-end Development Environment for handling the view layer for Web Applications using Bootstrap.	13
CO2	Examine the various React navigation components and Flow Architectures	12
CO3	Use Redux components for state management.	25
CO4	Build a Client Server communication in concern with application action using Redux and REST API.	25
CO5	Inference the essentials of JavaScript bundler for packing the modules of the Chosen web application	25

**CO Mapping with CDIO Curriculum Framework**

CO#	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3,
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.5.1, 4.5.3
CO3	TPS4	Apply	Value	Mechanism	1.3, 2.5.1, 4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.5.1, 4.5.3
CO5	TPS4	Apply	Value	Mechanism	1.3, 2.5.1, 4.5.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L											L		
CO2	S	M	L		S			S				S	M	M	L
CO3	S	M	L		S			S				S	M	M	L
CO4	S	M	L		S			S				S	M	M	L
CO5	S	M	L		S			S				S	M	M	L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember					
Understand	30	40			40
Apply	70	60	100	100	60
Analyse					
Evaluate					
Create					

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini-project / Assignment/Practical Component
Perception	-
Set	-
Guided Response	30
Mechanism	70
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome 1 (CO1):**

1. Explain the Bootstrap4 Web UI components.
2. Illustrate the architecture of Full Stack
3. Summarize the advantages and disadvantages

**Course Outcome 2 (CO2):**

1. Sketch a single page application for an use case of your choice
2. Apply the components of React to build a Railway reservation web application.
3. Illustrate ReactDOM for Hotel Management Application.

**Course Outcome 3 (CO3):**

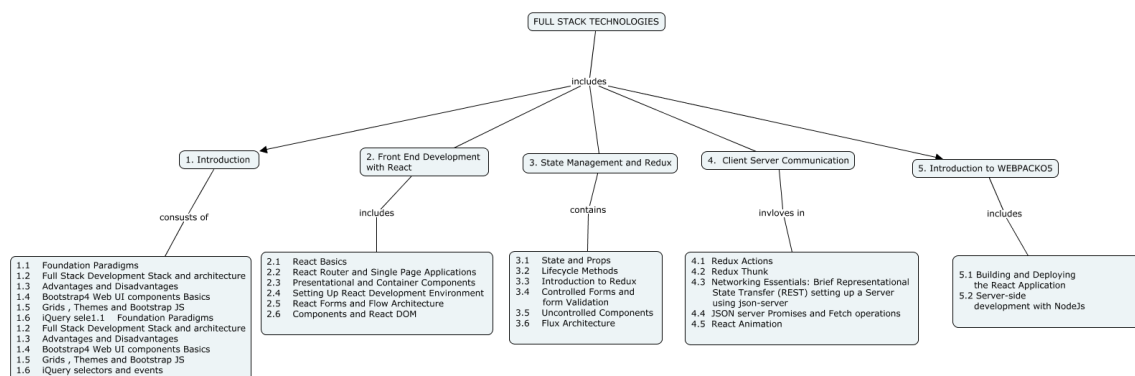
1. Build a web application with client and server validation control.
2. Adapt the Redux Environment to overcome the traditional distributed system.
3. Apply all the state management API for a Client and Server communication

**Course Outcome 4 (CO4):**

1. Build a Client and Server Communication in a traditional system and compare the features of REST API.
2. Adapt the micro service API functions in the client server communication.
3. Apply the application action functions using Redux and REST API.

**Course Outcome 5 (CO5):**

1. Practice with React animation to perform a Glitch animation effects in a web page
2. Demonstrate the web application for the online Hotel booking system using React and express
3. Use Webpack5 and illustrate how it takes all the resource files and other assets and transforms then into one huge file that can be sent by the server to a client's browser.

**Concept Map****Syllabus**

**Introduction** – Foundation Paradigms - Full Stack Development Stack and architecture – Advantages and Disadvantages - Bootstrap4 Web UI components Basics – Grids - Themes – Bootstrap JS – iQuery selectors and events.

**Front End Development with React** – React Basics - React Router and Single Page Applications – Presentational and Container Components- Setting Up React Development Environment – React Forms, Flow Architecture –Components - React DOM

**State Management and Redux** - State and Props - Lifecycle Methods - Introduction to Redux - Controlled Forms and form Validation-Uncontrolled Components - Flux Architecture

**Redux Client-Server Communication** - Redux Actions- Redux Thunk- Networking Essentials: Brief Representational State Transfer (REST) setting up a Server using json-server- Promises and Fetch operations-React Animation

**Introduction to Webpack** - Building and Deploying the React Application-Server side development with Express

**Learning Resources**

- Artemij Fedosejev, “**React.js Essentials**”, Packt Publishing, First Edition, 2015.
- Greg Sidelnikov, “**Learning React JavaScript Library From Scratch**”, River Tigris LLC, First Edition, 2016
- <https://reactjs.org/>

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Lectures	COs
1	<b>Introduction</b>		
1.1	Foundation Paradigms	1	CO1
1.2	Full Stack Development Stack and architecture	1	CO1
1.3	Advantages and Disadvantages	1	CO1
1.4	Bootstrap4 Web UI components Basics	1	CO1
1.5	Grids, Themes and Bootstrap JS	1	CO1
1.6	iQuery selectors and events.	1	CO1
2	<b>Front End Development with React</b>		
2.1	React Basics	2	CO2
2.2	React Router and Single Page Applications	1	CO2
2.3	Presentational and Container Components	1	CO2
2.4	Setting Up React Development Environment	2	CO2
2.5	React Forms and Flow Architecture	1	CO2
2.6	Components and React DOM	2	
3	<b>State Management and Redux</b>		
3.1	State and Props	2	CO3
3.2	Lifecycle Methods	2	CO3
3.3	Introduction to Redux	2	CO3
3.4	Controlled Forms and form Validation	1	CO4
3.5	Uncontrolled Components	1	CO4
3.6	Flux Architecture	2	CO4
4	<b>CLIENT-SERVER COMMUNICATION</b>		
4.1	Redux Actions	2	CO5
4.2	Redux Thunk	2	CO5
4.3	Networking Essentials: Brief Representational State Transfer (REST) setting up a Server using json-server	2	CO5
4.4	JSON server Promises and Fetch operations	2	CO5
4.5	React Animation	2	
5	<b>INTRODUCTION TO WEBPACK05</b>		
5.1	Building and Deploying the React Application	1	CO6
5.2	Server-side development with Express	1	CO6
	Total	36	

**Course Designers:**

S.Karthiga skait@tce.edu

K.Indira kiit@tce.edu

C.V.Nisha Angeline cvnait@tce.edu

<b>21ITPG0</b>	<b>SERVICES ORIENTED COMPUTING</b>	Category	L	T	P	Credit
		PE	3	0	0	3

### Preamble

This course provides understanding on architectural styles such as SoA, RESTful and Microservices that are used to develop software applications as services that are autonomous and platform independent. Also, insights into the tools such as Docker containers and Kubernetes is provided for deploying and managing the microservices are provided.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain Monolith, RESTful and Microservices architectural styles for web based application development	10
CO2	Develop web services using standards such as SOAP over HTTP, WSDL, UDDI and BPEL	10
CO3	Build APIs and access resources using RESTful architecture	20
CO4	Evolve single function modules from a monolith software and develop them as microservices using Microservices architecture	20
CO5	Containerize an application by creating Docker config files and build processes to produce all the necessary Docker images	20
CO6	Use Kubernetes to manage deploying, scaling, and updating applications	20

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6,2.5, 4.1, 4.5.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6,2.5, 4.1, 4.5.3
CO4	TPS4	Analyze	Organize	Complex Overt Responses	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6,2.5, 3.1, 3.2, 4.1, 4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6,2.5, 4.1, 4.5.3
CO6	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6,2.5, 4.1, 4.5.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		L			L	S	S		S	M	L	M
CO3	S	M	L		L			L	S	S		S	M	L	M
CO4	S	S	M	L	L			L	S	S		S	S	L	M
CO5	S	M	L		S			S	S	S		S	M	M	M
CO6	S	M	L		S			S	S	S		S	M	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	0
Understand	30	20	0	0	30
Apply	50	40	60	60	50
Analyse	0	20	40	40	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

CO2, CO3, CO4, CO5 and CO6 are evaluated by laboratory sessions/assignments  
 Attainment of course outcome 6 is evaluated through mini project which involves design and development of simple applications in Distributed Framework.

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	-
Guided Response	10
Mechanism	90
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\***

**Course Outcome 1(CO1):**

1. Describe about Monolith Architecture in the web application.
2. Discuss the drawbacks of Monolithic Architecture.
3. Summarize the importance of Monolithservices and Microservices.

**Course Outcome 2(CO2):**

1. Build a web service with a standardized way of including the address of the intended Recipient in SOAP headers.
2. Develop a Service Orchestration Engine (workflow) using WS-BPEL and implement Service composition. For example, a business process for planning business travels will invoke several services. This process will invoke several airline companies to check the airfare price and buy at the lowest price.

3. Generate WSDL file in the appropriate format for a interface computing currency exchange rate

**Course Outcome 3(CO3):**

1. Consider a resource at /students containing student details. Build the RESTful API so that it can be accessed using GET, PUT and DELETE methods
2. Use Jersey framework and compose RESTful services that adds, deletes and updates course information present at the location tce.edu/courses.
3. Consider the statelessness in RESTful webservices, and predict how the shortcoming can be overcome with caching at client end.

**Course Outcome 4 (CO4):**

1. Enlist the best practices to create a standard URI for a web service
2. Examine the challenges you face while working Microservice Architectures
3. Construct an Arithmetic calculator application using microservice approach that includes two microservices, Addition Service and Subtraction Service

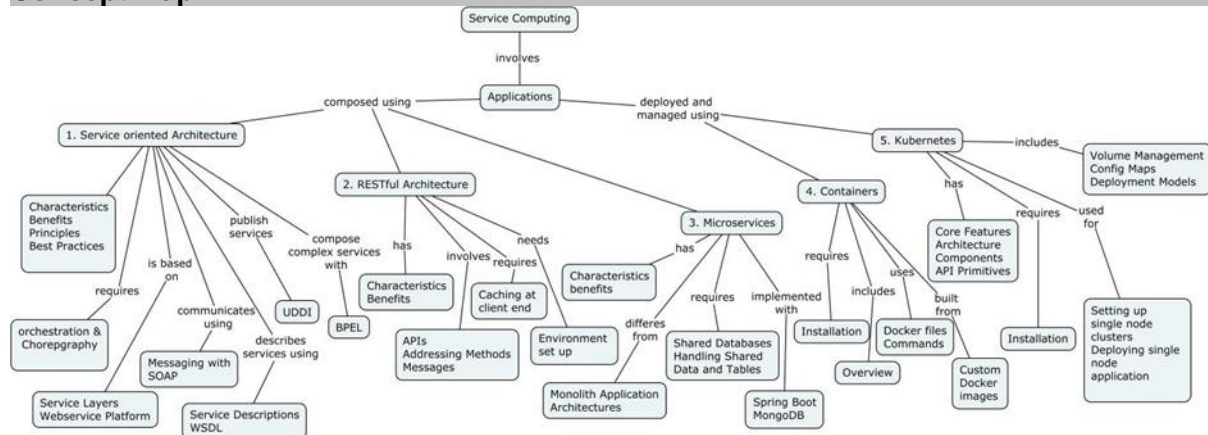
**Course Outcome 5 (CO5):**

1. Construct suitable Docker file for composing an image containing MySQL database on ubuntu OS
2. Show the steps for pulling a required image from docker hub and run it as a container
3. Demonstrate the process of loading dependencies for containerizing an application with appropriate commands

**Course Outcome 6(CO6):**

1. Use Kubernetes to manage deploying, scaling, and updating applications
2. Experiment with a multi-node cluster using Kuneadm
3. Demonstrate a Guest Book example on Kuernetes platform.

**Concept Map**



**Syllabus**

**SoA** - Characteristics of SOA, Benefits of SOA , Comparing SOA with Client-Server and Distributed architectures — Principles of Service Orientation – Service layers-Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography. SOA Best Practices

**RESTful Architecture-** Characteristics - Environment Setup- Messages- Building APIs Addressing Methods- Statelessness- Caching



**Microservices** – Key Characteristics- Benefits- SoA vs Microservices Architecture- Modeling Microservices from Monolith application - Shared Database - Handling Shared data and Tables - Implementation using spring boot - MongoDB connectivity - Testing - Deployment  
**Containers** – Containerization Overview - Docker - Installation - commands- Docker Image Management-Docker files - Building custom docker images -Best Practices  
**Kubernetes** – Kubernetes Overview-Architecture-Components- Kubernetes API Primitives-Installing Kubernetes-Setting Up a Single Node Kubernetes Cluster Using Minikube - Accessing Minikube - Kubernetes Building Blocks - Services-Deploying a Stand-Alone Application - Kubernetes Volume Management - ConfigMaps and Secrets-Ingress-Hosted Solutions and Deployment Models.

### Learning Resources

1. Newman, Sam. Building microservices: designing fine-grained systems. " O'Reilly Media, Inc.", 2015.
2. Thomas Erl, — Service Oriented Architecture: Concepts, Technology, and Design, Pearson Education, 2005
3. Kubernetes Basics - <https://kubernetes.io/docs/tutorials/kubernetes-basics/>
4. Getting Started with Kubernetes - <https://kubernetes.io/docs/setup/learning-environment/minikube/>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>SoA</b>		
1.1	Characteristics - Benefits of SOA	2	CO2
1.2	SOA vs Client-Server vs Distributed architectures – Principles of Service Orientation		CO1
1.3	Service layers -Web Services Platform		CO2
1.4	Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI	2	CO2
1.5	Service-Level Interaction Patterns – Orchestration and Choreography.	1	CO2
1.6	SoA Best Practices		
2.	<b>RESTful Architecture</b>		
2.1	Characteristics - Environment Setup	2	CO3
2.2	Using HTTP Messages	2	CO3
2.3	Building APIs - Addressing Methods	2	CO3
2.4	Statelessness- Caching	1	CO3
3.	<b>Microservices</b>		
3.1	Key Characteristics- Benefits	1	CO4
3.2	SoA vs Microservices Architecture	2	CO1
3.3	Modeling Microservices from Monolith application	2	CO4
3.4	Shared Database - Handling Shared data and Tables	1	CO4
3.5	Implementation using spring boot - MongoDB connectivity	2	CO4
3.6	Testing - Deployment	1	CO4
4.	<b>Containers</b>		
4.1	Containerization Overview	1	CO5
4.2	Docker - Installation - commands	1	CO5
4.3	Docker Image Management-Docker files	2	CO5
4.4	Building custom docker images -Best Practices	2	CO5
5	<b>Kubernetes</b>		
5.1	Kubernetes Overview-Architecture-Components	1	CO6

5.2	Kubernetes API Primitives	1	CO6
5.3	Kubernetes Installation	2	CO6
5.4	Setting Up a Single Node Kubernetes Cluster Using Minikube -Accessing Minikube	1	CO6
5.5	Kubernetes Building Blocks - Services-Deploying a Stand-Alone Application	2	CO6
5.6	Kubernetes Volume Management - ConfigMaps and Secrets	1	CO6
5.7	Ingress-Hosted Solutions and Deployment Models.	1	CO6
<b>Total Hours</b>		<b>36</b>	

**Course Designers:**

- |                             |                    |
|-----------------------------|--------------------|
| 1. K. Indira                | kiit@tce.edu       |
| 2. S.Thiruchadai Pandeewari | eshwarimsp@tce.edu |



<b>21ITPK0</b>	<b>SOCIAL NETWORK ANALYSIS</b>
----------------	--------------------------------

Category	L	T	P	Credit
PE	3	0	0	3

### Preamble

The course introduces concepts and methods of social network analysis. It aims to provide students with essential knowledge on network analysis applicable to real world data. Students will learn to extract, manage and visualize data about its structure and dynamics.

### Prerequisite

- NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Illustrate network data visualization using social network analysis packages	10%
CO2	Apply social network measures for the web graph	20%
CO3	Demonstrate graph mining and cascading effect using different algorithms for social networks	20%
CO4	Investigate social network behaviour using network properties	20%
CO5	Use social network theory and software packages for building social network models	20%
CO6	Determine the type of network suitable for modelling the real networked data	10%

### CO Mapping with CDIO Curriculum Framework

CO#	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.3, 3.2, 4.5.3
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.5.1, 3.2, 4.5.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.5.1, 3.2, 4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.5.1, 3.2, 4.5.3
CO5	TPS4	Analyze	Organize	Complex Overt Responses	1.3, 2.5.1, 3.1, 3.2, 4.1.2, 4.5.3
CO6	TPS4	Analyze	Organize	Complex Overt Responses	1.3, 2.5.1, 3.1, 3.2, 4.1.2, 4.5.3

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S			S		L		L	M	M	L
CO2	S	M	L		S			S		L		L	M	M	L
CO3	S	M	L		S			S		L		L	M	M	L
CO4	S	M	L		S			S		L		L	M	M	L
CO5	S	S	M	L	S	S	S	S	S	S	S	S	S	S	S
CO6	S	S	M	L	S	S	S	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination (Retained previous values)
	1	2	1	2	
Remember	10	10			10
Understand	30	30			30
Apply	40	40	50	50	50
Analyse	20	20	50	50	10
Evaluate					0
Create					0

**Assessment Pattern: Psychomotor**

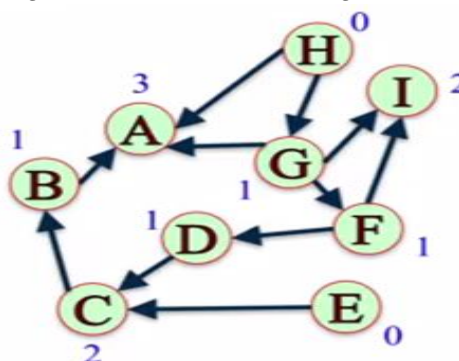
Psychomotor Skill	Mini-project / Assignment/Practical Component
Perception	-
Set	-
Guided Response	30
Mechanism	70
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome1 (CO1):**

1. Explain about scales of measurement of network data.
2. Explain the relations among actors in the network.
3. Plot a Multivariate Graph and draw sociomatrix for the given three relations (Friendship at the beginning, end, who lives nearer to whom) with actors in the Graph Theoretic Notation

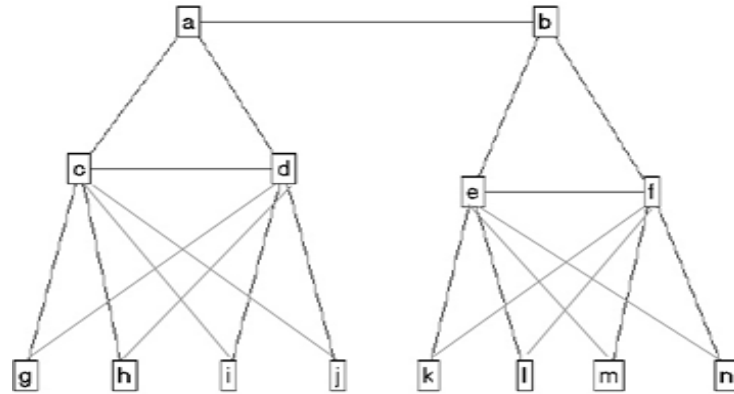
**Course Outcome2 (CO2):**

1. Justify the actor who has the highest degree is the "central" actor
2. Describe how the size of a network is measured.
3. Calculate and plot the In-Degree Distribution for the given network.

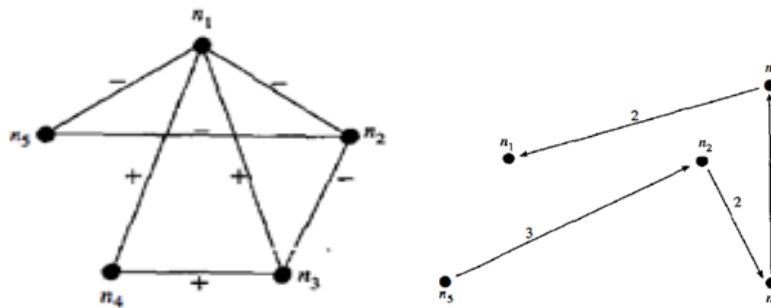
**Course Outcome 3 (CO3):**

1. Compute Graph, Permuted and Partitioned Matrix, Density Table, Image Matrix and Reduced Graph for any X.

- For the given Structurally Equivalent Actors, Plot Block Matrix and reduce it into Zero Block and One Block and calculate Density Table and Image Matrix.

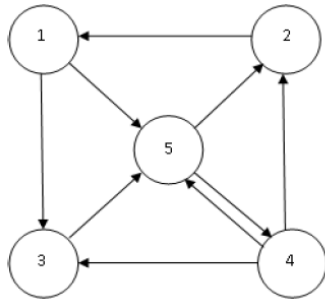


- Compute the signed graph and valued directed graph for the given network



**Course Outcome 4 (CO4):**

- A group of 20 students living on the third and fourth floors of a college dorm like to play on-line games. When a new game appears on campus, each of these students needs to decide whether to join, by registering, creating a player account, and taking a few other steps necessary in order to start playing. When a student evaluates whether to join a new on-line game, she bases her decision on how many of her friends in this group are involved in the game as well. (Not all pairs of people in this 20-person group are friends, and it is more important whether your friends are playing than whether many people in the group overall are playing.) To make the story concrete, let's suppose that each game goes through the following -life cycle within this group of students:
  - The game has some initial players in the group, who have discovered it and are already involved in it.
  - Each other student outside this set of initial players is willing to join the game if at least half of her friends in the group are playing it.
- A group of 20 students, 10 live on the third floor of the dorm and 10 live on the fourth floor. Suppose that each student in this group has two friends on their own floor, and one friend on the other floor. Now, a new game appears, and five students all living on the fourth floor each begin playing it. The question is: if the other students use the rule above to evaluate whether to join the game, will this new game eventually be adopted by all 20 students in the group? There are three possible answers to this question: yes, no, or there is not information in the set-up of the question to be able to tell. Say which answer you think is correct, and explain.
- Illustrate the given network with Link Analysis using power law concept.



**Course Outcome 5 (CO5):**

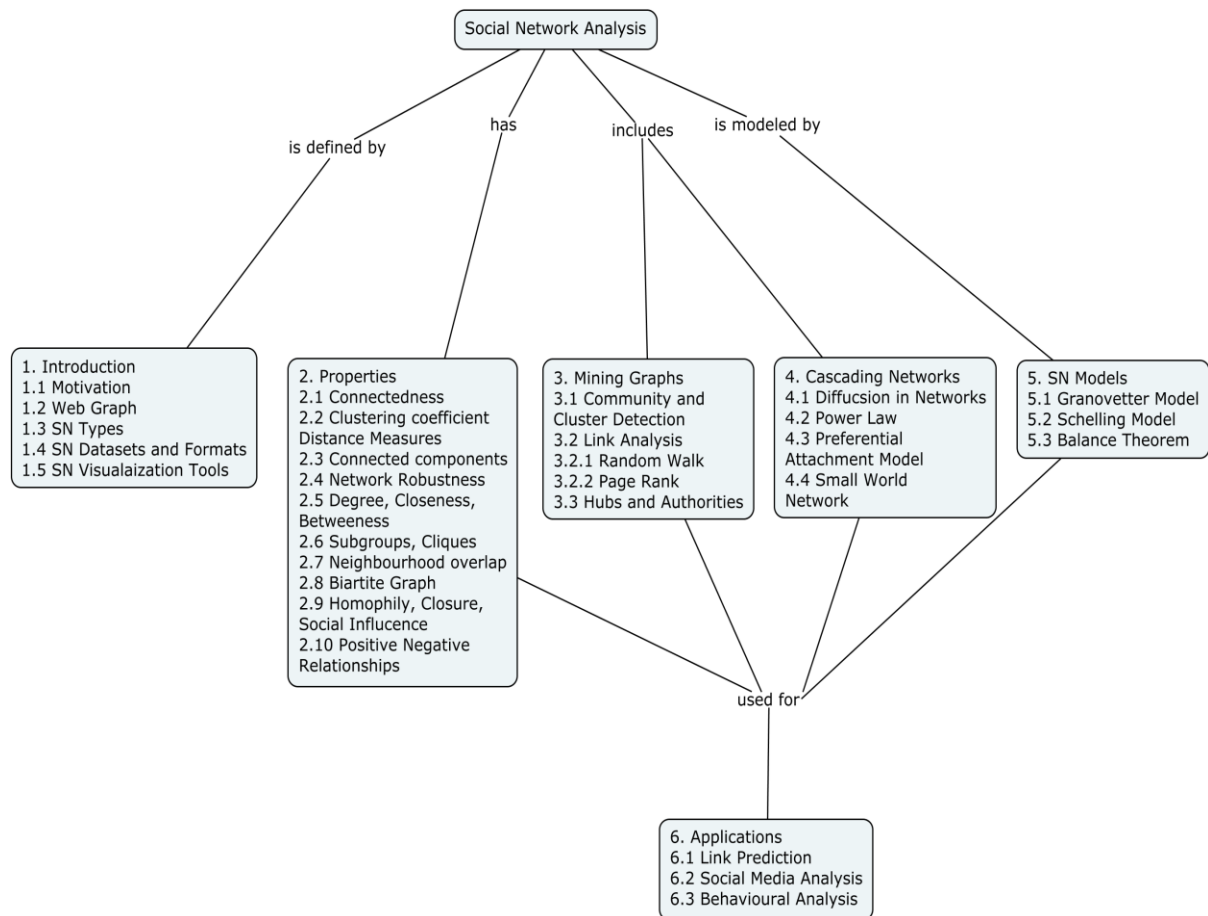
1. Compare Page Rank, Weighted Page Rank and Weighted Page Content Rank Algorithms.
2. Apply the various Methods for Mining Frequent Sub graphs
3. Analyze the Mining Newsgroups Using Networks

**Course Outcome 6 (CO6):**

Create models for the following problems using tools like Networkx, Gephi, NodeXL, Pajek, GraphViz, Tulip, R package, etc

1. Mining and modelling the open-source software community
2. Visualize twitter social network data using tools.
3. Analyze friendship networks

**Concept Map**



## Syllabus

**Introduction:** Motivation, Web Graph, Types of Social Networks, Social Network Datasets and formats, Social Network Data Visualization Tools - Networkx, Gephi, Pajek

**Properties:** Connectedness, Clustering Coefficient, Distance Measures, Connected Components, Network Robustness, Degree and Closeness Centrality, Betweenness Centrality, Subgroups, Cliques, Neighbourhood overlap, Bipartite graph, Homophily, Closure, Social Influence, Positive Negative Relationships

**Mining Graphs:** Community and Cluster detection, Link Analysis - Random Walk, Page Rank algorithms, Hubs and Authorities

**Cascading Networks:** Diffusion in networks, Power law, Preferential Attachment Models, Small World Network.

**Social Network Models** – Granovetter Model, Schelling Model, Balance Theorem

**Applications:** Link Prediction, Social media data analysis, Behavioural Analysis

## Learning Resources

1. Ian A. McCulloh, Helen L. Armstrong, Anthony N. Johnson, "Social Network Analysis with Applications", Wiley, 2013, First Edition
2. Charles Kadushin, "Understanding Social Networks: Theories, Concepts and Findings", Oxford University Press, 2011, First Edition
3. SWAYAM - NPTEL Course, "Social Networks",  
[https://onlinecourses.nptel.ac.in/noc19\\_cs66/preview](https://onlinecourses.nptel.ac.in/noc19_cs66/preview)
4. Coursera - "Applied Social Network Analysis in Python",  
<https://www.coursera.org/learn/python-social-network-analysis>
5. Xiaoming Fu, JarDer Luo, Margarete Boos, "Social Network Analysis Interdisciplinary Approaches and Case Studies", CRC Press, 2017, First Edition
6. P.M. Krishna Raj, Ankith Mohan, K.G. Srinivasa, "Practical Social Network Analysis with Python", Springer, 2018, First Edition
7. Stanley Wasserman, Katherine Faust, "Social Network analysis: methods and Applications", Cambridge University Press, 1994 (Reprinted 1999), First Edition.

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Introduction</b>		
1.1	Motivation	1	CO1, CO6
1.2	Web Graph		
1.3	Types of Social Network	1	
1.4	Datasets and Formats		
1.5	SN Data Visualization Tools	2	
<b>2</b>	<b>Properties</b>		
2.1	Connectedness	1	CO2, CO6
2.2	Clustering Coefficient, Distance Measures	1	
2.3	Connected Components	1	
2.4	Network Robustness	1	
2.5	Degree, Closeness Centrality, Betweenness	1	
2.6	Subgroups, Cliques	1	
2.7	Neighbourhood overlap	1	



2.8	Bipartite Graph	1	
2.9	Homophily, Closure, Social Influence	1	
2.10	Positive Negative Relationships	1	
<b>3</b>	<b>Mining Graphs</b>		
3.1	Community and Cluster Detection	3	CO3, CO4, CO6
3.2	Link Analysis		
3.2.1	Random Walk Algorithm	2	
3.2.2	Page Rank Algorithm	2	
3.3	Hubs and Authorities	3	
<b>4</b>	<b>Cascading Networks</b>		
4.1	Diffusion in Networks	2	CO3, CO4, CO6
4.2	Power Law	1	
4.3	Preferential Attachment Models	1	
4.4	Small World Network	2	
<b>5</b>	<b>Social Network Models</b>		
5.1	Granovetter Model	1	CO5
5.2	Schelling Model	1	
5.3	Balance Theorem	1	
<b>6</b>	<b>Applications</b>		
6.1	Link Prediction	1	CO6
6.2	Social media data Analysis	1	
6.3	Behavioural Analysis	1	
<b>Total Lecture Hours</b>		<b>36</b>	

**Course Designers:**

1. A.M. Abirami                      abiramiam@tce.edu
2. R.Parkavi                            rpit@tce.edu

**BOARD OF STUDIES MEETING**

B.Tech Degree (Information Technology) Program



**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A Government Aided ISO 9001-2000 certified  
Autonomous Institution affiliated to Anna University)

MADURAI – 625 015, TAMILNADU

Phone: 0452 – 2482240, 41

Fax: 0452 2483427

Web: [www.tce.edu](http://www.tce.edu)

**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.Tech DEGREE (INFORMATION TECHNOLOGY) PROGRAM**

**ONE CREDIT AND TWO CREDIT COURSES**

**FOR THE STUDENTS ADMITTED FROM THE**

**ACADEMIC YEAR 2018-19 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**

(A Government Aided ISO 9001-2000 certified  
Autonomous Institution affiliated to Anna University)

MADURAI – 625 015, TAMILNADU

Phone: 0452 – 2482240, 41

Fax: 0452 2483427

Web: [www.tce.edu](http://www.tce.edu)

**LIST OF ONE AND TWO CREDIT COURSES**

<b>COURSE CODE</b>	<b>COURSE NAME</b>
18IT2A0	MULTIPLATFORM MOBILE APPLICATION DEVELOPMENT
18IT2B0	PENETRATION TESTING METHODOLOGIES
18IT2C0	EDGE AND MOBILITY NETWORK SECURITY SOLUTIONS
18IT2D0	DATA SCIENCE AND AI APPLICATIONS
18CS1C0	CONTAINERIZATION TECHNOLOGIES(Common to IT and CSE)

18IT2A0	MULTIPLATFORM MOBILE APPLICATION DEVELOPMENT	Category	L	T	P	Credit
		PE	2	0	0	2

**Preamble**

Multiplatform Mobile Application Development explores Javascript based mobile application development in the React library with various aspects of React UI components. This course offers knowledge and skill on mobile application development in Multiplatform environment.

**Prerequisite**

- None

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Illustrate basic React Native components like Icons, Fonts and Buttons to develop hybrid mobile apps	15
CO2	Demonstrate Forms and Modals for specific mobile application domain	30
CO3	Adapt appropriate techniques to build a standalone apps.	35
CO4	Solve a real world problem by adapting capabilities of Devices in the native environment.	20

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO4	TPS4	Analyze	Organize	Complex Overt Responses	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1, 3.2, 4.1, 4.5.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		M			L	L	L		L	M	L	L
CO2	S	M	L		M			L	L	L		L	M	L	L
CO3	S	M	L		M			L	L	L		L	M	L	L
CO4	S	S	M	L	S	S	L	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

**AssessmentPattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests	Terminal Examination
Remember	0	20
Understand	30	40
Apply	40	40
Analyze	30	0
Evaluate	0	0
Create	0	0

CO4 will be assessed only through Mini Project.

**AssessmentPattern: Psychomotor**

Psychomotor Skill	Mini project/Assignment/Practical Component
Perception	-
Set	10
Guided Response	30
Mechanism	60
Complex Overt Responses	-
Adaptation	-
Origination	-

**Simple Questions for Course Outcome Assessment****Course Outcome 1 (CO1):**

1. Use JSX syntax to represent objects
2. Apply lifecycle methods to illustrate it with a class.
3. Use Props to show a notification in React.
4. Demonstrate Rendering and Extraction of Components in React.

**Course Outcome 2 (CO2):**

1. Use EventHandlering to identify the focus on various components in the application
2. Apply conditional operators to differentiate signed up and new users in an application
3. Demonstrate the use of Inline if
4. Experiment with Keys and Lists in React

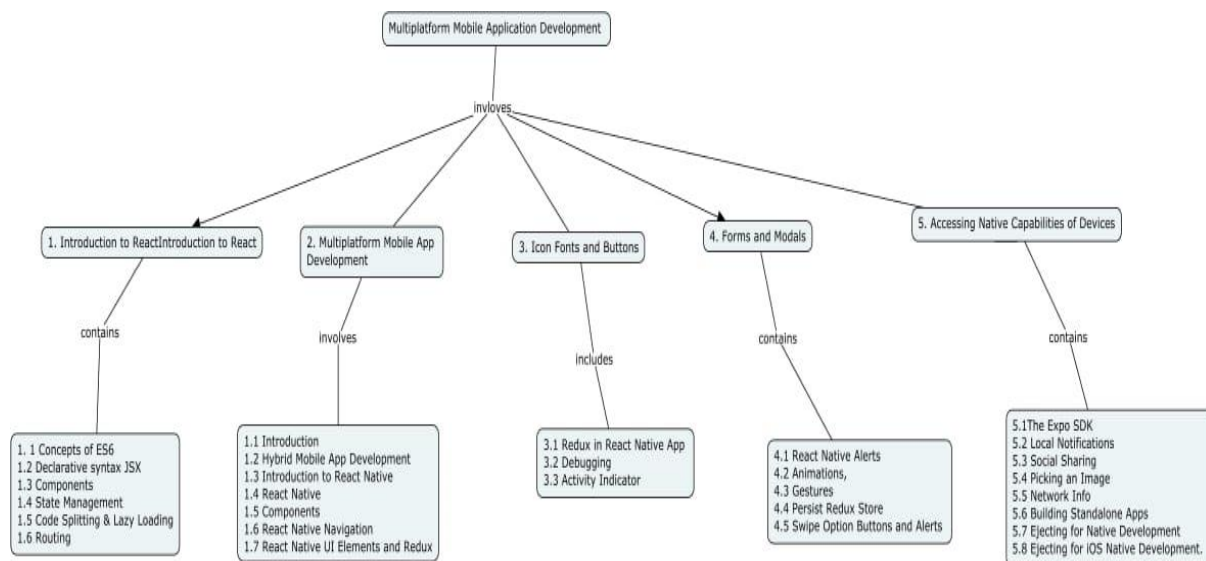
**Course Outcome 3 (CO3):**

1. Prepare a static version of your app in react
2. Produce a Form for Registration of a Job Fair
3. Relate if inheritance is needed with any application of your choice.
4. Relate various APIs that can be involved in building a commercial app.

**Course Outcome 4 (CO4):**

- CO4 is evaluated through mini project

## Concept Map



## Syllabus

**Introduction to React** - Concepts of ES6 - Declarative syntax JSX – Components – State Management - Code Splitting & Lazy Loading – Routing.

**Multiplatform Mobile App Development with React Native:** An Introduction –Hybrid Mobile App Development - Introduction to React Native - React Native - Components – React Native Navigation - React Native UI Elements and Redux.

**Icon Fonts and Buttons** - Redux in React Native App – Debugging - Activity Indicator.

**Forms and Modals-** React Native Alerts -Animations - Gestures- Persist Redux Store – Swipe Option Buttons and Alerts.

**Accessing Native Capabilities of Devices:** The Expo SDK - Local Notifications – Social Sharing - Picking an Image – Network Info - Building Standalone Apps -Ejecting for Native Development – Ejecting for iOS Native Development.

## Learning Resources

1. Emilio Rodriguez Martinez,"React: Cross-Platform Application Development with React Native" Build 4 real-world apps with React Native, Packt Publishing (March 13, 2018)
2. Devin Abbott, Houssein Djirdeh, Anthony Accomazzo , Sophia Shoemaker,"Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native", Independently published (January 11, 2019).
3. Dan Ward,"React Native Cookbook: Recipes for solving common React Native development problems, Packt Publishing; 2nd edition(January 31, 2019).
4. Bonnie Eisenman Learning React Native: Building Native Mobile Apps with JavaScript O'Reilly Media; 2 edition (November 12, 2017)

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lecture Hours	Course Outcome
<b>1</b>	<b>Introduction to React</b>		
1.1	Concepts of ES6	1	CO1
1.2	Declarative syntax JSX	1	
1.3	Components	1	
1.4	State Management	1	
1.5	Code Splitting & Lazy Loading	1	
1.6	Routing.	1	
<b>2</b>	<b>Multiplatform Mobile App Development with React Native:</b>		
2.1	An Introduction –Hybrid Mobile App Development	2	CO1
2.2	Introduction to React Native		
2.3	React Native - Components	2	
2.4	React Native Navigation	1	
2.5	React Native UI Elements and Redux	1	
<b>3</b>	<b>Icon Fonts and Buttons</b>		
3.1	Redux in React Native App	1	CO1
3.2	Debugging	1	
3.3	Activity Indicator	1	
<b>4</b>	<b>Forms and Modals</b>		
4.1	React Native Alerts	1	CO2
4.2	Animations	1	
4.3	Gestures	1	
4.4	Persist Redux Store	1	
4.5	Swipe Option Buttons and Alerts	1	
<b>5</b>	<b>Accessing Native Capabilities of Devices</b>		
5.1	The Expo SDK	1	CO3
5.2	Local Notifications	1	
5.3	Social Sharing	1	
5.4	Picking an Image	1	
5.5	Network Info	1	
5.6	Building Standalone Apps	1	CO4
5.7	Ejecting for Native Development	1	
5.8	Ejecting for iOS Native Development	1	
	<b>Total Hours</b>	<b>28</b>	

**Course Designers:**

- Industry Expert:** Mr.Manimaran Chellaperumal, Mobile Team Leader, Great Innovus Solutions, Madurai.
- S.Karthiga skait@tce.edu
- Mrs.K.Indira kiit@tce.edu
- Mrs.C.V.Nisha Angeline cvnait@gmail.com



18IT2B0	<b>PENETRATION TESTING METHODOLOGIES</b>	Category	L	T	P	Credit
		PE	2	0	0	2

**Preamble**

Penetration testing methodologies use offensive security tools available with the Kali Linux distribution. The course provides an ability to be presented with an unknown network, enumerate the targets within their scope, exploit them, and clearly document their results in a penetration test report.

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Demonstrate the tools and techniques used to perform penetration testing in Kali Linux.	30%
CO2	Examine the given web application to perform attacks using Web application Hacking methodologies.	40%
CO3	Utilize the appropriate tools to perform Exploit analysis.	15%
CO4	Make use of appropriate tools to perform and detect Hardware based attacks.	15%

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1.1, 3.2.2, 3.2.3, 3.2.6, 4.1.1, 4.3.1, 4.4.2, 4.5.1, 4.5.3, 4.5.5
CO2	TPS4	Analyse	Organise	Complex Overt Responses	1.3, 2.1.1, 2.1.2, 2.1.4, 2.1.5, 2.3.1, 2.4.4, 2.4.6, 3.1.1, 3.2.2, 3.2.3, 3.2.6, 4.1.1, 4.3.1, 4.4.2, 4.5.1, 4.5.3, 4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1.1, 3.2.2, 3.2.3, 3.2.6, 4.1.1, 4.3.1, 4.4.2, 4.5.1, 4.5.2, 4.5.3, 4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1.1, 3.2.2, 3.2.3, 3.2.6, 4.1.1, 4.3.1, 4.4.2, 4.5.1, 4.5.2, 4.5.3, 4.5.5

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	L	S	L	M	M	M	M		M	S	S	M
CO2	S	S	M	M	S	L	M	M	M	M	M	S	S	S	S
CO3	S	M	L	L	S	L	M	M	M	M		M	S	S	M
CO4	S	M	L	L	S	L	M	M	M	M		M	S	S	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests	Assignment	Terminal Examination
Remember	20	-	20
Understand	40	-	40
Apply	40	40	40
Analyse		60	
Evaluate		-	
Create		-	

Attainment of CO2 is assessed through Practical Assignments.

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	10
Guided Response	20
Mechanism	40
Complex Overt Responses	30
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome 1 (CO1):**

1. Organize the procedures to install, configure and updating system and network services in Kali Linux.
2. Experiment with Windows 7 System to perform Target Scoping, Information gathering, and Target discovery as part of penetration testing phases.
3. Interview the outcome of Kali Linux Penetration testing phases.

**Course Outcome 2 (CO2):**

1. Examine the Ticket Booking web application against Handling User Access, Handling User Input, and Handling Attackers defensive measures.
2. Analyze the Banking web application against Client-Side Controls, Authentication Mechanism, and Session Management Mechanism.
3. Inspect Educational Attendance and Mark web application against Access Controls, Input-Based Vulnerabilities, Function-Specific Input Vulnerabilities and Logic Flaws.

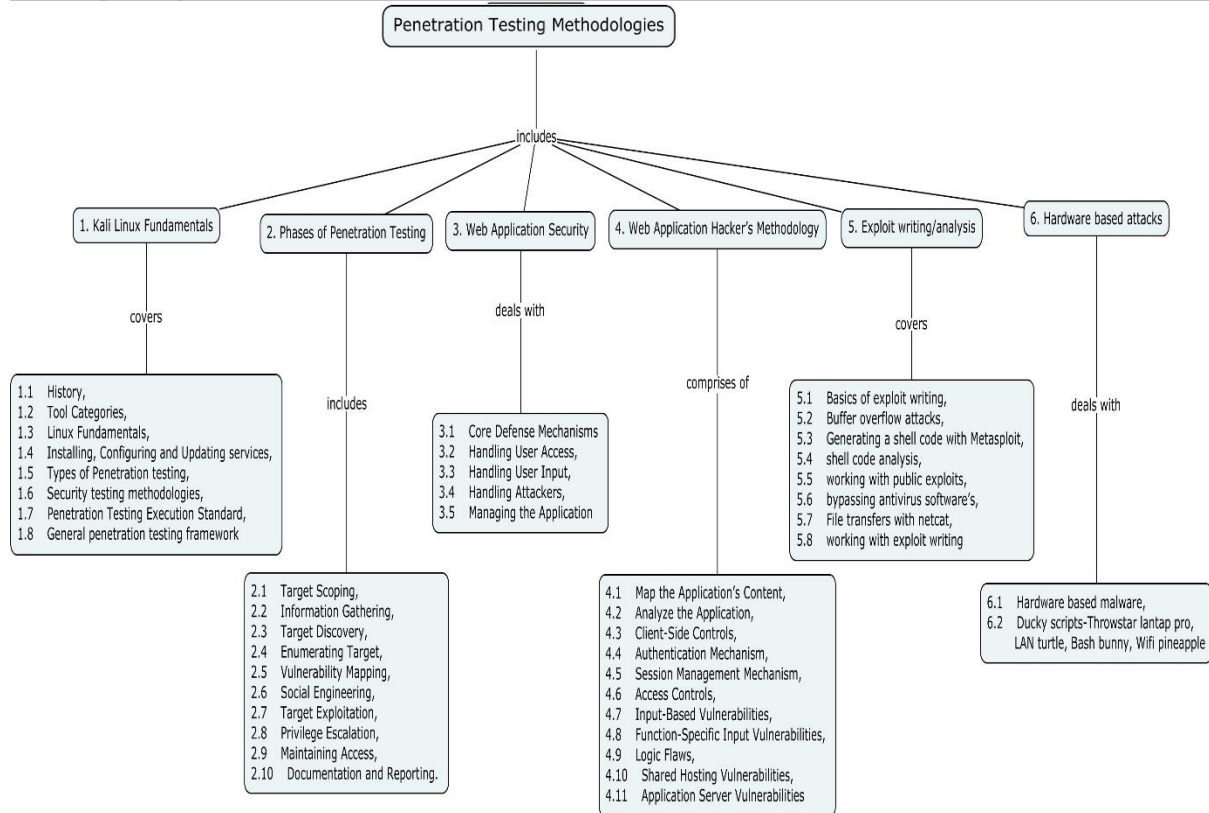
**Course Outcome 3 (CO3):**

1. Identify the path to access Windows 7 system in a network indirectly by generating a shell code with Metasploit.
2. Experiment with Windows 7 system exploits to bypass antivirus software's and File transfers.
3. Interview the Linux system exploits to bypass security features and File transfers.

**Course Outcome 4 (CO4):**

1. Utilize the appropriate tools to identify the Hardware based malware in i7 processor system.
2. Make use of appropriate tools to perform simple Hardware based malware in i7 processor system.
3. Interview the possible ways to perform and identify Hardware based malware in any process system.

## Concept Map



## Syllabus

**Kali Linux Fundamentals:** History, Tool Categories, Linux Fundamentals, Installing, Configuring and Updating services, Types of Penetration testing, Security testing methodologies, Penetration Testing Execution Standard, General penetration testing framework

**Phases of Penetration Testing:** Target Scoping, Information Gathering, Target Discovery, Enumerating Target, Vulnerability Mapping, Social Engineering, Target Exploitation, Privilege Escalation, Maintaining Access, Documentation and Reporting, Enumeration Techniques.

**Web Application Security:** Core Defense Mechanisms - Handling User Access, Handling User Input, Handling Attackers, Managing the Application.

**Web Application Hacker's Methodology:** Map the Application's Content, Analyze the Application, Client-Side Controls, Authentication Mechanism, Session Management Mechanism, Access Controls, Input-Based Vulnerabilities, Function-Specific Input Vulnerabilities, Logic Flaws, Shared Hosting Vulnerabilities, Application Server Vulnerabilities.

**Exploit writing/analysis:** Basics of exploit writing, Buffer overflow attacks, Generating a shell code with Metasploit, shell code analysis, working with public exploits, bypassing antivirus software's, File transfers with netcat, working with exploit writing.

**Hardware based attacks:** Hardware based malware, Ducky scripts-Throwstar lantap pro, LAN turtle, Bash bunny, Wifi pineapple.

### Tools essential:

Website Copier, The Harvester, Google-fu, Whois, SET, netcat, ncat, Wireshark, Tcpdump, Email harvesting, DNS, SMTP, SNMP, SMB, Metasploit, Shodan, Exploit-db, Nmap, Nikto, Password attacks.

**Learning Resources**

1. Raphaël Hertzog, Jim O’Gorman, Mati Aharoni, "Kali Linux Revealed - Mastering the Penetration Testing Distribution", OFFSEC Press, 1st Editon, 2017.
2. Lee Allen, Tedi Heriyanto, Shakeel Ali, " Kali Linux – Assuring Security by Penetration Testing", PACT Publishers, Second Edition, 2014.
3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress; 2 edition, 2013
4. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", Wiley, Second edition, 2011.
5. Owasp top 10, Url:[https://www.owasp.org/index.php/Top\\_10\\_2017-Top\\_10](https://www.owasp.org/index.php/Top_10_2017-Top_10)
6. Exploit database, Url: <https://www.exploit-db.com/>
7. SecurityFocus, Url: <http://www.securityfocus.com/>
8. Packetstormsecurity, Url:<https://packetstormsecurity.com/>
9. Basic Linux Privilege Escalation, Url: <http://blog.g0tmi1k.com/2011/08/basic-linux-privilege-escalation/>
10. Windows Privilege Escalation Fundamentals,  
Url: <http://www.fuzzysecurity.com/tutorials/16.html>
11. Capture the flag, Url: <https://ctftime.org/>

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Lectures	Course Outcome
1	<b>Kali Linux Fundamentals</b>		
1.1	History,	1	CO1
1.2	Tool Categories,		
1.3	Linux Fundamentals,		
1.4	Installing, Configuring and Updating services,		
1.5	Types of Penetration testing,		
1.6	Security testing methodologies,	1	
1.7	Penetration Testing Execution Standard,		
1.8	General penetration testing framework		
2	<b>Phases of Penetration Testing</b>		
2.1	Target Scoping,	1	CO1
2.2	Information Gathering,		
2.3	Target Discovery,		
2.4	Enumerating Target,		
2.5	Vulnerability Mapping,	1	
2.6	Social Engineering,		
2.7	Target Exploitation,	1	
2.8	Privilege Escalation,		
2.9	Maintaining Access,	1	
2.10	Documentation and Reporting & Enumeration Techniques		
3	<b>Web Application Security</b>		
3.1	Core Defense Mechanisms	1	CO2
3.2	Handling User Access,		
3.3	Handling User Input,		
3.4	Handling Attackers,		
3.5	Managing the Application		
4	<b>Web Application Hacker’s Methodology</b>		
4.1	Map the Application’s Content,	1	CO2
4.2	Analyze the Application,		
4.3	Client-Side Controls,		

4.4	Authentication Mechanism,	1	CO2
4.5	Session Management Mechanism,	1	
5	<b>Exploit writing/analysis</b>		CO3
5.1	Basics of exploit writing,	1	
5.2	Buffer overflow attacks,		
5.3	Generating a shell code with Metasploit,	1	
5.4	shell code analysis,		
5.5	working with public exploits,	1	
5.6	bypassing antivirus software's,		
5.7	File transfers with netcat,	1	
5.8	working with exploit writing		
6	<b>Hardware based attacks</b>		CO4
6.1	Hardware based malware,.	2	
6.2	Ducky scripts-Throwstar lantap pro, LAN turtle, Bash bunny, Wifi pineapple	2	
<b>Total Lectures</b>		<b>28</b>	

### Course Designers:

- Mr..J.Reegun Richard  
 Industry :  
 Area of Interests :

[reegunj@outlook.com](mailto:reegunj@outlook.com)  
 Symantec Corporation, India  
 Vulnerability researching in windows and web application penetration testing, analysing targeted attacks like exploit kits, Dynamic& static analysis of malware, Network traffic analysis, Adding rules to malicious network traffic, detailed analysis on malicious network traffic to get the URI patterns for exploit kits and targeted attacks, Expertise in removing malwares/rootkits manually.
- Mr.M.Thangavel  
 mtit@tce.edu

18IT2C0	<b>EDGE AND MOBILITY NETWORK SECURITY SOLUTIONS</b>	Category	L	T	P	Credit
		PE	2	0	0	2

### Preamble

Edge and Mobility Network Security Solutions course provide the knowledge of a network security engineer to configure and implement security on network perimeter edge devices such as a switch, router, and ASA firewall. It also provides knowledge of a network security engineer on the variety of Intrusion Prevention Systems (IPS) and Virtual Private Network (VPN) solutions on the ASA firewall.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Outline the vulnerabilities, attacks, risks, countermeasures and threats of the given Network.	30%
CO2	Configure the Firewall to implement security on network perimeter edge and mobility devices.	15%
CO3	Configure the IPS and VPN for securing communications with the network perimeter edge and mobility devices.	20%
CO4	Examine the given network to identify the possible attacks and appropriate configuration of network edge and mobility devices.	35%

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3, 2.1.1, 2.3.1
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1.1, 3.2.2, 3.2.3, 3.2.6, 4.1.1, 4.3.1, 4.4.2, 4.5.1, 4.5.3, 4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1.1, 3.2.2, 3.2.3, 3.2.6, 4.1.1, 4.3.1, 4.4.2, 4.5.1, 4.5.3, 4.5.5
CO4	TPS4	Analyse	Organise	Complex Overt Responses	1.3, 2.1.1, 2.1.2, 2.1.4, 2.1.5, 2.3.1, 2.4.4, 2.4.6, 3.1.1, 3.2.2, 3.2.3, 3.2.6, 4.1.1, 4.3.1, 4.4.2, 4.5.1, 4.5.3, 4.5.5

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L			S							L	L		L
CO2	S	M	L	L	S	L	M	M	M	M		M	S	M	S
CO3	S	M	L	L	S	L	M	M	M	M		M	S	M	S
CO4	S	S	M	M	S	L	M	M	M	M	M	S	S	M	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests	Assignment	Terminal Examination
Remember	20	-	20
Understand	40	-	40
Apply	40	40	40
Analyse		60	
Evaluate		-	
Create		-	

Attainment of CO4 is assessed through Practical Assignments.

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	10
Guided Response	20
Mechanism	40
Complex Overt Responses	30
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1 (CO1):**

1. Relate VLANs and VTP.
2. Compare the features of NAT and PAT.
3. Outline the security issues in TCP/IP, DNS and Routing.

**Course Outcome 2 (CO2):**

1. Identify the procedure to implement the Firewall ASA with application filtering, protocol inspection, and security contexts.
2. Experiment with Packet tracer, Packet capture and Syslog to monitor the Firewall.
3. Build an Firewall with three or more interfaces (inside, outside and DMZ) for an Educational institution with 8 departments connecting 1500 systems in the network.

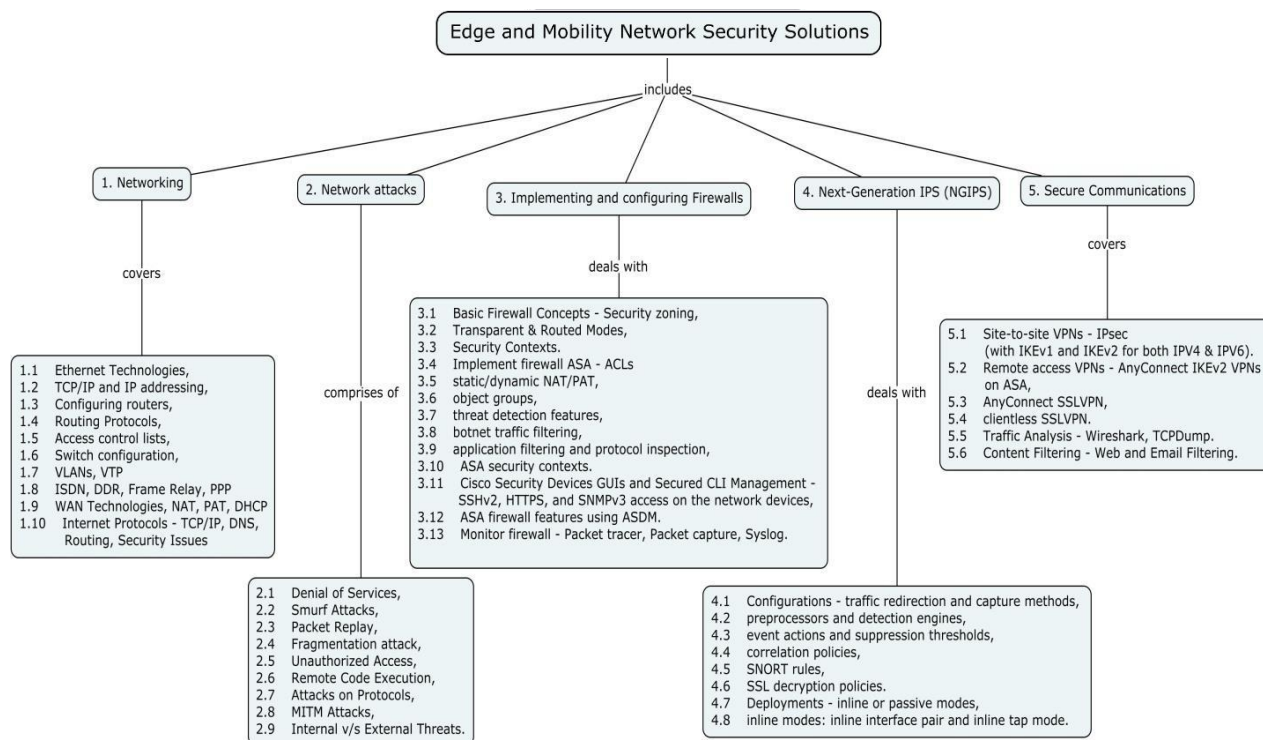
**Course Outcome 3 (CO3):**

1. Build an IPS signatures with appropriate attributes, type, file, micro, triggers and action to stop incoming malicious traffic in an educational institution network.
2. Construct an secure network with appropriate symmetric cryptosystem, asymmetric cryptosystem, key management, public key infrastructure and certificate authorities for remotely connected examination system
3. Interview the feasibility of implementing Site-to-site and Remote access VPN in an Educational organization.

**Course Outcome 4 (CO4):**

1. Examine the GUIs and CLI Management to access the network devices with firewall.
2. Analyze the strength of IPS against event actions and suppression thresholds, correlation policies, SNORT rules, SSL decryption policies.
3. Compare the concept of Traffic analysis and content filtering with the appropriate tools result.

## Concept Map



## Syllabus

**Networking:** Ethernet Technologies, TCP/IP and IP addressing, Configuring routers, Routing Protocols, Access control lists, Switch configuration, VLANs, VTP, ISDN, DDR, Frame Relay, PPP, WAN Technologies, NAT, PAT, DHCP, Internet Protocols - TCP/IP, DNS, Routing, Security Issues.

**Network attacks:** Denial of Services, Smurf Attacks, Packet Replay, Fragmentation attack, Unauthorized Access, Remote Code Execution, Attacks on Protocols, MITM Attacks, Internal v/s External Threats.

**Implementing and configuring Firewalls:** Basic Firewall Concepts - Security zoning, Transparent & Routed Modes, Security Contexts. Implement firewall ASA - ACLs, static/dynamic NAT/PAT, object groups, threat detection features, botnet traffic filtering, application filtering and protocol inspection, ASA security contexts. Cisco Security Devices GUIs and Secured CLI Management - SSHv2, HTTPS, and SNMPv3 access on the network devices, ASA firewall features using ASDM. Monitor firewall - Packet tracer, Packet capture, Syslog.

**Next-Generation IPS (NGIPS):** Configurations - traffic redirection and capture methods, preprocessors and detection engines, event actions and suppression thresholds, correlation policies, SNORT rules, SSL decryption policies. Deployments - inline or passive modes, inline modes: inline interface pair and inline tap mode.

**Secure Communications:** Site-to-site VPNs - IPsec (with IKEv1 and IKEv2 for both IPV4 & IPV6). Remote access VPNs - AnyConnect IKEv2 VPNs on ASA, AnyConnect SSLVPN, clientless SSLVPN. Traffic Analysis - Wireshark, TCPDump. Content Filtering - Web and Email Filtering.



### Learning Resources

1. Catherine Paquet, "Implementing Cisco Threat Control Solutions (SITCS) Foundation Learning Guide: (CCNP Security 300-207)", Cisco Press, 2015
2. Mark Bernard, David Burns, "CCNP Security SENSS 300-206 Official Cert Guide (Certification Guide)", Cisco Press, 2015
3. Natalie Timms, "CCNP Security SIMOS 300-209 Official Cert Guide (Certification Guide)", Cisco Press, 2015
4. William Stallings, "Network Security Essentials Applications and Standards", Pearson Education, Fourth Edition, 2011
5. John R. Vacca, "Network and System Security", Syngress Media, U.S., 2010.
6. "VPN Security", The Government of the Hong Kong Special Administrative Region 2008.
7. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006
8. Joseph Migga Kizza, "Computer Network Security", Springer, 2005.
9. Jan L. Harrington, "Network Security: A Practical Approach", Morgan Kaufmann, 2005

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>Networking</b>		CO1
1.1	Ethernet Technologies,	1	
1.2	TCP/IP and IP addressing,		
1.3	Configuring routers,	1	
1.4	Routing Protocols,		
1.5	Access control lists,	1	
1.6	Switch configuration,		
1.7	VLANs, VTP		
1.8	ISDN, DDR, Frame Relay, PPP	1	
1.9	WAN Technologies, NAT, PAT, DHCP	1	
1.10	Internet Protocols - TCP/IP, DNS, Routing, Security Issues	1	
2.	<b>Network attacks</b>		CO1
2.1	Denial of Services,	1	
2.2	Smurf Attacks,	1	
2.3	Packet Replay,		
2.4	Fragmentation attack,	1	
2.5	Unauthorized Access,		
2.6	Remote Code Execution,		
2.7	Attacks on Protocols,	1	
2.8	MITM Attacks,		
2.9	Internal v/s External Threats.		
3.	<b>Implementing and configuring Firewalls</b>		CO2 & CO4
3.1	Basic Firewall Concepts - Security zoning,	1	
3.2	Transparent & Routed Modes,	1	
3.3	Security Contexts.		
3.4	Implement firewall ASA - ACLs	1	
3.5	static/dynamic NAT/PAT,		
3.6	object groups,	1	
3.7	threat detection features,		
3.8	botnet traffic filtering,		
3.9	application filtering and protocol inspection,	1	
3.10	ASA security contexts.		



18IT2D0	DATA SCIENCE AND AI APPLICATIONS	Category	L	T	P	Credit
		PE	2	0	0	2

**Preamble**

The course aims to provide theoretical and practical foundations on Data Science and Artificial Intelligence techniques. It focuses on handling different use cases and solving them using Python packages and libraries.

**Prerequisite**

Basic Programming Knowledge in Python and familiarity with Machine Learning Algorithms

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Use suitable machine learning techniques like Naïve Bayes, and SVM for language identification in text analytics	15%
CO2	Use suitable deep learning techniques like CRF, LSTM for automation in text analytics	15%
CO3	Select suitable machine learning techniques like SVM, Decision trees and Neural network for automating the solution	20%
CO4	Apply regression modelling techniques to solve appropriate real time manufacturing machines level problems	20%
CO5	Use suitable machine learning algorithms with modification for the given problem and imbalanced dataset	15%
CO6	Compare performance of different machine learning algorithms for the given problem and dataset	15%

**CO Mapping with CDIO Curriculum Framework**

CO#	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO3	TPS4	Analyze	Organize	Complex Overt Responses	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 4.1, 4.5.3
CO6	TPS4	Analyze	Organize	Complex Overt Responses	1.3, 2.1.1, 2.1.2, 2.4.5, 2.4.6, 2.5, 3.1, 3.2, 4.1, 4.5.3

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		S	S	L	L				S	M	S	L
CO2	S	M	L		S	S	L	L				S	M	S	L
CO3	S	S	M	L	S	S	L	L				S	S	S	L
CO4	S	M	L		S	S	L	L				S	M	S	L
CO5	S	M	L		S	S	L	L				S	M	S	L
CO6	S	S	M	L	S	S	L	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests	Terminal Examination
Remember	0	20
Understand	30	40
Apply	40	40
Analyze	30	0
Evaluate	0	0
Create	0	0

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini-project/Assignment/Practical Component
Perception	-
Set	10
Guided Response	30
Mechanism	60
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome1 (CO1):**

1. Explain language identification problem in NLP
2. Use Naïve Bayes classifier for text analytics
3. Use SVM classifier for text analytics

**Course Outcome2 (CO2):**

1. Explain sequence classification problem
2. Discuss the principle of LSTM technique
3. Use CRF and LSTM techniques for the given product or service reviews or customer reviews.

**Course Outcome3 (CO3):**

1. Explain the approach how machine learning algorithm can be automated
2. Apply different machine learning algorithms for the given problem and dataset
3. Explain how does machine learning tools help in automation

**Course Outcome 4 (CO4):**

1. Use linear regression algorithm for the prediction of machine failure data set
2. Use multiple linear regression algorithm for the prediction of machine failure data set
3. Explain basis functions in machine learning.

**Course Outcome 5(CO5):**

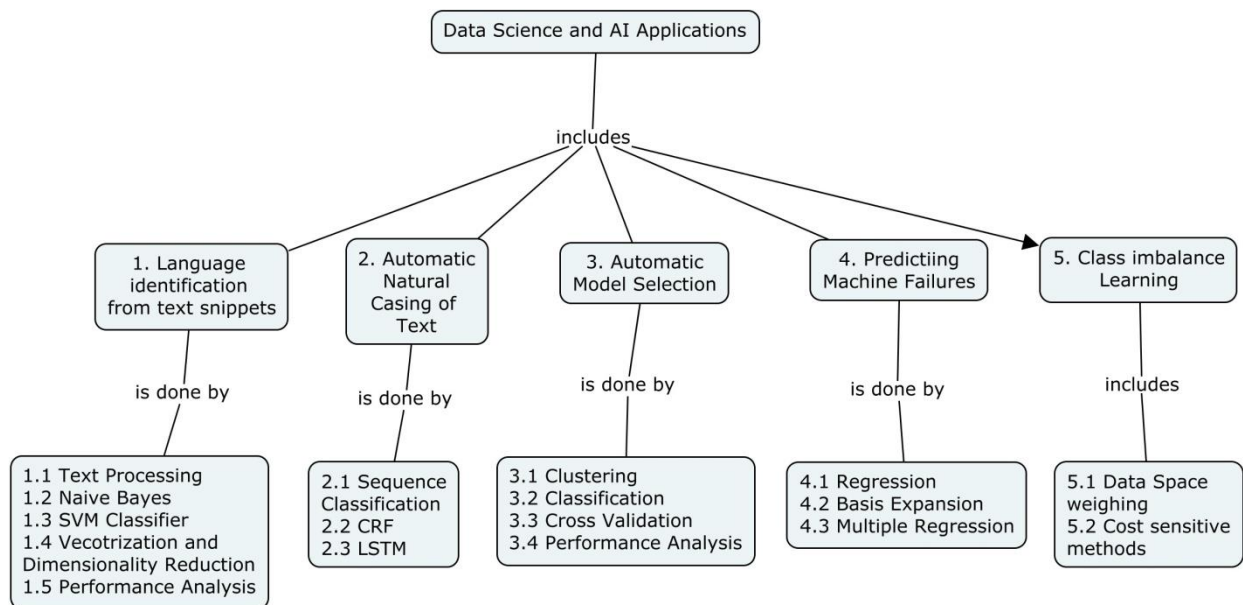
1. Explain the need for imbalanced classes use in machine learning techniques
2. Differentiate data space weighing and cost sensitive methods
3. Use suitable machine learning techniques for the given imbalanced data set

**Course Outcome 6(CO6):**

CO6 is evaluated through mini project

(Mini-project using dataset from Kaggle / UCI repository and Python packages/libraries)

**Concept Map**



**Syllabus**

**Use case UC1** Language Identification from Text Snippets – Text Processing, Naïve Bayes, SVM Classifiers, Vectorization and Dimensionality Reduction – Performance Analysis

**Use case UC2** Automatic Natural Casing of Text - Sequence classification, Conditional Random Field (CRF), Long Short Term Memory (LSTM) techniques

**Use case UC3** Automatic Model Selection - Clustering, Classification, Cross-validation – Performance Analysis

**Use case UC4** Predicting Machine Failures from manufacturing data - Regression, Basis Expansion and Multiple Regressions

**Use case UC5** Class Imbalance Learning - Data space weighing, Cost-sensitive methods.

**Project Implementation**

**Learning Resources**

1. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and Tensor Flow", 3<sup>rd</sup> Edition, Packt Publishers, 2020.
2. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 2<sup>nd</sup> Edition, O'Reilly, 2020.
3. Web Reference - <https://towardsdatascience.com/>
4. Dataset : <https://www.kaggle.com/>

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Hours	Course Outcome
<b>1</b>	<b>Language Identification from Text Snippets</b>	5	CO1
1.1	Text Processing		
1.2	Naïve Bayes Classifier		
1.3	SVM Classifier		
1.4	Vectorization and Dimensionality Reduction		
1.5	Performance Analysis		
<b>2</b>	<b>Automatic Natural Casing of Text</b>	5	CO2
2.1	Sequence Classification Problem		
2.2	Conditional Random Field (CRF)		
2.3	Long Short Term Memory (LSTM)		
<b>3</b>	<b>Automatic Model Selection</b>	5	CO3
3.1	Clustering technique		
3.2	Classification techniques		
3.3	Cross-validation		
3.3	Performance Analysis		
<b>4</b>	<b>Predicting Machine Failures from manufacturing data</b>	5	CO4
4.1	Regression Technique		
4.2	Basis Expansion		
4.3	Multiple Regression Techniques		
<b>5</b>	<b>Class Imbalance Learning</b>	5	CO5
5.1	Data space weighting		
5.2	Cost-sensitive methods.		
<b>6</b>	<b>Project Implementation</b>	3	CO6
<b>Total Hours</b>		<b>28</b>	

**Course Designers:**

1. Mr. Sudarsun Santhiappan : [sudar@buddi.ai](mailto:sudar@buddi.ai)  
Industry : Chief Scientist @ BUDDI.AI, India
2. Dr.R. Suganya : [rsuganya@tce.edu](mailto:rsuganya@tce.edu)
3. Dr.A.M. Abirami : [abiramiam.@tce.edu](mailto:abiramiam.@tce.edu)
4. Dr.A.Sheik Abdullah : [asait@tce.edu](mailto:asait@tce.edu)

**OUTCOME BASED EDUCATION  
CURRICULUM AND DETAILED SYLLABI  
FOR**

**B.Tech. INFORMATION TECHNOLOGY DEGREE PROGRAMME  
GENERAL ELECTIVES COURSES**

**FOR THE STUDENTS ADMITTED IN THE  
ACADEMIC YEAR 2018-19 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**

(A Government Aided ISO 9001:2008 certified Autonomous Institution affiliated to Anna University)

**MADURAI – 625 015, TAMILNADU**

Phone: 0452 – 2482240, 41

Fax: 0452 2483427

Web: [www.tce.edu](http://www.tce.edu)

### LIST OF GENERAL ELECTIVES COURSES

<b>S. No.</b>	<b>COURSE CODE</b>	<b>COURSE NAME</b>
1.	18ITGA0	Database Management System
2.	18ITGB0	Python for Data science
3.	18ITGC0	Object Oriented Programming with Java
4.	18ITGD0	Software Engineering
5.	18ITGE0	Cloud Technologies
6.	18ITGF0	Assistive Technology



<b>18ITGA0</b>	<b>DATABASE MANAGEMENT SYSTEM</b>	Category	L	T	P	Credit
		GE	3	0	0	3

### Preamble

This course is intended for enabling students to understand the various functionalities of Database management system and develop solutions for the real world problem. It emphasizes the need for design of database systems and provides an in depth coverage of various principles of database systems.

### Prerequisite

- None

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain structured, unstructured data and Data Base Management Systems.	19%
CO2	Apply DDL and DML Commands to solve the simple SQL query.	19%
CO3	Illustrate the use of complex query languages to populate, update and retrieve the data from database.	14%
CO4	Use PL/SQL to perform various Query operations for a given database.	22%
CO5	Apply normalization techniques to design a database for a given application.	14%
CO6	Explain transaction, concurrency control mechanism.	5%
CO7	Develop an application by incorporating database concepts with Database connectivity.	7%

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3,2.3.2,2.3.3
CO2	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO3	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO4	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO5	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO6	TPS2	Understand	Respond	Guided Response	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO7	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		S			S	S	M		L	M	M	M
CO3	S	M	L		S			S	S	M		L	M	M	M
CO4	S	M	L		S			S	S	M		L	M	M	M
CO5	S	M	L										M		
CO6	M	L											L		
CO7	S	M	L		S			S	S	M		L	M	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2 (Practical)	3	1	2	3	
Remember	20	0	20	-	-	-	20
Understand	30	0	30	-	-	-	20
Apply	50	100	50	100	100	100	60
Analyse	0	0	0	-	-	-	-
Evaluate	0	0	0	-	-	-	-
Create	0	0	0	-	-	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	-
Set	20
Guided Response	20
Mechanism	60
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\***

\*\* (2 to 3 at the cognitive level of course outcome)

**Course Outcome 1 (CO1):**

1. Discuss the main categories of data models. What are the basic differences between the relational model, the object model, and the XML model?
2. Describe the three-schema architecture. Why do we need mappings between schema levels? How do different schema definition languages support this architecture?
3. Construct the Entity Relationship (ER) diagram for the " Airline Reservation System".

**Course Outcome 2 (CO2):**

1. Consider the following relations:

Employee (empID, FirstName, LastName, address, DOB, sex, position, deptNo),  
 Department(dtptNo, deptName, mgr, empID),  
 Project(projNo, projName, deptNo),  
 Workon(empID, projNo, hoursworked).

Write the SQL statements for the following:

- List the name and addresses of all employees who work for the IT department.
- List the total hours worked by each employee, arranged in order of department number and within department, alphabetically by employee surname.
- List the total number of employees in each department for those departments with more than 10 employees.
- List the project number, project name and the number of employees who work on that project.

2. Consider the following relational schema:

Suppliers(sid:integer, sname:string, city:string, street:string)  
 Parts(pid:integer, pname:string, color:string)  
 Catalog(sid:integer, pid:integer, cost:real)

- Find the names of all suppliers who have supplied a non-blue part.
- Find the names of all suppliers who have not supplied a non-blue part.
- Find the names of all suppliers who have supplied only blue parts.
- Find the names of all suppliers who have not supplied only blue parts.
- Find the number of supplier who live in Madurai

3. Consider the following relations:

Student(snum: integer, sname: string, major: string, level: string, age: integer)

Class(name: string, meets at: string, room: string, fid: integer)

Enrolled(snum: integer, cname: string)

Faculty(fid: integer, fname: string, deptid: integer)

The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class.

Major means Subjects like history, data structures.etc. Level means Junior (JR) or Senior (SR).

Write the following queries in SQL. No duplicates should be printed in any of the answers.

- Find the names of faculty members who teach in every room in which some class is taught.
- Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.
- For each level, print the level and the average age of students for that level.
- For all levels except JR, print the level and the average age of students for that level.
- For each faculty member that has taught classes only in room R128, print the faculty member's name and the total number of classes she or he has taught.
- Find the names of students enrolled in the maximum number of classes.
- Find the names of students not enrolled in any class.

**Course Outcome 3 (CO3):**

1. Specify the following views in SQL on the COMPANY database schema

**EMPLOYEE**

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
-------	-------	-------	------------	-------	---------	-----	--------	-----------	-----

**DEPARTMENT**

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
-------	----------------	---------	----------------

**DEPT\_LOCATIONS**

<u>Dnumber</u>	<u>Dlocation</u>
----------------	------------------

**PROJECT**

Pname	<u>Pnumber</u>	Plocation	Dnum
-------	----------------	-----------	------

**WORKS\_ON**

<u>Essn</u>	<u>Pno</u>	Hours
-------------	------------	-------

**DEPENDENT**

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
-------------	-----------------------	-----	-------	--------------

- a. A view that has the department name, manager name, and manager salary for every department
  - b. A view that has the employee name, supervisor name, and employee salary for each employee who works in the 'Research' department.
  - c. A view that has the project name, controlling department name, number of employees, and total hours worked per week on the project for each project.
  - d. A view that has the project name, controlling department name, number of employees, and total hours worked per week on the project for each project *with more than one employee working on it.*
2. In SQL, specify the following queries on the database in Question No. 1 using the concept of nested queries and concepts.
- a. Retrieve the names of all employees who work in the department that has the employee with the highest salary among all employees.
  - b. Retrieve the names of all employees whose supervisor's supervisor has '888665555' for Ssn.
  - c. Retrieve the names of employees who make at least \$10,000 more than the employee who is paid the least in the company.
3. Perform Natural Join, Left Join, Right Join operation for the relations  
Suppliers (sid:integer, sname:string, city:string, street:string)  
Parts (pid:integer, pname:string, color:string)

**Course Outcome 4 (CO4):**

1. Write a PL/SQL Function to find square root and cube root of a given number
2. Consider the Employee Database  
Employee(Employee\_name,street,city)  
Works (Employee\_name, company\_name, salary)

Company(Company\_name,city)

Manages (Employee\_name,Manager\_name)

Write PL/SQL procedure to display the employee name and salary

3.Consider the following relations.

SUPPLIER(Sno, Sname)

PART(Pno, Pname)

PROJECT(Jno, Jname)

SUPPLY(Sno, Pno, Jno)

- a) Create one system defined exception and one user defined exception for any of the relation given above.
- b) Write a PL/SQL procedure to find the minimum number among 3 given numbers.

### Course Outcome 5 (CO5):

1. Consider the following relational schema:  
Suppliers(sid:integer, sname:string, city:string, street:string)  
Parts(pid:integer, pname:string, color:string)  
Catalog(sid:integer, pid:integer, cost:real)

Assume that, in the suppliers relation above, each supplier and each street within a city has a unique name, and (sname, city) forms a candidate key. No other functional dependencies are implied other than those implied by primary and candidate keys. Apply all possible Normalization techniques in the above relations and display the table before and after normalization.

2. Suppose that we have the following requirements for a university database that is used to keep track of students' transcripts:
  - a. The university keeps track of each student's name (SNAME); student number (SNUM); social security number (SSN); current address (SCADDR) and phone (SCPHONE); permanent address (SPADDR) and phone (SPPHONE); birth date (BDATE);sex(SEX);class (CLASS) (freshman, sophomore, ..., graduate); major department(MAJORCODE); minor department (MINORCODE) (if any); and degree program (PROG) (B.A., B.S., ..., PH.D.). Both SSSN and student number have unique values for each student.
  - b. Each department is described by a name (DNAME), department code (DCODE), office number (DOFFICE), office phone (DPHONE), and college (DCOLLEGE). Both name and code have unique values for each department.
  - c. Each course has a course name (CNAME), description (CDESC), course number (CNUM), number of semester hours (CREDIT), level (LEVEL), and offering department(CDEPT). The course number is unique for each course.
  - d. Each section has an instructor (INAME), semester (SEMESTER), year (YEAR), course(SECCOURSE), and section number (SECNUM). The section number distinguishes different sections of the same course that are taught during the same semester/year its values are 1, 2, 3, .up to the total number of sections taught during each semester.
  - e. A grade record refers to a student (SSN), a particular section, and a grade (GRADE).

Prepare a relational database schema for this database application. First show all the functional dependencies that should hold among the attributes. Then design relation schemas for the database that are each in 3NF or BCNF. Specify the key attributes of each relation.

3.Convert the following table that that no cyclic dependencies exist.

propertyNo	itemDescription	supplierNo
PG4	Bed	S1
PG4	Chair	S2
PG16	Bed	S2
PG4	Bed	S2

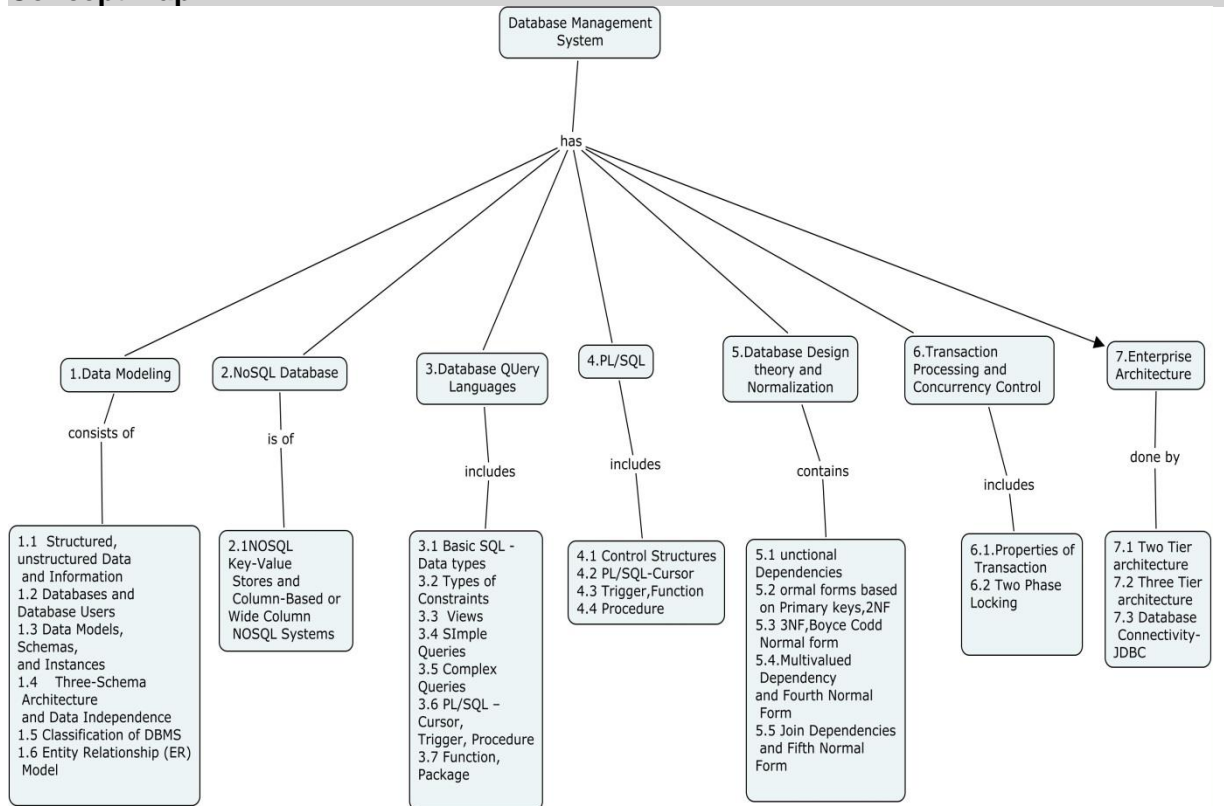
**Course Outcome 6 (CO6):**

1. List the different types of Transaction failures.
2. Describe ACID properties.
3. Explain Two phase locking protocol.

**Course Outcome 7 (CO7):**

1. Write a JDBC program to connect the Employee database and perform insertion, updation and deletion.
2. Consider student database system .Calculate the number of students in individual department by using Java Program.
3. Consider the following relational schema:  
 Suppliers (sid:integer, sname:string, city:string, street:string)  
 Parts (pid:integer, pname:string, color:string)  
 Catalog (sid:integer, pid:integer, cost:real)  
 Write a Java program to get the user preference and retrieve the Suppliers details from the database.

**Concept Map**



## Syllabus

**Database Systems Concepts:** Structured data, unstructured data and Information, Databases and Database Users. Data models and its Types, Schemas and Instances, Three Schema Architecture, Classification of DBMS.**Data Modeling:** Entity Relationship (ER) Model .**NOSQL database-** NOSQL Key-Value Stores- Column-Based or Wide Column NOSQL Systems.

**Database query language:** Basic SQL- Data types –Types of Constraints, Views, Simple and Complex Queries.

**Programming Language Extension to SQL (PL/SQL)–** Fundamentals, Control Structures, PL/SQL –Cursor, Trigger, Procedure, and Function.

**Database Design Theory and Normalization:** Functional Dependencies-Normal forms based on Primary keys-2NF-3NF-Boyce Codd Normal form-Multivalued dependence and Fourth Normal form-Join dependencies and Fifth Normal Form.

**Transaction:** Properties of Transaction. **Concurrency Control** –Two Phase Locking

**Enterprise Architecture** – Two tier architecture, Three tier architecture, Database Connectivity,JDBC.

## Learning Resources

1. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, Seventh Edition, 2016
2. Nilesh Shah, "Database Systems using Oracle", 2nd edition, Prentice Hall of India Pvt Ltd, 2007
3. C.J Date, A.Kannan, S.Swamynathan , "An Introduction to database systems", Pearson Education, Eighth Edition, 2006.
4. Abraham Silberschatz, Henry F.Korth and Sudarshan, "Database System Concepts", Tata Mcgraw-Hill, Sixth edition, 2010
5. Raghu Ramakrishnan, Johannes Gehrke, —Database Management Systemsll, McGraw Hill ,Fourth Edition, 2010
6. Pramod J. Sadalage, Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson, 2013
7. Web Reference :<http://nptel.ac.in/courses/106106093/> Course Name: Database Design.

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lecture Hours	Course Outcome
<b>1</b>	<b>Database Systems Concepts and Data Modeling</b>		
1.1	Structured data, unstructured data and Information	1	CO1
1.2	Databases and Database Users		
1.3	Data models and its Types, Schemas and Instances	1	
1.4	Three Schema Architecture	1	
1.5	Classification of DBMS	1	
1.6	Entity Relationship (ER) Model	1	
<b>2</b>	<b>NOSQL Database</b>		
2.1	NOSQL Key-Value Stores- Column-Based or Wide Column NOSQL Systems.	2	
<b>3</b>	<b>Database query language</b>		
3.1	Basic SQL- Data types	2	CO2
3.2	Types of Constraints	1	
3.3	Views	1	
3.4	Simple Queries	3	
3.5	Complex Queries	5	CO3
<b>4</b>	<b>Programming Language Extension to SQL (PL/SQL)</b>		
4.1	Control Structures	2	CO4
4.2	PL/SQL - Cursor	2	
4.3	Trigger, Function	2	
4.4	Procedure	2	
<b>5</b>	<b>Database Design Theory and Normalization: Functional Dependencies- -</b>		
5.1	Functional Dependencies	1	CO5
5.2	Normal forms based on Primary keys, 2NF	1	
5.3	3NF, Boyce Codd Normal form	1	
5.4	Multivalued dependence and Fourth Normal form	1	
5.5	Join dependencies and Fifth Normal Form	1	
<b>6</b>	<b>Transaction, Concurrency Control, and Enterprise Architecture</b>		
6.1	Properties of Transaction	1	CO6
6.2	Two Phase Locking	1	
6.3	Two tier architecture, Three Tier Architecture	1	CO7
6.4	Database Connectivity, JDBC	1	
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

1. K.V.UMA kvuit@tce.edu
2. S. SRIDEVI sridevi@tce.edu



<b>18ITGB0</b>	<b>DATA SCIENCE</b>	Category	L	T	P	Credit
		GE	3	0	0	3

### Preamble

Data Science is used in organizations for making better business decisions and is used in sciences to verify or disprove existing models or theories. This course will provide an overview of the wide area of data science, with a particular focus on the tools required to store, clean, manipulate, visualize, model, and ultimately extract information from large amounts of data.

### Prerequisite

Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain Data Science life cycle process.	11%
CO2	Explain different Data sampling techniques.	15%
CO3	Demonstrate Exploratory data analysis for the given dataset.	15%
CO4	Apply Data Visualisation technique for the given dataset.	5%
CO5	Demonstrate Supervised learning technique such as Decision tree, Regression .	22%
CO6	Demonstrate Unsupervised learning technique such as K Means ,Kmedoids clustering.	16%
CO7	Develop data models for any real time applications by following Data science life cycle process using Python.	16%

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3,2.3.2,2.3.3
CO2	TPS2	Understand	Respond	Guided Response	1.3,2.3.2,2.3.3
CO3	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO4	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO5	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO6	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4
CO7	TPS3	Apply	Value	Mechanism	1.3,2.1,2.2.3,4.3.1,4.3.2,4.3.3,4.4

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	M	L											L		
CO3	S	M	L		S			S	S	M			M	M	M
CO4	S	M	L		S			S	S	M			M	M	M
CO5	S	M	L		S			S	S	M			M	M	M
CO6	S	M	L		S			S	S	M			M	M	M
CO7	S	M	L		S			S	S	M		L	M	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	20	-	-	-	20
Understand	30	30	30	-	-	-	30
Apply	50	50	50	100	100	100	50
Analyse	0	0	0	-	-	-	-
Evaluate	0	0	0	-	-	-	-
Create	0	0	0	-	-	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	-
Set	20
Guided Response	30
Mechanism	50
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1 (CO1):**

1. Describe the standard life cycle phases of the data science project.
2. Explain Descriptive statistics.
3. Explain the different types of data.

**Course Outcome 2 (CO2):**

1. Relate sampling techniques with and without replacement.
2. Explain the different Data collection methods.
3. Explain Stratified sampling with an example.

**Course Outcome 3 (CO3):**

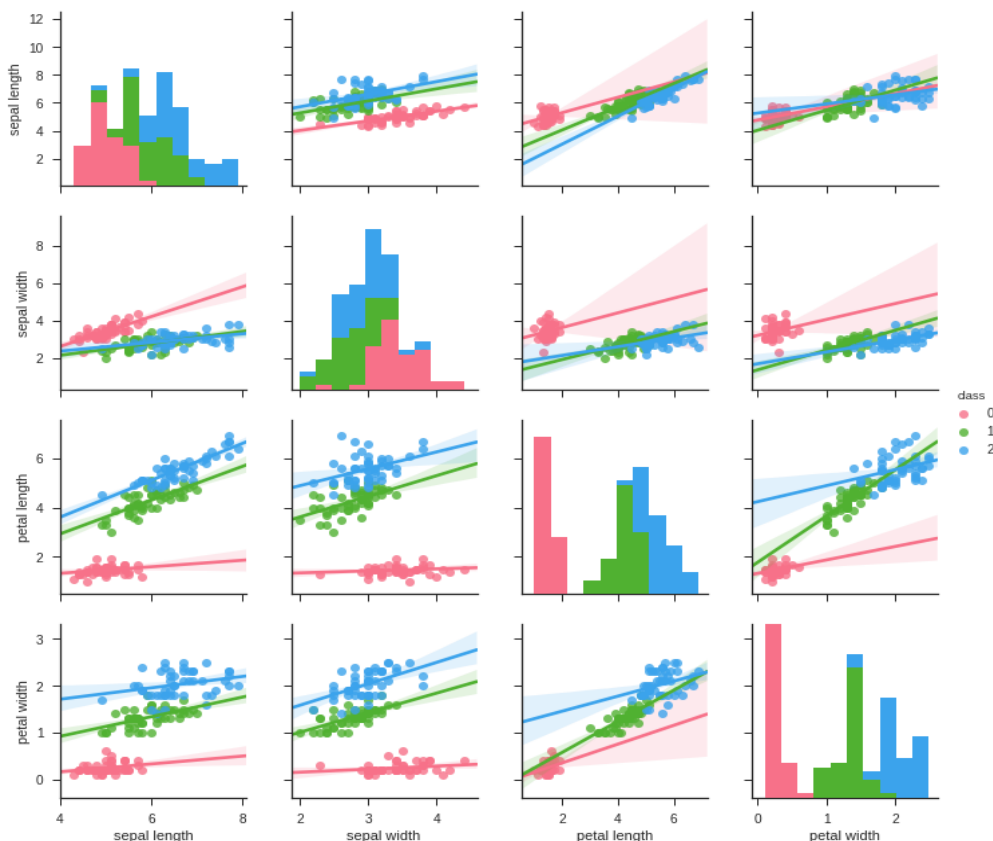
1. Consider the following data for the attribute *age*: 13, 15,16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46,52, 70.  
Use min-max normalization to transform the value 35 for *age* onto the range [0.0, 1.0].And, apply z-score normalization to transform the value 35 for *age*, where the standard deviation of *age* is 12.94 years.
2. Determine the use of Outlier data present in a dataset.
3. Suppose that the data for analysis includes the attribute *age*. The age values for the data tuples are 75, 63, 55, 47, 77, 48, 63, 54, 60, 38, and 54.
  - a. Find the mean, median and mid-range of the data.
  - b. Can you find (roughly) the first quartile (Q1) and the third quartile (Q3) of the data?
  - c. Comment on the data’s modality (i.e., bimodal, trimodal, etc.).

**Course Outcome 4 (CO4):**

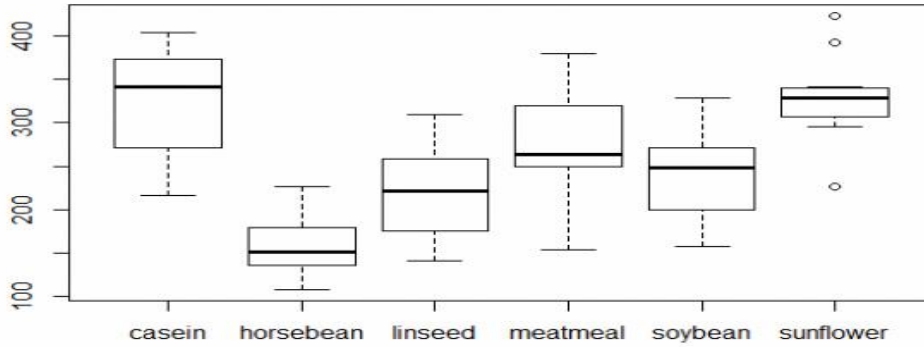
1. Use scatter plot for the following hospital data and mention the relationship between the age and fat.

<i>age</i>	23	23	27	27	39	41	47	49	50
<i>%fat</i>	9.5	26.5	7.8	17.8	31.4	25.9	27.4	27.2	31.2
<i>age</i>	52	54	54	56	57	58	58	60	61
<i>%fat</i>	34.6	42.5	28.8	33.4	30.2	34.1	32.9	41.2	35.7

2. Interpret the following Pairplot of Iris dataset.



3. Interpret the distribution of each species given in the following Box plot.



**Course Outcome 5 (CO5):**

1. Consider the following Loan Repayment dataset that contains the whether the borrower is default or not. Classify by Decision tree algorithm.  
(Hint: Discretize the Annual Income (60K to 100K as “medium” and >100K as “high”)

Tid	Home Owner	Marital Status	Annual Income	Defaulted Borrower
1	Yes	Single	125K	No
2	No	Married	100K	No
3	No	Single	70K	No
4	Yes	Married	120K	No
5	No	Divorced	95K	Yes
6	No	Married	60K	No
7	Yes	Divorced	220K	No
8	No	Single	85K	Yes
9	No	Married	75K	No
10	No	Single	90K	Yes

2. Compute the value of ‘Profit’ attribute for the following test tuple using Naïve bayes Classification. X = (Age = Middle-aged, Competition = Yes, Type = Hardware, Profit = ?)

Age	Competition	Type	Profit
Senior	Yes	Software	Down
Senior	No	Software	Down
Senior	No	Hardware	Down
Middle-aged	Yes	Software	Down
Middle-aged	Yes	Hardware	Down
Middle-aged	No	Hardware	Up
Middle-aged	No	Software	Up
Youth	Yes	Software	Up

Youth	No	Hardware	Up
-------	----	----------	----

3. Depict a predictive model using multiclass classification techniques for any real-time application.

### Course Outcome 6 (CO6):

1. Cluster the following flower data set into 3 clusters. The distance function is Euclidean distance. Use K-Means algorithm to show the final three clusters

Flower No	Sepal Length	Sepal Width	Petal Length	Petal Width
1.	5.1	3.5	1.3	0.2
2.	4.6	3.1	1.4	0.2
3.	4.5	2.3	1.5	0.2
4.	7.0	3.2	1.7	0.4
5.	5.2	2.7	1.4	0.1
6.	5.7	2.8	1.5	0.3
7.	6.5	3.0	1.7	0.2
8.	6.9	3.1	1.4	0.3

2. Use ML technique which is used to determine the optimal value of K to perform the K-Means Clustering Algorithm.
3. Consider the Iris data given above. Use K-Medoid algorithm to show the final two clusters.

### Course Outcome 7(CO7):

\*CO6 will be assessed through Mini Project / Assignment

#### Guidelines for the Mini-Project:

Group formation: Students are split into project groups with around 3 members in each group. A team can execute the project using appropriate data mining algorithms and improve the efficiency of the algorithm by pre-processing methods using any of the data mining software like R tool, Rapid Miner and python etc.

At the end of the semester, the team members have to present their project, submit their report and share their lessons learnt/best practices with other teams. Some of the activities may include: (but not limited to)

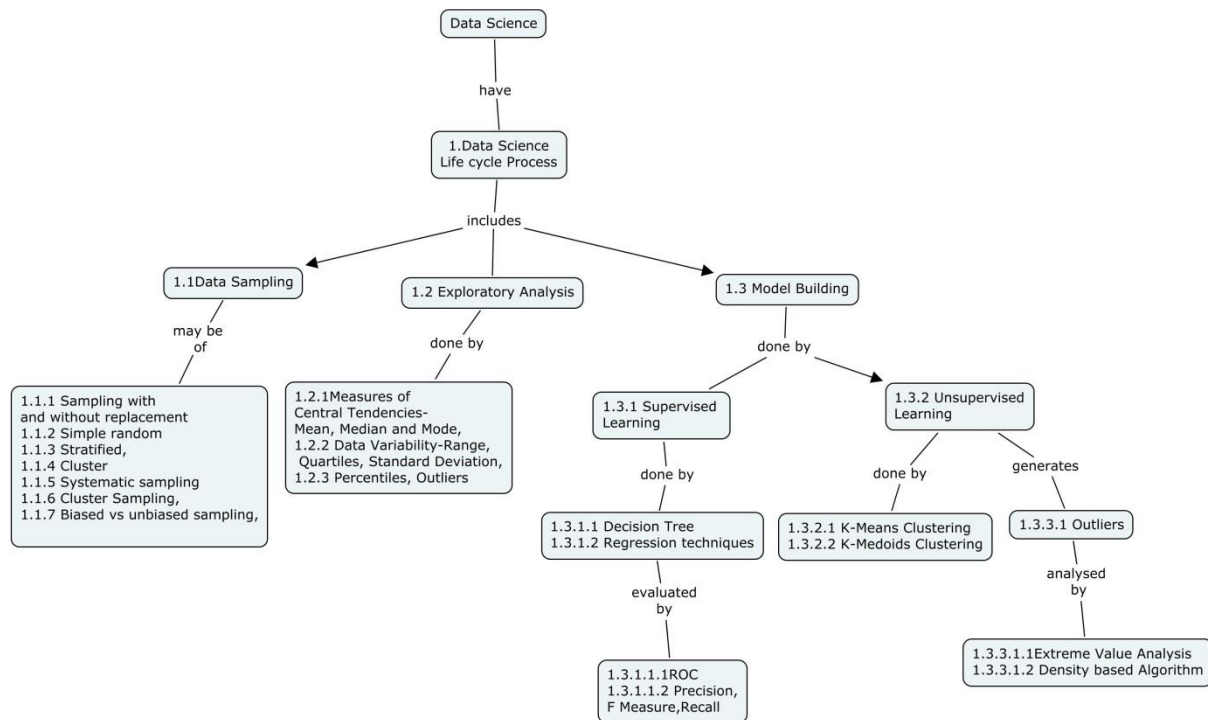
- ✓Application identification and data set collection
- ✓Selecting relevant data mining algorithm to extract knowledge from the data set
- ✓Design diagram / Data Modeling
- ✓Results and performance analysis for the chosen data mining technique
- ✓Documentation

Some of the Mini-project titles may include: (but not limited to)

- Financial Data Analysis
- Retail Industry

- Telecommunication Industry
- Biological Data Analysis
- Intrusion Detection
- Healthcare data Analysis
- Market Basket Analysis

### Concept Map



### Syllabus

**Data Science:** Data Science life cycle process. Applied statistics in business- Descriptive Statistics, Inferential Statistics. Type of Data - Quantitative vs Qualitative Data

**Data Sampling:** Sampling with and without replacement, Simple random, Stratified, Cluster, Systematic sampling, Cluster Sampling, Biased vs unbiased sampling, Sampling Error. Data Collection methods.

**Exploratory Analysis:** Measures of Central Tendencies, Mean, Median and Mode, Data Variability: Range, Quartiles, Standard Deviation, Calculating Standard Deviation-Score/Standard Score, Calculating Percentiles, Outliers

**Data visualization:** Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.

**Supervised Learning:** Decision Tree, Regression- Linear, Multiple, Logistic regression, Naïve Bayes Classification. Receiver Operating Characteristics RoC – Metrics Precision, Recall, F Measure, Accuracy – Cross validation.

**Unsupervised Learning:** K-means clustering, K-Medoids Clustering.

**Outlier Analysis:** Extreme Value Analysis, Density based algorithm

**Case Study:** Churn Prediction and Air quality prediction using Python Machine learning libraries

### Learning Resources

1. Bart Baesens, “Analytics in a Big Data World”, The Essential Guide to Data Science and its Applications, , Wiley, First edition, 2014.

2. Samir Madhavan, ” Mastering python for data science”, Ingram short title, 2010

3. Douglas Montgomery ,”Applied statistics and probability for engineers” Wiley; Sixth edition,2016.

4. Web Reference: [https://swayam.gov.in/nd1\\_noc19\\_cs59/preview](https://swayam.gov.in/nd1_noc19_cs59/preview) Course Name: Python for Data Science

### Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours	Course Outcome
<b>1</b>	<b>Data Science</b>		
1.1	Data Science life cycle Process	2	<b>CO1</b>
1.2	Applied statistics in business- Descriptive Statistics, Inferential Statistics.	1	
1.3	Type of Data - Quantitative vs Qualitative Data	1	
<b>2.</b>	<b>Data Sampling</b>		
2.1	Sampling with and without replacement	1	<b>CO2</b>
2.2	Simple random, Stratified, Cluster, Systematic sampling, Cluster Sampling	1	
2.3	Biased vs unbiased sampling	1	
2.4	Sampling Error	1	
2.5	Data Collection methods.	1	
<b>3.</b>	<b>Exploratory Analysis</b>		
3.1	Measures of Central Tendencies, Mean, Median and Mode	1	<b>CO3</b>
3.2	Data Variability: Range, Quartiles, Standard Deviation, Calculating Standard Deviation-Score/Standard Score,	2	
3.3	Calculating Percentiles, Outliers	2	
<b>4</b>	<b>Data visualization</b>		
4.1	Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.	2	<b>CO4</b>
<b>5.</b>	<b>Supervised Learning</b>		
5.1	Decision Tree	2	<b>CO5</b>
5.2	Regression- Linear, Multiple, Logistic regression	3	
5.3	Naïve Bayes Classification	1	
5.4	Receiver Operating Characteristics RoC – Metrics Precision, Recall, F Measure, Accuracy – Cross validation	2	
<b>6</b>	<b>Unsupervised Learning</b>		
6.1	K-means clustering	2	<b>CO6</b>
6.2	K-Medoids Clustering.	2	
<b>7.</b>	<b>Outlier Analysis</b>		
7.1	Extreme Value Analysis, Density based algorithm	2	
<b>8</b>	<b>Case Study</b>		

8.1	Python Machine learning libraries	3	<b>CO7</b>
8.2	Churn Prediction and Air quality prediction	3	
<b>Total</b>		<b>36</b>	

**Course Designers:**

1. K.V.UMA kvuit@tce.edu
- 2 .S. KARTHIGAskait@tce.edu



18ITGC0	Object Oriented Programming with Java	Category	L	T	P	Credit
		GE	3	0	0	3

### Preamble

This course aims to provide students with broad theoretical and practical skills in object oriented programming. This course focus on various OOP concepts like Class, Object, Encapsulation, Inheritance and Polymorphism. It also focuses on various libraries & Swing for programming an interactive real world application.

### Prerequisite

- None

### Course Outcomes

On successful completion of the course, students will be able to

Course Outcomes		Weightage*** in %
CO1	Use programming constructs like Data types, Control structures, looping statements	16
CO2	Construct object-oriented programs for the given scenario using object oriented concepts like abstraction, encapsulation, polymorphism and inheritance.	17
CO3	Apply JAR, package, and exception handling mechanism for the given problem.	17
CO4	Implement various libraries like String, I/O, Collection classes and JDBC	16
CO5	Develop interactive, user friendly software for real world applications using swing and Event Handling	17
CO6	Construct Java based solutions for various domain areas.	17

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2,2.1.5
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2,2.1.5
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2,2.1.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2,2.1.5
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2,2.1.5
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2,2.1.5,2.4.3, ,2.4.6, 2.5.1,3.1.1,3.2.1-3.2.6, 4.4.1,4.5.1

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L		L			M				M	L	L	
CO2	M	L	L		L			M				M	L	L	
CO3	M	L	L		L			M				M	L	L	
CO4	S	M	L		S			M				M	S	S	M
CO5	S	M	L		S			S	S	S		S	S	S	M
CO6	S	M	L		S			S	S	S		S	S	S	M

S- Strong; M-Medium; L-Low

### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	20	-	-	-	20
Understand	30	30	20	-	-	-	20
Apply	50	50	60	100	100	100	60
Analyze	0	0	0	-	-	-	-
Evaluate	0	0	0	-	-	-	-
Create	0	0	0	-	-	-	-

### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project /Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	-
Complex Overt Responses	-
Adaptation	-
Origination	-

**CO6 is assessed through Mini Project**

**Mini Project Details:**

1. Group formation: Students are split into project groups
2. Identify a suitable problem from various domain areas.
3. Select suitable java concepts
4. Identify appropriate library classes.
5. Implement and submit the results and findings.

**Course Level Assessment Questions****Course Outcome 1 (CO1):**

1. Explain about the benefits of Object oriented Programming.
2. Write a Java program to create 2 two-dimensional arrays which hold numbers. Write a method which takes the arrays as arguments to perform matrix multiplication.

**Course Outcome 2 (CO2):**

1. Write a Java Program to implement multilevel inheritance for the following classes: Project, Task and Module. Assume the data members and methods used.
3. Write a java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.
4. Illustrate compile time and runtime polymorphism for employee management system using a java program.
5. Discuss the ways of implementing interface with example program.

**Course Outcome 3 (CO3):**

1. Illustrate the following exceptions with a sample program and handle it using try with multiple catch.
  - Number Format Exception
  - Array Index Out of Bounds Exception
  - Arithmetic Exception
2. Differentiate checked exception from unchecked exception.
3. Write a Java program to create a package which has classes and methods to read Student Admission details.

**Course Outcome 4 (CO4):**

1. Create any 3 collections for different types of books. Find the name of the book based on the given id. Generate the bill for the purchased books.
2. List out various Collection Interfaces.
3. Write a Java Program to Copy the file contents from one to another.
4. Identify the suitable collection for storing the student name (inclusive of duplicates) in the random order. Perform the following operations.
  - Display the student name without duplicate
  - Arrange the name in ascending order
  - Count the number of students with duplicate

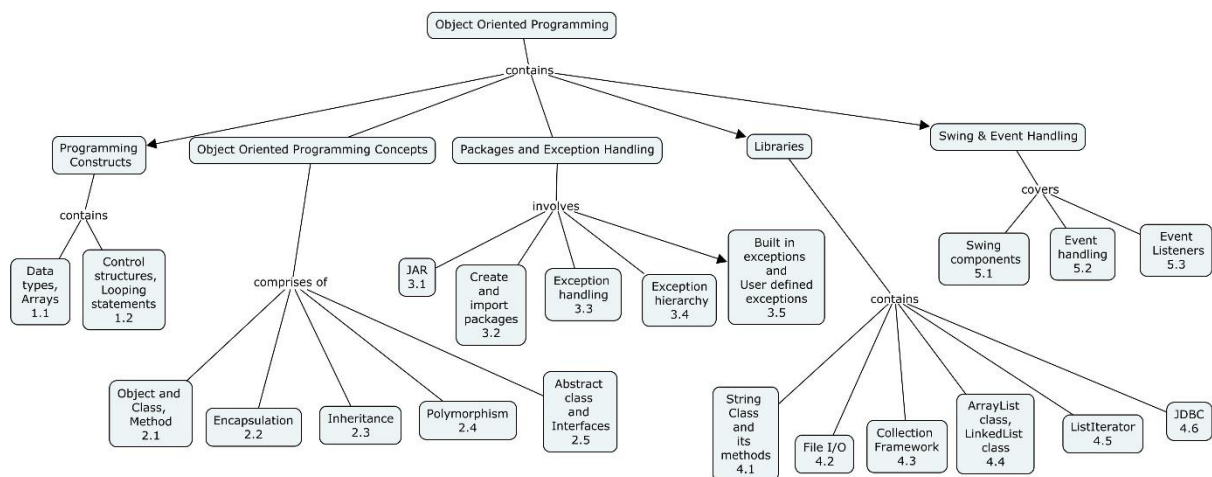
Remove the student whose index is at '5'

Identify any three levels of logs for electrical billing application. Write a program to generate it and store it in a file.

### Course Outcome 5 (CO5):

1. Design and develop an application for bill calculation of a book shop using swing with events.
2. Write an applet to perform the 4 basic arithmetic operations as buttons in a form accepting two integers in text boxes and display their result.
3. List out any four Listener Interfaces in Event Handling.
4. Recall the syntax of different layouts in swing handling.
5. Write a java program that simulates a traffic signal. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.

### Concept Map



### Syllabus

**Programming Constructs:** Data types, Arrays, Control structures, Looping statements,

**Object Oriented Programming Concepts:** Object and Class, Method, Encapsulation, Inheritance, Polymorphism, Abstract class and Interfaces

**Packages and Exception Handling:** JAR, Create and import packages, Exception handling, Exception hierarchy, Built in exceptions and User defined exceptions

**Libraries:** String Class and its methods, File I/O, Collection Framework- ArrayList class, LinkedList class, ListIterator, JDBC

**Swing & Event Handling:** Swing components, Event handling, Event Listeners

**Text Books**

- Herbert Schildt, "Java : The Complete Reference", McGraw-Hill. Ninth Edition, 2014.

**References**

- Paul Deitel and Harvey Deitel, "Java How to Program (Early Objects)", Pearson, Eleventh Edition, 2017.
- E.Balagurusamy, "Programming with Java" , McGraw-Hill, Fifth Edition, 2014.
- Kathy Sierra, "Head First Java", Shroff publications, Second edition, 2005.
- Cay S. Horstmann and Gary Cornell, "Core Java, Volume I - Fundamentals", Prentice Hall, Ninth Edition, 2013.
- Cay S. Horstmann and Gary Cornell, "Core Java, Volume II – Advanced Features : 2", Prentice Hall, Eleventh Edition, 2018.

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lecture Hours	Course outcome
<b>1</b>	<b>Programming Constructs</b>		
1.1	Data types, Arrays	2	CO1
1.2	Control structures, Looping statements	2	
<b>2</b>	<b>Object Oriented Programming Concepts</b>		
2.1	Object and Class, Method	2	CO2
2.2	Encapsulation	2	
2.3	Inheritance	2	
2.4	Polymorphism	2	
2.5	Abstract class and Interfaces	2	
<b>3</b>	<b>Packages and Exception Handling</b>		
3.1	JAR	2	CO3
3.2	Create and import packages	2	
3.3	Exception handling	2	
3.4	Exception hierarchy	1	
3.5	Built in exceptions and User defined exceptions	2	
<b>4</b>	<b>Libraries</b>		
4.1	String Class and its methods	1	CO4
4.2	File I/O	1	
4.3	Collection Framework	2	
4.4	ArrayListclass,LinkedList class	2	
4.5	ListIterator	1	
4.6	JDBC	2	
<b>5</b>	<b>Swing &amp; Event Handling</b>		
5.1	Swing components	1	CO5
5.2	Event handling	2	
5.3	Event Listeners	1	
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers**

1. Ms.C.V.Nisha Angeline cvnait@tce.edu
2. Mr.M.Manikandakumar mmrit@tce.edu

18ITGDO	SOFTWARE ENGINEERING	Category	L	T	P	Credit
		GE	3	0	0	3

**Preamble**

The course highlights the application of systematic, disciplined, quantifiable approach to the development, operation and maintenance of software. Aims to impart knowledge on the basic principles, concepts and standard practices of software lifecycle process. The course also enables the students to acquire team building and managerial skills through team project activities using agile practices

**Prerequisite**

NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Compare various software process models and Devops practices.	16
CO2	Identify functional and non-functional requirements for any given problem and document it systematically.	16
CO3	Prepare design documents with standards for any given user requirements.	25
CO4	Build optimal test cases using appropriate testing techniques.	22
CO5	Illustrate the benefits upon usage of version controlling and tracking mechanisms in software development	11
CO6	Develop an application using software engineering best practices and standards.	10

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.2,2.3.1,2.3.2
CO2	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.1.4,3.1.5
CO3	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,3.2.3,4.4.1,4.4.2
CO4	TPS3	Apply	Value	Mechanism	1.2,2.3.1,2.3.2,2.3.3,2.3.4,4.4.1,4.4.2,4.5.5
CO5	TPS2	Understand	Respond	Guided Response	1.2,4.3.4
CO6	TPS3	Apply	Value	Mechanism	1.2,2.1.1,2.1.4,3.1,4.5.1

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L				M		L	S	S			L	L	M
CO2	S	M	L		M				S	S			M	L	M
CO3	S	M	L		S								M	L	
CO4	S	M	L										M		
CO5	M	L											L		
CO6	S	M	L						S	S	S	M	M		S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	20	-	-	-	10
Understand	40	30	30	-	-	-	30
Apply	40	50	50	100	100	100	60
Analyse	-	-	-	-	-	-	-
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	100
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1(CO1):**

1. Define Software Engineering.
2. Explain the pros and cons of Waterfall model and spiral model with diagram.
3. Discuss Kanban- agile software development methodology in detail.

**Course Outcome 2(CO2):**

**Scenario:1** With the advancement of technology, Company ABC has agreed to develop the Web portal for the Hospital XYZ. Mutual agreement has been drawn to address the following requirements: Software has to maintain and manage all patient records. It needs to give results for patient and physician queries like past treatment undergone, lab reports, medical prescription, etc. using patient identification number. Patient can make appointments with his physicians or doctors online. And also the system should send reminder to the patients for periodic check-ups. Hospital makes billing for patient and it can be settled through Medi-claim policy issued by insurance company PQRS.

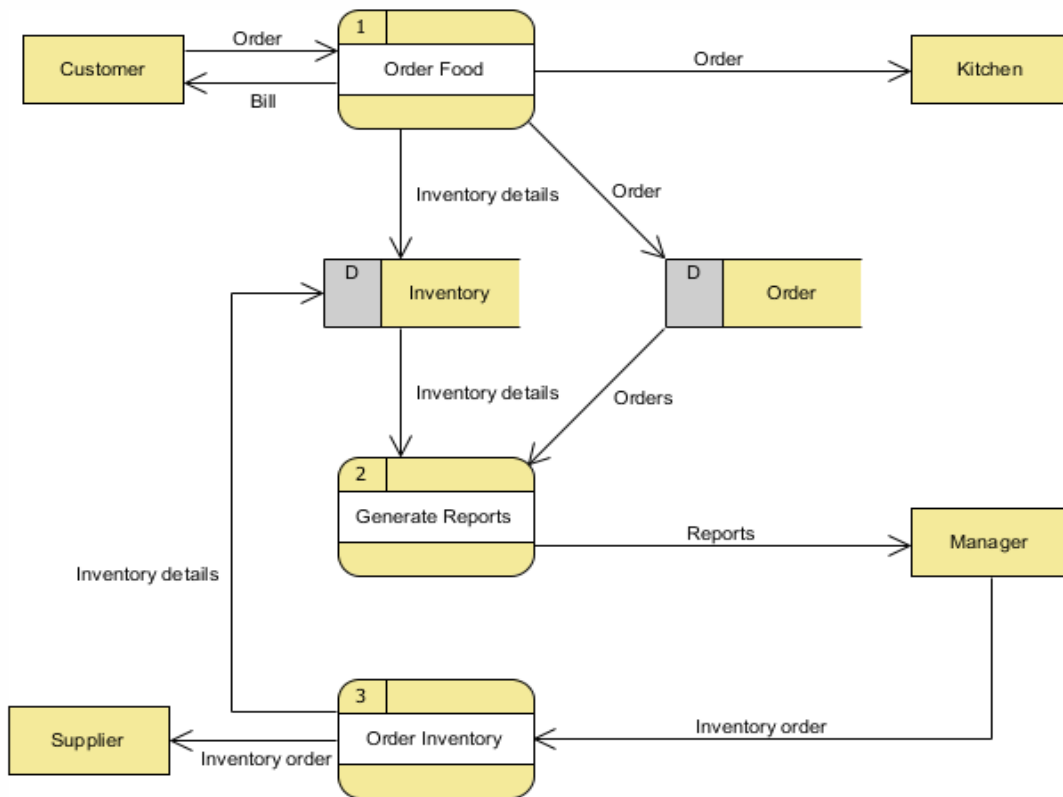
Considering the above scenario,

1. Prepare a FR and NFR document for the system.
2. Draw Use case diagram with appropriate notations.
3. Identify features and sequence of activities required and depict them using User story map

**Course Outcome 3(CO3):**

1. Draw the following Data Flow Diagrams for the **Scenario 1**
  - Level 0 DFD
  - Level 1 DFD
  - Level 2 DFD

2. Describe the given Data Flow Diagram w.r.t its notations, entities, processes and data flow



3. For the given **Scenario 1**, draw class diagram, activity and sequence diagrams

**Course Outcome 4 (CO4):**

1. Explain the various types of black-box testing methods.
2. A program specs state the following for an input field: The program shall accept an input value of 4 digit integer equal or greater than 2000 and less than or equal 8000. Determine the test cases using
  - (i) Equivalence class partitioning.
  - (ii) Boundary Value Analysis.
3. Show the proper pseudo-code and generate test cases for simple subtraction.

**Course Outcome 5 (CO5):**

1. Describe the tasks involved in Software Configuration management
2. Define version control
3. Differentiate reverse engineering and reengineering concepts

**Course Outcome 6(CO6):**

CO6 would be evaluated through Mini-project that may include but not limited to the following topics

1. Health Monitoring System
2. Smart City Applications
3. Farmer support system
4. Vehicle Tracking System





2.1	Requirement Gathering techniques	1	CO2,CO6
2.2	User story map	1	
2.3	Functional Requirements	1	
2.4	Non-functional Requirements	1	
2.5	Use Cases	1	
2.6	Documentation	1	
3	<b>Software Design</b>		
3.1	Design concepts	1	CO3
3.2	Design notations	1	CO3,CO6
3.3	Design techniques	4	
3.4	Design guidelines	1	
3.5	Design Tools	2	
3.6	Documentation		
4.	<b>Software Development</b>		
4.1	Coding standards	1	CO6
4.2	code inspection ,reviews and walkthroughs	1	
5.	<b>Software Testing</b>		
5.1	Testing process	1	CO4
5.2	Testing levels		
5.3	Black box testing	1	
5.4	White box testing	1	
5.5	Unit testing	1	
5.6	Integration testing	1	
5.7	System testing	1	
5.8	Test Case generation	2	CO4,CO6
6	<b>Software Configuration and maintenance management</b>		
6.1	Tasks	1	CO5
6.2	version control		
6.3	tracking	1	
6.4	Software release and maintenance	1	
6.5	Reverse engineering and reengineering.	1	
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

1. Santhiya.C                      santhiya.c@gmail.com
2. Pudumalar.S                    spmit@tce.edu

18ITGE0	CLOUD TECHNOLOGIES	Category	L	T	P	Credit
		GE	3	0	0	3

### Preamble

Cloud technologies are pervasive, touching our daily lives whenever accessing the World Wide Web, a mobile app, or making retail. The objective of this course is to provide a comprehensive study of cloud concepts and capabilities across the various cloud service models. The students will be able to apply principles of best practice in cloud application design and management through the study of the state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo etc.

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Explain the core concepts behind the cloud computing paradigm	19
CO2	Discuss the virtualization and their role in enabling the cloud system model	17
CO3	Make use of the appropriate cloud service model for a given application	17
CO4	Utilize the fundamental concepts of cloud storage such as Amazon S3 for the real time application	14
CO5	Choose the appropriate infrastructure to solve the core issues such as resource provisioning and managing SLAs	19
CO6	Deploy applications over commercial cloud computing infrastructures such as Amazon Web services, Google App Engine	14

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3, 2.3.1, 3.2.3
CO2	TPS2	Understand	Respond	Guided Response	1.3, 2.3.1, 3.2.3
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5
CO6	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1 – 3.2.6, 4.5.3, 4.5.5

**Mapping with Programme Outcomes and Programme Specific Outcomes**

Co s	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	M	L											L		
CO 2	M	L			L								L		
CO 3	S	M	L			L			M	L	M	M	M	L	M
CO 4	S	M	L		L				L	M		M	M	L	L
CO 5	S	M	L		M	L			L	M	M	M	M	M	M
CO 6	S	M	L		L	M		L	M	M	M	M	M	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	30	20	10	-	-	-	10
Understand	30	30	30	-	-	-	30
Apply	40	50	60	100	100	100	60
Analyse	0	0	0	-	-	-	-
Evaluate	0	0	0	-	-	-	-
Create	0	0	0	-	-	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	20
Mechanism	80
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment****Course Outcome 1(CO1):**

1. Compare between cloud and On-premise computing.
2. Explain the layers of Paas Architecture.
3. List the Platforms that are used for large-scale Cloud Computing.

**Course Outcome 2(CO2):**

1. Explain VM Cloning.
2. List the key components of VM infrastructure.
3. State the main components of Vcenter Server Architecture.

**Course Outcome 3(CO3):**

1. Select the essential things that must be followed before going to cloud computing platform.
2. Identify the various modes for Implementing IaaS Strategy in cloud.
3. Model a cloud computing which will have a best system integrator.

**Course Outcome 4 (CO4):**

1. Compare and contrast various storage architectures of cloud.
2. Apply security strategies for the given cloud architecture.
3. Interpret the security criteria for building internal cloud.

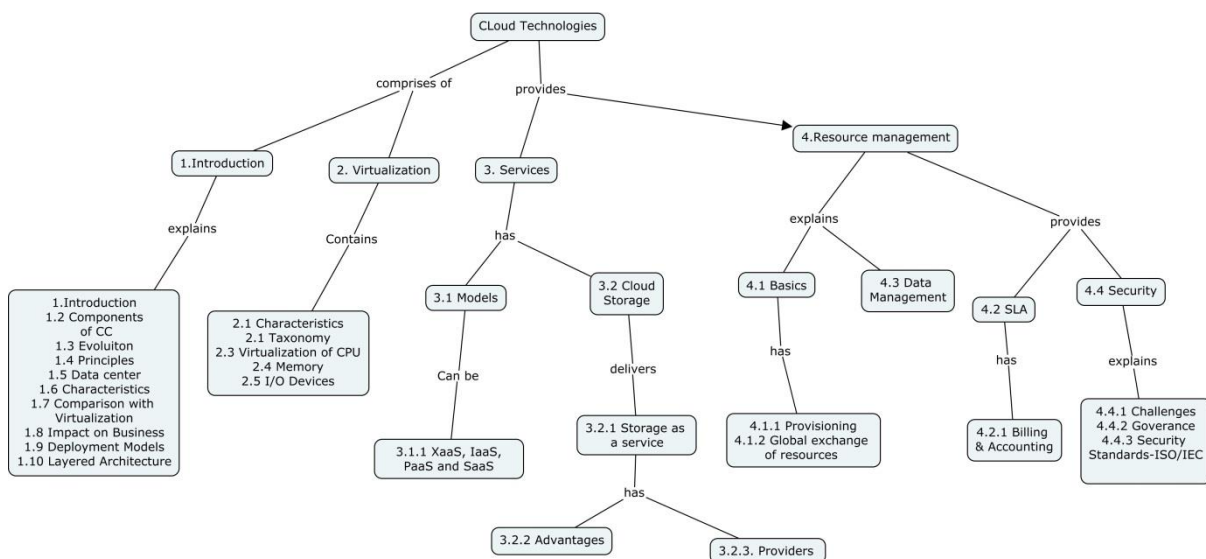
**Course Outcome 5 (CO5):**

1. Develop an internal cloud platform which satisfies win-win approach for both customer and developer.
2. Plan and deliver a best SLA strategy for your client.
3. Identify which type of resource provisioning is needed for a given demand.

**Course Outcome 6(CO6):**

1. You have a distributed application that periodically processes large volumes of data across multiple Amazon EC2 Instances. The application is designed to recover gracefully from Amazon EC2 instance failures. You are required to accomplish this task in the most cost effective way. Choose the best type of instances which meets your requirement and justify.
2. Develop a cloud environment in which you will optimize the availability of your application.
3. Select the best strategy for transporting the application data to the cloud environment.

**Concept Map**



**Syllabus**

**Introduction to Cloud Computing:** Introduction – Component of CC – Evolution of cloud computing- Underlying principles of Parallel and Distributed computing-Data center-Cloud characteristics-Comparing CC with Virtualization, Impact of CC on Business –Cloud Deployment Models, Layered Cloud Architecture Development.

**Virtualization:** Characteristics, Taxonomy, Virtualization of CPU, Memory, I/O Devices, Pros & Cons. **Case study:** Xen, KVM, VMware, and Microsoft Hyper-V.

**Cloud computing Services:** Cloud Service Models - XaaS, IaaS, PaaS and SaaS.Cloud Storage- Storage as Service-Advantages of cloud storage-Cloud storage providers-S3.

**Resource management and security in cloud:** Introduction– Resource Provisioning– Global Exchange of Cloud Resources – Service Level Agreements (SLAs), Billing & Accounting, Managing Data- Security Overview – Cloud Security Challenges – Security Governance – Security Standards-ISO/IEC Standards

**Case Study – Cloud Platforms-** Megdhoot-Amazon AWS, Google App Engine, Microsoft Azure, Cloud Software Environments - CloudSim

### Learning Resources

1. RajkumarBuyya , James Broberg, AndrzejGoscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. RajkumarBuyya, Christian Vacchiola, S.ThamaraiSelvi “Mastering Cloud Computing”, McGraw Hill, 2013.
3. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter ,Cloud Computing: A Practical Approach, , McGraw Fill, 2010.
4. ArshadeepBahga, Vijay Madiseti, Cloud Computing, A Hands on approach, University Press.
5. Barrie Sosinsky , Cloud Computing Bible, Wiley Publishers, 2010.

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>Introduction to Cloud Computing</b>		
1.1	Introduction	2	CO1
1.2	Component of CC		
1.3	Evolution of cloud computing		
1.4	Underlying principles of Parallel and Distributed computing	1	CO1
1.5	Data center	1	CO1
1.6	Cloud characteristics	1	CO1
1.7	Comparing CC with Virtualization		
1.8	Impact of CC on Business		
1.9	Cloud Deployment Models	1	CO1
1.10	Layered Cloud Architecture Development	1	
2	<b>Virtualization</b>		
2.1	Characteristics	1	CO2
2.2	Taxonomy		
2.3	Virtualization of CPU		
2.4	Memory		
2.5	I/O Devices		
2.6	Pros &Cons		
	<b>Case study:</b> Xen, KVM, VMware, and Microsoft Hyper-V	2	CO2
3	<b>Cloud computing Services</b>		
3.1	Cloud Service Models	2	CO3
3.1.1	XaaS, IaaS, PaaS and SaaS	4	
3.2	Cloud storage	1	CO4
3.2.1	Storage as Service	1	
3.2.2	Advantages of cloud storage	1	
3.2.3	Cloud storage providers-S3	2	
4	<b>Resource management and security in cloud</b>		

4.1	Introduction	1	CO5
4.1.1	Resource Provisioning		
4.1.2	Global Exchange of Cloud Resources	1	CO5
4.2	Service Level Agreements (SLAs)	2	
4.2.1	Billing & Accounting		
4.3	Managing Data	1	
4.4	Security Overview		
4.4.1	Cloud Security Challenges	1	
4.4.2	Security Governance	1	CO5
4.4.3	Security Standards-ISO/IEC Standards		
	<b>Case Study</b> – Cloud Platforms ,Megdhoot ,Amazon AWS, Google App Engine, Microsoft Azure, Cloud Software Environments - CloudSim	5	CO6
	<b>Total Lectures</b>	<b>36</b>	

**Course Designers:**

1. Dr.S.Padmavathi [spmcs@tce.edu](mailto:spmcs@tce.edu)
2. Mrs.C.Santhiya [csit@tce.edu](mailto:csit@tce.edu)

<b>18ITGF0</b>	<b>Assistive Technology</b>	Category	L	T	P	Credit
		GE	3	0	0	3

**Preamble**

This course gives the design and evaluation of Assistive Technologies with ethics, policies. It covers the attributes of many impairments and assisting or enabling technologies currently use. It's a course to design, prototype and evaluate the assistance with new/existing devices. Bridging the gap between people and assistive devices develop the client centred projects for various disability in the society.

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Fundamentals of disability, communicating with the disability people and their needs	20
CO2	Understand the existing devices and technology used to assist the disability people	20
CO3	Analyse the gap between people and devices,	12
CO4	Finding the issues in Human Interface Design, Product idea, physical and cognitive impairments	14
CO5	Client Centred Design for various disabilities	10
CO6	Case studies for various disabilities design/modify/fabricate/devices to assist the people based on their needs	24

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

**CO Mapping with CDIO Curriculum Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TSP2	Understand	Respond		1.2,2.3.1,2.3.2
CO2	TSP2	Understand	Respond		1.2, 2.2, 2.3.1, 2.3.2, 3.1.4, 3.1.5
CO3	TSP3	Apply	Value		1.2, 2.2, 2.3.1, 2.3.2, 3.1.4, 3.1.5
CO4	TSP3	Apply	Value		1.2, 2.3.1, 2.3.2, 2.3.3, 4.4.1, 4.5.3, 4.5.5
CO5	TSP4	Analyse	Organise		1.2, 4.3.4, 4.6.1
CO6	TSP4	Analyse	Organise		1.2, 4.3.4, 4.5.3, 4.5.6, 4.6.1

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L										L	L		L
CO2	M	L										M	L		L
CO3	S	M	L									M	M		L
CO4	S	M	L		L							S	M	L	L
CO5	S	S	M	L	L			L	M			S	S	L	M
CO6	S	S	M	L	M	S	M	M	M	M		S	S	S	M

S- Strong; M-Medium; L-Low



**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Continuous Assessment			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	10	10	-	-	-	10
Understand	30	30	20	20	-	-	20
Apply	50	40	40	40	50	50	40
Analyse		20	30	40	50	50	30
Evaluate							
Create							

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini project /Practical Component/Observation
Perception	-
Set	-
Guided Response	-
Mechanism	-
Complex Overt Responses	-
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1 (CO1)**

1. Discuss the first language exceptions for ability people
3. Discuss the workplace disability etiquetee
4. Describe the key elements of inclusive culture

**Course Outcome 2 (CO2)**

1. Explain about IDEA ( Individual with Disability Education Act)
2. Discuss the features of Smart Beetle device for visually challenging people
3. Discribe the purpose of mousekeys

**Course Outcome 3 (CO3)**

1. Illustrate the barriers faced by ability people and WHO initiatives
2. Show the High Tech Environment Assistive Technology for ability people
3. Illustrate Disability Theology with respect to Moral,Medical, Human, Social and econmic model

**Course Outcome 4 (CO4)**

1. Illustrate orthotics and prosthetics devices with diagram
2. List the accessibility desing aspects for ability people
3. Illustrate the working of Augmentative Communication devices in detail

**Course Outcome 5 (CO5)**

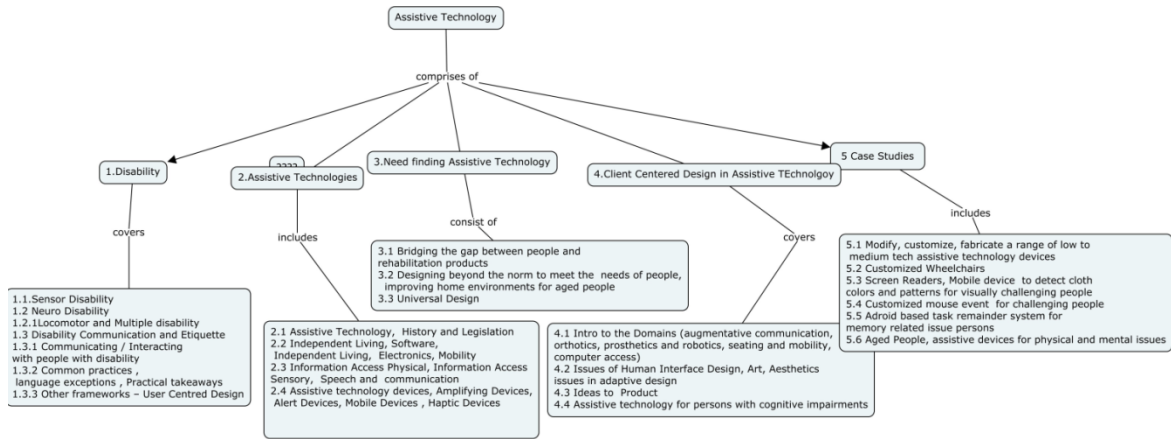
1. Discover the Enhancement needed for wheel chair based on environment factors
2. Analyse screen readers in the maket and discss its design issues
3. Compare cognitive and physical imparments

**Course Outcome 6 (CO6)**

1. Discover the mouse event for challenging people to control the mouse with eyes

2. Experiment new app to give reminders for aged people with memory issue
3. Experiment mobile device to detect cloth colors and patterns for visually challenging people

**Concept Map**



**Syllabus**

**Disabilities** – Sensor Disabilities – Neurodevelopmental Disabilities – Locomotors and Multiple Disabilities **Disability Communication and Etiquette** – Communicating / Interacting with people with disability – Common practices – people-first language exceptions – Practical takeaways – other frameworks – User Centered Design

**Assistive Technology** - History and Legislation – Independent Living – Software, Independent Living - Electronics – Mobility – Information Access Physical – Information Access – Sensory – Speech and communication– Assistive technology devices– Amplifying Devices – Alert Devices –Mobile Devices - Haptic Devices

**Need finding and Assistive Technology** – Bridging the gap between people and rehabilitation products – Designing beyond the norm to meet the needs of people- improving home environments for aged people

**Client-centered design in Assistive Technology** - Intro to the Domains (augmentative communication, orthotics, prosthetics and robotics, seating and mobility, computer access,) - Issues of Human Interface Design - Art, Aesthetics issues in adaptive design –Ideas to Product – Assistive technology for persons with cognitive impairments

**Case Studies** - Modify, customize, fabricate a range of low to medium tech assistive technology devices – Customized Wheelchairs – Screen Readers - Mobile device to detect cloth colors and patterns for visually challenging people – Customized mouse event for challenging people to control the mouse with eyes – Android-based task-reminder and sequencing system for a person with a brain injury causing deficits in working memory- Aged People – assistive devices for physical and mental issues

**Learning Resources**

1. Cook, Albert M., and Jan Miller Polgar. *Cook & Hussey's Assistive Technologies: Principles and Practice*. 3rd ed. Mosby Elsevier, 2007. ISBN: 9780323039079.
2. Bryant, D. P. & Bryant, B. R. (2012). *Assistive technology for people with disabilities*. Upper Saddle River, New York: Pearson

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Lecture Hours	CO
1	<b>Disabilities</b>		
1.1	Sensor Disabilities	1	CO1
1.2	Neurodevelopmental Disabilities , Locomotors and Multiple	2	
1.3	Disability Communication and Etiquette	1	
1.3.1	Communicating / Interacting with people with disability	1	
1.3.2	Common practices , people-first language exceptions , Practical takeaways	1	
1.3.3	Other frameworks – User Centred Design	1	
2	<b>Assistive Technology</b>		
2.1	Assistive Technology, History and Legislation	2	CO2
2.2	Independent Living, Software, Independent Living, Electronics, Mobility	2	
2.3	Information Access Physical, Information Access Sensory, Speech and communication	2	
2.4	Assistive technology devices, Amplifying Devices, Alert Devices, Mobile Devices , Haptic Devices	2	
3	<b>Need finding and Assistive Technology</b>		
3.1	Bridging the gap between people and rehabilitation products	2	CO3
3.2	Designing beyond the norm to meet the needs of people, improving home environments for aged people	2	
3.3	Universal Design	2	CO4
4	<b>Client-centered design in Assistive Technology</b>		
4.1	Intro to the Domains (augmentative communication, orthotics, prosthetics and robotics, seating and mobility, computer access)	2	CO4
4.2	Issues of Human Interface Design, Art, Aesthetics issues in adaptive design	1	CO5
4.3	Ideas to Product	1	
4.4	Assistive technology for persons with cognitive impairments	2	
5	<b>Case Studies</b>		
5.1	Modify, customize, fabricate a range of low to medium tech assistive technology devices	1	CO6
5.2	Customized Wheelchairs	1	
5.3	Screen Readers, Mobile device to detect cloth colors and patterns for visually challenging people	2	
5.4	Customized mouse event for challenging people to control the mouse with eyes	1	
5.5	Android-based task-reminder and sequencing system for a person with a brain injury causing deficits in working memory	1	
5.6	Aged People, assistive devices for physical and mental issues	3	
	Total Hours	36	

**Course Designers**

Dr.D.Tamilselvi  
Mrs.T.Manju

dtamilselvi@tce.edu  
tmanju@tce.edu

18ITGH0	Kotlin Programming	Category	L	T	P	Credit
		GE	3	0	0	3

### Preamble

The objective of the course is to provide a detailed description of Kotlin, open source programming language. The course focuses on basic concepts of Kotlin along with the object oriented programming constructs using Kotlin

### Prerequisite

- Nil

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Understand the fundamentals of the Kotlin Programming language	11
CO2	Make use of Functions and Lambdas expressions to solve a problem using Kotlin	12
CO3	Apply OOP concepts using Kotlin for the given application	25
CO4	Use Collections and Annotations to the given application	22
CO5	Illustrate interoperability between Kotlin and Java and apply the regular expressions for the given application	19
CO6	Develop professional applications using Kotlin language for any real time problem.	11

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3, 2.5.1
CO2	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3, 2.5.1
CO3	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3, 2.5.1
CO4	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3, 2.5.1
CO5	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3, 2.5.1
CO6	TPS3	Apply	Value	Mechanism	1.2, 2.1.1, 2.1.2, 2.1.5, 2.3, 2.5.1

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	M	L	L		L			M				M	L	L	
CO2	M	L	L		L			M				M	L	L	
CO3	M	L	L		L			M				M	L	L	
CO4	S	M	L		S			M				M	S	S	M
CO5	S	M	L		S			S	S	S		S	S	S	M

CO6	S	M	L		S			S	S	S		S	S	S	M
-----	---	---	---	--	---	--	--	---	---	---	--	---	---	---	---

S- Strong; M-Medium; L-Low

#### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	20	-	-	-	20
Understand	30	30	30	-	-	-	80
Apply	50	50	50	100	100	100	20
Analyze	0	0	0	-	-	-	-
Evaluate	0	0	0	-	-	-	-
Create	0	0	0	-	-	-	-

CO6 will be assessed only through Mini Project.

#### Assessment Pattern: Psychomotor

Psychomotor Skill	Mini project/Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	100
Complex Overt Responses	-
Adaptation	-
Origination	-

#### Sample Questions for Course Outcome Assessment\*\*

##### Course Outcome 1 (CO1):

1. Explain the features of Kotlin Programming Language
2. Write about input/output functionalities using Kotlin
3. Apply various kinds of typecasting using Kotlin

##### Course Outcome 2 (CO2):

1. Write a recursive function to calculate the fibonacci series.
2. Write a note on lambda expressions.
3. Apply inline functions to calculate 2 nos.

##### Course Outcome 3 (CO3):

1. Illustrate collection interfaces in Kotlin with a neat diagram
2. Use suitable collection to sort a given list of names
3. Explain in detail about annotations with a sample program

##### Course Outcome 4 (CO4):

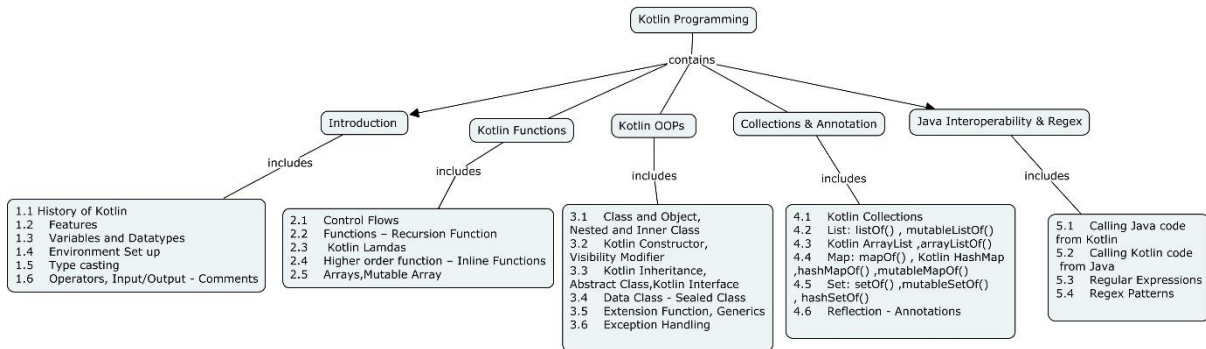
1. Apply inheritance to illustrate a Electricity bill generation in domestic and commercial places
2. Apply Interfaces to implement pet behaviour in Animal class and it subclasses
3. Illustrate Generics in Kotlin with a suitable example.
- 4.

##### Course Outcome 5 (CO5):

1. Show the interoperability of Java with Kotlin with a sample program
2. Use matches() function in Kotlin to solve a simple problem

3. Show find() function in Kotlin

**Concept Map**



**Syllabus**

**Introduction** - History of Kotlin – Features – Variables and Datatypes – Environment Set up – Type casting – Operators – Input/Output - Comments

**Kotlin Functions** - Control Flows – Functions – Recursion Function – Kotlin Lamdas – Higher order function – Inline Functions - Arrays-Mutable Array

**Kotlin OOPs** - Class and Object - Nested and Inner Class - Kotlin Constructor - Visibility Modifier - Kotlin Inheritance - Abstract Class - Kotlin Interface - Data Class - Sealed Class - Extension Function - Kotlin Generics - Exception Handling

**Collections & Annotation** - Kotlin Collections - List: listOf() - mutableListOf() - Kotlin ArrayList - arrayListOf() - Map: mapOf() - Kotlin HashMap - hashMapOf() - mutableMapOf() - Set: setOf() - mutableSetOf() - hashSetOf() – Reflection - Annotations

**Java Interoperability & Regex** - Calling Java code from Kotlin - Calling Kotlin code from Java - Regular Expressions - Regex patterns

**Learning Resources**

1. Tim Lavers, “Learn to Program with Kotlin”,Apress, 2021
2. David Griffiths and Dawn Griffiths, “Head First Kotlin: A Brain-Friendly Guide”, O’reilly; 1st edition, 2019
3. Stephen Samuel, Stefan Bocutiu,“Learn Kotlin Programming: A Comprehensive Guide to OOP, Functions, Concurrency, and Coroutines in Kotlin”,Packt,2<sup>nd</sup> edition,2019.

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Lectures	COs
1	<b>Introduction</b>		
1.1	History of Kotlin	1	CO1
1.2	Features	1	
1.3	Variables and Datatypes	1	
1.4	Environment Set up	1	
1.5	Type casting	1	
1.6	Operators, Input/Output - Comments	1	
2	<b>Kotlin Functions</b>		
2.1	Control Flows	1	CO2
2.2	Functions – Recursion Function	1	

2.3	Kotlin Lamdas	1	
2.4	Higher order function – Inline Functions	1	
2.5	Arrays,Mutable Array	1	
3	<b>Kotlin OOPs</b>		
3.1	Class and Object, Nested and Inner Class	1	CO3
3.2	Kotlin Constructor,Visibility Modifier	2	
3.3	Kotlin Inheritance, Abstract Class,Kotlin Interface	2	
3.4	Data Class - Sealed Class	2	
3.5	Extension Function, Generics	2	
3.6	Exception Handling	2	
4	<b>Collections &amp; Annotation</b>		
4.1	Kotlin Collections	2	CO4
4.2	List: listOf() , mutableListOf()	1	
4.3	Kotlin ArrayList ,arrayListOf()	1	
4.4	Map: mapOf() , Kotlin HashMap ,hashMapOf() ,mutableMapOf()	1	
4.5	Set: setOf() ,mutableSetOf() , hashSetOf()	1	
4.6	Reflection - Annotations	2	
5	<b>Java Interoperability &amp; Regex</b>		
5.1	Calling Java code from Kotlin	1	CO5
5.2	Calling Kotlin code from Java	1	
5.3	Regular Expressions	1	
5.4	Regex Patterns	1	
	<b>Total</b>	<b>36 Hours</b>	

**Course Designers:**

1. S.Karthiga [skait@tce.edu](mailto:skait@tce.edu)
2. C.V.Nisha Angeline [cvnait@tce.edu](mailto:cvnait@tce.edu)

18ITGJ0	<b>CLOUD APPLICATION DEVELOPMENT ESSENTIALS</b>	Category	L	T	P	Credit
		GE	3	0	0	3

**Preamble**

This course aims to provide fundamental understanding on components and frameworks required for cloud-based application development and deployment. It also provides insights into building an application by leveraging cloud services and other modern frameworks such as serverless and cloud-native platforms

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Recognize the essential components of three tier application architecture	10
CO2	Build applications leveraging cloud-based Platforms and infrastructure	25
CO3	Employ cloud-based databases and storage for a given application	25
CO4	Make use of cloud native components in workload deployment and migration to cloud	20
CO5	Demonstrate the use of cloud for distributed data processing	10
CO6	Examine the given requirements for building an application using an appropriate cloud-based technology stack	10

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

**CO Mapping with CDIO Curricular Framework**

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS2	Understand	Respond	Guided Response	1.3, 2.3.1, 3.2.3
CO2	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1-3.2.6, 4.5.3,4.5.5
CO3	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1-3.2.6, 4.5.3,4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1-3.2.6, 4.5.3,4.5.5
CO5	TPS3	Apply	Value	Mechanism	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1-3.2.6, 4.5.3,4.5.5
CO6	TPS2	Analyse	Organise	Complex Overt Responses	1.3, 2.4.5, 2.4.6, 2.5.1, 3.1.1, 3.2.1-3.2.6, 4.5.3,4.5.5

**Mapping with Programme Specific Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		M								M	L	
CO3	S	M	L		M			M	M	M		L	M	L	L
CO4	S	M	L		M			M	M	M		L	M	L	L



CO5	S	M	L		M			M	M	M		L	M	L	L
CO6	S	S	M	L	M			M	M	M		L	S	L	M

S- Strong; M-Medium; L-Low

#### AssessmentPattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests			Assignment			Terminal Examination
	1	2	3	1	2	3	
Remember	20	20	20	-	-	-	20
Understand	20	20	20	20	20	20	20
Apply	60	60	40	80	80	60	40
Analyse	-	-	20	-	-	20	20
Evaluate	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-

CO2-CO6 may be evaluated through Mini-Projects. Projects may be on the following (not restricted to) themes

Distributed applications such as E-Health care management system, E-Learning, E-Commerce systems

IoT systems requiring cloud for processing support

Machine learning / Deep learning applications

#### AssessmentPattern: Psychomotor

Psychomotor Skill	Miniproject/Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	80
Complex Overt Responses	20
Adaptation	-
Origination	-

#### Sample Questions for Course Outcome Assessment\*\*

\*\* (2 to 3 at the cognitive level of course outcome)

##### Course Outcome1(CO1):

1. Outline the front-end and back-end technologies.
2. Explain the client-server architecture
3. What is the role of web server?

##### Course Outcome 2(CO2):

1. How to leverage cloud-native environments for App development?
2. How to deploy a web application in Google App Engine? Explain
3. Develop a cloud application with a user interface for health care system.

##### Course Outcome 3(CO3):

1. Develop an online data store using an appropriate cloud services
2. Identify the ways of using MongoDB for creating distributed data stores
3. Make use of storage services provided by Dropbox for backup files and photos.

**Course Outcome 4 (CO4):**

1. Demonstrate the Function as a service (FaaS) model with suitable examples.
2. How to build an ecommerce application as serverless?
3. Make use of AWS Lambda for developing a distributed application with appropriate functions.

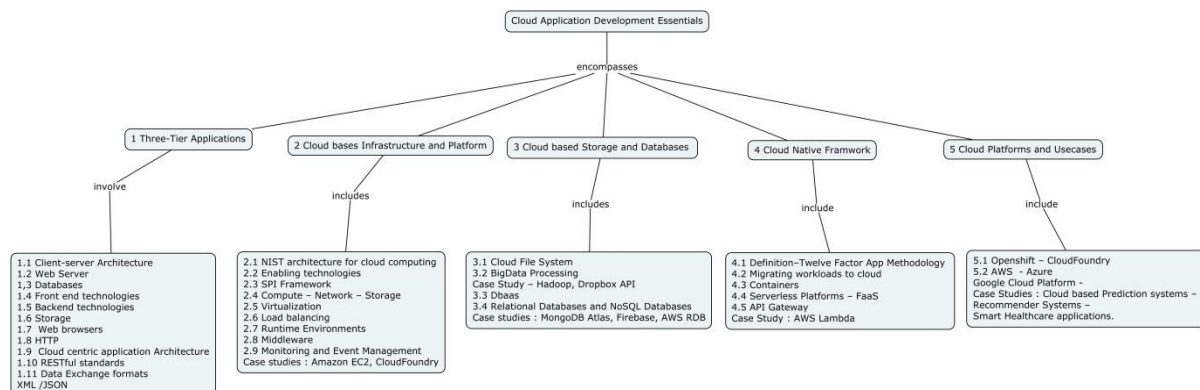
**Course Outcome 5 (CO5):**

1. Make use of cloud environment for big data processing.
2. Illustrate on how cloud and big data related to each other.
3. With an example code explain on how Hadoop analyzes data?

**Course Outcome 6(CO6):**

1. Identify the suitable type of cloud service for providing entire compute infrastructure such as server, storage and network through on-demand in terms of working principle.
2. An Organization wants to send data to users residing in almost all parts of the world out of which some of the transfers may want to be secured. Discover the support offered by cloud providers for performing the same
3. Analyze the requirements for building Movie Recommender system in cloud platform .

**Concept Map**



**Syllabus**

**Three-Tier Applications** – Client-server Architecture – Web Server – Databases – Front end technologies – Backend technologies - Storage – Web browsers – HTTP - Cloud centric application Architecture – RESTful standards – Data Exchange formats – XML /JSON

**Cloud based Infrastructure and Platform** – NIST architecture for cloud computing – Enabling technologies –SPI Framework – Compute – Network – Storage – Virtualization – Load balancing – Runtime Environments –Middleware - Monitoring and Event Management – Case studies : Amazon EC2, CloudFoundry

**Cloud based Storage and Databases** -Cloud File System –BigData Processing – Case Study – Hadoop, Dropbox API - DbaaS – Relational Databases and NoSQL Databases, Case studies : MongoDB Atlas, Firebase, AWS RDB

**Cloud Native Framework**–Definition – Twelve Factor App Methodology – Migrating workloads to cloud –Containers – Serverless Platforms – FaaS- API Gateway – Case Study : AWS Lambda

**Cloud Platforms and usecases** – Openshift – CloudFoundry – AWS - Azure – Google Cloud Platform - Case Studies : Cloud based Prediction systems – Recommender Systems – Smart Healthcare applications.

### Learning Resources

1. Huang, Dijiang, and Huijun Wu. *Mobile cloud computing: foundations and service models*. Morgan Kaufmann, 2017.
2. Understanding Cloud Native Applications - <https://www.redhat.com/en/topics/cloud-native-apps>
3. Amies, Alex. *Developing and hosting applications on the cloud*. IBM Press, 2012.
4. How to build a web app: A beginner's guide (2021) - <https://budibase.com/blog/web-application-development/>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
<b>1.</b>	<b>Three-Tier Applications</b>		
1.1	Client-server Architecture	1	CO1
1.2	Web Server – Databases - Storage		CO1
1.3	Front end technologies	1	CO1
1.4	Backend technologies		CO1
1.5	Web browsers – HTTP	1	CO1
1.6	Cloud centric application Architecture		CO1
1.7	Web Services - SOA	1	CO1
1.8	RESTful standards		CO1
<b>2.</b>	<b>Cloud based Infrastructure and Platform</b>		CO2
2.1	NIST architecture for cloud computing	1	CO2
2.2	Enabling technologies		CO2
2.3	SPI Framework	1	CO2
2.4	Compute – Network – Storage	2	CO2
2.5	Virtualization	1	CO2
2.6	Load balancing	1	CO2
2.7	Middleware		CO2
2.8	Monitoring and Event Management	1	CO2
	Case studies : Amazon EC2, CloudFoundry	1	CO2
<b>3</b>	<b>Cloud based Storage and Databases</b>		
3.2	Cloud File System	1	CO5
3.3	BigData Processing	1	CO5
3.4	Case Study – Hadoop, Dropbox API	3	CO3
3.5	DbaaS – Relational Databases and NoSQL Databases	1	CO3
3.6	Case studies : MongoDB Atlas, Firebase, AWS RDB	2	CO3
<b>4</b>	<b>Cloud Native Framework</b>		
4.1	Definition – Twelve Factor App Methodology	2	CO4
4.2	Migrating workloads to cloud	1	CO4
4.3	Containers	2	CO4
4.4	Serverless Platforms – FaaS	1	CO4
4.5	API Gateway – Case Study : AWS Lambda	2	CO4
<b>5</b>	<b>Cloud Platforms and usecases</b>		
4.1	Openshift – CloudFoundry	2	CO4
4.2	AWS - Azure – Google Cloud Platform	2	CO4

4.3	Case Studies : Cloud based Prediction systems –	2	CO4
4.4	Recommender Systems – Smart Healthcare applications.	2	CO5
<b>Total Lecture Hours</b>		<b>36</b>	

**Course Designers:**

1. S.Padmavathi                      spmcse@tce.edu
2. S.Thiruchadai Pandeewari    eshwarimsp@tce.edu

**CURRICULUM AND DETAILED SYLLABI**

**FOR**

**B.TECH INFORMATION TECHNOLOGY DEGREE PROGRAMME**

**INDUSTRY SUPPORTED COURSES**

**FOR THE STUDENTS ADMITTED IN THE**

**ACADEMIC YEAR 2018-19 ONWARDS**

**THIAGARAJAR COLLEGE OF ENGINEERING**

(A Government Aided Autonomous Institution affiliated to Anna University)

**MADURAI – 625 015, TAMILNADU**

Phone: 0452 – 2482240, 41

Fax: 0452 2483427

Web: [www.tce.edu](http://www.tce.edu)

18IT1F0	Knowledge Graph and its Applications	Category	L	T	P	Credit
		PE	1	0	1	1

### Preamble

The course on Knowledge Graph (KG) provides useful insights based on the representation, construction and thus establishes a framework for data integration, unification and analytics. It also facilitates the student by interpreting the real-world problems by examining knowledge graph along with supervised and unsupervised learning algorithms.

### Prerequisite

18IT530 Data Mining

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage*** in %
CO1	Select suitable Knowledge Graph representations for the real-world application.	30%
CO2	Construct and enrich knowledge graph using NER, Relation extraction, entity resolution and link prediction algorithms.	30%
CO3	Analyse the performance of the knowledge graph algorithms for the specified use-cases.	40%

\*\*\* Weightage depends on Bloom's Level, number of contact hours,

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.3, 3.2, 4.4.1 – 4.4.3
CO2	TPS3	Apply	Value	Mechanism	1.3, 3.2, 4.4.1 – 4.4.3
CO3	TPS4	Analyze	Organize	Complex Overt Responses	1.3, 2.5.1, 3.1, 3.2, 4.4.1 – 4.4.3, 4.5.3

### Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L		M							M	M	L	L
CO2	S	M	L		M							M	M	L	L
CO3	S	S	M	L	S	S	M	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

### Assessment Pattern: Cognitive Domain

Cognitive Levels	Continuous Assessment Tests / Mini Project	Review
Remember	-	-
Understand	30	30
Apply	40	40
Analyse	30	30

Evaluate	-	-
Create	-	-

### Assessment Pattern: Psychomotor

Psychomotor Skill	Miniproject /Assignment/Practical Component
Perception	-
Set	-
Guided Response	20
Mechanism	50
ComplexOvert Responses	30
Adaptation	-
Origination	-

### Sample Questions for Course Outcome Assessment\*\*

#### Course Outcome 1(CO1):

1. Describe the components of the Knowledge Graph.
2. Compare RDF Triple stores and Labeled property Graphs.
3. Identify the subjects, objects, predicates and formulate the RDF triples for the given statement: There is a Person identified by <http://www.w3.org/People/EM/contact#me>, whose name is Eric Miller, whose email address is e. miller123(at)example, and whose title is Dr.

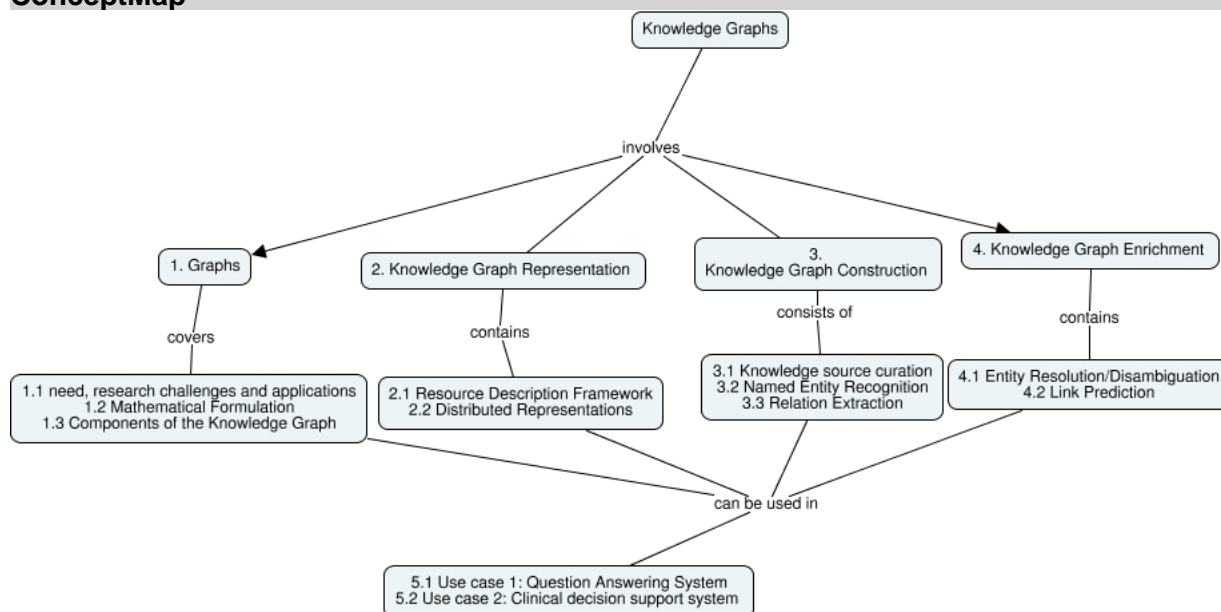
#### Course Outcome 2(CO2):

1. Discuss the various terminologies and algorithms used for link prediction.
2. Build a Knowledge Graph for the given Wikipedia data using Named Entity Recognition.
3. Express as a KG the sentence " Michael's lawyer and friend, John Robbins, represented him on a felony charge in the District Court of Oz. Oz is the capital of Netherland. In attendance at the court were Cowardly Lion and the Wicked Witch of the West". How many relations and entities are in your KG? Are there events in your KG?

#### Course Outcome 3(CO3):

1. Develop a Knowledge Graphs and extract the relations for the use case Clinical decision support system.
2. Build a Knowledge Graph for each source and apply entity resolution for the application news articles.
3. Apply link prediction for the use case Clinical decision support system. Develop pseudo code for the above.

## ConceptMap



## Syllabus

**Knowledge Graphs** – Introduction, need, research challenges and applications, Mathematical Formulation, components of the Knowledge Graph, Relationship between semantic web and Knowledge graph

**Knowledge Graph Representation** - Resource Description Framework, Distributed Representations

**Knowledge Graph Construction** - Knowledge source curation, Named Entity Recognition (NER)- Approaches for NER, Relation Extraction (RE) – Techniques for RE

**Knowledge Graph Enrichment** - Entity Resolution/Disambiguation, Link Prediction

**Knowledge Graph Applications** - Use case 1: Question Answering System, Use case 2: Clinical decision support system

## Learning Resources

1. Mayank Kejriwal, Craig A. Knoblock and Pedro Szekely, “Knowledge Graphs - Fundamentals, Techniques, and Applications”, First Edition, MIT Press, 2021.
2. <https://open.hpi.de/courses/knowledgegraphs2020>
3. <https://web.stanford.edu/class/cs520/>

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours	Course Outcome
1.	<b>Knowledge Graphs</b>		CO1
1.1	Introduction, need, research challenges and applications	1	
1.2	Mathematical Formulation		
1.3	Components of the Knowledge Graph, Relationship between semantic web and Knowledge graph	1	



2	<b>Knowledge Graph Representation</b>		CO1
2.1	Resource Description Framework	1	
2.2	Distributed Representations		
3.	<b>Knowledge Graph Construction</b>		CO2
3.1	Knowledge source curation	1	
3.2	Named Entity Recognition (NER), Approaches for NER	1	
3.3	Relation Extraction (RE) – Techniques for RE		
4.	<b>Knowledge Graph Enrichment</b>		CO2
4.1	Entity Resolution/Disambiguation	1	
4.2	Link Prediction	1	
5.	<b>Knowledge Graph Applications</b>		CO3
5.1	Use case 1: Question Answering System	3	
5.2	Use case 2: Clinical decision support system	3	
	<b>Total hours</b>	13	

**Course Designers:**

1. Mr. Jeshuren Chelladurai, Research Scientist @ BUDDI.AI and Ph.D scholar@ IITM, [jeshurench@gmail.com](mailto:jeshurench@gmail.com)  
Profile page: <https://jeshuren.github.io/>
2. Mr. Sudarsun Santhiappan, Chief Scientist @ BUDDI.AI [sudar@buddi.ai](mailto:sudar@buddi.ai)  
Profile page: <https://www.linkedin.com/in/sudarsun/>
3. Dr.C.Deisy [cdcse@tce.edu](mailto:cdcse@tce.edu)
4. Dr.S.Sridevi [sridevi@tce.edu](mailto:sridevi@tce.edu)

18IT2E0	API Development and Deployment	Category	L	T	P	Credit
		PE	1	0	2	2

### Preamble

This course provides enables the learners to create, build and deploy web applications and APIs using back-end web scripting technologies like NodeJS, ExpressJS and NoSQL data models.

### Prerequisite

NIL

### Course Outcomes

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	Weightage in %
CO1	Draw architecture design diagram for three tier Web Applications	15%
CO2	Use ExpressJS for building Web Applications	15%
CO3	Develop APIs using NodeJs, ExpressJS and MongoDB or PostgreSQL using suitable data formatting	50%
CO4	Use Webpack for packaging files for deployment	10%
CO5	Use Vue.JS components for designing user interface (UI)	15%

### CO Mapping with CDIO Curriculum Framework

CO #	TCE Proficiency Scale	Learning Domain Level			CDIO Curricular Components (X.Y.Z)
		Cognitive	Affective	Psychomotor	
CO1	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3
CO2	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3
CO3	TPS4	Analyze	Organize	Complex Overt Responses	1.2, 3.2, 4.1.1, 4.2.1, 4.3.1, 4.3.2, 4.4.1 – 4.4.3, 4.5.1, 4.5.3, 4.5.5
CO4	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3
CO5	TPS3	Apply	Value	Mechanism	1.2, 3.2, 4.4.1 – 4.4.3

### Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	M	L		S							S	M	M	L
CO2	S	M	L		S							S	M	M	L
CO3	S	S	M	L	S			S	S	S	S	S	S	S	S
CO4	S	M	L		S							S	M	M	L
CO5	S	M	L		S							S	M	M	L

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

Cognitive Levels	Mini Project Review 1	Mini Project Review 2	Terminal Laboratory Examination (Project Demo)
Remember	-	-	-
Understand	40	20	40
Apply	60	50	40
Analyze	-	30	20
Evaluate	-	-	-
Create	-	-	-

**Assessment Pattern: Psychomotor**

Psychomotor Skill	Mini-project/Assignment/Practical Component
Perception	-
Set	-
Guided Response	-
Mechanism	30
Complex Overt Responses	70
Adaptation	-
Origination	-

**Sample Questions for Course Outcome Assessment\*\*****Course Outcome 1 (CO1):**

1. Draw Application Architecture Diagram for the given problem
2. Draw Class Diagram for the identified entities for the given problem
3. Draw ER Diagram for the data flow between the entities for the given problem

**Course Outcome 2 (CO2):**

1. Explain the features of ExpressJS
2. Explain the Requests – Responses mechanism of ExpressJS
3. Use ExpressJS for developing Web Applications

**Course Outcome 3 (CO3):**

1. Write suitable endpoints for APIs for the given problem
2. Identify security requirements for the given problem
3. Develop Web Application with suitable APIs and scripting languages

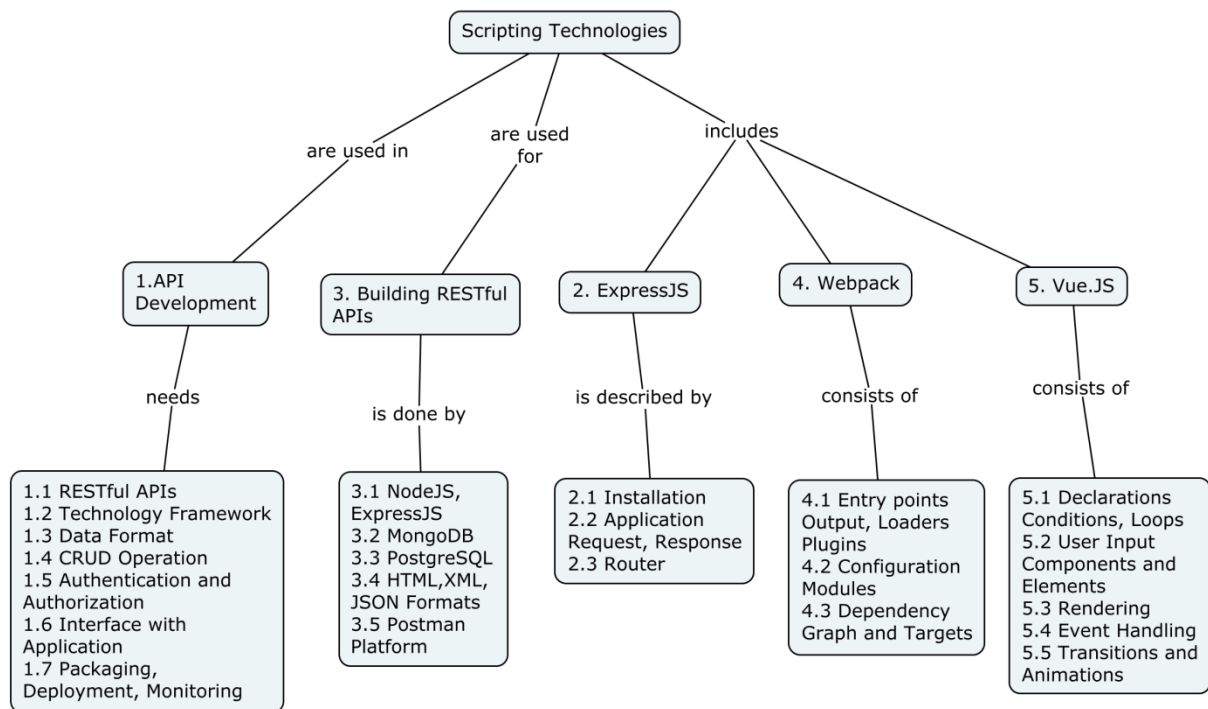
**Course Outcome 4 (CO4):**

1. Explain the purpose of Webpack
2. Use webpack for packaging files
3. Perform deployment and application testing

**Course Outcome 5 (CO5):**

1. Differentiate AngularJS, ReactJS and VueJS
2. Design simple UI using VueJS components and controls
3. Design simple animations using VueJS components and controls

**Concept Map**



**Syllabus**

**API RESTful APIs** – Technology Framework – Data Format – CRUD Operation – Authentication and Authorization - Interface with Application – Packaging - Deployment - Monitoring

**ExpressJS** Installation - Application Request, Response - Router

**Build RESTful API** NodeJS - ExpressJS – MongoDB – PostgreSQL – HTML, XML, JSON Formats, Postman platform

**Webpack** Entry points - Output - Loaders – Plugins – Configuration – Modules - Dependency Graph and Targets

**VueJS** – Declarations – Conditions – Loops - User Input Components and Elements – Rendering - Event Handling - Transitions - Animations

**Learning Resources**

1. <https://reactjs.org/docs/introducing-jsx.html>
2. <https://webpack.js.org/concepts/>
3. <https://vuejs.org/v2/guide/>
4. <http://expressjs.com/>

**Course Contents and Lecture Schedule**

Module No	Topic	No. of Lecture Hours	Course Outcomes
1.	API		CO1
1.1	RESTful APIs	1	

1.2	Technology Framework		
1.3	Dat Format		
1.4	CRUD Operation		
1.5	Authentication and Authorization	1	
1.6	Interface with Application		
1.7	Packaging, Deployment and Monitoring		
<b>2.</b>	<b>ExpressJS</b>		
2.1	Installation	2	CO2
2.2	Application Request, Response		
2.3	Router		
<b>3</b>	<b>Building RESTful APIs</b>		
3.1	NodeJS, ExpressJS	1	CO3
3.2	MongoDB	1	
3.3	PostgreSQL	1	
3.4	HTML, XML, JSON Formats	1	
3.5	Postman Platform	2	
<b>4</b>	<b>Webpack</b>		
4.1	Entry points, Output, Loaders, Plugins	2	CO4
4.2	Configuration, Modules		
4.3	Dependency graph and Targets		
<b>5</b>	<b>VueJS</b>		
5.1	Declarations, conditions, loops	1	CO5
5.2	User input Components and Elements		
5.3	Rendering		
5.4	Event Handling	1	
5.5	Transitions and Animations		
	<b>Total Lecture Hours</b>	<b>14</b>	

	Mini Project	No. of Practical Hours
1.	Team formation & problem identification	1
2	Architectural Design	2
3	Application Development with APIs	4
4	Packaging and Deployment	2
5	Documentation & Presentation	1
	<b>Total Practical Hours</b>	<b>14</b>

**Course Designers:**

1. P.Arunkumar, , Technical Lead, Zebra Technologies, Bengaluru, [XPJV68@zebra.com](mailto:XPJV68@zebra.com)
2. P.Karthikeyan karthikit@tce.edu
3. A.M.Abirami abiramiam@tce.edu



**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

**IV SEMESTER**

**21ITR10-Probability and Statistics**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examinations
	1	2	1	2	
Remember	10	10	-	-	-
Understand	30	30	-	-	30
Apply	60	60	100	100	70
Analyse					
Evaluate					
Create					

**21IT420 Algorithm Design Principles**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination (100) - Retained the previous values
	1	2	1	2	
Remember	10	10	0	0	10
Understand	20	20	0	0	20
Apply	40	50	40	60	50
Analyse	30	20	60	40	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

**21IT430 Computer Networks**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
			1	2	
Remember	20	10			10
Understand	20	30	20	20	30
Apply	60	60	80	80	60
Analyse	0	0	0	0	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

<b>21IT490 Project Management</b>					
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	
Remember	20	20			10
Understand	30	30	20	20	30
Apply	50	50	80	80	60
Analyse	0	0	0	0	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

<b>21IT440 Database Management Systems</b>					
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	
Remember	20	10			10
Understand	20	30	20	20	40
Apply	60	60	80	80	50
Analyse					0
Evaluate					0
Create					0

**21ITL10 DISCRETE MATHEMATICS AND PROBABILITY**

<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examinations</b>
	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	
Remember	10	10	-	-	-
Understand	30	30	-	-	30
Apply	60	60	100	100	70
Analyse					
Evaluate					
Create					



**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

**V SEMESTER**

<b>21IT511</b>	<b>Web Technologies</b>				
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	
Remember	20	20	0	0	20
Understand	40	40	20	20	40
Apply	40	40	80	80	40
Analyse	0	0	0	0	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

<b>21IT520 Information Security</b>					
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	
Remember	20	20	0	0	10
Understand	20	20	0	0	20
Apply	40	40	70	70	50
Analyse	20	20	30	30	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

<b>21IT530 Data Mining</b>					
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	
Remember	20	10			20
Understand	20	20	20	20	20
Apply	60	70	80	80	60
Analyse					0
Evaluate					0
Create					0

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

**21IT540 ACCOUNTING AND FINANCE**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	-	-	20
Understand	30	30	-	-	20
Apply	50	50	100	100	60
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**VI SEMESTER**

**21IT630 Programming for Internet of Things**

Cognitive Levels	Continuous Assessment Tests		Practical component/Observation	Model Exam	Terminal Examination
	CAT 1	Lab Test 2			
Remember	20	-	-	-	20
Understand	20	20	20	20	30
Apply	60	80	80	80	50
Analyse					0
Evaluate					0
Create					0

**21IT660 Mobile Application Development**

Cognitive Levels	Continuous Assessment Tests		Practical component/Observation	Model Exam	Terminal Examination
	CAT 1	Lab Test 2			
Remember	20	-	-	-	-
Understand	20	20	20	20	20
Apply	60	80	80	80	80
Analyse					
Evaluate					
Create					

**21IT610 Cloud Computing**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	10	10			10
Understand	30	20	20	20	20

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

Apply	60	60	80	70	60
Analyse		10		10	10
Evaluate					0
Create					0

**VII SEMESTER**

**21IT 710 Human Computer Interaction**

Cognitive Levels	Continuous Assessment Tests(60)		Assignment(40)		Terminal Examination(100)
	1	2	1	2	
Remember	10	10			10
Understand	20	10			20
Apply	40	50	50	50	40
Analyse	30	30	50	50	30
Evaluate	0				
Create	0				

**Programme Electives**

**21ITPA0 Machine Learning**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	30	20	0	0	20
Understand	20	20	0	0	20
Apply	50	60	70	60	60
Analyze	0	0	30	40	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

**21ITPD0 DISTRIBUTED APPLICATION DEVELOPMENT**

Cognitive Levels	Continuous Assessment Tests(60)		Assignment(40)		Terminal Examination(100)
	1	2	1	2	
Remember	10	10			10
Understand	30	30	20	20	30
Apply	60	60	80	80	60
Analyse					

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

Evaluate					
Create					
<b>21ITPE0</b>	<b>FOG COMPUTING</b>				
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination(100)
	1	2	1	2	
Remember	20	10			20
Understand	20	30			20
Apply	40	40	100	40	50
Analyse	20	20		60	10
Evaluate					
Create					

<b>21ITPK0</b>	<b>Social Network Analysis</b>				
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination (Retained previous values)
	1	2	1	2	
Remember	10	10			10
Understand	30	30			30
Apply	40	40	50	50	50
Analyse	20	20	50	50	10
Evaluate					0
Create					0

<b>21ITRE0</b>	<b>FULL STACK TECHNOLOGIES</b>				
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember					
Understand	30	40			40
Apply	70	60	100	100	60
Analyse					
Evaluate					
Create					

<b>21ITPQ0</b>	<b>Software Testing</b>				
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	20
Understand	40	40	20	20	30

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

Apply	40	40	80	80	50
Analyse	0	0	0	0	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0
<b>21ITPM0 Ethical Hacking</b>					
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	1	2	1	2	
Remember	10				10
Understand	20	10			20
Apply	40	50	60	60	40
Analyse	30	40	40	40	30
Evaluate					
Create					

<b>21ITPF0 Software Defined Networks</b>					
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	1	2	1	2	
Remember	20	10			10
Understand	40	20	20	20	30
Apply	40	60	80	60	40
Analyse		10		20	20
Evaluate					
Create					

<b>21ITRJ0 Kotlin Programming for Android</b>					
<b>Cognitive Levels</b>	<b>Continuous Assessment Tests</b>		<b>Assignment</b>		<b>Terminal Examination</b>
	1	2	1	2	
Remember	20	20			20
Understand	30	30			80
Apply	50	50	100	100	20
Analyse					
Evaluate					
Create					

<b>21ITRA0 Information Security Auditing and Management</b>			
<b>Cognitive</b>	<b>Continuous Assessment</b>	<b>Assignment</b>	<b>Terminal Examination</b>

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

Levels	Tests				(Retained previous values)
	1	2	1	2	
Remember	20	10			10
Understand	40	20			20
Apply	40	40	50	50	40
Analyse		30	50	50	30
Evaluate					0
Create					0

<b>21ITPR0 C# and .NET FRAMEWORK</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	0	0	0	0	0
Understand	50	30	0	0	30
Apply	50	70	80	80	60
Analyse	0	0	20	20	10
Evaluate	0	0	0	0	0
Create	0	0	0	0	0
<b>21ITPG0 Service Oriented computing</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	0
Understand	30	20	0	0	30
Apply	50	40	60	60	50
Analyse	0	20	40	40	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0
<b>21ITPJ0 (PSE)- Wireless and Mobile Communication</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

Remember	20	20	0	0	20
Understand	30	40	60	40	40
Apply	50	40	40	50	40
Analyse	0	0	0	10	0
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

<b>21ITPP0 Blockchain Technologies</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	20	0	0	10
Understand	30	20	0	0	20
Apply	50	40	60	60	50
Analyse	0	20	40	40	20
Evaluate	0	0	0	0	0
Create	0	0	0	0	0

**General Electives**

<b>21ITGE0 Cloud Technologies</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination
	1	2	1	2	
Remember	20	10			10
Understand	30	30			30
Apply	50	60	100	100	60
Analyse					
Evaluate					
Create					

**21ITGCO Object Oriented Programming with Java**

Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination(Retained previous values)
	1	2	1	2	
Remember	20	20			20
Understand	20	20			20

**Change in Internal Assessment Pattern -IV SEMESTER onwards  
For students admitted in the academic year 2021**

Apply	60	60	100	100	60
Analyse					
Evaluate					
Create					
<b>21ITGHO Kotlin Programming</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination(Retained previous values)
	1	2	1	2	
Remember	20	20			20
Understand	30	30			80
Apply	50	50	100	100	20
Analyse					0
Evaluate					0
Create					0
<b>21ITGDO Software Engineering</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination(Retained previous values)
	1	2	1	2	
Remember	20	20			10
Understand	40	30			30
Apply	40	50	100	100	60
Analyse					0
Evaluate					0
Create					0
<b>21ITGA0 Database Management System</b>					
Cognitive Levels	Continuous Assessment Tests		Assignment		Terminal Examination(Retained previous values)
	1	2	1	2	
Remember	20	20			20
Understand	20	20			20
Apply	60	60	100	100	60
Analyse					-
Evaluate					-
Create					-



**CURRICULUM AND DETAILED SYLLABI**

For

**VERTICALS FOR B.TECH. (HONOURS) INFORMATION TECHNOLOGY  
and  
MINOR WITH DATA SCIENCE SPECIALIZATION**

For the students admitted from the  
academic year 2021 - 2022 onwards



**THIAGARAJAR COLLEGE OF ENGINEERING**

(A Govt. Aided, Autonomous Institution affiliated to Anna University)

MADURAI – 625 015



**VERTICALS FOR B.TECH. (HONOURS)  
INFORMATION TECHNOLOGY  
PROFESSIONAL ELECTIVES**

	Honours				Minor
Professional Electives	Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V
	<b>Data Engineering</b>	<b>Cyber Security and Data Privacy</b>	<b>Cloud Technologies</b>	<b>Emerging Technologies</b>	<b>Data science</b>
<b>1.</b>	21ITPA0 Machine Learning	21ITPM0 Ethical Hacking	21ITPD0 Distributed Application Development	21ITPJ0 Wireless and Mobile Communication	21ITQA0 Machine Learning
<b>2.</b>	21ITPK0 Social Network Analysis	21ITPL0 Cyber Physical Systems	21ITPG0 Service Oriented Computing	21ITRC0 Programming Wireless Sensor Networks	21ITQB0 Artificial Intelligence
<b>3.</b>	21ITPU0 Big Data Tools and Technologies	21ITPN0 Cyber forensics	21ITPY0 Storage systems	21ITRE0 Full Stack Technologies	21ITQC0 Social Network Analysis
<b>4.</b>	21ITRF0 Data Analytics for Internet of Things	21ITPP0 Blockchain Technologies	21ITPZ0 Next Generation networks	21ITPQ0 Software Testing	Applied Data Science with Visualization
<b>5.</b>	21ITPB0 Deep Learning	21ITRA0 Information Security Auditing and Management	21ITPE0 Fog Computing	21ITPR0 C# and .NET FRAMEWORK	Business Analytics
<b>6.</b>	21ITPC0 Information Retrieval	21ITRB0 Multimedia Security	21ITPF0 Software Defined Networks	21ITRDO Cross Platform Application Development	Statistical Analysis and Computing
<b>7.</b>	21ITPV0 Reinforcement Learning		21ITRH0 Optimization Techniques for IT	21ITRJ0 Kotlin Programming for Android	
<b>7.</b>	21ITPW0 Natural Language Processing		21ITRL0 Edge computing for smart systems	21ITRK0 Enterprise Design Patterns	
<b>8.</b>	21ITRG0 Artificial Intelligence				

21ITQA0

**MACHINE LEARNING**

Category	L	T	P	Credit
EM	3	0	0	3

**Preamble**

The course on machine learning provides an emphasis on data dimensionality reduction techniques, supervised, unsupervised and neural network models. It also facilitates the student by interpreting the real world problems by examining with appropriate machine learning tools.

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course, students will be able to

CO	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Describe theory underlying machine learning concepts and techniques.	TPS2	70	70
CO2	Apply suitable dimensionality reduction techniques to select the features from the given dataset.	TPS3	70	65
CO3	Construct algorithms to learn linear and non-linear classification and Regression models.	TPS3	70	65
CO4	Implement data clustering algorithms such as Hierarchical Clustering, Gaussian Mixture Models, Expected Maximization and Hidden Markov Model to cluster the given dataset and hence identify the outliers.	TPS3	70	65
CO5	Apply neural network techniques for real life problems especially medical data set.	TPS3	70	65
CO6	Analyze the performance of various classifiers, regression models, clustering algorithms in terms of time and space complexity.	TPS4	70	60

**Mapping with Programme Outcomes**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	M	L											L		
CO2	S	M	L		M							M	M	L	L
CO3	S	M	L		M							M	M	L	L
CO4	S	M	L		M							M	M	L	L
CO5	S	M	L		M							M	M	L	L
CO6	S	S	M	L	S	M		M	M	M		S	S	S	M

S- Strong; M-Medium; L-Low

**Assessment Pattern**

CO	Assessment 1 (Theory)				Assessment 2 (Theory)				Terminal (Theory)													
	CAT 1		Assignment 1		CAT 2		Assignment 2															
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	6				
CO1	2	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	10	-	-	-	-
CO2	6	10	30	-	-	-	50	-	-	-	-	-	-	-	-	-	2	10	15	-	-	-
CO3	2	-	30	-	-	-	50	-	-	-	-	-	-	-	-	-	2	-	15	-	-	-
CO4	-	-	-	-	-	-	-	-	4	10	30	-	-	-	30	-	2	-	15	-	-	-
CO5	-	-	-	-	-	-	-	-	4	10	30	-	-	-	30	-	2	-	15	-	-	-
CO6	-	-	-	-	-	-	-	-	2	-	10	-	-	-	-	40	-	-	10	-	-	-

\*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

**Syllabus**

**Basic Concepts :** Probability, Linear Algebra

**Introduction to Machine Learning:** Components of learning – Inductive Learning Hypotheses- Learning models – geometric models, probabilistic models, logic models, Statistical Decision Theory, Bayesian Learning (ML, MAP, Bayes estimates, Conjugate priors)

**Supervised learning :**

Bayes Optimal Classifier, Naive Bayes, Nearest Neighbour Models - Bayesian Learning - Bayesian Optimal Classifier - Belief Network – SVM

**Evaluation measures:**

Ensemble Methods, Bagging Adaboost Gradient Boosting, Diagnosis and Regularization of Bias Vs Variance - Learning Curve

**Unsupervised Learning:**

Hierarchical Clustering, Divisive and Agglomerative, Anomaly Detection – Outlier Types, Techniques of Anomaly Detection

**Neural Networks:**

Basics, Early Models, Perceptron Learning, Backpropagation

**Text Book**

1. Tom M Mitchell, "Machine Learning", McGraw-Hill, Indian Edition, 2017

**Reference Books & web resources**

1. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning using Python", Wiley, First Edition, 2019..
2. Y. S. Abu-Mostafa, M. Magdon-Ismael, and H.-T. Lin, "Learning from Data", AML Book Publishers, First Edition, 2012.
3. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, First Edition, 2012.
4. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, First Edition, 2012
5. M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, First Edition, 2012.
6. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, First Edition, 2007.
7. <https://nptel.ac.in/courses/106105152/> - Introduction to Machine Learning by Prof. Sudeshna Sarkar, IIT Kharagpur
8. <https://www.coursera.org/learn/machine-learning> - Machine Learning by Prof. Andrew Ng, Stanford University

**Course Contents and Lecture Schedule**

<b>Module No.</b>	<b>Topic</b>	<b>No. of Periods</b>
<b>1</b>	<b>Basic Concepts</b>	
1.1	Probability	1
1.2	Linear Algebra	1
<b>2</b>	<b>Introduction to Machine Learning</b>	
2.1	Components of learning	1
2.2	Inductive Learning Hypotheses	1
2.3	Learning models – geometric models,	2
2.4	probabilistic models	1
2.5	logic models	1
2.6	Statistical Decision Theory	1
2.7	Bayesian Learning (ML, MAP, Bayes estimates, Conjugate priors)	2
<b>3</b>	<b>Supervised Learning</b>	
3.1	Bayes Optimal Classifier	1
3.2	Naive Bayes	1
3.3	Nearest Neighbour Models	1
3.4	Bayesian Learning	1
3.5	Bayesian Optimal Classifier	1
3.6	Belief Network	1
3.7	SVM	1
<b>4</b>	<b>Evaluation measures</b>	
4.1	Ensemble Methods	1
4.2	Bagging Adaboost Gradient Boosting	2
4.3	Diagnosis and Regularization of Bias Vs Variance	2
4.4	Learning Curve	1
<b>5</b>	<b>Unsupervised Learning</b>	
5.1	Hierarchical Clustering	1
5.2	Divisive and Agglomerative	2
5.3	Anomaly Detection– Outlier Types	1
5.4	Techniques of Anomaly Detection	2
<b>6</b>	<b>Neural Networks</b>	

Module No.	Topic	No. of Periods
6.1	Basics	1
6.2	Early Models	1
6.3	Perceptron Learning	2
6.4	Backpropagation	2
	Total	36

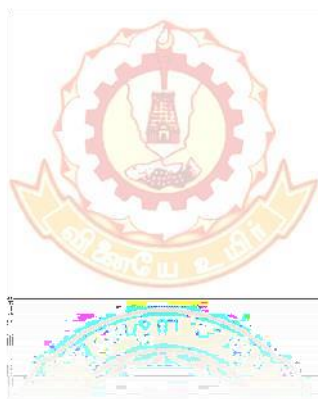
**Course Designer(s):**

1. Dr.C.Deisy, Professor, IT

cdcse@tce.edu

2. Ms.P.Vijaya Praba, Assistant Professor, IT

pvpit@tce.edu



<b>21ITQB0</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>EM</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Preamble**

This course deals with the development of intelligent information systems that can be used to solve well-defined problems with the knowledge of Search techniques, Deep Learning, and Computer Vision systems.

**Prerequisite**

- NIL

**Course Outcomes**

On the successful completion of the course, students will be able to

CO Number	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the key characteristics of intelligent agents	TPS2	80	80
CO2	Solve search problems by applying a suitable search strategy	TPS3	80	70
CO3	Find the optimal move for a given game using adversarial search	TPS3	80	70
CO4	Solve Constraint Satisfaction Problems such as Map Coloring, Job-Shop Scheduling etc using Backtracking search	TPS3	80	70
CO5	Apply different deep learning algorithms for object detection and recognition	TPS3	80	70
CO6	Examine various Search techniques , Deep learning, Computer Vision techniques for solving engineering problems in the fields of science, medicine, finance etc.	TPS4	80	70

**Mapping with Programme Outcomes**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	M	L											L		
CO2	S	M	L									L	M	M	L
CO3	S	M	L					M	L	L	L	L	M		L
CO4	S	M	L		M	L		M	M	M	L	M	M	M	L
CO5	S	M	L		M	L		M	M	M	L	M	M	M	L
CO6	S	S	M	L	M	L	L	M	M	M	L	S	M	M	M

S- Strong; M-Medium; L-Low



**Assessment Pattern**

CO	Theory				Assignment 1				Theory				Terminal									
	CAT1				Assignment 1				CAT2				Assignment 2									
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	6
CO1	2	10															2	5				
CO2	2	12	30				50										2	5	10			
CO3	2	12	30				50										2	5	10			
CO4									2	12	20				25		2	5	10			
CO5									2	12	20				25		2	5	10			
CO6									2	10	20				20	30		5	20			

\*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

**Syllabus**

**Introduction to AI and Intelligent Agents :** The Foundations of Artificial Intelligence- The History of Artificial Intelligence- Risks and Benefits of AI .Intelligent Agents - Agents and Environments- Good Behavior: The Concept of Rationality - The Nature of Environments - The Structure of Agent, Ethics in AI

**Solving Problems by Searching:** Problem-Solving Agents- Search Algorithms- Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions, Search in Complex Environments: Local Search and Optimization Problems- Hill-climbing search- Simulated annealing -Local beam search

**Adversarial Search and Games:** Game Theory- Optimal Decisions in Games – Heuristic Alpha--Beta Tree Search -Monte Carlo Tree Search- Stochastic Games -Limitations of Game Search Algorithms

**Constraint Satisfaction Problem:** Defining Constraint Satisfaction Problems: tic-tac-toe, Sudoku, n queens, cryptarithmic puzzle- Constraint Propagation: Inference in CSPs- Backtracking Search for CSPs.

**Deep Learning and Computer vision:** Simple Feed forward Networks- Convolutional Neural Networks – Recurrent Neural Networks- GANs- Transfer Learning, **Computer vision:** Image formation processing-Image Features, Feature Extraction-Classifying Images – Object Detection and Recognition: face recognition, pose estimation

**Text Book**

1. "Artificial Intelligence: A Modern Approach" by S. Russell and P. Norvig , Pearson, Fourth Edition, 2020

**Reference Books & web resources**

1. Michael Negnevitsky, "ARTIFICIAL INTELLIGENCE: A Guide to Intelligent Systems", Addison-Wesley, Third Edition, 2011.
2. Freeman and Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Pearson Education Asia, 2001.
3. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.

4. James H Martin and Daniel Jurafsky, “ Speech and Language Processing : An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition” , 2014.
5. Josh Patterson and Adam Gibson, “Deep Learning: A Practitioner's Approach” , OReilly, 2017.
6. Mohamed Elgendy , “Deep Learning for Vision Systems”, Manning,2020
7. <https://nptel.ac.in/courses/106105077>

### Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1.	<b>Introduction to AI and Intelligent Agents</b>	
1.1	The Foundations of Artificial Intelligence- The History of Artificial Intelligence- Risks and Benefits of AI	2
1.2	Intelligent Agents - Agents and Environments	1
1.3	Good Behavior: The Concept of Rationality - The Nature of Environments -The Structure of Agent	2
1.4	Ethics in AI	1
2.	<b>Solving Problems by Searching</b>	
2.1	Problem-Solving Agents- Search Algorithms Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions	3
2.2	Search in Complex Environments : Local Search and Optimization Problems	2
2.3	Hill-climbing search- Simulated annealing -Local beam search	1
3.	<b>Adversarial Search and Games</b>	
3.1	Game Theory- Optimal Decisions in Games	2
3.2	Heuristic-Alpha-Beta Tree Search -Monte Carlo Tree Search	2
3.3	Stochastic Games -Limitations of Game Search Algorithms	2
4	<b>Constraint Satisfaction Problem</b>	
4.1	Defining Constraint Satisfaction Problems- Constraint Propagation	3
4.2	Inference in CSPs- Backtracking Search for CSPs	1
5	<b>Deep Learning and Computer Vision</b>	
5.1	Simple Feed forward Networks	2
5.2	Convolutional Neural Networks –Recurrent Neural Networks	3
5.3	GANs-Transfer Learning	2
	<b>Computer Vision:</b>	
5.4	Image Processing- Features Extraction	2
5.5	Classifying Images	2
5.6	Object Detection and Recognition	3
	<b>Total periods</b>	<b>36</b>

### Course Designers:

- |                    |                          |                |
|--------------------|--------------------------|----------------|
| 1. Dr.C.Deisy,     | Professor, IT Department | cdcse@tce.edu  |
| 2. Dr.S.Padmavathi | Professor, IT Department | sPMCSE@tce.edu |

21ITQC0	<b>SOCIAL NETWORK ANALYSIS</b>	Category	L	T	P	Credit
		EM	3	0	0	3

**Preamble**

The course introduces concepts and methods of social network analysis. It aims to provide students with essential knowledge on network analysis applicable to real world data. Students will learn to extract, manage and visualize data about its structure and dynamics.

**Prerequisite**

- NIL

**Course Outcomes**

On the successful completion of the course students will be able to

CO Number	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Illustrate network data visualization using social network analysis packages	TPS3	70	70
CO2	Apply social network measures for the web graph	TPS3	70	70
CO3	Demonstrate graph mining and cascading effect using different algorithms for social networks	TPS3	70	70
CO4	Investigate social network behaviour using network properties	TPS3	70	70
CO5	Use social network theory and software packages for building social network models	TPS4	70	70
CO6	Determine the type of network suitable for modelling the real networked data	TPS4	70	70

**Mapping with Programme Outcomes and Programme Specific Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	S	M	L		S			S		L		L	M	M	L
CO2	S	M	L		S			S		L		L	M	M	L
CO3	S	M	L		S			S		L		L	M	M	L
CO4	S	M	L		S			S		L		L	M	M	L
CO5	S	S	M	L	S	S	S	S	S	S	S	S	S	S	S
CO6	S	S	M	L	S	S	S	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

**Assessment Pattern: Cognitive Domain**

CO	CAT 1			Assignment I				CAT 2			Assignment II				Terminal					
	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	5	6
TPS Scale	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	5	6
CO1	5	10				10									2	5	5			
CO2	5	10	20			20									2	5	5			
CO3	10	10	20			20				10			10		2	5	10			
CO4								10	10	20			20		2	5	10			
CO5								10	10	20			20		2	5	10	5		
CO6			10			30	20			10			20	20		5	10	5		

## Syllabus

**Introduction:** Motivation, Web Graph, Types of Social Networks, Social Network Datasets and formats, Social Network Data Visualization Tools - Networkx, Gephi, Pajek

**Properties:** Connectedness, Clustering Coefficient, Distance Measures, Connected Components, Network Robustness, Degree and Closeness Centrality, Betweenness Centrality, Subgroups, Cliques, Neighbourhood overlap, Bipartite graph, Homophily, Closure, Social Influence, Positive Negative Relationships

**Mining Graphs:** Community and Cluster detection, Link Analysis - Random Walk, Page Rank algorithms, Hubs and Authorities

**Cascading Networks:** Diffusion in networks, Power law, Preferential Attachment Models, Small World Network.

**Social Network Models** – Granovetter Model, Schelling Model, Balance Theorem

**Applications:** Link Prediction, Social media data analysis, Behavioural Analysis

## Learning Resources

1. Ian A. McCulloh, Helen L. Armstrong, Anthony N. Johnson, "Social Network Analysis with Applications", Wiley, 2013, First Edition
2. Charles Kadushin, "Understanding Social Networks: Theories, Concepts and Findings", Oxford University Press, 2011, First Edition
3. SWAYAM - NPTEL Course, "Social Networks", [https://onlinecourses.nptel.ac.in/noc19\\_cs66/preview](https://onlinecourses.nptel.ac.in/noc19_cs66/preview)
4. Coursera - "Applied Social Network Analysis in Python", <https://www.coursera.org/learn/python-social-network-analysis>
5. Xiaoming Fu, JarDer Luo, Margarete Boos, "Social Network Analysis Interdisciplinary Approaches and Case Studies", CRC Press, 2017, First Edition
6. P.M. Krishna Raj, Ankith Mohan, K.G. Srinivasa, "Practical Social Network Analysis with Python", Springer, 2018, First Edition
7. Stanley Wasserman, Katherine Faust, "Social Network analysis: methods and Applications", Cambridge University Press, 1994 (Reprinted 1999), First Edition.

## Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
<b>1</b>	<b>Introduction</b>	
1.1	Motivation	1
1.2	Web Graph	
1.3	Types of Social Network	
1.4	Datasets and Formats	1
1.5	SN Data Visualization Tools	
<b>2</b>	<b>Properties</b>	
2.1	Connectedness	1
2.2	Clustering Coefficient, Distance Measures	1
2.3	Connected Components	1
2.4	Network Robustness	1
2.5	Degree, Closeness Centrality, Betweenness	1

2.6	Subgroups, Cliques	1
2.7	Neighbourhood overlap	1
2.8	Bipartite Graph	1
2.9	Homophily, Closure, Social Influence	1
2.10	Positive Negative Relationships	1
<b>3</b>	<b>Mining Graphs</b>	
3.1	Community and Cluster Detection	3
3.2	Link Analysis	
3.2.1	Random Walk Algorithm	2
3.2.2	Page Rank Algorithm	2
3.3	Hubs and Authorities	3
<b>4</b>	<b>Cascading Networks</b>	
4.1	Diffusion in Networks	2
4.2	Power Law	1
4.3	Preferential Attachment Models	1
4.4	Small World Network	2
<b>5</b>	<b>Social Network Models</b>	
5.1	Granovetter Model	1
5.2	Schelling Model	1
5.3	Balance Theorem	1
<b>6</b>	<b>Applications</b>	
6.1	Link Prediction	1
6.2	Social media data Analysis	1
6.3	Behavioural Analysis	1
<b>Total Lecture Hours</b>		<b>36</b>

**Course Designers:**

- |                 |                   |
|-----------------|-------------------|
| 1. C.Deisy      | cdcse@tce.edu     |
| 2. S.Sridevi    | sridevi@tce.edu   |
| 3. A.M. Abirami | abiramiam@tce.edu |
| 4. K.V. Uma     | kvuit@tce.edu     |
| 5. R.Parkavi    | rpit@tce.edu      |

**CURRICULUM AND DETAILED SYLLABI**

For

**B.Tech INFORMATION TECHNOLOGY  
PROGRAMME ELECTIVES**

For the students admitted from the  
academic year 2021 - 2022 onwards



**THIAGARAJAR COLLEGE OF ENGINEERING**

(A Govt. Aided, Autonomous Institution affiliated to Anna University)

MADURAI – 625 015

21ITRL0

**EDGE COMPUTING FOR SMART SYSTEMS**

Category	L	T	P	Credit
PE	3	0	0	3

**Preamble**

This course aims to provide a comprehensive understanding of computing paradigms such as Edge/Fog/Cloud computing significant to modern IOT applications and the relevance of well-known ML/DL techniques for prominent use-cases

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course, students will be able to

CO	Course Outcome 1 (CO1)	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Review the benefits and use cases of modern computing paradigms such as Edge, Fog, and Cloud.	TPS 2	70	75
CO2	Adapt suitable networking and storage techniques for Fog/Edge-based IoT applications	TPS 3	70	75
CO3	Use containerization techniques for application deployment in Fog/Edge	TPS 3	70	65
CO4	Make use of EdgeML for data analytics applications	TPS 3	70	60
CO5	Perform Task offloading among Fog/Edge devices and the cloud using ML/DL techniques	TPS 3	70	65
CO6	Perform real-time data integration and analysis using IOT edge platforms such as AWS IOT and Azure IOT hub	TPS 3	70	65

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1.	M	L											L		
CO2.	S	M	L										M		
CO3	S	M	L		S			M	M	M			M	M	M
CO4	S	M	L		S			M	M	M	L	L	M	M	M
CO5	S	M	L	L	S			M	M	M	L	L	M	L	M
CO6	S	M	L		S			M	M	M		L	M	M	M

S- Strong; M-Medium; L-Low

**Assessment Pattern**

CO	CAT 1			ASSIGNMENT 1			CAT 2			ASSIGNMENT 2			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	10	10	-	-	-	-	-	-	-	-	-	-	5	5	-
CO2	5	10	30	-	20	-	-	-	-	-	-	-	3	5	15
CO3	5	10	20	-	-	80	-	-	-	-	-	-	2	5	10
CO4	-	-	-	-	-	-	5	10	30	-	-	40	2	5	15
CO5	-	-	-	-	-	-	5	10	20	-	-	40	3	5	10
CO6	-	-	-	-	-	-	10	10	-	-	-	20	5	5	-

## Syllabus

**Computing Paradigms:** Cloud vs Fog vs Edge computing Concepts - Characteristics-Services - Challenges

**Fog/Edge Computing:** Architecture - Motivations – Performance Enhancements - Enabling Technologies – overview of Edge-based applications.

**IoT, Edge and Fog:** Introduction to IoT platform - Communication Protocols: MQTT – CoAP – Kafka.

**Networking Requirements:** Challenges - Software Definition of Networks - Plane Separation - Control Plane - Data Plane - SDN Controllers - SDN Enabled Fog Architecture.

**IOT Edge Storage:** Design of Key-Value Stores – Apache Cassandra – Consistency Solutions

**App Deployment in Edge:** Containerization with Docker-Kubernetes

**IoT Edge Platform:** Azure IoT Hub-AWS IoT Platform

**Data Processing in Fog/Edge:** Spark Fundamentals – Installation of Apache Spark – Data processing with Spark

**Edge Intelligence for IoT:** Traditional IoT Platform – Issues – ML on Cloud vs ML on Edge

**Edge ML – EdgeML – Advantages – Applications – Workflow of Edge ML - ML-based Predictive Analytics at Edge**

**Workload offloading – Mathematical formulations for Task offloading – Task offloading techniques based on DL methods**

**Usecases:** Fog-based real-time sensor data analysis - Vehicular Networks - 5G systems

## Learning Resources

1. "Fog and Edge Computing: Principles and Paradigms", Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor), Wiley, 2019
2. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
3. "Cloud Computing: Principles and Paradigms", Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
4. "Cloud and Distributed Computing: Algorithms and Systems", Rajiv Misra, Yashwant Patel, Wiley 2020

## Lecture schedule

Module No.	Topic	No. of Periods	CO
<b>1</b>	<b>Computing Paradigms</b>		
1.1	Cloud vs Fog vs Edge computing Concepts	2	CO1
1.2	Characteristics-Services - Challenges	1	CO1
<b>2</b>	<b>Fog/Edge Computing</b>		
2.1	Architecture - Motivations	1	CO1
2.2	Performance Enhancements - Enabling Technologies	1	CO1



Module No.	Topic	No. of Periods	CO
2.3	Overview of Edge-based applications	1	CO1
<b>3</b>	<b>IoT, Edge and Fog</b>		
3.1	Introduction to IoT platform	1	CO2
3.2	Communication Protocols: MQTT – CoAP	1	CO2
3.3	Kafka	1	CO2
<b>4.</b>	<b>Networking Requirements</b>		
4.1	Challenges - Software Definition of Networks	1	CO2
4.2	Plane Separation - Control Plane - Data Plane - SDN Controllers	1	CO2
4.3	SDN Enabled Fog Architecture.	1	CO2
<b>5</b>	<b>IOT Edge Storage</b>		
5.1	Design of Key-Value Stores	1	CO2
5.2	Apache Cassandra Consistency Solutions	1	CO2
5.3	Consistency Solutions	1	CO2
<b>6</b>	<b>App Deployment in Edge</b>		
6.1	Containerization with Docker	2	CO3
6.2	Kubernetes	1	CO3
<b>7</b>	<b>IoT Edge Platform</b>		
7.1	Azure IoT Hub	1	CO6
7.2	AWS IoT Platform	2	CO6
<b>8</b>	<b>Data Processing in Fog/Edge</b>		
8.1	Spark Fundamentals	1	CO4
8.2	Installation of Apache Spark	1	CO4
8.3	Data processing with Spark	1	CO4
<b>9</b>	<b>Edge Intelligence for IoT</b>		
9.1	Traditional IoT Platform – Issues	1	CO4
9.2	ML on Cloud vs ML on Edge	2	CO4
<b>10</b>	<b>Edge ML</b>		
10.1	EdgeML – Advantages – Applications	1	CO4
10.2	Workflow of Edge ML	1	CO4
10.3	ML-based Predictive Analytics at Edge	1	CO4
<b>11</b>	<b>Workload offloading</b>		
11.1	Mathematical formulations for Task offloading	1	CO5
11.2	Task offloading techniques based on DL methods	2	CO5
<b>12</b>	<b>Usecases</b>		
12.1	Fog-based real-time sensor data analysis	1	CO6

<b>Module No.</b>	<b>Topic</b>	<b>No. of Periods</b>	<b>CO</b>
12.2	Vehicular Networks	1	CO6
12.3	5G systems	1	CO6
	<b>Total lectures</b>	<b>36</b>	

**Course Designer(s):**

- |  |                    |
|--|--------------------|
| 1. Dr.S.Padmavathi, Professor, IT,                       | spmcse@tce.edu     |
| 2. Dr.K.Indira, Assistant Professor, IT                  | kiit@tce.edu       |
| 3. Mrs.S.Thiruchadai Pandeewari, Assistant Professor, IT | eshwarimsp@tce.edu |

**CURRICULUM AND DETAILED SYLLABI**

For

**B.Tech INFORMATION TECHNOLOGY**  
**Revision of Courses**

For the students admitted from the  
academic year 2023 - 2024 onwards



**THIAGARAJAR COLLEGE OF ENGINEERING**  
(A Govt. Aided, Autonomous Institution affiliated to Anna University)  
MADURAI – 625 015

Approved in 65<sup>th</sup> Academic Council meeting on 27.5.2023

22IT161

**PROBLEM SOLVING USING  
COMPUTERS**

Category	L	T	P	Credit
ESC	1	0	4	3

**Terminal Exam Type:** Practical**Preamble**

The course on problem solving using computers is intended to introduce the students about computational thinking, the methodology of programming with emphasis on modularity and the coding of computer programs. The purpose of this course is to introduce the field of programming using Python language.

**Prerequisite**

None

**Course Outcomes**

On the successful completion of the course, students will be able to

COs	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Practice the following terms in the context of problem solving by a computer: Problem specification, input-output analysis, algorithm, flowchart, pseudo-code, High level language, assembly language, machine language, and compilation and execution.	TPS3	70	90
CO2	Solve the given problem statement using programming concepts such as data types, operators, conditions and loops	TPS3	70	90
CO3	Use of functions, scoping and abstraction in development of simple applications	TPS3	70	90
CO4	Use File I/O and exception handling in development of simple applications	TPS3	70	90
CO5	Examine the given problem to Implement, test and debug the solution using Python programming language.	TPS4	70	80
CO6	Use python libraries such as random, numpy, matplotlib, etc in the development of applications	TPS3	70	90

**Mapping with Programme Outcomes**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	M	L		L							S	M	L	L
CO2	S	M	L		L							S	M	L	L
CO3	S	M	L		L							S	M	L	L
CO4	S	M	L		L							S	M	L	L
CO5	S	S	M	L	L							S	S	L	L
CO6	S	M	L		S			S	S	S	L	S	S	M	S

S- Strong; M-Medium; L-Low

**Assessment Pattern**

CO	CAT 1						CAT 2						Model Lab & Record						Terminal Practical					
	Theory						Theory																	
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
CO1		10	10												10						10			
CO2	20	20	20												20						20			
CO3							10	10	20						20						20			
CO4							10	10	20						10						10			
CO5			20						20						20						20			
CO6															20						20			

**Syllabus**

**Introduction to Problem Solving** – Problem Specification, input-output analysis, Algorithms – Design and Analysis, Implementation of Algorithms, Flowcharts, Programming – High level languages, language translators, syntax, semantics, compilation and execution, Debugging and Program verification

**Fundamentals of Python** – The basic elements of Python, Variable types, Operators, Expressions, Operator precedence, Conditions, Loops, Nested loops – Strings, Lists, Tuples – Data type Conversions **Problem Solving Techniques** – Simple Problems and Algorithms, Solving by Analogy, Factorization, Array Techniques

**Functions, Scoping, Abstraction** – Function definition, Keyword arguments, Default values, Variable arguments – Scoping – Global variables. **Problem Solving Techniques** Recursion

**Structured types, Mutability, Higher Order Functions** – Sets, Dictionaries - Mutable Immutable data types – File I/O – Exceptions - Applications

**Python Libraries and Modules** – Math, Random, Numpy, Date & Time, Turtle, Tkinter - Applications

**Text Book**

1. John V.Gutttag, "Introduction to Computation and Programming Using Python : With Application to Understanding Data", Prentice-Hall International publishers, Second Edition, 2017
2. R.G.Dromey, "How to solve it by Computers", Pearson Education India , First Edition, 2008
3. Meenu Kohli, "Basic Core Python Programming", BPB Publications, First Edition, 2021.

**Reference Books & web resources**

1. MIT Open Courseware
2. SWAYAM/NPTEL Course – Joy of Computing using Python

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Periods
<b>1</b>	<b>Introduction to Problem Solving</b>	
1.1	Problem Specification	1
1.2	Input - Output analysis	
1.3	Algorithms - Design and Analysis, Implementation of Algorithms	
1.4	Flowcharts	1

Module No.	Topic	No. of Periods
1.5	Programming – High level languages, language translators, syntax, semantics	
1.6	Compilation and Execution	
1.7	Debugging and Program verification	
<b>2</b>	<b>Fundamentals of Python</b>	
2.1	The basic elements of Python, Variable types	1
2.2	Operators, Expressions, Operator precedence,	
2.3	Conditions	
2.4	Problem Solving Techniques – Simple Problems and Algorithms	1
2.5	Loops, Nested loops	
2.6	Problem Solving Techniques – Solving by Analogy, Factorization	1
2.7	Strings	1
2.8	Lists	1
2.9	Tuples	1
2.10	Data type Conversions	
2.11	Problem Solving Techniques – Array Techniques	
<b>3</b>	<b>Functions, Scoping, Abstraction</b>	
3.1	Function Definition	2
3.2	Keyword Arguments, Default values, Variable arguments	
3.3	Scoping – Global variables	
3.4	Problem Solving Techniques – Recursion	
<b>4</b>	<b>Structured types, Mutability, Higher Order Functions</b>	
4.1	Sets	1
4.2	Dictionaries	
4.3	Mutable Immutable data types	
4.4	File I/O	1
4.5	Exceptions	1
4.6	Applications	
<b>Total Hours</b>		<b>12</b>

#### List of Experiments

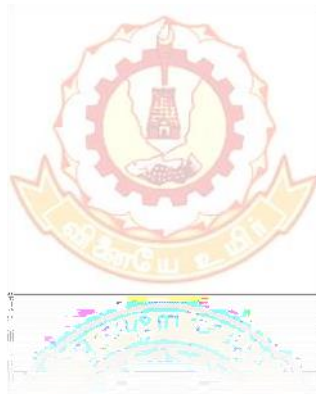
Ex.No	Experiment Name	No. of Hours	COs
1.	Simple Programs	4	CO1, CO2, CO5
2.	Branching Programs	2	CO1, CO2, CO5
3.	Looping Programs	6	CO1, CO2, CO5
4.	Applications using Strings	2	CO1, CO2, CO5
5.	Applications using Lists	4	CO2, CO5
6.	Applications using Tuples	2	CO2, CO5
5.	Functions and Scoping	6	CO3, CO5
6.	Applications using Sets, Dictionary	4	CO3, CO5
7.	Matrix Applications	4	CO3, CO5
8.	Applications using built-in and user defined Exceptions	4	CO4, CO5
9.	Applications using File Handling	4	CO4, CO5
10.	Mini-project using Python Libraries	6	CO5, CO6
<b>Total Hours</b>		<b>48</b>	

List of Problems/Applications but not limited to:

- Calculation of Simple and Compound Interest, Area and Volume for Geometry Shapes, Conversion of Currency, Temperature, etc
- Checking Leap Year, Finding the biggest/smallest number, Divisibility of Numbers
- Prime Number Generation, Fibonacci Series, Perfect Number , Armstrong Number, Pattern Generation
- Count number of vowels, consonants, digits, etc, Rotation of array/list elements, Encoder / Decoder
- Recursive approach for Factorial, Fibonacci, GCD, etc
- Merge two dictionaries, Sort dictionary based on keys/values, Set operations
- Matrix Problems like Sum of matrices, Product of Matrices, Sum of diagonal elements, Print upper/lower triangular matrix
- Copy contents of one file to another file, Print character/word/line count of file, Use Exception Handling mechanism for File I/O
- Use libraries like Turtle, Tkinter, PIL, Numpy, Random for Game Development

### Course Designers

1. P. Karthikeyan
2. A.M. Abirami



karthikit@tce.edu  
abiramiam@tce.edu

**23IT250****DIGITAL SYSTEM DESIGN**

Category	L	T	P	Credit
ESC	3	0	0	3

**Preamble**

The main objective of this subject is to make the students understand the basic building blocks of computers, logic gates, Combinational and sequential circuits.

**Prerequisite**

- Nil

**Course Outcomes**

On the successful completion of the course, students will be able to

Cos	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain different number systems and number base conversions.	TPS2	70	75
CO2	Explain the Boolean Laws and verify the Boolean theorems with Truth table.	TPS2	70	65
CO3	Simplify the Boolean expression using Map and Tabulation techniques and realize it using Logic gates.	TPS3	70	65
CO4	Design Combinational circuits like BCD to Seven Segment decoder, Code converter etc.	TPS3	70	65
CO5	Design Sequential circuits like Counters, Sequence detectors using Flip flops.	TPS3	70	65
CO6	Design a Combinational and Sequential circuit using Open Source Simulator such as Multisim.	TPS3	70	65

**Mapping with Programme Outcomes**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	M	L											L		
CO2	M	L											L		
CO3	S	M	L										M		
CO4	S	M	L										M		
CO5	S	M	L										M		
CO6	S	M	L		L			S	L	L			M	L	L

S- Strong; M-Medium; L-Low



**Assessment Pattern**

CO	CAT1			Assignment 1			CAT2			Assignment 2			Terminal		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	10	20			25								5	5	
CO2	10	20			25								5	5	
CO3		20	20			50							5	5	20
CO4							10	20	20			25	5	5	20
CO5							10	20	20			25	5	5	10
CO6												50			

**Syllabus**

**Binary Systems:** Representation of Data- Number systems and codes, Representation of unsigned and signed integers, Fixed-point representation of real numbers, Floating-point representation of real numbers, Representation of character data, Representation of signals.

**Switching Theory:** Laws of Boolean algebra, Theorems of Boolean algebra, Switching functions, Methods for specification of switching functions - Truth tables and Algebraic forms, Realization of functions using logic gates.

**Simplification of Boolean Expressions and Functions:** Algebraic methods, Canonical forms of Boolean functions, Minimization of functions using Karnaugh maps, Minimization of functions using Quine-McClusky method.

**Combinational Logic:** Combinational Circuits - Analysis and Design Procedure - Binary Adder- Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders and Encoders – Multiplexers.

**Sequential Logic: Synchronous Sequential Logic:** Models of sequential circuits - Moore machine and Mealy machine. Latches and Flip Flops. Analysis and Design Procedures – State Reduction and State Assignment. Shift Registers and Counters.

**Asynchronous Sequential Logic:** Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

**Text Book**

- 1.M. Morris Mano,"Digital Design :With an Introduction to the Verilog HDL, VHDL, and System Verilog ",Pearson,6<sup>th</sup> edition,2018.
2. M. Morris Mano,"Digital Design :Introduction to Verilog HDL",Prentice Hall of India Private Ltd,5<sup>th</sup> edition,2013.

**Reference Books & web resources**

1. Charles H.Roth, Larry L.Kinney, "Fundamentals of Logic Design:", 7<sup>th</sup>Edition,Jaico Publishing House,2013.
2. Donald D.Givone," Digital Principles and Design",Tata McGraw Hill,2003.

**Course Contents and Lecture Schedule**

Module No.	Topic	No. of Lectures
<b>1</b>	<b>Binary Systems</b>	
1.1	Representation of Data- Number systems and codes	1
1.2	Representation of unsigned and signed integers	1
1.3	Fixed-point representation of real numbers	1
1.4	Floating-point representation of real numbers	1
1.5	Representation of character data	1
1.6	Representation of signals	1
<b>2</b>	<b>Switching Theory</b>	
2.1	Laws of Boolean algebra	1
2.2	Theorems of Boolean algebra	1
2.3	Switching functions	1
2.4	Methods for specification of switching functions - Truth tables and Algebraic forms	2
2.5	Realization of functions using logic gates	1
<b>3</b>	<b>Simplification of Boolean Expressions and Functions</b>	
3.1	Algebraic methods	1
3.2	Canonical forms of Boolean functions	1
3.3	Minimization of functions using Karnaugh maps	1
3.4	Minimization of functions using Quine-McClusky method	1
<b>4</b>	<b>Combinational Logic</b>	
4.1	Combinational Circuits - Analysis and Design Procedure	2
4.2	Binary Adder- Subtractor	1
4.3	Decimal Adder - Binary Multiplier	1
4.4	Magnitude Comparator	1
4.5	Decoders and Encoders	1
4.6	Multiplexers	1
4.7	Simulation of Combinational Circuits	1
<b>5</b>	<b>Sequential Logic</b>	
5.1	<b>Synchronous Sequential Logic</b>	
5.1.1	Models of sequential circuits - Moore machine and Mealy machine	1
5.1.2	Latches and Flip Flops	1
5.1.3	Analysis and Design Procedures	2
5.1.4	State Reduction and State Assignment	1
5.1.5	Shift Registers and Counters	1
5.1.6	Simulation of Sequential Circuits	1
5.2	<b>Asynchronous Sequential Logic</b>	
5.2.1	Analysis and Design of Asynchronous Sequential Circuits	2
5.2.2	Reduction of State and Flow Tables	1
5.2.3	Race-free State Assignment	1
5.2.4	Hazards	1
<b>Total Lectures</b>		<b>36</b>

**Course Designer(s):**

1. Dr.K.V.Uma, Assistant Professor, Department of Information Technology kvuit@tce.edu
2. Mrs.R.Parkavi, Assistant Professor, Department of Information Technology rpit@tce.edu

<b>22ITL10</b>	<b>DISCRETE MATHEMATICS AND PROBABILITY</b>
----------------	---

Category	L	T	P	Credit
BSC	3	1	0	4

### Preamble

An engineering student needs to know some basic mathematical tools and techniques to apply in diverse applications in Engineering. This emphasizes the development of rigorous logical thinking and analytical skills of the student and to equip him the complete procedure for solving different kinds of problems that occur in engineering. Based on this, the course aims at giving adequate exposure to relations, functions, propositional and predicate calculus, random variables, probability distributions, regression and correlation, test of hypothesis.

### Prerequisite

- Nil

### Course Outcomes

On the successful completion of the course, students will be able to

	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Apply the concept of functions, relations to solve the given problem and solve the recurrence relation	TPS3	70	65
CO2	Outline an equivalent logical proposition for a real world statement by applying proposition, predicates and quantifiers and Interpret.	TPS3	70	65
CO3	Check the validity of propositional calculus, predicate calculus statements using rules of inference.	TPS2	75	70
CO4	Using appropriate probability distributions, compute the probability values for engineering problems.	TPS3	70	65
CO5	Compute the correlation and regression coefficients for the engineering problems.	TPS3	70	65
CO6	Apply the concepts of large/small sample tests into real life problems.	TPS3	70	65

### Mapping with Programme Outcomes

COs	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1.	S	M	L										S		
CO2.	S	M	L										S		
CO3.	M	L											M		
CO4	S	M	L										S		
CO5	S	M	L										S		
CO6	S	M	L										S		

S- Strong; M-Medium; L-Low

## Assessment Pattern

CO	Assessment 1						Assessment 2						Terminal (%)		
	CAT 1 (%)			Assignment 1 (%)			CAT 2 (%)			Assignment 2 (%)			1	2	3
TPS	1	2	3	1	2	3	1	2	3	1	2	3			
	10	30	60	-	-	100	10	30	60	-	-	100	-	30	70
CO1	-	20	30	-	-	50	-	-	-	-	-	-	-	6	19
CO2	3	-	30	-	-	50	-	-	-	-	-	-	-	6	10
CO3	7	10	-	-	-	-	-	-	-	-	-	-	-	9	-
CO4	-	-	-	-	-	-	7	20	24	-	-	50	-	6	19
CO5	-	-	-	-	-	-	-	-	21	-	-	20	-	-	10
CO6	-	-	-	-	-	-	3	10	15	-	-	30	-	3	12
TOTAL	10	30	60	-	-	100	10	30	60	-	-	100	-	30	70

## Syllabus

**Relations and Functions:** Relations and their properties - Combining relations- Representing relations - Equivalence relations- Functions-Bijections- Solving linear homogeneous Recurrence relations- Solving linear non homogeneous Recurrence relations.

[12 hours]

**The Foundations: Logic:** Propositional logic - Propositional equivalences – Logical Equivalence – De Morgan's law – Constructing New logical equivalences - Predicates and Quantifiers(single variable only) - Rules of Inference

[12 hours]

**Random Variables and Probability Distributions:** Probability – Sample space, Events and Axioms of Probability- Discrete Random Variables- Distributions for Discrete Random Variables- Expected Values for Discrete Random Variables- Binomial Probability distribution- Probability Density functions and Expected Values - Normal distribution

[12 hours]

**Statistics:** Linear correlation - Linear regression - Test of Hypothesis: Large and small sample tests - Z - tests for Hypotheses about a population mean - Difference between two Means in large samples using Z- test - t - tests for Hypotheses about a population mean – Difference between two Means in small samples using t- test.

[12 hours]

## Learning Resources

1. Kenneth H. Rosen, "Discrete Mathematics and its applications", McGrawHill Education, Seventh Edition, 2017
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning India Pvt Ltd, New Delhi, 2012
3. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44<sup>th</sup> Edition, New Delhi, 2012.
4. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGrawHill Education, 2017.

## Reference Books & web resources

1. Dr.M.K.Venkataraman., Dr.N.Sridharan and N.Chandrasekaran, "Discrete Mathematics", National Publishing Company, Chennai.of India, 2004.
2. Eitan Farchi, Ben-Chaim, "Mathematical Logic and its Application to Computer Science Lecture Notes", March 3, 2010.

3. Richard A. Johnson, Irwin Miller, John Freund, "Miller & Freund's Probability and Statistics for Engineers", 8th Edition, Pearson, 2015
4. Ronald E. Walpole, Sharon L. Myers, Keying Ye, "Probability & Statistics for Engineers and Scientists", 9th Edition, Pearson Education, New Delhi, 2012.

### Course Contents and Lecture Schedule

Module No.	Topic	CO	No. of Lectures
<b>1</b>	<b>Relations and Functions</b>		
1.1	Relations and their properties	1	2
1.2	Combining relations	1	1
	Tutorial		1
1.3	Representing relations	1	1
1.4	Equivalence relations	1	2
	Tutorial		1
1.5	Functions- Bijections	1	1
1.6	Solving linear homogeneous Recurrence relations	1	1
1.7	Solving linear non homogeneous Recurrence relations	1	1
	Tutorial		1
<b>2</b>	<b>The Foundations: Logic</b>		
2.1	Propositional logic	2	2
2.2	Propositional equivalences – Logical Equivalence	2	1
	Tutorial		1
2.3	Propositional equivalences – DE Morgan's law – Constructing New logical equivalences	2	1
2.4	Predicates and Quantifiers(single variable only)	2	2
	Tutorial		1
2.5	Rules of Inference – Propositions	3	2
2.6	Rules of Inference – Predicates	3	1
	Tutorial		1
<b>3</b>	<b>Random Variables and Probability Distributions</b>		
3.1	Probability – Sample space, Events and Axioms of Probability	4	1
3.2	Discrete Random Variables	4	1
3.3	Probability Distributions for Discrete Random Variables	4	1
	Tutorial		1
3.4	Expected Values for Discrete Random Variables	4	1
3.5	Binomial Probability distribution	4	2
	Tutorial		1
3.6	Probability Density functions and Expected Values	4	1
3.7	Normal distributions	4	2
	Tutorial		1
<b>4</b>	<b>Statistics</b>		
4.1	Linear correlation	5	2
4.2	Linear regression	5	2
	Tutorial		1
4.3	Test of Hypothesis: Large and small sample tests	6	1

4.4	Z - tests for Hypotheses about a population mean	6	1
4.5	Difference between two Means in large samples using Z- test	6	1
	Tutorial		1
4.6	t - tests for Hypotheses about a population mean	6	1
4.7	Difference between two Means in small samples using t- test	6	1
	Tutorial		1
	<b>Total</b>		<b>48</b>

#### Course Designer(s):

1. Ms. H. Sri Vinodhini [srivinodhini@tce.edu](mailto:srivinodhini@tce.edu)
2. Dr. P. Victor [pvmat@tce.edu](mailto:pvmat@tce.edu)
3. Dr. P. Krishnapriya [pkamat@tce.edu](mailto:pkamat@tce.edu)

