

**OUTCOME BASED EDUCATION
CURRICULUM AND DETAILED SYLLABI
FOR**

B.Tech. INFORMATION TECHNOLOGY DEGREE PROGRAMME

**FOR THE STUDENTS ADMITTED IN THE
ACADEMIC YEAR 2025-26**

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

B. TECH IT -SCHEDULING OF COURSES FOR STUDENTS JOINING FROM ACADEMIC YEAR 2025

Sem	Theory / Theory cum Practical / Practical									CDIO courses	Audit Courses	Credit
	1	2	3	4	5	6	7	8	9			
I	22MA112 CALCULUS FOR ENGINEERS (BSC-4)	23PH121 PHYSICS (BSC-3)	22CH131 CHEMISTRY (BS-3)	22EG141 TECHNICAL ENGLISH (HSMC-2)	22IT151 ENGINEERING EXPLORATION (ESC-2)	22IT162 PROBLEM SOLVING USING COMPUTERS (ESC-3) (TCP)	22EG171 ENGLISH LABORATORY (HSMC-1)	22PH182 PHYSICS LABORATORY (BSC-1)	22CH191 CHEMISTRY LABORATORY (BSC-1)			20
II	22IT211 LINEAR ALGEBRA, ORDINARY DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS	22IT222 OPERATING SYSTEMS (PCC-3)	22IT231 COMPUTER ORGANISATION (PCC-3)	22IT241 IT INFRASTRUTURE MANAGEMENT (ESC-3)	23IT251 DIGITAL SYSTEM DESIGN (ESC-3)	22IT261 Web Essentials (PCC-2) (TCP)	22IT271 COMPUTER PROGRAMMING (PCC-2) (TCP)				22CHAA1 ENVIRONMENTAL SCIENCE	20
III	22IT311 DISCRETE MATHEMATICS (BSC-4)	22IT321 OBJECT ORIENTED PROGRAMMING (PCC-3)	22IT331 SOFTWARE ENGINEERING (PCC-3)	22IT341 DATA STRUCTURES (PCC-3)	22IT351 IT OPERATIONS AND MANAGEMENT (ESC-2)	22IT361 SYSTEM ADMINISTRATION LAB. (ESC-1)	22IT371 OBJECT ORIENTED PROGRAMMING LAB (PCC-1)	22IT381 DATA STRUCTURES LAB (PCC-1)		22ES391 DESIGN THINKING (ESC-3)		21
IV	22IT411 PROBABILITY AND STATISTICS (BSC-4)	22IT421 ALGORITHM DESIGN PRINCIPLES (PCC-3)	22IT431 COMPUTER NETWORKS (PCC-3)	22IT441 DATABASE MANAGEMENT SYSTEMS (PCC-3)	22IT451 PROGRAMMING FOR INTERNET OF THINGS (ESC-3)		22IT471 COMPUTER NETWORKS LAB (PCC-1)	22IT481 DATABASE MANAGEMENT SYSTEMS LAB (PCC-1)		22IT491 PROJECT MANAGEMENT (HSMC-3)	23CHAD1 INDIAN CONSTITUTION AND KNOWLEDGE SYSTEMS	21
V	22IT511 INFORMATION SECURITY (PCC-3)	22IT521 MACHINE LEARNING (PCC-3)	22IT531 CLOUD COMPUTING (PCC-3)	22ITPX1 Programme Elective (PEC-3)	22IT551 WEB TECHNOLOGIES (PCC-3) (TCP)	22XXGX1 INTERDISCIPLINAR ELECTIVE (IEC-3)	22IT571 INFORMATION SECURITY LAB (PCC-1)	22IT581 CLOUD COMPUTING LAB (PCC-1)		22IT591 PROJECT -I (PW-3)	23CHAE1 UNIVERSAL HUMAN VALUES AND ETHICS	23
VI	22IT611 Engineering Economics and Financial Accounting HSMC-3	22IT621 ARTIFICIAL INTELLIGENCE (PCC-3)	22ITPX1 Programme Elective (PEC-3)	22ITPX1 Programme Elective (PEC-3)	22IT651 MOBILE APPLICATION DEVELOPMENT (PCC-3) (TCP)	22IT661 PROFESSIONAL COMMUNICATION HSMC-2	22XXBX1 BASIC SCIENCE ELECTIVE (BSE-3)	22IT681 DATA SCIENCE LAB (PCC-1)		22IT691 PROJECT -II (PW-3)		24
VII	22IT711 COGNITIVE SCIENCE (ESC-2)	22ITPX1 Programme Elective (PEC-3)	22ITPX1 Programme Elective (PEC-3)	22ITPX1 Programme Elective (PEC-3)	22ITPX1 Programme Elective (PEC-3)	22ITPX1 Programme Elective (PE-3)	22IT771 VIRTUALIZATION TECHNOLOGIES LAB (PCC-1)	22IT781 MULTIMEDIA LAB (PCC-1)		22IT791 PROJECT -III (PW-3)		22
VIII	22ITPX1 Programme Elective (PE-3)	22ITPX1 Programme Elective (PE-3)								22IT891 PROJECT -IV (PW-3)		9
HSMC		BSC		ESC		PCC		PEC		IE/BSE		Total
11		24		22		55		30		6		160

THIAGARAJAR COLLEGE OF ENGINEERING

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

MADURAI-625 015

DEPARTMENT OF INFORMATION TECHNOLOGY

Telephone: +91-452-2482240-42

Fax: +91-452-2483427

Website: <http://www.tce.edu>

CREDIT DISTRIBUTION FOR STUDENTS ADMITTED IN THE YEAR 2022 ONWARDS

S.No	Category	Credits
A	Foundation Courses (FC)	54-66
	Humanities and Social Sciences including Management Courses (HSMC)	9-12
	Basic Science Courses (BSC)	24- 27
	Engineering Science Courses (ESC)	21 -27
B	Professional Core Courses (PCC)	55
C	Professional Elective Courses (PEC)	24 - 39
	Programme Specific Elective (PSE)	15 - 24
	Programme Elective for Expanded Scope (PEES)	9-15
D	Open Elective Courses (OEC)	6-12
	Interdisciplinary Elective (IE)	3-6
	Basic Science Elective (BSE)	3-6
E	Project work	12
F	Internship and Mandatory Audit Courses as per Regulatory authorities	Non-Credit (Not included for CGPA)
	Minimum Credits to be earned for the award of the Degree	160 (from A to E) and the successful completion of Mandatory Courses

CURRICULUM AND DETAILED SYLLABI

For

B.Tech Information Technology

First Semester

For the students admitted from the
academic year 2025



THIAGARAJAR COLLEGE OF ENGINEERING

(A Govt. Aided, Autonomous Institution affiliated to Anna University)

MADURAI – 625 015

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY

(For the candidates admitted from 2025 onwards)

FIRST SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22MA112	Calculus For Engineers	BSC	3	1	-	4
23PH121	Physics	BSC	3	-	-	3
22CH131	Chemistry	BSC	3	-	-	3
22EG141	Technical English	HSMC	2	-	-	2
22IT151	Engineering Exploration	ESC	1	1	-	2
THEORY CUM PRACTICAL						
22IT162	Problem solving using Computers	ESC	2	-	2	3
PRACTICAL						
22EG171	English Laboratory	HSMC	-	-	2	1
22PH182	Physics Laboratory	BSC	-	-	2	1
22CH191	Chemistry Laboratory	BSC	-	-	2	1
AUDIT COURSES						
22TAAA1	Heritage of Tamils(Tamizhar Marabhu)					
Total			14	2	8	20

HSMC : Humanities and Social Sciences including Management Courses

BSC : Basic Science Courses

ESC : Engineering Science Courses

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted from 2025 onwards)

FIRST SEMESTER

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continu- ous Asses- sment *	Termin- al Exam **	Max. Mark s	Terminal Exam	Total
THEORY								
1	22MA112	Calculus For Engineers	3	40	60	100	27	50
2	23PH121	Physics	3	40	60	100	27	50
3	22CH131	Chemistry	3	40	60	100	27	50
4	22EG141	Technical English	3	40	60	100	27	50
5	22IT151	Engineering Exploration	3	40	60	100	27	50
THEORY CUM PRACTICAL								
6	***22IT162	Problem Solving Using Computers	3	50	50	100	25	50
PRACTICAL								
7	22EG171	English Laboratory	3	60	40	100	18	50
8	22PH182	PHYSICS LABORATORY	3	60	40	100	18	50
9	22CH191	Chemistry Laboratory	3	60	40	100	18	50
AUDIT COURSES								
10	22TAAA1	Heritage of Tamils(Tamizhar Marabhu)	AC	1	-	-	-	AC

* 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.

NOTE: *22IT160PROBLEM SOLVING USING COMPUTERS-TERMINAL EXAM TYPE-PRACTICAL**

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY

(For the candidates admitted from 2025 onwards)

SECOND SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22IT211	Linear Algebra, Ordinary Differential Equations and Laplace Transforms	BSC	3	1	-	4
22IT222	Operating systems	PCC	3	-	-	3
22IT231	Computer Organization	PCC	3	-	-	3
22IT241	IT Infrastructure Management	ESC	3	-	-	3
THEORY CUM PRACTICAL						
22IT251	Computer Aided Engineering Graphics	ESC	2	-	2	3
22IT261	Web Essentials	PCC	1	-	2	2
22IT271	Computer Programming	PCC	1	-	2	2
AUDIT COURSE						
22CHAA1	Environmental Science	AC	1	-	-	-
22TAAB1	Tamils and Technology	AC	1	-	-	-
Total			17	1	6	20

BSC : Basic Science

HSC : Humanities and Social Science

ESC : Engineering Science

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
 (For the candidates admitted from 2025 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
THEORY								
1	22IT211	Linear Algebra, Ordinary Differential Equations and Laplace Transforms	3	40	60	100	27	50
2	22IT222	Operating systems	3	40	60	100	27	50
3	22IT231	Computer Organization	3	40	60	100	27	50
4	22IT241	IT Infrastructure Management	3	40	60	100	27	50
THEORY CUM PRACTICAL								
5	22IT251	Computer Aided Engineering Graphics	3	50	50	100	25	50
6	22IT261	Web Essentials	3	50	50	100	25	50
7	22IT271	Computer Programming	3	50	50	100	25	50
Audit course								
8	22CHAA1	Environmental Science	-	100	-	-	-	-

* 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.

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY
 (For the candidates admitted from 2025 onwards)

THIRD SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22IT311	Discrete Mathematics	BSC	3	1	-	4
22IT321	Object Oriented Programming	PCC	3	-	-	3
22IT331	Software Engineering	PCC	3	-	-	3
22IT341	Data Structures	PCC	3	-	-	3
22IT351	IT Operations and Management	ESC	2	-	-	2
PRACTICAL						
22IT361	System Administration Lab	ESC	-	-	2	1
22IT371	Object Oriented Programming Lab	PCC	-	-	2	1
22IT381	Data Structures Lab	PCC	-	-	2	1
22ES391	Design Thinking	ESC	-	-	6	3
Total			14	1	12	21

BS : Basic Science
 HSS : Humanities and Social Science
 ES : Engineering Science

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
 (For the candidates admitted from 2025 onwards)

THIRD SEMESTER

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continu- ous Asses- sment *	Termin- al Exam **	Max. Mark s	Terminal Exam	Total
THEORY								
1	22IT311	Discrete Mathematics	3	40	60	100	27	50
2	22IT321	Object Oriented Programming	3	40	60	100	27	50
3	22IT331	Software Engineering	3	40	60	100	27	50
4	22IT341	Data Structures	3	40	60	100	27	50
5	22IT351	IT Operations and Management	3	40	60	100	27	50
PRACTICAL								
6	22IT361	System Administration Lab	3	60	40	100	18	50
7	22IT371	Object Oriented Programming Lab	3	60	40	100	18	50
8	22IT381	Data Structures Lab	3	60	40	100	18	50
9	22ES391	Design Thinking	3	100			100	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.

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY

(For the candidates admitted from 2025 onwards)

FOURTH SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22IT411	Probability and Statistics	BSC	3	1	-	4
22IT421	Algorithm Design Principles	PCC	3	-	-	3
22IT431	Computer Networks	PCC	3	-	-	3
22IT441	Database Management Systems	PCC	3	-	-	3
22IT491	Project Management	HSMC	3	-	-	3
THEORY CUM PRACTICAL						
22IT451	Programming for Internet of Things	ESC	2	-	2	3
PRACTICAL						
22IT471	Computer Networks Laboratory	PCC	-	-	2	1
22IT481	Database Management Systems Lab	PCC	-	-	2	1
AUDIT COURSE						
23CHAD1	Indian Constitution and Knowledge Systems	AC	1			-
Total			17	1	6	21

BS : Basic Science

HSS : Humanities and Social Science

ES : Engineering Science

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS

(For the candidates admitted from 2025 onwards)

FOURTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				CA *	TE **	Max. Marks	Terminal Exam	Total
THEORY								
1	22IT411	Probability and Statistics	3	40	60	100	27	50
2	22IT421	Algorithm Design Principles	3	40	60	100	27	50
3	22IT431	Computer Networks	3	40	60	100	27	50
4	22IT441	Database Management Systems	3	40	60	100	27	50
5	22IT491	Project Management	3	40	60	100	27	50
THEORY CUM PRACTICAL								
6	22IT451	Programming for Internet of Things	3	50	50	100	25	50
PRACTICAL								
7	22IT471	Computer Networks Laboratory	3	60	40	100	18	50
8	22IT481	Database Management Systems Lab	3	60	40	100	18	50
AUDIT COURSE								
9	23CHAD1	Indian Constitution and Knowledge Systems	-	100	-	-	-	-

* 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.

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY
 (For the candidates admitted from 2025 onwards)

FIFTH SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22IT511	Information security	PCC	3	-	-	3
22IT521	Machine Learning	PCC	3	-	-	3
22IT531	Cloud Computing	PCC	3	-	-	3
22ITPX1	Programme Elective	PEC	3	-	-	3
22XXBX1	Interdisciplinary Elective	IE	3	-	-	3
THEORY CUM PRACTICAL						
22IT551	Web Technologies	PCC	1	-	4	3
PRACTICAL						
22IT571	Information security Lab	PCC	-	2		1
22IT581	Cloud Computing Lab	PCC	-	2		1
PROJECT						
22IT591	Project I	PW	-	6		3
AUDIT COURSES						
23CHAE1	Universal Human Values And Ethics	AC				-
Total			16	-	14	23

BS : Basic Science
 HSS : Humanities and Social Science
 ESC : Engineering Science

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
 (For the candidates admitted from 2025onwards)

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
THEORY								
1	22IT511	Information security	3	40	60	100	27	50
2	22IT521	Machine Learning	3	40	60	100	27	50
3	22IT531	Cloud Computing	3	40	60	100	27	50
4	22ITPX1	Programme Elective	3	40	60	100	27	50
5	22XXBX1	Interdisciplinary Elective	3	40	60	100	27	50
THEORY CUM PRACTICAL								
6	22IT551	Web Technologies	3	50	50	100	22.5	50
PRACTICAL								
6	22IT571	Information security Lab	3	60	40	100	18	50
7	22IT581	Cloud Computing Lab	3	60	40	100	18	50
PROJECT								
9	22IT591	Project I	3	40	60	100	27	50
AUDIT COURSES								
10	23CHAE1	Universal Human Values And Ethics	-	100	-	-	-	-

* 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.

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY
 (For the candidates admitted from 2025 onwards)

SIXTH SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22IT611	Accounting and Finance	HSMC	3	-	-	3
22IT621	Artificial Intelligence	PCC	3	-	-	3
22ITPX1	Programme Elective	PEC	3	-	-	3
22XXBX1	Basic Science Elective	BSE	3	-	-	3
THEORY CUM PRACTICAL						
22IT651	Mobile Application Development	PCC	3	-	-	3
22EG661	Professional Communication	HSMC	-	1	2	2
PRACTICAL						
22IT681	Data Science Lab	PCC	-	2		1
PROJECT						
22IT691	Project -II	PW	-	6		3
Total			1	10		21

BS : Basic Science
 HSS : Humanities and Social Science
 ESC : Engineering Science

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
 (For the candidates admitted from 2025onwards)

SIXTH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continu ous Assess ment *	Termin al Exam **	Max. Mark s	Terminal Exam	Total
THEORY								
1	22IT611	Accounting and Finance	3	40	60	100	27	50
2	22IT621	Artificial Intelligence	3	40	60	100	27	50
3	22ITPX1	Programme Elective	3	40	60	100	27	50
4	22ITPX1	Programme Elective	3	40	60	100	27	50
5	22XXBX1	Basic Science Elective	3	40	60	100	27	50
THEORY CUM PRACTICAL								
6	22IT651	Mobile Application Development	3	50	50	100	22.5	50
7	22EG661	Professional Communication	3	50	50	100	22.5	50
PRACTICAL								
8	22IT681	Data Science Lab	3	60	40	100	18	50
PROJECT								
9	22IT691	Project -II	3	40	60	100	27	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.

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY
 (For the candidates admitted from 2025 onwards)

SEVENTH SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22IT711	Cognitive Science	ESC	2	-	-	2
22ITPX1	Programme Elective	PEC	3	-	-	3
22ITPX1	Programme Elective	PEC	3	-	-	3
22ITPX1	Programme Elective	PEC	3	-	-	3
22ITPX1	Programme Elective	PEC	3	-	-	3
22ITPX1	Programme Elective	PEC	3	-	-	3
PRACTICAL						
22IT771	Virtualization Technologies Lab	PCC	-	2		1
22IT781	Multimedia Lab	PCC	-	2		1
PROJECT						
22IT791	Project -III	PW	-	6		3
Total			-	10		22

BS : Basic Science
 HSS : Humanities and Social Science
 ESC : Engineering Science

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
 (For the candidates admitted from 2025onwards)

SEVENTH 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
THEORY								
1	22IT711	Cognitive Science	3	40	60	100	27	50
2	22ITPX1	Programme Elective	3	40	60	100	27	50
3	22ITPX1	Programme Elective	3	40	60	100	27	50
4	22ITPX1	Programme Elective	3	40	60	100	27	50
5	22ITPX1	Programme Elective	3	40	60	100	27	50
6	22ITPX1	Programme Elective	3	40	60	100	27	50
PRACTICAL								
7	22IT771	Virtualization Technologies Lab	3	60	40	100	18	50
8	22IT781	Multimedia Lab	3	60	40	100	18	50
PROJECT								
9	22IT791	Project -III	3	40	60	100	27	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.

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY
 (For the candidates admitted from 2025 onwards)

EIGHTH SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
22ITPX1	Programme Elective	PEC	3	-	-	3
22ITPX1	Programme Elective	PEC	3	-	-	3
PROJECT						
22IT891	Project -IV	PW	-	6		3
Total			-	6		9

BS : Basic Science
 HSS : Humanities and Social Science
 ESC : Engineering Science

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.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
 (For the candidates admitted from 2025 onwards)

EIGHTH 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
THEORY								
1	22ITPX1	Programme Elective	3	40	60	100	27	50
2	22ITPX1	Programme Elective	3	40	60	100	27	50
PROJECT								
3	22IT891	Project -IV	3	40	60	100	27	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.

22MA112	CALCULUS FOR ENGINEERS	Category	L	T	P	Credits
		BSC	3	1	0	4

Preamble

This course aims to provide technical competence of modeling engineering problems using calculus. In this course, the calculus concepts are taught geometrically, numerically, algebraically and verbally. Students will apply the main tools for analyzing and describing the behavior of functions of single and multi-variables: limits, derivatives, integrals of single and multi-variables to model and solve complex engineering problems using analytical methods and MATLAB.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency (in %)	Expected Attainment Level (in %)
CO1	Cognize the concept of functions, limits and continuity	TPS2	75	70
CO2	Compute derivatives and apply them in solving engineering problems	TPS3	70	65
CO3	Employ partial derivatives to find maxima minima of functions of multi variables	TPS3	70	65
CO4	Demonstrate the techniques of integration to find the surface area of revolution of a curve.	TPS3	70	65
CO5	Utilize double integrals to evaluate area enclosed between two curves.	TPS3	70	65
CO6	Apply triple integrals to find volume enclosed between surfaces	TPS3	70	65

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S – Strong

M – Medium

L – Low

Assessment Pattern

CO	Assessment 1 (%)						Assessment 2 (%)						Terminal (%)			
	CAT 1			Assignment 1			CAT 1			Assignment 1						
TPS	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Total
CO1	20			50			-			-			-	10	-	10
CO2	32						-			-			-	-	16	16
CO3	36						-			-			-	-	18	18
CO4	12			-			39			50			-	-	25	25
CO5	-			-			35						-	-	17	17
CO6	-			-			26						-	-	14	14
MATLAB	-			50			-			50			-	-	-	-
TOTAL	100			100			100			100			-	10	90	100

* Assignment 1: (i) Application Problems in CO1, CO2 and CO3 (50%)

(ii) MATLAB Onramp & Introduction to symbolic Math with MATLAB (50%).

**Assignment 2: (i) Application Problems in CO4, CO5 and CO6 (50%).

(ii) Application problems using MATLAB. (50%).

***Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

DIFFERENTIAL CALCULUS

Functions - New functions from old functions - Limit of a function - Continuity - Limits at infinity - Derivative as a function - Maxima and Minima of functions of one variable – Mean value theorem - Effect of derivatives on the shape of a graph- Application problems in engineering using MATLAB.

FUNCTIONS OF SEVERAL VARIABLES:

Function of several variables- Level curves and level surfaces - Partial derivatives – Chain rule - Maxima and minima of functions of two variables –Method of Lagrange's Multipliers - Application problems in engineering using MATLAB.

INTEGRAL CALCULUS:

The definite integral – Fundamental theorem of Calculus – Indefinite integrals and the Net Change Theorem – Improper integrals – Area of surface of revolution - Volume of solid of revolution -Application problems in engineering using MATLAB.

MULTIPLE INTEGRALS:

Iterated integrals-Double integrals over general regions-Double integrals in polar coordinates-Applications of double integrals (density, mass, moments & moments of inertia problems only)-triple integrals- triple integrals in cylindrical coordinates- triple integrals in spherical coordinates-change of variables in multiple integrals - Application problems in engineering using MATLAB.

Text Book(s)

- James Stewart, "Calculus Early Transcendentals", 9th Edition, Cengage Learning, New Delhi, 2019.
 - DIFFERENTIAL CALCULUS: [Sections: 1.3, 2.2, 2.5, 2.6, 2.8, 4.1, 4.2 and 4.3.]
 - FUNCTIONS OF SEVERAL VARIABLES: [Sections: 14.1, 14.3, 14.5, 14.7 and 14.8.]
 - INTEGRAL CALCULUS: [Sections: 5.2, 5.3, 5.4, 7.8, 8.2 and 6.2.]
 - MULTIPLE INTEGRAL: [Sections: 15.1-15.4, 15.6-15.9]

- Lecture Notes on Calculus Through Engineering Application Problems and Solutions, Department of Mathematics, Thiagarajar College of Engineering, Madurai.

Reference Books & Web Resources

- George B. Thomas, "Thomas Calculus: early Transcendentals", 14th edition, Pearson, New Delhi, 2018.
- Howard Anton, Irl Bivens and Stephen Davis, "Calculus: Early Transcendentals", 12th edition, John Wiley & Sons, 2021.
- Kuldeep Singh, "Engineering Mathematics Through Applications", 2nd edition, Bloomsbury publishing, 2019.
- Kuldip S. Rattan, Nathan W. Klingbeil, Introductory Mathematics for Engineering Applications, 2nd edition, John Wiley & Sons, 2021

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	DIFFERENTIAL CALCULUS	
1.1	Functions and New functions from old functions	2
1.2	Limit of a function & Continuity of a function	1
	Tutorial	1
1.3	Limits at infinity	1
1.4	Derivative as a function	2
	Tutorial	1
1.5	Maxima and Minima of functions of single variable	2
1.6	The Mean value theorem and effect of derivatives on the shape of a graph of a function	1
	Tutorial	1
1.7	Application problems in engineering using MATLAB	1
2	FUNCTIONS OF SEVERAL VARIABLES	
2.1	Level curves and level surfaces	2
2.2	Partial derivatives – Chain rule	1
	Tutorial	1
2.3	Maxima and minima of functions of two variables	2
2.4	Method of Lagrange's Multipliers	1
	Tutorial	1
2.5	Application problems in engineering using MATLAB	1
3	INTEGRAL CALCULUS	
3.1	The definite integral	1
3.2	Fundamental theorem of Calculus	2
	Tutorial	1
3.3	Indefinite integrals and the Net Change Theorem	1
3.4	Improper integrals	2
	Tutorial	1
3.5	Area of surface of revolution	1

Module No.	Topic	No. of Periods
3.6	Volume of solid of revolution.	2
3.7	Application problems in engineering using MATLAB	1
4	MULTIPLE INTEGRALS	
4.1	Iterated integrals	1
4.2	Double integrals over general regions	2
	Tutorial	1
4.3	Double integrals in polar coordinates	1
4.4	Applications of double integrals (density, mass, moments & moments of inertia problems only)	2
	Tutorial	1
4.5	Triple integrals	1
4.6	Triple integrals in cylindrical coordinates	1
4.7	Triple integrals in spherical coordinates	1
	Tutorial	1
4.8	Change of variables in multiple integrals	1
4.9	Application problems in engineering using MATLAB	1
	Total	48

Course Designers:

1. Dr. B. Vellaikannan, bvkmata@tce.edu
2. Dr. C.S. Senthilkumar, kumarstays@tce.edu
3. Dr. S.P. Suriya Prabha, suriyaprabha@tce.edu
4. Dr. S. Saravanakumar, sskmat@tce.edu
5. Dr. M. Sundar, msrmat@tce.edu

23PH121	PHYSICS	Category	L	T	P	Credits
		BSC	3	0	0	3

Preamble

The course work aims in imparting fundamental knowledge of mechanics, oscillations and waves and optics, electromagnetism and quantum mechanics which are essential in understanding and explaining engineering devices.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency (in %)	Expected Attainment Level (in %)
CO1	Apply the vector calculus approach and Newton's law in polar coordinates to solve problems in mechanics	TPS3	85	80
CO2	Solve for the solutions and describe the behaviour of a damped harmonic oscillator and waves.	TPS3	85	80
CO3	Introduce Schrodinger equation to arrive at the energy values of particle in a box and linear harmonic oscillator	TPS3	85	80
CO4	Use the principle of quantum mechanics for quantum mechanical tunnelling, quantum confinement and quantum computation	TPS2	85	80
CO5	Use the laws of electrostatics and magnetostatics to explain electromagnetic wave propagation	TPS3	85	80
CO6	Explain the fundamentals of optical phenomena and its applications	TPS2	85	80

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S – Strong

M – Medium

L – Low

Assessment Pattern

CO	Assessment 1 (%)						Assessment 2 (%)						Terminal (%)			
	CAT 1			Assignment 1			CAT 2			Assignment 2						
TPS	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Total
CO1	8	15	22	100			-	-	-	-	-	-	6	6	10	22
CO2	8	10	15				-	-	-	-	-	-	4	3	10	17
CO3	4	5	13				-	-	15	100			-	2	15	17
CO4	-	-	-				4	15	-				4	6	-	10
CO5	-	-	-				-	-	35				-	3	15	18
CO6	-	-	-				16	15	-				6	10	-	16
Total	20	30	50	100			20	30	50	100			20	30	50	100

*Assignment I, II –Quiz/ Puzzle/ Case analysis/ Problem-solving/ Presentation/ Writing tasks

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Mechanics of Particles:

Scalars and vectors under rotation transformation - Coordinate system - Cartesian, Polar, Spherical, Cylindrical - Newton's second law of motion - Forces in nature - Central forces - Conservative and non-conservative forces - Work - Energy theorem - Conservation of angular momentum - Satellite manoeuvres

Oscillations and Waves:

Simple harmonic oscillators - Energy decay in a Damped harmonic oscillator - Q factor- Impedance matching- Wave groups and group velocity - Non dispersive Transverse and Longitudinal waves - Waves with dispersion - Water waves - Acoustic waves - Earthquake and Tsunami waves

Quantum Mechanics:

Wave nature of particles - wave function - probability current density and expectation values - Schrodinger wave equation - Uncertainty principle - Particle in a box in 1D - Linear harmonic oscillator - Quantum tunnelling – Quantum confinement in 0D, 1D, 2D systems - Scanning tunnelling microscope - Quantum Cascade lasers - Quantum computation (qubit) - Entanglement - Teleportation

Electromagnetic Fields and Waves:

Electric potential and Electric field of a charged disc - Magnetic Vector potential - Maxwell's equation - Equation of continuity – Poynting Vector - Energy and momentum of EM waves - CT/MRI scan

Optics:

Ray paths in inhomogeneous medium and its solutions – Applications - Fibre optics - Numerical Aperture & Acceptance angle - Fibre optic sensors - Liquid Level & Medical Applications - Interference in non-reflecting films - Fabry-Perot interferometer - Diffraction - Fraunhofer diffraction due to double slit.

Text Book(s)

1. Principles of Physics, Halliday, Resnick and Jearl Walker, 9th Edition, Wiley, 2011
2. Paul A. Tipler and G. Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008

Reference Books & Web Resources

MECHANICS OF PARTICLES

1. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 4, 9 & 10).
2. Manoj K. Harbola, Engineering Mechanics, 2nd Edition, Cengage, 2018.

OSCILLATIONS AND WAVES

3. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 14 & 15).
4. H. J. Pain, The Physics of Vibrations and Waves, 6th Edition, John Wiley, 2005 (Chapters 2, 5 & 6).

ELECTROMAGNETIC FIELDS AND WAVES

5. Principles of Physics, Halliday, Resnick and Jearl Walker, 9th Edition, Wiley, 2011 (Chapters - 23, 24, 32 & 33)
6. Paul M. Fishbane, Stephen G. Gasiorowicz and Stephen T. Thornton, Physics for Scientists and Engineers with Modern Physics, 3rd Edition, Pearson, 2005 (Chapters - 26, 28, 31 & 34).

OPTICS

7. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 31 & 33).
8. Ajoy Ghatak, Optics, 5th Edition, Tata McGraw Hill, 2012 (Chapters – 3, 18, 20)

QUANTUM MECHANICS

9. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, Freeman, 2008 (Chapters – 34 & 35).
10. Stephen T. Thornton and Andrew Rex, Modern Physics for Scientists and Engineers, 4th Edition, Cengage, 2013. (Chapters - 5 & 6).
11. R. Shankar, Fundamentals of Physics – I, II, Yale University Press, 2014, 2016.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Mechanics of Particles	8
1.1	Scalars and vectors under rotation transformation	2
1.2	Coordinate system - Cartesian, Polar, Spherical, Cylindrical	2
1.3	Newton's second law of motion - Forces in nature - Central forces	2
1.4	Conservative and non-conservative forces - Work - Energy theorem - Conservation of angular momentum - Satellite maneuvers	2
2	Oscillations and Waves	6
2.1	Simple harmonic oscillators - Energy decay in a Damped harmonic oscillator	2
2.2	Q factor- Impedance matching – Wave groups and group velocity	2
2.3	Non-dispersive transverse and Longitudinal waves	1
2.4	Waves with dispersion- Water waves -Acoustic waves – Earthquake and Tsunami waves	1
3	Quantum Mechanics	10

3.1	Wave nature of particles - wave function -probability current density and expectation values - Schrodinger wave equation	3
	<i>CAT-I after 18 contact hours</i>	
3.2	Uncertainty principle - Particle in a box in 1D – Linear harmonic oscillator	3
3.3	Quantum tunnelling – Quantum confinement in 0D, 1D, 2D systems - Scanning tunnelling microscope – Quantum Cascade lasers – Quantum computation (qubit) – Entanglement - Teleportation	4
4	Electromagnetic Fields and Waves	6
4.1	Electric potential and Electric field of a charged disc	1
4.2	Magnetic Vector potential – Maxwell's Equations	2
4.3	Equation of continuity-Poynting Vector-Energy and momentum of EM waves	2
4.4	CT/MRI scan	1
5	Optics	6
5.1	Ray paths in inhomogeneous medium & its solutions–Applications – Fiber optics	2
5.2	Numerical Aperture& Acceptance angle - Fiber optic sensors - Liquid Level & Medical Applications	2
5.3	Interference in non-reflecting films - Fabry- Perot interferometer - Diffraction - Two slit Fraunhofer diffraction	2
	<i>CAT-II after 18 contact hours</i>	
	<i>Total</i>	36

Course Designers:

1. Dr. M. Mahendran, Professor, manickam-mahendran@tce.edu
2. Mr. V. Veeraganesh, Assistant Professor, vvgphy@tce.edu
3. Dr. A LSubramaniyan, Assistant Professor, alsphy@tce.edu
4. Dr. A. Karuppusamy, Assistant Professor, akphy@ce.edu

22CH131	CHEMISTRY	Category	L	T	P	Credits
		BSC	3	0	0	3

Preamble

The objective of this course is to bestow basic concepts of chemistry and its applications in engineering domain. It imparts knowledge on properties and treatment methods of water, spectroscopic techniques and their applications. This course provides exposure on electrochemical techniques for corrosion control, surface coatings and energy storage devices and also emphasis the properties and applications of engineering materials.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency (in %)	Expected Attainment Level (in %)
CO1	Explain the essential water quality parameters of water	TPS2	70	70
CO2	Determine hardness of water and identify suitable water treatment method	TPS3	70	70
CO3	Explain the electrochemical process involved in energy storage devices and corrosion of metals	TPS2	70	70
CO4	Interpret the electrochemical principles in modern energy storage devices and corrosion control methods	TPS3	70	70
CO5	Identify the appropriate spectroscopic technique for various applications	TPS3	70	70
CO6	Select the materials based on the properties for Engineering applications	TPS3	70	70

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	L	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	L	-	-	-	L	-	-	-	-	-	-	-
CO3	M	L	-	-	-	-	-	-	-	-	-	-	-	-
CO4	S	M	L	-	-	-	-	-	L	-	-	-	-	-
CO5	S	M	L	-	-	-	L	-	L	-	-	-	-	-
CO6	S	M	L	-	-	-	-	-	-	-	-	-	-	-

S – Strong

M – Medium

L – Low

Assessment Pattern

CO	Assessment 1 (%)						Assessment 2 (%)						Terminal (%)			
	CAT 1			Assignment 1			CAT 2			Assignment 2						
TPS	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	Total
CO1	4	20	0	-	-	-	-	-	-	-	-	-	2	8	-	10
CO2	4	0	20	-	-	50	-	-	-	-	-	-	2	4	10	16
CO3	4	20	0	-	-	-	-	-	-	-	-	-	2	8	-	10
CO4	8	0	20	-	-	50	-	-	-	-	-	-	2	4	10	16
CO5	-	-	-	-	-	-	12	20	20	-	-	50	6	8	10	24
CO6	-	-	-	-	-	-	8	20	20	-	-	50	6	8	10	24
Total	20	40	40	100			20	40	40	100			20	40	40	100

*Assessment type of Assignments: Quiz / Test /Presentation

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Water:

Water-sources- physical - characteristics - alkalinity - hardness of water – types -determination of hardness by EDTA method. Boiler trouble-Softening of water: internal and External treatment methods. Waste water treatment process.

Electrochemical technologies for energy storage and surface engineering:

Electrochemistry and Energy storage: Basics of electrochemistry. Batteries - Primary and Secondary batteries. Fuel cells. Hydrogen generation and storage. Corrosion and Surface Engineering–Basics –Corrosion - causes- factors- types - corrosion of metal and computer components- Corrosion control. Electroplating - Electroless process.

Spectroscopic technique and applications:

Principle, instrumentation, and applications: X-ray-diffraction - UV–Visible spectroscopy- Atomic Absorption Spectroscopy - Fluorescence spectroscopy - Inductively Coupled Plasma - Optical Emission Spectroscopy- Infra-red spectroscopy - Nuclear magnetic resonance spectroscopy.

Engineering materials:

Bonding and their influences on the property of materials - melting point - brittleness, ductility – thermal, electrical, and ionic conductivity - optical – magnetic properties, hydrophobic, hydrophilic. Polymer composites - structure and properties-applications. Ceramics and advanced ceramics - types-properties-applications Nano-materials – Synthesis, structure, and properties –applications.

Text Book(s)

1. P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, DhanpatRai publications, New Delhi, 16thedition, 2015.

Reference Books & Web Resources

1. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry", S.Chand& Company, 12thEdition, Reprint, 2013.
2. Shashi Chawla, " A text book of Engineering Chemistry", DhanpatRai& Co.(pvt) Ltd, 3rd edition, reprint 2011.
3. C. N. Banwell and E.M. McCash, "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill (India), 5thEdition, 2013.

4. W.F. Smith, Principles of Materials Science and Engineering: An Introduction; Tata Mc-Graw Hill, 2008.
5. V. Raghavan, Introduction to Materials Science and Engineering; PHI, Delhi, 2005.
6. M. Akay, 2015, An introduction to polymer matrix composites,” from: https://www.academia.edu/37778336/An_introduction_to_polymer_matrix_composites

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Water	
1.1	Importance of water, sources, standards for drinking water, (WHO, BIS & ICMR standards) physical, chemical & biological characteristics, Alkalinity (principle only)	1
1.2	Hardness of water - types, units. Determination of hardness by EDTA method and numerical problems	2
1.3	boiler trouble: Scale and sludge formation, boiler corrosion, priming and foaming, caustic embrittlement	1
1.4	Internal treatment methods: Carbonate, Phosphate, Colloidal, Calgon conditioning	1
1.5	softening of water: External treatment methods: Lime-soda process (concept only), zeolite process, ion exchange process	2
1.6	Desalination- reverse osmosis, electro dialysis, solar and multistage flash distillation, nano-filtration	1
1.7	Waste water treatment – primary, secondary, and tertiary treatment	1
2	Electrochemical technologies for energy storage and surface engineering	
2.1	Electrochemistry and Energy storage: Introduction– Basics of electrochemistry – Redox process, EMF	1
2.2	Energy storage – Batteries, Battery quality parameters	1
2.3	Primary battery – Dry cell and Alkaline cell	1
2.4	Secondary battery – Lead-acid battery, Lithium-ion battery	1
2.5	Fuel cells – Fundamentals, types and applications. Hydrogen generation and storage	1
2.6	Corrosion and Surface Engineering- Basics –Corrosion - causes- factors- types	1
2.7	chemical, electrochemical corrosion (galvanic, differential aeration), corrosion of metal and computer components-	1
2.8	Corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method	1
2.9	Electroplating –Introduction, Process, Applications (Gold and nickel plating). Electroless plating – Principle, process, Applications (PCB manufacturing)	1
3	Spectroscopic technique and applications	
3.1	Introduction to Electromagnetic Radiation, Types of atomic and molecular spectra	1
3.2	Principle, Instrumentation and Applications: X-ray-diffraction	1

Module No.	Topic	No. of Periods
3.3	UV–Visible spectroscopy, Atomic Absorption Spectroscopy	2
3.4	Fluorescence spectroscopy, Inductively Coupled Plasma - Optical Emission Spectroscopy	2
3.5	Infra-red spectroscopy	2
3.6	Nuclear magnetic resonance spectroscopy – Magnetic resonance imaging	1
4	Engineering materials	
4.1	Bonding and its influence on the property of materials	1
4.2	Properties of materials- melting point - brittleness, ductility - thermal, electrical and ionic conductivity	1
4.3	optical – magnetic properties, hydrophobic, hydrophilic	1
4.4	Polymer composites - structure and properties	1
4.5	applications -automotive, aerospace, marine, biomedical, and defense	1
4.6	Ceramics and advanced ceramics - types-properties	1
4.7	applications- medicine, electrical, electronics, space	1
4.8	Nano-materials – Synthesis, structure and properties	1
4.9	applications - sensors, drug delivery, photo and electro-catalysis, and pollution control	1
	Total	36

Course Designers:

1. Dr. M. Kottaisamy, Professor, Chemistry, hodchem@tce.edu
2. Dr. V. Velkannan, Assistant Professor, Chemistry, velkannan@tce.edu
3. Dr. S. Sivailango, Assistant Professor, Chemistry, drssilango@tce.edu
4. Dr. M. Velayudham, Assistant Professor, Chemistry, mvchem@tce.edu
5. Dr. R. KodiPandyam, Assistant Professor, Chemistry, rkp@tce.edu
6. Dr. A. Ramalinga Chandrasekar, Assistant Professor, Chemistry, arcchem@tce.edu
7. Dr. B. Shankar, Assistant Professor, Chemistry, bsrchem@tce.edu

22EG141	TECHNICAL ENGLISH	Category	L	T	P	Credits
		HSMC	2	0	0	2

Preamble

The course aims at fostering the students 'ability to communicate effectively in various academic, professional, and social settings through oral and written forms. Besides imparting the basic skills namely Listening, Speaking, Reading and Writing (LSRW), significant emphasis is placed on enriching their analytical, descriptive, and creative skills, enabling them to develop and demonstrate a holistic English language proficiency.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency (in %)	Expected Attainment Level (in %)
CO1	Relate the fundamentals of language in terms of vocabulary, grammar and pronunciation in technical communication.	Understand	70%	80%
CO2	Infer ideas from technical and general contexts by identifying main ideas, specific details, predicting and note making	Understand	70%	80%
CO3	Make use of language in professional and social contexts with clarity and conciseness.	Apply	60%	70%
CO4	Identify specific contexts in technical writing, where appropriate lexical and grammatical functions are applied	Apply	60%	70%
CO5	Develop the skills such as understanding, evaluating, analysing and summarising the text and graphical representations.	Apply	60%	70%
CO6	Organise ideas with coherence, cohesion and precision in formal written communication	Apply	70%	80%

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	S	-	S	-	-
CO2	-	-	-	-	-	-	-	-	M	S	-	S	-	-
CO3	-	-	-	-	-	-	-	L	M	S	-	S	-	-
CO4	-	-	-	-	-	-	-	-	M	S	-	S	-	-
CO5	-	-	-	-	-	-	-	-	M	S	-	S	-	-
CO6	-	-	-	-	-	-	-	L	M	S	-	S	-	-

S – Strong

M – Medium

L – Low

Assessment Pattern

CO	Assessment 1 (%)						Assessment 2 (%)						Terminal (%)		
	CAT 1			Assignment 1			CAT 2			Assignment 2					
TPS	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	-	24	-	100			-	-	-	-	-	-	-	10	-
CO2	-	34	-				-	-	-	-	-	-	-	20	-
CO3	-	-	14				-	-	24	-	-	-	-	-	20
CO4	-	-	14	-	-	-	-	-	34	100			-	-	10
CO5	-	-	14	-	-	-	-	-	-				-	-	20
CO6	-	-	-	-	-	-	-	-	42				-	-	20
Total	100			100			100			100			100		

* Assignment 1: Speaking activities in CO1, CO2, and CO3 (100%).

**Assignment 2: Writing activities in CO4, CO5, and CO6 (100%).

***Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

MODULE- I - Basics of Language (CO1)

Vocabulary - Word Building, Prefix, Suffix and Root Words, Basics of Grammar – Parts of Speech, Tenses, Phonetics - Phonemes, Syllables and Stress.

MODULE- II– Reading (CO2)

Reading- Skimming and Scanning of Short Comprehension Passages and Answering Questions or Cloze exercises based on the text prescribed for extensive reading, Note-Making.

MODULE- III–Functional English (CO3)

Framing Questions (WH and Yes/No), Modals, Manual Writing, Recommendations Writing, Agenda and Minutes of Meeting.

MODULE-IV – Technical Notions (CO4)

Technical Notions - Subject-Verb Agreement, Relative Clause, Phrasal Verbs, Impersonal Passive Voice, Noun Compounds, Classifications and Definitions, Cause and Effect, Purpose and Function, Numerical Adjectives.

MODULE-V – Analytical Writing and Business Correspondence (CO5 & CO6)

Summary Writing, Interpretation of Graphics, Jumbled Sentences, Paragraph Writing, Formal Letters (Seeking Permission for Industrial Visit / internship / Bonafide), E-mail Writing (BEC Vantage Writing Task I)

Text Book(s)

1. Murphy, Raymond, English Grammar in Use with Answers; Reference and Practice for Intermediate Students, Cambridge: CUP, 2004
2. Jones, Daniel. An English Pronouncing Dictionary, Cambridge: CUP, 2006
3. Brook-Hart, Guy. Cambridge English- Business Benchmark-Upper Intermediate, CUP,2013.
4. Dhanavel, S.P. English and Communication Skills for Students of Science & Engineering, Orient BlackSwan, Chennai: 2016.
5. Swan, Michael. Practical English Usage.4thEdn. OUP. 2017.
6. Elbow, Peter. Writing with Power: Techniques for Mastering the Writing Process. New York, Oxford University Press, 1998.

Reference Books & Web Resources

1. Anthology of Select Five Short Stories
2. Tagore, Rabindranath. Chitra, a Play in One Act. London, Macmillan and Co., 1914.
3. www.englishclub.com
4. owl.english.purdue.edu
5. www.oxfordonlineenglish.com
6. www.bbclearningenglish.com
7. tcesrenglish.blogspot.com

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1.	Word Building, Prefix, Suffix and Root Words	1
2.	Parts of Speech	1
3.	Tenses	1
4.	Skimming and Scanning of Short Comprehension Passages	1
5.	Manual Writing	1
6.	Recommendations	1
7.	Note-Making	1
8.	Subject-Verb Agreement	1
9.	Phonemes	1
10.	Syllables and Stress	1
11.	Answering Questions or Cloze exercises based on the text prescribed for extensive reading	1
12.	Noun Compounds, Classifications and Definitions	1
13.	Cause and Effect, Purpose and Function	1
14.	Summary Writing	1
15.	Interpretation of Graphics	1
16.	Jumbled Sentences	1
17.	Formal Letters (Seeking Permission for Industrial Visit / internship / Bonafide)	1
18.	Phrasal Verbs and Impersonal Passive Voice	1
19.	Numerical Adjectives	1
20.	Framing Questions (WH and Yes/No) and Modals	1
21.	Agenda and Minutes of Meeting	1
22.	Relative Clause	1
23.	E-mail Writing (BEC Vantage Writing Task I)	1
24.	Paragraph Writing	1
Total		24

Course Designers:

1. Dr. A. Tamilselvi, tamilselvi@tce.edu
2. Dr. S. Rajaram, sreng@tce.edu
3. Dr. G. JeyaJeevakani, gjjeng@tce.edu
4. Dr. R. TamilSelvi, rtseng@tce.edu
5. Mrs M Sarpparaje, mseeng@tce.edu

22IT151	ENGINEERING EXPLORATION	Category	L	T	P	Credits
		ESC	1	1	0	2

Preamble

The course Engineering Exploration provides an introduction to the engineering field. It is designed to help the student to learn about engineering and how it affects our everyday lives. On the successful completion of the course, students will be able to explain how engineering is different from science and technology and how science, mathematics and technology are an integral part of engineering design. Students will understand the basic computer engineering concepts.

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	Explain technological & engineering development, change and impacts of engineering	TPS2	B	80
CO2	Draw a product in enough detail that others can accurately build it and write specification sheet for a given product	TPS3	B	80
CO3	Complete initial steps (Define a problem, list criteria and constraints, brainstorm potential solutions and document the ideas) in engineering design process	TPS3	B	80
CO4	Draw sketches to a design problem and provide a trade-off matrix	TPS3	B	80
CO5	Communicate possible solutions through drawings and prepare project report	TPS3	B	80
CO6	Apply Combinational and Sequential circuit design procedure for a given scenario with the knowledge of Boolean expression and Logic gates.	TPS3	B	80

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	PSO1	PSO2	PSO3
CO1	M	L	-										M		
CO2	S	M	L										M		
CO3	S	M	L										M		
CO4	S	M	L										M		
CO5	S	M	L										M		
CO6	S	M	L										M		
CO7	S	M	L										M		

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Worksheet-1			Worksheet-2			CAT			Terminal (Theory)
	1	2	3	1	2	3	1	2	3	
TPS Scale										
CO1	5	20							5	10
CO2		5	20						5	10
CO3					5	20			10	20
CO4					5	20			10	20
CO5									10	20
CO6									10	20

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

What is Engineering: Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements

Engineering Design: Problem definition, idea generation through brainstorming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement.

Defining problems and Brainstorming: Researching design, sketching problem solving

Communicating solution: Dimensioning orthographic drawing, perspective drawing

Modelling and Testing final output: Product evaluation, reverse engineering, final project report.

Information Technology: Number Systems Representation, Logic Gates, Combinational Circuits and its Applications, Sequential Circuits and its Applications.

Text Book

1. Ryan A.Brown, Joshua W.Brown and Michael Berkiher: "Engineering Fundamentals: Design, Principles, and Careers", Goodheart-Willcox Publisher, Second Edition, 2014.
2. Saeed Moaveni, "Engineering Fundamentals: An Introduction to Engineering", Cengage learning, Fourth Edition, 2011.
3. Morris Mano M. "Digital Design: with an Introduction to Verilog HDL :", Pearson Education, Fifth Edition, 2013

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1.	What is Engineering	
1.1	Engineering Requirement	1
1.2	Knowledge within Engineering disciplines,	1
1.3	Engineering advancements	1
2	Engineering Design	
2.1	Problem definition,	1
2.2	idea generation through brainstorming and researching	1

No.	Topic	No. of Lectures
2.3	solution creation through evaluating and communicating,	1
2.4	text/analysis	1
2.5	final solution and design improvement	1
3	Defining problems and Brainstorming:	
3.1	Researching design	1
3.2	sketching problem solving	2
4	Communicating solution	
4.1	Dimensioning orthographic drawing	1
4.2	perspective drawing	1
5	Modelling and Testing final output	
5.1	Product evaluation	1
5.2	reverse engineering	1
5.3	final project report	1
6	Information Technology	
6.1	Number Systems Representation	2
6.2	Logic Gates	2
6.3	Combinational Circuits and its applications	2
6.4	Sequential Circuits and its applications	2
	Total	24

Course Designers

1. Dr. D.Tamilselvi dtamilselvi@tce.edu
2. R.Parkavi rpit@tce.edu
3. P.VijayaPrabha pvpit@tce.edu

22IT162

**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					
	Theory						Theory												Practical					
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
1	Introduction to Problem Solving	
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	
2	Fundamentals of Python	
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	
2.5	Loops, Nested loops	1
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	
3	Functions, Scoping, Abstraction	
3.1	Function Definition	2
3.2	Keyword Arguments, Default values, Variable arguments	
3.3	Scoping – Global variables	
3.4	Problem Solving Techniques – Recursion	
4	Structured types, Mutability, Higher Order Functions	
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	
Total Hours		12

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
Total Hours		48	

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

22EG171	ENGLISH LABORATORY	Category	L	T	P	Credits
		HSMC	0	0	2	1

Preamble

This practical course enables the students to develop and evaluate their basic English language skills through individualized learning process at the Language Lab, using English Software and online resources. In addition, it facilitates students with the need-based student-centric presentation sessions in a multi-media driven classroom environment.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome Statement	TCE Proficiency Scale
CO1	Interpret words correctly through listening and watching general and technical online contents	Understand
CO2	Develop appropriate pronunciation skills through listening and speaking practices	Apply
CO3	Build and apply a wide range of lexicons in general and technical presentations	Apply
CO4	Identify and apply the key ideas and spoken English features learnt through auditory and visual listening tools	Apply
CO5	Experiment with inventiveness by creating a blog, vlog, or YouTube channel.	Apply
CO6	Prepare and deliver oral and written presentations using digital tools.	Apply

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	S	-	S	-	-
CO2	-	-	-	-	-	-	-		M	S	-	M	-	-
CO3	-	-	-	-	-	-	-	L	M	S	-	S	-	-
CO4	-	-	-	-	-	-	-	L	M	S	-	M	-	-
CO5	-	-	-	-	-	-	-	L	M	S	-	S	-	-
CO6	-	-	-	-	-	-	-	L	S	S	-	S	-	-

S – Strong

M – Medium

L – Low

Assessment Pattern

Students' performance will be assessed in the language lab/ classroom as given below:

- Spoken Task - General / Technical Presentation / Picture Description : 20 Marks
- Listening Task – (MCQs, Gap Filling Exercises) : 10 Marks
- Written Test - Phonetics, Grammar, Vocabulary, Reading : 20 Marks

External:

- Online Exam- Phonetics, Grammar, Vocabulary, Reading (45 Minutes) : 50 Marks
- Listening Test : 20 Marks
- Submission of Students' Record on Practical Tasks in the Class and Lab : 10 Marks
- BEC Vantage Speaking Tasks I and II : 20 Marks

List of Experiments

Sl. No.	Topic	Hours
LAB ACTIVITIES (12 Hours)		
1	Listening to TED Talks/ Podcasts/ Product Advertisements/ News Bulletins.	2
2	Phonetics – Tutorials through Online Repositories, English Movie Clips and Software in the Lab(S-net)	2
3	Vocabulary Development through Movies / Short Films/ Documentaries	2
4	Language Development through English software S-net and Online Content (Tenses, Voices, SV Agreement, Prepositions, Coherence Markers, Relative Clauses, Modals, Punctuation)	2
5	Reading Comprehension – I (General / Technical, BEC Vantage Reading Task III)	2
6	Creating a Blog/Vlog/YouTube Channel –Uploading MP3/MP4 – Practice (Movie/Book/ Gadget Review, General/Tech Talks, Interview with Celebrities)	1
7	Revision – Model Online Aptitude Test	1
CLASSROOM ACTIVITIES (12 Hours)		
8	Introduction of Spoken English Features	1
9	Self-introduction and Introducing others	1
10	Video Comprehension – Brainstorming and Note-Taking	2
11	Role-Play, Picture/Movie Description	1
12	Reporting the events from Media / Newspapers – Discussion	1
13	Interactive Games for Language Development	1
14	Reading / Note Making (Extensive Reading – News Paper Reports)	1
15	Presentation – I (Book /Movie Review, Story Telling, General Presentations)	2
16	Presentation – II (Technical Presentations)	2
Total		24

Software Used:

1. English Software S Net
2. Business English Certificate-Vantage- Practice Software

Teaching Resources and Websites:

1. Open Online Repositories from Oxford / Cambridge / British Council/ Voice of America
2. Free Video Downloads from YouTube
3. www.ted.com
4. tcesrenglish.blogspot.com

Course Designers:

1. Dr. A.Tamilselvi, tamilselvi@tce.edu
2. Dr. S. Rajaram, sreng@tce.edu
3. Dr. RS. Swarnalakshmi, rssleng@tce.edu
4. Mrs. M. Sarpparaje, mseeng@tce.edu

22PH182	PHYSICS LABORATORY	Category	L	T	P	Credits
		BSC	0	0	2	1

Preamble

This course ensures that students are able to apply the basic physics concepts and carry out the experiments to determine the various physical parameters related to the material

- Learn the necessary theory to understand the concept involved in the experiment.
- Acquire the skills to carry out the experiment.
- Tabulate the observed data and use the formula to evaluate the required quantities.
- Plot the data in a graph and use it for calculation.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency (in %)	Expected Attainment Level (in %)
CO1	Analyse the mechanical & electrical oscillations and determine their resonance frequency	TPS3	85	90
CO2	Analyse the interference and diffraction patterns for micron sized objects	TPS3	85	90
CO3	Investigate the V-I characteristics of photodiode, phototransistor under dark and bright illumination conditions	TPS3	85	90
CO4	Determine the Planck's constant using LEDs	TPS3	85	90
CO5	Plot the VI characteristics of solar cell and find the fill factor	TPS3	85	90
CO6	Determine the reversibility of classical and quantum logic gates	TPS3	85	90
CO7	Identify the variation of magnetic field with distance for circular coils	TPS3	85	90

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S – Strong

M – Medium

L – Low

List of Experiments

1. Quantum Logic Gate-Toffoli gate
2. Study of Optoelectronic Devices- Photodiode, Phototransistor.
3. Solar cell VI characteristics, fill factor & Optical fibre-Determination of numerical aperture.
4. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of regular objects.
5. Laser Diffraction - Determination of wave length of the laser using grating and determination of micro particle size. (Observing diffraction pattern due to single and double slit)
6. Air wedge – Determination of thickness of a thin sheet/wire.
7. Determination of Planck's constant through V-I characteristics of LED.
8. Determination of magnetic field-Stewart and Gees.
9. LCR Circuit – Determination of resonant frequency

Course Designers:

1. Dr. N. Sankarasubramanian, Professor, nssphy@tce.edu
2. Dr. A. L. Subramaniyan, Assistant Professor, alsphy@tce.edu
3. Dr. P.K. Kannan, Assistant Professor, akphy@ce.edu

22CH191	CHEMISTRY LABORATORY	Category	L	T	P	Credits
		BSC	0	0	2	1

Preamble

This course aims to provide the students, a basic practical knowledge in chemistry. The objective of this course is to develop intellectual and psychomotor skills of the students by providing hands on experience in quantitative, electrochemical and photo-chemical analysis.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome Statement	TCE Proficiency Scale
CO1	Estimate the chemical water quality parameters of sample water / effluent	Apply
CO2	Demonstrate presence of calcium ions in milk sample	Apply
CO3	Determine the surface tension of solvent mixtures	Apply
CO4	Estimate pH and acid content of samples using pH metric and conductometric titrations	Apply
CO5	Illustrate the strength of oxidisable materials present in given sample by potentiometric method	Apply
CO6	Determine Fe ²⁺ ion in effluent using colorimetric method	Apply
CO7	Calculate the efficiency of electroplating	Apply
CO8	Determine the rate of corrosion of metal & alloy using potentiodynamic polarisation method	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S – Strong

M – Medium

L – Low

List of Experiments

Experimental List	CO
Quantitative Analysis	
Estimation of total hardness of water sample	CO1
Estimation of COD of industrial effluent	CO1
Determination of calcium ion in milk sample	CO2
Determination of surface tension of solvent mixture	CO3
Electrochemical and Photochemical Analysis	
Determination of the Phosphoric acid content in soft drinks using conductometric titration	CO4
Determination of pH of soil by pH metric titration	CO4
Potentiometric redox titration ($K_2Cr_2O_7$ vs FAS, $KMnO_4$ vs FAS)	CO5
Estimation of iron content in water sample using colorimeter	CO6
Estimation of current density of electroplating process using Hull cell	CO7
Determination of rate of corrosion of metal and alloy using potentio-dynamic polarisation technique (TAFEL)	CO8

Learning Resources:

1. Vogel's Textbook of Quantitative Chemical Analysis (8TH edition, 2014)
2. Laboratory Manual – Department of Chemistry, Thiagarajar College of Engineering (2022)

Course Designers:

1. Dr. M. Kottaisamy, hodchem@tce.edu
2. Dr. S. Balaji, sbalaji@tce.edu
3. Dr. V. Velkannan, velkannan@tce.edu
4. Dr. S. Sivailango, drssilango@tce.edu
5. Dr. M Velayudham, mvchem@tce.edu
6. Dr. R Kodi Pandyan, rkp@tce.edu
7. Dr. A Ramalinga Chandrasekar, arcchem@tce.edu
8. Dr. B. Shankar, bsrchem@tce.edu

22IT211	LINEAR ALGEBRA, ORDINARY DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS
----------------	---

Category	L	T	P	Credit
BSC	3	1	0	4

Preamble

Linear algebra is a mathematical subfield concerned with vectors, matrices, and linear transforms. This course provides the knowledge about linear transformations, matrix types, Eigen values, and Eigen vectors. Differential equations have numerous applications in engineering and science. This course teaches students the fundamentals of Linear Algebra and ordinary differential equations enabling them to understand the mathematics applied in modelling real-time engineering problems.

Prerequisite

Nil

Course Outcomes

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

COs	Course Outcome	TCE Proficiency Scale	Expected Proficiency %	Expected Attainment Level %
CO1	Identify basis, row space, column space, null space and dimension of a vector space	TPS3	70	65
CO2	Represent linear transformations by a matrix and vice - versa	TPS2	75	70
CO3	Compute the orthonormal basis of an inner product space	TPS3	70	65
CO4	Apply matrix algebra techniques for transformations to diagonalize and to produce single value decomposition	TPS3	70	65
CO5	Solve homogeneous and non-homogeneous second-order ordinary differential equations	TPS3	70	65
CO6	Apply the concept of the Laplace transform to engineering problems.	TPS3	70	65

Mapping with Programme Outcomes

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

Assessment Pattern: Cognitive Domain

CO	Assessment 1						Assessment 2						Terminal		
	CAT 1			Assignment 1			CAT 2			Assignment 2					
TPS	1 10	2 30	3 60	1 -	2 -	3 100	1 10	2 30	3 60	1 -	2 -	3 100	1 -	2 30	3 70
CO1	3	10	34	-	-	60	-	-	-	-	-	-	-	9	14
CO2	7	10	-	-	-	-	-	-	-	-	-	-	-	9	-
CO3	-	10	26	-	-	40	-	-	-	-	-	-	-	3	15
CO4	-	-	-	-	-	-	3	10	20	-	-	33	-	3	14
CO5	-	-	-	-	-	-	3	10	20	-	-	33	-	3	13
CO6	-	-	-	-	-	-	4	10	20	-	-	34	-	3	14
TOTAL	10	30	60	-	-	100	10	30	60	-	-	100	-	30	70

Tutorials: Program Using Python / Matlab

Syllabus

Vector Space: Vector space - Definition and Examples, Subspaces, Null spaces, The span of a set of vectors, Linearly independent, dependent, Basis and Dimension, Row spaces, The rank Nullity theorem, Column spaces.

Linear Transformations and Orthogonality: Definitions and Examples - Linear Operators on $\mathbf{R}^2$, Linear Transformations from $\mathbf{R}^n$ to $\mathbf{R}^m$ - Linear Transformations from $\mathbf{V}$ to $\mathbf{W}$ -Matrix Representations of Linear Transformations, Matrix representation theorem. **Orthogonality:** The scalar Product in $\mathbf{R}^2$ and $\mathbf{R}^3$ - Scalar and Vector Projections-Orthogonality in $\mathbf{R}^n$ - Orthogonal Subspaces-Fundamental Subspaces - Inner Product spaces, Basic properties of Inner product Spaces-Norms, Orthonormal sets, Orthogonal Matrices, Gram-Schmidt process.

Matrix Eigen Value Problem: Eigen values and Eigen vectors –Some Applications of Eigen value Problems – Symmetric, Skew symmetric and orthogonal matrices – Eigen bases, Diagonalization -Singular Value Decomposition - Quadratic forms.

Ordinary Differential Equations: Homogeneous Linear ODEs of second order – Homogeneous Linear ODEs with constant coefficients – Euler Cauchy Equation – Existence and uniqueness of solutions, Wronskian - Nonhomogeneous ODE - Solution by Variation of Parameters.

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.

Text Book

1. Steven J. Leon., "Linear Algebra with Application" Ninth Edition, Pearson, 2015.
2. ERWIN KREYSZIG., "Advanced Engineering Mathematics" 10th Edition, John Wiley & Sons, INC. 2011

Reference Books

1. DAVID C.LAY., "Linear Algebra and its Applications" 4th Edition, 2012.
2. GILBERT STRANG., "Introduction to Linear Algebra" 5th Edition, 2016.

Course contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	VECTOR SPACE	
1.1	Definition and Examples	1
1.2	Subspaces, Null spaces, The span of a set of vectors	2
	Tutorial	1
1.3	Linearly independent, dependent	2
1.4	Basis, Dimension	1
	Tutorial	1
1.5	Row spaces, The rank Nullity theorem, Column spaces	2
	Tutorial	1
2	LINEAR TRANSFORMATION AND ORTHOGONALITY	
2.1	Linear transformation: Definition and Examples, Linear Operators on $\mathbf{R}^2$, Linear Transformations from $\mathbf{R}^n$ to $\mathbf{R}^m$	1
2.2	Linear Transformations from $\mathbf{V}$ to $\mathbf{W}$	1
2.3	Matrix Representations of Linear Transformations, Matrix representation theorem	1
	Tutorial	1
2.4	Orthogonality: The scalar Product in $\mathbf{R}^2$ and $\mathbf{R}^3$, Scalar and Vector Projections, Orthogonality in $\mathbf{R}^n$	1
2.5	Orthogonal Subspaces, Fundamental Subspaces	1
2.6	Inner Product spaces, Basic properties of Inner product Spaces	1
	Tutorial	1
2.7	Norms, Orthonormal sets, Orthogonal Matrices,	2
2.8	Gram-Schmidt process	2
	Tutorial	1
3	MATRIX EIGEN VALUE PROBLEM	
3.1	Eigenvalues and Eigen vectors	1
3.2	Some Applications of Eigen value Problems	1
3.3	Symmetric, Skew symmetric and orthogonal matrices	1
3.4	Tutorial	1
3.5	Eigen bases, Diagonalization	1
3.6	The Single Value Decomposition	1
3.7	Quadratic forms	1
	Tutorial	1
4	ORDINARY DIFFERENTIAL EQUATION	
4.1	Homogeneous Linear ODEs of second order – Homogeneous Linear ODEs with constant coefficients	1
4.2	Euler Cauchy Equation	1
4.3	Existence and uniqueness of solutions	2
	Tutorial	1

4.4	Wronskian - Nonhomogeneous ODE	1
4.5	Solution by Variation of Parameters.	1
	Tutorial	1
5	LAPLACE TRANSFORMS	
5.1	Laplace transform, Linearity	1
5.2	First Shifting theorem - Transforms of derivatives and integrals	1
5.3	ODEs – Unit step function, Second shifting theorem	1
	Tutorial	1
5.4	Short Impulses, Dirac's delta function, partial fractions	1
5.5	Convolution, Integral Equations	1
5.6	Differentiation and integration of transforms	1
5.7	Tutorial	1
	Total	48

Course Designer(s):

- | | |
|-------------------------|--|
| 1. Dr. P. Krishnapriya | pkamat@tce.edu |
| 2. Ms. H. Sri Vinodhini | srvinodhini@tce.edu |
| 3. Dr. P. Victor | pvmat@tce.edu |

22IT222	OPERATING SYSTEMS
----------------	--------------------------

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

This course provides a strong foundation on basic operating systems components, mechanisms and implementations. The core focus is on the various algorithms and implementation approaches used for process management, memory management, deadlock handling and case studies with Linux, Windows and mobile OS.

Prerequisite

- Nil

Course Outcomes

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

COs	Course Outcomes	TPS	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the essential types, features, components, services and structure of operating systems	TPS2	70	75
CO2	Use process synchronization to handle critical section problem	TPS3	70	65
CO3	Report various scheduling mechanisms like CPU scheduling and thread scheduling	TPS3	70	65
CO4	Demonstrate deadlock with system model and how to handle deadlocks	TPS3	70	65
CO5	Report various memory management techniques such as paging and segmentation	TPS3	70	65
CO6	Review different operating systems like Linux, Windows with case studies.	TPS2	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	S	M	L					M	M	M			M		L
CO3	S	M	L					M	M	M			M		L
CO4	S	M	L										M		
CO5	S	M	L					M	M	M			M		L
CO6	M	L											L		

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1			Assignment 1			CAT2			Assignment 2			Terminal		
	100			100			100			100			100		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	4	16			25								2	5	
CO2	4	16	20			25							2	5	10
CO3	4	16	20			50							2	10	10
CO4							4	16	20			50	2	10	10
CO5							4	16	20			50	2	10	10
CO6							4	16						10	

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Operating Systems Overview – OS Structure - Operations – OS Types – Resource Management - Kernel Data structures - Free and open source operating systems– System Calls – Programs- Security: The Security Problem-Program Threats-System and Network Threats

Process Management – Scheduling – operations – Inter-process Communication – Threads: Multicore programming – Multi-threading models- Libraries– Process Synchronization: The critical section problem- Mutex locks – Semaphores – Case Study: problems of synchronization-Bounded Buffer Problem, Reader's Writer's Problem, Dining Philosopher's Problem.

Scheduling - CPU Scheduling: Scheduling algorithm – Multiple processor scheduling – Thread scheduling – Real-time CPU scheduling – Algorithm Evaluation

Deadlock: System Deadlock Model, Deadlock characterization - Deadlock Detection - Deadlock Avoidance - Deadlock Prevention - Deadlock Recovery

Memory Management – Main Memory: Swapping – Continuous Memory allocation – Segmentation – Paging – Page table– Virtual Memory: Demand Paging- Copy-on-Write- Page Replacement– File systems : Structure and Implementation – Storage : Disk Scheduling – I/O: Kernel I/O Subsystem.

Case studies – Linux: Components, Process Management, Scheduling, Windows: Terminal Services, File System, Distributed Operating Systems: Needs and Design Goals Mobile OS: comparison of Android OS and MAC OS.

Text Book

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", John Wiley & Sons Pvt. Ltd., Tenth Edition, 2018
2. Mobile OS Trends - <https://people.apache.org/~xli/papers/itj2012-mobile-os-trends.pdf>.

Reference Books & web resources

1. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, 2019.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Operating Systems Overview	
1.1	OS Structure - Operations – OS Types	1
1.2	Resource Management - Kernel Data structures	1
1.3	Free and Open source operating systems	1
1.4	System Calls – Programs	1
1.5	Security: The Security Problem-Program Threats-System and Network Threats	2
2	Process Management	
2.1	Scheduling – Operations	1
2.2	Inter-process Communication, Threads: Multicore programming	1
2.3	Multi-threading models- Libraries	1
2.4	Process Synchronization: The critical section problem	1
2.5	Mutex locks – Semaphores	1
2.6	Case Study: problems of synchronization-Bounded Buffer Problem, Reader's Writer's Problem, Dining Philosopher's Problem	3
3	Scheduling	
3.1	CPU Scheduling: Scheduling algorithm	3
3.2	Multiple processor scheduling	1
3.3	Thread scheduling	1
3.4	Real-time CPU scheduling – Algorithm Evaluation	1
4	Deadlock	
4.1	System Deadlock Model, Deadlock characterization	1
4.2	Deadlock Detection	1
4.3	Deadlock Avoidance	1
4.4	Deadlock Prevention	1
4.5	Deadlock Recovery	
5	Memory Management	
5.1	Main Memory: Swapping – Continuous Memory allocation	1
5.2	Segmentation – Paging – Page table	1
5.3	Virtual Memory– Demand paging	1
5.4	Copy-on-write, Page Replacement	2
5.5	File systems: Structure and Implementation	1
5.6	Storage: Disk scheduling	1
5.7	I/O: Kernel I/O Subsystem	1
6	Case studies	
6.1	Linux: Components, Process Management, Scheduling,	1
6.2	Windows: Terminal Services, File System,	1
6.3	Distributed Operating Systems: Needs and Design Goals	1
6.4	Mobile OS: comparison of Android OS and MAC OS	1
	Total Lecture Hours	36

Course Designer(s):

1. R.Parkavi, Assistant Professor, rpit@tce.edu, Information Technology
2. M.Akila Rani, Assistant Professor, marit@tce.edu, Information Technology

22IT231	COMPUTER ORGANIZATION
----------------	------------------------------

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

The course on Computer organization introduces the basic structure and operations of a computer and describe the instruction execution and performance of a machine. It discusses about the performance up gradation through Pipelining, Multicore processing and discusses on Memory hierarchy and communication with I/O devices.

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 the Basic Structure of Computer.	TPS2	70	75
CO2	Apply Instruction set architecture to write an Assembly level language program for simple applications.	TPS3	70	65
CO3	Explain the Basic Input/Output unit and Processing unit.	TPS2	70	75
CO4	Identify the type of hazard in a given sequence of instructions and the methods to overcome it.	TPS3	70	65
CO5	Describe storage and retrieval of information from Memory.	TPS2	70	75
CO6	Explain the basic concepts of Parallel processing.	TPS2	70	75

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory						Theory						Terminal		
	CAT1			CAT2			Assignment 1			Assignment 2			Theory		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	10	10	-	-	-	-	-	-	-	-	-	-	3	10	-
CO2	-	20	30	-	-	-	-	-	100	-	-	-	3	5	15
CO3	10	20	-	-	-	-	-	-	-	-	-	-	3	10	-
CO4	-	-	-	-	20	30	-	-	-	-	-	100	3	10	15
CO5	-	-	-	10	10	-	-	-	-	-	-	-	3	10	-
CO6	-	-	-	10	20	-	-	-	-	-	-	-	3	10	-

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Basic Structure of Computers: Computer Types- Functional Units - Basic Operational Concepts- Number Representation and Arithmetic Operations - Character Representation – Floating point arithmetic-Performance- Historical Perspective.

Instruction Set Architecture: Memory Locations and Addresses-Memory Operations- Instructions and Instruction Sequencing- Addressing Modes-Assembly Language-Stack-Subroutine- CISC Instruction Sets

Basic Processing Unit: Instruction Execution-Hardware Components-Instruction Fetch and Execution Steps-Control Signals-Hardwired Control-CISC Style Processors

Pipelining: Pipeline Organization- Pipelining Issues-Data Dependencies-Memory Delays-Branch delays -Resource Limitation-Performance Evaluation-Superscalar Operation-Pipelining in CISC Processors

Input/Output Organization: Bus Structure-Bus Operation-Arbitration-InterfaceCircuits-Interconnection Standards- Accessing I/O Devices- Interrupts

Memory System: Semiconductor RAM Memories- Read-only Memories- Direct Memory Access-Memory Hierarchy-Cache Memories-Performance Consideration-Secondary storage

Parallel Processing: Vector (SIMD) Processing- Shared-Memory Multiprocessors- Cache Coherence- Parallel Programming for Multiprocessors.

Case study on Indian made Processors

Text Book

1. Carl Hamacher,Zvonko Vranesic,Safwat Zaky, Naraig Manjikian ,”Computer Organization and Embedded Systems” , Tata McGraw Hill ,Sixth Edition ,2012.

Reference Books & web resources

1. David A Patterson, John L. Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, 4th Edition, Morgan Kaufmann, 2009
2. William Stallings, “Computer Architecture and Organization”, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003
3. Assembly Language, Online notes, <http://linuxassembly.org/>.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Basic Structure of Computers	
1.1	Computer Types- Functional Units	1
1.2	Basic Operational Concepts	1
1.3	Number Representation and Arithmetic Operations	1
1.4	Character Representation, Floating point arithmetic	1
1.5	Performance- Historical Perspective	1
2	Instruction Set Architecture	
2.1	Memory Locations and Addresses	1
2.2	Memory Operations	1
2.3	Instructions and Instruction Sequencing	1
2.4	Addressing Modes	1
2.5	Assembly Language-Stack-Subroutine	1
2.6	CISC Instruction Sets	1
3	Basic Processing Unit	
3.1	Instruction Execution-Hardware Components	1
3.2	Instruction Fetch and Execution Steps	1
3.3	Control Signals	1
3.4	Hardwired Control	1
3.5	CISC Style Processors	1
4	Pipelining	
4.1	Pipeline Organization	1
4.2	Pipelining Issues-	1
4.3	Data Dependencies	1
4.4	Memory Delays-	1
4.5	Branch delays	1
4.6	Resource Limitation-Performance Evaluation	1
4.7	Superscalar Operation	1
4.8	Pipelining in CISC Processors	1

Module No.	Topic	No. of Periods
5	Input/Output Organization	
5.1	Bus Structure	1
5.2	Bus Operation-Arbitration	1
5.3	Interface circuits-Interconnection Standards	1
5.4	Accessing I/O Devices- Interrupts	1
6	Memory System	
6.1	Semiconductor RAM Memories- Read-only Memories	1
6.2	Direct Memory Access-Memory Hierarchy	1
6.3	Cache Memories	1
6.4	Performance Consideration-Secondary storage	1
7	Parallel Processing	
7.1	Vector (SIMD) Processing	1
7.2	Shared-Memory Multiprocessors	1
7.3	Cache Coherence	1
7.4	Parallel Programming for Multiprocessors.	1
	Total	36

Course Designer(s):

1. K.V.Uma
2. R.Parkavi

kvuit@tce.edu
rpit@tce.edu

22IT241	IT INFRASTRUCTURE MANAGEMENT
----------------	---

Category	L	T	P	Credit
ESC	3	0	0	3

Preamble

This course covers modern storage technologies for enterprise-grade data storage and data management. It includes networked storage models, applications in business continuity and exposure to real-world storage networking technologies.

Prerequisite

Nil

Course Outcomes

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

CO	Course Outcomes	TPS Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the building blocks of Infrastructure for IT applications	TPS2	70	70
CO2	Demonstrate the networking infrastructure requirements for a given application.	TPS3	70	70
CO3	Use enterprise storage technologies such as SAN, Cloud-based storage and storage virtualization to provide storage solutions	TPS3	70	70
CO4	Adapt suitable backup and recovery strategy for a given application scenario	TPS3	70	70
CO5	Employ appropriate performance metrics to ascertain information availability	TPS3	70	70
CO6	Describe the essential steps of business continuity planning	TPS2	70	70

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO9.	M	L											L		
CO10	S	M	L					M	M	M			M		L
CO3	S	M	L					M	M	M			M		L
CO4	S	M	L					M	M	M			M		L
CO5	S	M	L					M	M	M			M		L
CO6	M	L					L					M	L		

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory						Theory						Terminal					
	CAT 1			Assignment 1			CAT 2			Assignment 2			Theory					
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	10	10	-	-	-	-	-	-	-	-	-	-	5	5	-	-	-	-
CO2	5	10	20	-	-	50	-	-	-	-	-	-	2	5	10	-	-	-
CO3	5	10	10	-	-	50	-	-	-	-	-	-	2	5	20	-	-	-
CO4	-	10	10	-	-	-	5	10	40	-	-	50	1	5	20	-	-	-
CO5	-	-	-	-	-	-	5	20	-	-	25	-	5	5	-	-	-	-
CO6	-	-	-	-	-	-	10	10	-	-	25	-	5	5	-	-	-	-

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Storage Infrastructure: Storage Systems: Levels – Types - HDD – SSD - RAID – Infrastructure for Application deployment - Data Center – Cloud Fundamentals

Network Infrastructure: Network Devices - Switches, Routers, Hub, Bridges, Network types-LAN, WAN, Wireless Networks – Global internet – DNS

Storage for Enterprises: Direct Attached Storage - Architecture and components - Network Attached Storage – Architecture and components and connectivity -NFS – CIFS – SMB protocol – SAN: IP SAN and FC SAN: Architecture and Components– Storage Virtualization

Backup and Recovery: Backup and Recovery: Architecture – Components – Types – Granularity – Topologies - Tools

Information Availability: Information Life Cycle Management - Data Categorization – Information Availability – Business Continuity: Needs-Goals and Planning - Scalable storage systems – Service Oriented Storage – Serverless Technologies.

Text Book

1. SJaak Laan, "IT Infrastructure Architecture – Infrastructure Building Blocks and Concepts", Third Edition, Lulu Press Inc, 2017.
2. G.Somasundaram, A.Shrivastava, "EMC Corporation, Information Storage and Management: Storing, Managing and Protecting Digital Information in Classic, Virtualized and Cloud Environment", 2nd Edition, Wiley publication, 2012

Reference Books & web resources

1. Robert Spalding, "Storage Networks : The Complete Reference", Tata McGraw Hill, Osborne, 2003.
2. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
3. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Prentice Hall, 2013.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Storage Infrastructure	
1.1	Storage Systems: Levels – Types - HDD – SSD	1
1.2	RAID	2
1.3	Infrastructure for Application deployment	2
1.4	Data Center Infrastructure	2
1.5	Cloud Fundamentals	2
2	Network Infrastructure	
2.1	Network Devices - Switches, Routers, Hub, Bridges	1
2.2	Network types-LAN, WAN, Wireless Networks	1
2.3	Global internet -DNS	1
3	Storage for Enterprises	
3.1	Direct Attached Storage - Architecture and components	1
3.2	Network Attached Storage – Architecture and components and connectivity -NFS – CIFS – SMB protocol	3
3.3	SAN: IP SAN and FC SAN : Architecture and Components	3
3.4	Storage Virtualization	2
4	Backup and Recovery	
4.1	Backup and Recovery: Architecture	2
4.2	Components – Types – Granularity	2
4.3	Topologies - Tools	2
5	Information Availability	
5.1	Information Life Cycle Management - Data Categorization	2
5.2	Information Availability	3
5.3	Business Continuity: Needs-Goals and Planning	2
5.4	Scalable storage systems – Service Oriented Storage – Serverless Technologies.	2
	Total hours	36

Course Designer(s):

- 1.S. Pudumalar, Assistant Professor, Dept of IT
 2.S. Thiruchadai Pandeewari, Assistant Professor,
 Dept of IT

spmit@tce.edu
eshwarimsp@tce.edu

23IT251**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		
CO 3	S	M	L										M		
CO 4	S	M	L										M		
CO 5	S	M	L										M		
CO 6	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		
TPS Scale	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,6th edition,2018.
2. M. Morris Mano,"Digital Design :Introduction to Verilog HDL",Prentice Hall of India Private Ltd,5th edition,2013.

Reference Books& web resources

1. Charles H.Roth, Larry L.Kinney, "Fundamentals of Logic Design:", 7thEdition,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
1	Binary Systems	
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
2	Switching Theory	
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
3	Simplification of Boolean Expressions and Functions	
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
4	Combinational Logic	
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
5	Sequential Logic	
5.1	Synchronous Sequential Logic	
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	Asynchronous Sequential Logic	
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
Total Lectures		36

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

22IT261	WEB ESSENTIALS
----------------	-----------------------

Category	L	T	P	Credit
PCC	1	0	2	2

Terminal Exam: Practical**Preamble**

The course aims to provide the web essentials for designing a simple application to the novice students. It includes web design using HTML, CSS, Scripting through Java script and PHP.

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	Explain the web application terminologies such as web browser, web server	TPS2	70	80
CO2	Practice UI Design tools such as wireframe	TPS3	70	70
CO3	Design simple web pages using HTML elements	TPS3	70	70
CO4	Design the web pages by including different styles using CSS	TPS3	70	70
CO5	Develop simple Web Applications with client side scripting	TPS3	70	70
CO6	Develop simple Web Applications with server side scripting	TPS3	70	70

Mapping with Programme Outcomes

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

CO	CAT1						CAT2						RECORD & MODEL LAB						TERMINAL					
	THEORY						THEORY						THEORY & PRACTICAL						PRACTICAL					
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									
CO2			20												20						20			
CO3			40						10						20						20			
CO4			30						10						20						20			
CO5									50						20						20			
CO6									20						10						20			

Assessment Pattern

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Web Design Essentials: Internet – WWW – Website – Two/Three tier architecture – Types of Servers – Application Server, Web Server, Database Server – Web browser – Web pages – static and dynamic – UI Design – Wireframe - HTML – Elements, Attributes, Headings, Paragraphs, Links, Images, Tables, Lists, Forms – CSS – inline, internal, external

Scripting Essentials: Client Side Scripting (Java script) – Fundamentals, Arrays, Functions- Events, Form Validations – Server Side Scripting (PHP) – Fundamentals, Functions, Arrays – Forms – Data base

Applications Case Study– Enterprise Applications in Healthcare, Finance, Transport, Education, Society, Agriculture, Governance

Text Book

1. Robin Nixon, "Learning PHP, MySQL & Javascript with jQuery, CSS, HTML5", O'Reilly, 2018 Edition.

Reference Books & web resources

1. Steven Holzner, "PHP: The Complete Reference", Fifth Edition, Mc Graw Hill, 2017.
2. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, "Mastering HTML, CSS & JavaScript Web Publishing", BPB Publications, 2016.

Course Contents and Lecture Schedule

Module No	Topic	No. Of Hours
1	Web Design Essentials	
1.1	Internet – WWW – Website – Two/Three tier architecture	1
1.2	Types of Servers – Application Server, Web Server, Database Server – Web browser – Web pages – static and dynamic	
1.3	UI Design - Wireframe	1
1.4	HTML – Elements, Attributes, Headings, Paragraphs, Links, Images	1
1.5	Tables, Lists, Forms	1
1.6	CSS – inline, internal, external	1

2	Scripting Essentials	
2.1	Client Side Scripting (Java script) – Fundamentals,	1
2.2	Arrays, Functions-	1
2.3	Events, Form Validations	1
2.4	Server Side Scripting (PHP) – Fundamentals	1
2.5	Functions, Arrays	1
2.6	Forms – Data base	1
3	Application Case Study	
3.1	– Enterprise Applications in Healthcare, Finance, Transport, Education, Society, Agriculture, Governance	1
	Total No. Of Lecture Hours	12

List of Experiments

Ex. No	Experiment Name	No. Of Hours
1.	Study of various web applications of different domains such as education, governance, healthcare etc	2
2.	UI Design using Wireframe	2
3.	Web page design using HTML	2
4.	Include styles for the web pages using CSS properties	2
5.	Simple Java scripts	2
6.	Java script forms and Validations using Events	2
7.	Simple PHP scripts	2
8.	PHP script forms and Validations using Events	2
9.	PHP with DB connection	4
10.	Mini-Project	4
	Total No. of Practical Hours	24

Course Designer(s):

1. Dr. C.Jeyamala, Associate Professor, Department of Information Technology jeyamala@tce.edu
2. Dr. P.Karthikeyan, Associate Professor, Department of Information Technology karthikit@tce.edu

22IT271	COMPUTER PROGRAMMING
----------------	-----------------------------

Category	L	T	P	Credit
PCC	1	0	2	2

Terminal Exam: Practical**Preamble**

The Computer Programming course aims at providing hands on experience on programming using C. The students will gain a practical insight in to structured programming concepts and improve their problem solving and programming skills.

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 C programs using basic programming constructs for simple problems	TPS3	70	80
CO2	Practice C programs using arrays for simple problems	TPS3	70	80
CO3	Apply the strings and functions for the given problem	TPS3	70	80
CO4	Practice simple programs using pointers	TPS3	70	80
CO5	Develop simple applications using structures, file processing	TPS3	70	80
CO6	Implement, test and debug the solution for a given problem using C programming language.	TPS3	70	80

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1						CAT2						Record & Model Lab						Terminal					
	Theory						Theory						Theory & Practical						Practical					
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			30												20						20			
CO2			40						10						20						20			
CO3			20						10						20						20			
CO4									20						20						10			
CO5									40						20						20			
CO6			10						20												10			

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Programming constructs Structured Programming Languages – Data types – Operators – Conditional Constructs – Looping Constructs – Functions - Recursion – Scope Rules – Storage classes

Arrays 1D Array – 2D Array – Multi Dimensional Array – Arrays and Functions – Strings – String Functions

Structures and Pointers Structures – Array of Structures – Pointers — Pointers and Arrays – Pointers and Functions - Pointers and Structures – Dynamic Memory Allocation – Unions – Enum – Bit fields

File Processing Files – Preprocessor – Command Line Arguments

Text Book

1. Byron S Gottfried, "Programming with C", 4th edition, Schaum's Outlines, 2018.

Reference Books & web resources

1. Yashwant Kanetkar, "Let us C", 18th Edition, BPB Publications, 2021.
2. Kernighan, B.W and Ritchie, D.M, The C Programming language, Second Edition, Pearson Education, 2015.

Course Contents and Lecture Schedule

Module No	Topic	No. Of Hours
1	Programming Constructs	
1.1	Structured Programming Languages	1
1.2	Data types	
1.3	Operators	
1.4	Conditional Constructs	1
1.5	Looping Constructs	
1.6	Functions	1
1.7	Recursion	
1.8	Scope Rules and Storage classes	1
2	Arrays	
2.1	1D Array	1
2.2	2D Array	
2.3	Multi Dimensional Array	1
2.4	Arrays and Functions	
2.5	Strings	1
2.6	String Functions	
3	Structures and Pointers	
3.1	Structures	1
3.2	Array of Structures	
3.3	Pointers	1
3.4	Pointers and Arrays	
3.5	Pointers and Functions	1
3.6	Pointers and Structures	
3.7	Dynamic Memory Allocation	1
3.8	Unions, Enum, Bit fields	
4	Files Processing	

4.1	Files Processing	1
4.2	Preprocessor	
4.3	Command Line Arguments	
Total No. Of Lecture Hours		12

List of Experiments

Ex. No	Experiment Name	No. Of Hours
11	Simple programs with operators, expressions and conditional statements	2
12	Simple programs using loops, nested loops, break and continue statements	2
13	Applications using functions	2
14	Applications using one dimensional array	2
15	Applications using two dimensional array	2
16	Applications using string library functions	2
17	Applications using Structures, and Array of Structures	2
18	Applications using Dynamic memory allocation	4
19	Applications using File operations	4
20	Practice union, enum and macros	2
Total No. of Practical Hours		24

List of Problems/Applications but not limited to:

- Sequential search and Binary Search algorithms
- Matrix Problems
- Factorial, Fibonacci, GCD, etc using iterative and recursive approach
- CPU Scheduling algorithms like FCFS
- Linux file system organization using appropriate header files and methods
- Implementation of Linux File System commands like cat, ls, grep, cp, mv, rm, etc

Course Designer(s):

1. Dr. P.Karthikeyan, Associate Professor, Department of karthikit@tce.edu
Information Technology
2. Dr. A.M.Abirami, Associate Professor, Department of Information abiramiam@tce.edu
Technology

22IT311	DISCRETE MATHEMATICS
----------------	-----------------------------

Category	L	T	P	Credit
BSC	3	1	0	4

Preamble

The Ideas of Discrete Mathematics are the fundamental to the science and technology specific to the computer age. This course provides an introduction to some fundamental concepts in Discrete Mathematics. The topics covered include: set theory, functions, relations, and lattice theory, mathematical logic, proof techniques, recurrence relations, counting methods, graphs and predicate calculus. These topics have wide range of applications in algorithm design, automata theory, compiler theory, artificial intelligence, software engineering etc.

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	Apply the concepts of relations and functions to solve the given problem.	TPS3	70	65
CO2	Construct the recurrence relation for a given engineering problem and solve the recurrence relation using generating functions and also solve combinatorial problems using counting techniques.	TPS3	70	65
CO3	Understand the concepts of graph connectivity, matching and coloring.	TPS2	75	70
CO4	Construct Hasse diagram for the given POSET and also verify the constructed Hasse diagram for modular, distributive, bounded and complemented lattice.	TPS3	70	65
CO5	Apply the concepts of logical operators, truth table and tautology to prove logical expressions are equivalent and to compute normal forms.	TPS3	70	65
CO6	Apply logic rules of inference to check the validity of the propositional calculus and predicate calculus statements and to prove theorems	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	S	L	L		L							S	L	
CO2.	S	M	L	L		L							M	L	
CO3.	S	S	L	L		L							S	L	
CO4	S	S	L	L		L							S	L	
CO5	S	M	L	L		L							M	L	
CO6	S	S	L	L		L							S	L	

Assessment Pattern

CO	Assessment 1						Assessment 2						Terminal		
	CAT 1			Assignment 1			CAT 2			Assignment 2					
TPS	1 10	2 30	3 60	1 -	2 -	3 100	1 10	2 30	3 60	1 -	2 -	3 100	1 -	2 30	3 70
CO1	3	-	23	-	-	40	-	-	-	-	-	-	-	3	10
CO2	7	10	23	-	-	40	-	-	-	-	-	-	-	3	17
CO3	-	20	-	-	-	-	-	-	-	-	-	-	-	9	-
CO4	-	-	14	-	-	20	3	-	13	-	-	20	-	6	10
CO5	-	-	-	-	-	-	4	20	20			40	-	6	16
CO6	-	-	-	-	-	-	3	10	27			40	-	3	17
TOTAL	10	30	60	-	-	100	10	30	60	-	-	100	-	30	70

ASSIGNMENT II - CASE STUDY*Syllabus**

Relations and Functions: Relations, Binary Relations, Equivalence Relations, Composition of relations - Functions, Bijections, composition of functions -- Mathematical Induction – The Basics of counting, The Pigeonhole principle, Permutations and combinations - Recurrence relations - Generating functions.

Graphs and Lattice Theory: Graphs, Planar graphs, Connectivity, Matching, Colouring - Partially ordered set, POSET as Lattice, Properties of Lattice, Sub lattice, 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.

Theory of inference and Predicate Calculus: Checking the validity using the truth table, Rules of Inference: P, T, CP, AP rules – Consistency of premises. Predicates - Function, Variables and Quantifiers, Predicate formulas – Free and Bound Variables (One Place Predicate).

Text Book

1. Kenneth H. Rosen., "Discrete Mathematics and Its Applications", 8th Edition, McGraw hill publications, 2019.
2. T.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with application to Computer Science", Tata McGraw Hill, 2002.

Reference Books & web resources

1. Dr.M.K.Venkataraman., Dr.N.Sridharan and N.Chandrasekaran, "Discrete Mathematics", National Publishing Company, Chennai, 2004.
2. EitanFarchi, Ben-Chaim, "Mathematical Logic and its Application to Computer Science Lecture Notes", March 3, 2010

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Relational Structures on Sets	
1.1	Definition of Relation – Matrix & Graph representation of a relation - Binary Relation – Properties of Binary Relation.	2
1.2	Equivalence relation - Composition of Relations	1
	Tutorial	1
1.3	Functions –Bijjective Function-Inverse functions	2
1.4	Mathematical Induction	1
	Tutorial	1
1.5	The Basics of counting	1
1.6	The Pigeonhole principle	1
1.7	Permutations	1
	Tutorial	1
1.8	Combinations	1
1.9	Recurrence relation and Generating Functions	2
	Tutorial	1
2	Graphs and Lattice Theory	
2.1	Graphs, Graph models and Connectivity	2
2.2	Matching of a graph and graph coloring	2
	Tutorial	1
2.3	POSET, Hasse Diagram, Lattices	2
2.4	Properties of Lattices, Sublattice	1
	Tutorial	1
2.5	Modular Lattice, Distributive lattice and Complemented lattice	1
2.6	Bounded and Boolean lattices, De'Morgan's Law in Lattice theory	1
	Tutorial	1
3	Propositional Calculus	

Module No.	Topic	No. of Periods
3.1	Introduction – Statements and Notations	1
3.2	Negation – Conjunction – Disjunction – Truth table	1
3.3	Conditional – Biconditional – Tautological Statements	1
	Tutorial	1
3.4	Logically equivalent and Equivalence of Formulas	1
3.5	Duality Law – Tautological Implications-	1
3.6	Functionally Complete set of Connectives, Nand, Nor	1
	Tutorial	1
3.7	Disjunctive – Conjunctive – Principle Disjunctive – Principle Conjunctive	2
	Tutorial	1
4	Inference Theory and Predicate Calculus	
4.1	Checking the validity using the truth table, Rules of inference: Direct method	1
4.2	Consistency of premises and Rules of inference: Indirect Method	1
4.3	Rules of inference: CP & AP rules	1
	Tutorial	1
4.4	Predicates-Functions, Variables and quantifier	1
4.5	Quantifier: essential quantifier, universal quantifier	1
4.6	Predicate formulas – Free and Bound Variables	2
	Tutorial	1
	Total	48

Course Designer(s):

- | | |
|-------------------------|--|
| 1. Dr. P. Victor | pvmat@tce.edu |
| 2. Ms. H. Sri Vinodhini | srivinodhini@tce.edu |
| 3. Dr. P. Krishnapriya | pkamat@tce.edu |

22IT321	OBJECT ORIENTED PROGRAMMING
----------------	------------------------------------

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

This course aims to give practice on object-oriented programming constructs such as encapsulation, inheritance, and polymorphism using Java. It also covers various packages such as I/O, utility, and event handling to develop applications for real-world problems.

Prerequisite

Nil

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Apply basic programming constructs like Control structures, looping, arrays, type casting for the given problems	TPS3	70	70
CO2	Apply encapsulation, inheritance and polymorphism for the given problems	TPS3	70	70
CO3	Implement interface, exceptions for solving the given problems	TPS3	70	70
CO4	Implement threading for solving the given problems	TPS3	70	70
CO5	Apply packages for handling files, string, collections and logging for the given problem.	TPS3	70	70
CO6	Develop object-oriented applications for the given scenario that uses event handling.	TPS3	70	70

Mapping with Programme 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	L
CO2	S	M	L		S							M	M	M	L
CO3	S	M	L		S							M	M	M	L
CO4	S	M	L		S							M	M	M	L
CO5	S	M	L		S							M	M	M	L
CO6	S	M	L		S							M	M	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1			Assignment -I			CAT2			Assignment - II			Terminal					
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	10		20			20								10				
CO2	5	10	20			40							5		15			
CO3	5	10	20			40							5		15			
CO4							10	5	20			30	5	10				
CO5							5	10	20			40	5		15			
CO6							5	5	20			30			15			

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Basic Programming Constructs: object-oriented paradigm, class, methods, data types, arrays, Scanner, control structures - condition, loops, type casting

Object Oriented Programming Constructs: Encapsulation, Constructors - overloading, static, this, Inheritance, compile-time polymorphism – method overloading, method overriding, runtime polymorphism – dynamic method dispatch, super, abstract, final, interface, Exception Handling – built-in exceptions and user-defined exceptions, Threading – Create Thread, Multi threads, Priority, Synchronization, Inter thread communication

Packages: User-defined packages, String Handling - Methods, I/O – File Reading and Writing, StringTokenizer, Collections - ArrayList, linked list, HashSet, Linked Hashset, Tree Set, Logging - create logs, log files

Event Handling: Event classes, EventListener Interfaces - Action Listener, Focus Listener, Item Listener, Key Listener, Mouse Listener, Text Listener, AWT components - Frame, Label, Button, TextField, CheckBox, CheckBoxGroup, Choice, List, Layout – grid, card.

Text Book

1. Herbert Schildt, "Java: The Complete Reference", McGraw-Hill, [Eleventh Edition](#), 2017

Reference Books& web resources

1. Paul Deitel and Harvey Deitel, "Java How to Program (Early Objects)", Pearson, Eleventh Edition, 2017.
2. E.Balagurusamy, "Programming with Java" , McGraw-Hill, Fifth Edition, 2014.
3. Kathy Sierra, "Head First Java", Shroff publications, Second edition, 2005.
4. Cay S. Horstmann and Gary Cornell, "Core Java, Volume I - Fundamentals", Prentice Hall, Ninth Edition, 2013.
5. Cay S. Horstmann and Gary Cornell, "Core Java, Volume II – Advanced Features : 2", Prentice Hall, Eleventh Edition, 2018.
6. https://onlinecourses.nptel.ac.in/noc19_cs07/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lecture Hours
1	Basic Programming Constructs	
1.1	Object-oriented paradigm, class, methods	1
1.2	Data types, arrays, Scanner	1
1.3	control structures - condition, loops, type casting,	2
2	Object Oriented Programming Constructs	
2.1	Encapsulation	1
2.2	Constructors - Overloading	1
2.3	Static, this	1
2.4	Inheritance	2
2.5	Compile time polymorphism – method overloading	1
2.6	Method overriding	1
2.7	Runtime polymorphism – dynamic method dispatch	1
2.8	Super, abstract, final	1
2.9	Interface	1
2.10	Exception Handling – Built in exceptions	1
2.11	User defined exceptions	1
2.12	Threading – Create thread	2
2.13	Multi threads, Priority	1
2.14	Synchronization	1
2.15	Inter thread communication	1
3	Packages	
3.1	User defined packages	1
3.2	String Handling - Methods	1
3.3	I/O – File Reading and Writing, StringTokenizer	1
3.4	Collections	1
3.5	Arraylist, linked list	1
3.6	Hashset, Linked Hashset, Tree Set	1
3.7	Logging –create logs	2
3.8	Log files	1
4	Event Handling	
4.1	Event classes, EventListener Interfaces - Action Listener, Focus Listener, Item Listener	2
4.2	Key Listener, Mouse Listener, Text Listener	1
4.3	AWT components - Frame, Label, Button, TextField, CheckBox, CheckBoxGroup, Choice, List	2
4.4	Layout – grid, card	1
	Total Lecture Hours	36

Course Designer(s):

1. Dr.S.Sridevi, Associate Professor - IT
2. Dr.P.Karthikeyan, Associate Professor - IT

sridevi@tce.edu
rthikit@tce.edu

22IT331	SOFTWARE ENGINEERING
----------------	-----------------------------

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

This course highlights the process, models and tools involved in building quality software in a productive manner. It also enables the students to acquire analytical, critical, technical writing, team building and managerial skills for real world scenarios by using agile practices.

Prerequisite

NIL

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Compare traditional and agile software process models	TPS2	70	70
CO2	Identify user stories, Story map, functional and non-functional requirements for any given problem	TPS3	70	60
CO3	Prepare design documents with standards for the given requirements	TPS3	70	60
CO4	Develop test cases using appropriate testing techniques for an application	TPS3	70	60
CO5	Explain the scope of the software maintenance problem and demonstrate the use of version controlling and tracking mechanisms.	TPS2	70	70
CO6	Demonstrate DEVOPS life cycle processes and introduce state of art tools used in large scale software systems.	TPS2	70	70

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
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

Assessment Pattern

CO	Theory						Theory						Terminal		
	CAT 1			Assignment 1			CAT 2			Assignment 2			Theory		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	15	15	-	-	-	-	-	-	-	-	-	-	5	5	-
CO2	10	15	15	-	-	50	-	-	-	-	-	-	1	5	20
CO3	5	10	15	-	-	50			20	-	-		2	5	20
CO4	-	-	-	-	-	-	5	10	20	-	-	50	2	5	10
CO5	-	-	-	-	-	-	10	15	-	-	25	-	5	5	-
CO6	-	-	-	-	-	-	5	15	-	-	25	-	5	5	-

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

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- Requirements Management Tools.

Design: Design process - Concepts - Guidelines – Design Approach - Structured approach – Object-oriented approach. Architectural Styles and Pattern-Based Design- Data Design - Design Notations – Data Flow Diagram – Context Diagram - UML Diagrams – Class Diagram – Sequence Diagram –Activity Diagram-State Machine Diagram- User Interface Design - Design Documentation. Exploration of Design tools.

Software Development: Coding standards and Practices, code inspection, reviews and walkthroughs

Testing: Testing Process-STLC – Testing Strategies – 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 – Traceability Matrices -Verification & Validation Report-. Automated Testing tools

Devops: Goals & principles- Stakeholders – DevOps Architecture Features–Lifecycle phases- DevOps Workflow and Practices- -DevOps Automation Tools

Software Maintenance and Configuration Management: Characteristics, controlling factors, maintenance tasks-Configuration Management: Tasks- version control- tracking-VC tools-GIT-Software release - reverse engineering and re-engineering. Software Quality Models: SEI-CMM

Text Book

1. Software Engineering: A Practitioner's Approach By Roger S. Pressman and Bruce Maxim McGraw-Hill Higher International; ISBN-10: 1259872971; ISBN-13: 978-1259872976, 9 th Edition (09/19)

2. Orit Hazzan, Yael Dubinsky, "Agile software engineering II", Springer, 2014
3. Michael Duffy, "DevOps Automation Cookbook", Kindle editions, 2015

Reference Books & web resources

1. Rajib Mall, "Fundamentals of Software Engineering", PHI, 4th edition, 2014.
2. Pankaj Jalote, An integrated approach to Software Engineering, Springer/Narosa.
3. Ian Sommerville, Software Engineering, Addison-Wesley 10th edition, 2015.
4. <https://cloudacademy.com/blog/introduction-to-devops/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Software Process Models	
1.1	Generic Process Models	1
1.2	Agile Process model	1
1.3	Agile Software Development methodologies	
1.3.1	Extreme Programming (XP)- Adaptive Software Development (ASD)	1
1.3.2	Dynamic Systems Development Method (DSDM)- Scrum	1
1.3.3	Crystal- Feature Driven Development (FDD)	1
1.3.4	Generic Process Models Vs Agile Process model	1
1.4	Roles and responsibilities of software project manager	1
2	Requirements Analysis	
2.1	Requirement Gathering	1
2.2	Eliciting user stories- story map	1
2.3	Functional Requirements	1
2.4	Non-functional Requirements	
2.5	Use Cases	
2.6	SRS Documentation	1
2.7	Requirements Management Tools.	1
3	Design	
3.1	Design process-concepts – guidelines	1
3.2	Design Approach - Structured approach – Object-oriented approach.	
3.3	Software Architecture - Data design –Architectural styles and pattern -based design	1
3.4	Design Notations	1
3.5	Data Flow Diagram – Context Diagram	1
3.6	UML Diagrams – Class Diagram - Sequential Diagram –Activity Diagram-State Machine Diagram User Interface Design	3
3.7	Design Documentation- Exploration of Design tools.	1

4	Development and Testing	
4.1	Coding standards and Practices	1
4.2	Code inspection	
4.3	Reviews and walkthroughs	1
5	Testing techniques	
5.1	Testing Process-STLC – Testing Strategies	1
5.2	White box testing	2
5.2.1	Basis path testing	
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	Traceability Matrices -Verification & Validation Report	1
5.6	Automated Testing tools	1
6	Devops	
6.1	Goals & principles- Stakeholders- DevOps Architecture Features–Lifecycle phases- DevOps Workflow and Practices	2
6.2	DevOps Automation Tools	1
7	Software Maintenance and Configuration Management	
7.1	Software Maintenance-Characteristics, controlling factors, maintenance tasks	1
7.2	Configuration Management: Tasks- version control- tracking-VC tools-GIT	1
7.3	Software release - reverse engineering and re-engineering.	1
7.4	Software Quality Models: SEI-CMM	1
	Total Hours	36

Course Designer(s):

S.Karthiga, Asst.Professor,Dept of IT
S.Pudumalar, Asst.Professor,Dept. of IT

skait@tce.edu
spmit@tce.edu

22IT341	DATA STRUCTURES
----------------	------------------------

Category	L	T	P	Credit
PCC	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

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	Use suitable linear data structures and their operations for solving a given problem	TPS3	70	70
CO2	Use suitable non-linear data structures like trees and their operations for solving a given problem	TPS3	70	70
CO3	Use suitable non-linear data structures like hash table, graph and their operations for solving a given problem	TPS3	70	70
CO4	Compute space and time complexity of a given problem	TPS3	70	70
CO5	Interpret computational efficiency of searching and sorting algorithms	TPS3	70	70
CO6	Formulate solutions by identifying suitable ADTs for solving problems using suitable programming languages	TPS3	70	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	PSO 1	PSO 2	PSO 3
CO1	S	M	L					M				M	S		M
CO2	S	M	L					M				M	S		M
CO3	S	M	L					M				M	S		M
CO4	S	M	L					M				M	S		M
CO5	S	M	L					M				M	S		M
CO6	S	M	L		M			M	M	M	L	M	S	L	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory						Theory						Terminal					
	Test 1			Assignment 1			Test 2			Assignment 2								
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	10	15	25			30							6	10	10			
CO2							5	10	20			30	6	5	10			
CO3							5	10	20			20	4	5	10			
CO4	5		5										2		8			
CO5		10	10			10							2	10				
CO6			20			50			30			50			12			

Assignments include solving coding challenges, quiz, problem solving using Programming languages.

Syllabus

Data Abstraction: Data Representation - Types of Data Structures - Abstract Data Type

Linear ADTs: List - Stack - Queue - Circular Queue - Linked List - Singly Linked List, Doubly Linked List, Circular Linked List - Applications - Expression evaluation, Scheduling Algorithms, Polynomial Evaluation, Josephus Problem

Non-linear ADTs: Tree Terminology - Binary tree - Tree traversals - Expression Tree – Binary Search Tree - AVL Tree - B-tree - Binary Heap – Red Black Tree – Tries - Applications – Dictionary, kth smallest element, Hash Table – Hashing Techniques, Rehashing – Graphs – Graph Terminology – Graph Representation – Graph traversals – Connected Components - Applications

Algorithm Analysis: Asymptotic Measures – Space Complexity – Time Complexity

Searching and Sorting: Searching Techniques - Sequential Search, Binary Search, Search trees – Sorting Techniques – Bubble Sort, Insertion Sort, Selection Sort, Shell Sort, Quick Sort, Merge Sort, Heap Sort

Text Book

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.

Reference Books & web resources

1. M. A. Weiss, "Data Structures and Algorithm Analysis in Java", Second Edition, Pearson Education, 2014
2. Aho, J.E. Hopcroft and J.D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Basant Agarwal, Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition, 2018
4. SWAYAM / NPTEL's Course for Data Structures – http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/data_str_algo/frameset.htm
5. Web Reference for Data Structures – <https://www.geeksforgeeks.org/data-structures>
6. Web Reference for Data Structures – <https://www.hackerrank.com/domains/data-structures>
7. Web Reference for Data Structures – www.leetcode.com/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Data Abstraction	
1.1	Data Representation	1
1.2	Types of Data Structures	
1.3	Abstract Data Type (ADT)	

Module No.	Topic	No. of Periods
2	Linear ADTs	
2.1	List	2
2.2	Applications – Array Problems, Matrix Problems, Strings problems	1
2.3	Stack ADT	2
2.4	Queue ADT	1
2.5	Circular Queue ADT	1
2.6	Linked List – Singly, Double, Circular Lists	3
2.7	Applications – Expression evaluation, Polynomial Evaluation, Josephus Problem	3
3	Non-linear ADTs:	
3.1	Trees	
3.1.1	Trees Terminology	1
3.1.2	Binary Tree traversals	1
3.1.3	Expression Tree	1
3.1.4	Binary Search Tree	2
3.1.5	AVL Tree	2
3.1.6	B-tree	2
3.1.7	Binary Heap	2
3.1.8	Applications – Dictionary, kth smallest element	1
3.2	Hash Table	
3.2.1	Hashing Techniques	2
3.2.2	Rehashing	
3.3	Graph	
3.3.1	Graph Terminology	1
3.3.2	Graph Representation	
3.3.3	Graph traversals	
3.3.4	Connected Components	2
3.3.5	Applications	
4	Algorithm Analysis:	
4.1	Asymptotic Measures	1
4.2	Space Complexity	
4.3	Time Complexity	
5	Searching and Sorting	
5.1	Searching Techniques	
5.1.1	Sequential Search	1
5.1.2	Binary Search	
5.1.3	Search trees	
5.2	Sorting Techniques	

Module No.	Topic	No. of Periods
5.2.1	Bubble Sort	1
5.2.2	Insertion Sort	
5.2.3	Selection Sort	
5.2.4	Shell Sort	1
5.2.5	Quick Sort	
5.2.6	Merge Sort	1
5.2.7	Heap Sort	
Total Lecture Hours		36

Course Designer(s):

- | | |
|-----------------|-------------------|
| 1. A M Abirami | abiramiam@tce.edu |
| 2. P.Manojkumar | pmkit@tce.edu |

22IT351	IT OPERATIONS AND MANAGEMENT
----------------	---

Category	L	T	P	Credit
ESC	2	0	0	2

Preamble

This course offers a strong foundation on system administration that involves Linux and Windows server administration, Configuration and Monitoring of various server roles. This course also provides exposure to shell commands and implementation of system admin tasks using bash scripting.

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	Explain the essential roles of the system administrator in administrating IT Infrastructure	TPS2	70	80
CO2	Use appropriate shell commands to manage users, files and devices in the Linux system	TPS3	70	80
CO3	Make use of bash scripting to implement system administration tasks.	TPS3	70	80
CO4	Configure and monitor various server roles such as DNS server, Web server and Mail server on windows server.	TPS3	70	80
CO5	Implement group policy settings and manage resources using Active Directory in Windows Server.	TPS3	70	80
CO6	Outline emerging system administration functions such as Devops, MLOps and serverless infrastructure.	TPS2	70	80

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory						Theory						Terminal		
	CAT1			Assignment 1			CAT2			Assignment 2					
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	10	10	-	-	-	-	-	-	-	-	-	-	5	-	-
CO2	10	20	20	-	-	20	-	-	-	-	-	-	5	5	10
CO3	-	-	30	-	-	80	-	-	-	-	-	-	-	-	20
CO4	-	-	-	-	-	-	10	5	20	-	-	60	5	5	20
CO5	-	-	-	-	-	-	5	5	30	-	-	20	-	5	10
CO6	-	-	-	-	-	-	5	20	-	-	20	-	5	5	-

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

System Administration basics – Essential Duties and Roles of a system administrator – Datacenter – Overview – Datacenter Infrastructure Management

Linux Administration – Boot Process – System daemons: init and systemd – GRUB Configurations and Commands – Rootly powers – Access Control – File privileges – User Management – Process control – File System – Types, mounting, fsck, repair, User and group quotas - Network File system – Logs – Cron jobs - Linux Troubleshooting

Scripting for Administration – Bash scripting: Redirections and Pipelines - Arithmetic operations – functions – Command Line arguments – Control Flow – Loops.

Windows Administration – Server Roles and Features - User accounts – Group Policy - Active directory- Network policies- Remote access- Managing File services

Server Configuration and Monitoring – Web Server – Mail Server – DNS server — Configuration and Management on Linux and Windows.

Evolving arenas for System Admins – Devops – pipelining CI and CD, MLOps, Serverless Infrastructure.

Text Book

1. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben whaley, Dan Mackin, Unix and Linux System Administration Handbook, Pearson Education, Fifth Edition, 2018.
2. Windows Server Management - <https://learn.microsoft.com/en-us/windows-server/administration/manage-windows-server>

Reference Books & web resources

1. Linux commands and Bash Scripting - <https://linuxhint.com/>
2. Windows Server Administration - https://en.wikiversity.org/wiki/Windows_Server_Administration

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	System Administration basics	
1.1	Essential Duties and Roles of a system administrator	1
1.2	Datacenter – Overview	1
1.3	DCIM	2
2	Linux Administration	
2.1	Boot Process	1
2.2	System daemons: init and systemd	
2.3	GRUB Configurations and Commands	1
2.4	Rootly powers	
2.5	Access Control	1
2.6	File privileges, Log Management	
2.7	User Management	2

Module No.	Topic	No. of Periods
2.8	Process control	
2.9	File System: types, mounting, fsck, repair	
2.10	User and group quotas, Cron Jobs	1
2.11	Network File system	
2.12	Linux Troubleshooting	
3	Scripting for Administration	
3.1	Bash scripting: Redirections and Pipelines	2
3.2	Arithmetic operations	
3.3	functions – Command Line arguments	
3.4	Control Flow – Loops	1
4.	Windows Administration	
4.1	Server Roles and Features	1
4.2	User accounts	1
4.3	Group Policy	1
4.4	Active directory	
4.5	Network policies	1
4.6	Remote access- Managing File services	2
5	Server Configuration and Monitoring	
5.1	Web Server	1
5.2	Mail Server	
5.3	DNS server	1
5.4	Configuration and Management on Linux and Windows.	2
5.5	Managing File services	
6	Evolving arenas for System Admins	
6.1	Devops	2
6.2	Pipelining CI and CD	
6.3	MLOps, Serverless Infrastructure.	
	Total	24

Course Designer(s):

1. S. Thiruchadai Pandeewari, Assistant Professor, IT, eshwarimsp@tce.edu
2. Dr K. Indira, Assistant Professor, IT kiit@tce.edu

22IT361	System Administration Lab
----------------	----------------------------------

Category	L	T	P	Credit
ES	0	0	2	1

Preamble

This laboratory course aims to provide foundational skills in System administration which include user management, file management, server roles configuration and management on Linux and Windows server operating systems.

Prerequisite

None

Course Outcomes

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

COs	Course Outcomes	TCE Proficiency Scale	Expected Proficiency (%)	Expected Attainment Level (%)
CO1	Use shell commands for basic utilities and file manipulation on Linux server	TPS3	70	80
CO2	Change file privileges and ownership using appropriate shell commands on Linux server	TPS3	70	80
CO3	Perform process management, user management and access control using suitable commands on Linux server	TPS3	70	80
CO4	Construct bash scripts for implementing user-process-file management and other system administration tasks	TPS3	70	80
CO5	Install, configure and monitor Web-DNS-File-Mail servers on both Linux and Windows server OS	TPS3	70	80
CO6	Configure Active Directory Domain Services on Windows server OS and apply group policy settings	TPS3	70	80

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Observation-Record			Test			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3
CO1	5	5	-	-	-	10	-	-	10
CO2	10	10	-	-	-	20	-	-	20
CO3	10	10	-	-	-	20	-	-	20
CO4	10	10	-	-	-	20	-	-	20
CO5	10	10	-	-	-	20	-	-	20
CO6	5	5	-	-	-	10	-	-	10

Course Contents

Ex. No.	Topic	No. of Sessions	COs Mapping
Linux Administration			
1	Installation of Linux Server OS	1	CO1
2	Basic utilities and File Manipulation		CO1
3	Managing File Ownership and File Privileges – Mounting Filesystems	1	CO2
4	User Management		CO3
5	Process Management and Troubleshooting	1	CO3
6	Implementation of bash scripts for user-file-process management tasks	1	CO4
7	Installation of Web Server and hosting a static webpage	1	CO5
8	Installation and Configuration of DNS Server	1	CO5
9	Implementation of File server and Mail server	1	CO5
10	Study on Directory services on Linux Server	1	CO3
Windows Administration			
11	a) Installation of IIS Server and hosting a static webpage b) Installation of SMTP Server	1	CO3
12	Configuring DNS server role	1	CO4
13	Implementation of Active Directory and Group Policy Settings	1	CO5
14	Configuration of File Server Resource Manager	1	CO6
15	Study on NPS server role and Network Administration		CO5
Total Lecture Hours		12	

Course Designer(s):

- 1.S. Thiruchadai Pandeewari, Assistant Professor IT,
- 2.Dr K. Indira, Assistant Professor, IT

eshwarimsp@tce.edu
kiit@tce.edu

22IT371	OBJECT ORIENTED PROGRAMMING LAB
----------------	--

Category	L	T	P	Credit
PCC	0	0	2	1

Preamble

The course is designed to develop programming skills for writing applications using object-oriented programming constructs. It strengthens the logical reasoning skills of students to solve problems and develop efficient applications in Java.

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	Develop simple applications using object-oriented programming constructs	TPS3	80	70
CO2	Practice file operations with string and handle exceptions for the given problems	TPS3	80	70
CO3	Develop packages with classes and interfaces for the given scenario	TPS3	80	70
CO4	Apply multithreading and generate logs for the given problems	TPS3	80	70
CO5	Practice the event handling techniques with the given UI based applications	TPS3	80	70
CO6	Develop a simple application with database connectivity	TPS3	80	70

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

Cognitive Levels	Model Examination	Terminal Examination
Remember		
Understand	20	20
Apply	80	80
Analyse		
Evaluate		
Create		

Course Contents

Ex. No.	Topic	No. of Sessions	COs
1	Basic Programming using loops and control statements	1	CO1
2	Demonstrate Encapsulation	1	CO1
3	Practice Inheritance	1	CO1
4	Practice Polymorphism	1	CO1
5	Practice Packages & Interfaces	1	CO3
6	Demonstrate built-in Exceptions and User defined Exceptions	1	CO2
7	Practice Threading	1	CO4
8	Practice I/O with string handling	1	CO2
9	Practice Collections with string methods	1	CO2
10	Practice Logging	1	CO4
11	Practice Event Handling	1	CO5
12	Develop simple application with database connectivity	1	CO6
Total Sessions		12	

Course Designer(s):

1. Dr.S.Sridevi, Associate Professor, Department of IT
2. Dr.P.Karthikeyan, Associate Professor, Department of IT

sridevi@tce.edu
karthikit@tce.edu

22IT381	DATA STRUCTURES LAB
----------------	----------------------------

Category	L	T	P	Credit
PCC	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

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	Use suitable array-based linear data structures for a given problem	TPS3	70	80
CO2	Use suitable linked list data structures and their operations for a given problem	TPS3	70	80
CO3	Use suitable tree data structures and their operations for a given problem	TPS3	70	80
CO4	Use suitable hashing techniques for a given problem	TPS3	70	80
CO5	Use suitable graph data structure and its operations for a given problem	TPS3	70	80
CO6	Experiment with different searching and sorting algorithms using time complexity measures	TPS3	70	80

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	L	L		S	S	L	M
CO2	S	M	L		L			S	L	L		S	S	L	M
CO3	S	M	L		L			S	L	L		S	S	L	M
CO4	S	M	L		L			S	L	L		S	S	L	M
CO5	S	M	L		L			S	L	L		S	S	L	M
CO6	S	M	L		L			S	L	L		S	S	L	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Cognitive Levels	Model Examination	Terminal Examination
Remember	0	0
Understand	20	20
Apply	80	80
Analyse	0	0
Evaluate	0	0
Create	0	0

Course Contents and Lecture Schedule

Ex. 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	CO1
3	Implementation of Stack ADT for simple applications	1	CO1
4	Implementation of Queue and Circular Queue ADT for simple applications	1	CO1
5	Implementation of Linked List ADT for simple applications	1	CO2
6	Implementation of Doubly Linked List ADT for simple applications	1	CO2
7	Implementation of Circular Linked List ADT for simple applications	1	CO2
8	Implementation of Binary Search Tree ADT for simple applications	1	CO3
9	Implementation of Binary Heap ADT for simple applications	1	CO3
10	Implementation of Hashing techniques for simple applications	1	CO4
11	Implementation of Graph ADT for simple applications	1	CO5
12	Performance analysis of searching and sorting algorithms	1	CO6
Total Lecture Hours		12	

List of problems/applications but not limited to:

- Matrix problems like Sparse Array
- Expression evaluation using Stack ADT
- CPU scheduling / Disk scheduling algorithm (like FCFS) using Queue ADT
- Polynomial evaluation using Linked List ADT
- Josephus problem using Circular Linked List ADT
- Finding Middle number, Palindrome checking using Doubly Linked List ADT
- Expression tree, Dictionary using Binary Search Tree
- kth smallest element using Binary Heap ADT
- Searching, Indexing, Encoding/Decoding problems using Hashing techniques
- Graph traversals, Connected components using Graph ADT
- Time complexity analysis of Sorting Algorithms for 1k-5k numbers

Course Designer(s):

- | | |
|-----------------|-------------------|
| 1. A M Abirami | abiramiam@tce.edu |
| 2. P.Manojkumar | pmkit@tce.edu |

22IT411	PROBABILITY AND STATISTICS
----------------	-----------------------------------

Category	L	T	P	Credit
BSC	3	1	0	4

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 computer networks. Statistical methods are important tools which provide the engineers with both descriptive and analytical methods for dealing with the variability in observed data. This course 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

Basics of Probability and Statistics.

Course Outcomes

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

COs		TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Identify mathematical expectation, probability mass/density functions, entropy	TPS2	75	70
CO2	Compute the conditional probability using Baye's theorem or compute the probability for the defined distributions	TPS3	70	65
CO3	Apply the concept of correlation and regressions to solve engineering problems	TPS3	70	65
CO4	Apply the concepts of large/small sample tests into real life problems.	TPS3	70	65
CO5	Use the appropriate non parametric hypothesis testing procedures based on inferences to solve the problem under study.	TPS3	70	65
CO6	Design and conduct of engineering experiments involving a single factor, two factors and three factors.	TPS3	70	65

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Assessment 1						Assessment 2						Terminal		
	CAT 1			Assignment 1			CAT 2			Assignment 2					
TPS	1 10	2 30	3 60	1 -	2 -	3 100	1 10	2 30	3 60	1 -	2 -	3 100	1 -	2 30	3 70
CO1	10	20	-	-	-	-	-	-	-	-	-	-	-	15	-
CO2	-	10	28	-	-	50	-	-	-	-	-	-	-	3	16
CO3	-	-	32	-	-	50	-	-	-	-	-	-	-	3	13
CO4	-	-	-	-	-	-	10	20	20	-	-	50	-	9	16
CO5	-	-	-	-	-	-	-	-	20	-	-	20	-	-	10
CO6	-	-	-	-	-	-	-	10	20	-	-	30	-	-	15
TOTAL	10	30	60	-	-	100	10	30	60	-	-	100	-	30	70

TUTORIALS: PROGRAM USING R-PROGRAMMING/PYTHON**ASSIGNMENT II – CASE STUDY****Syllabus**

PROBABILITY DISTRIBUTIONS: Conditional probability -Bayes" theorem- Random variables - Probability distribution for Discrete random variable, The cumulative distribution function - Expected Value, Expected value of a function, Rules of Expectation, The variance of X, Rule of variance. The Binomial Distribution, The Poisson Distribution, Continuous random variables and Probability Distributions- Probability Density Functions – Probability distribution for continuous variable - Cumulative distribution function and Expected Values - The Normal Distribution, Jointly Distributed Random Variables – Two discrete Random Variables – Independent random variables, Continuous distributions - Expected Values, Covariance, Correlation. Entropy - Entropy as Uncertainty - Systems and States - The Boltzmann-Planck Entropy - The Boltzmann-Gibbs-Shannon Entropy

STATISTICS: Linear correlation - Bivariate Correlation -Rank correlation- Linear Regression - Multiple and partial correlations

TEST OF HYPOTHESIS: Hypotheses and Test Procedures, Test about Population Mean, Test Concerning Population proportion, P – Values – P-values for z-test, P-values for t-test. z-test and confidence interval for difference between two population means, The two sample t-test and confidence interval, Inference concerning a difference between two population proportion – A large sample test procedure, Inference concerning two population variance – F distribution – P values for F distribution – Confidence Interval, Goodness of fit: Chi-square distributions.

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

The Analysis of Variance: Single-Factor ANOVA - Two-Factor ANOVA - Three-Factor ANOVA.

Text Book

1. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences" (English) 9th Edition, Cengage Learning India Pvt Ltd, New Delhi, 2012.
2. John D Ramshaw, "The Statistical foundations of Entrophy", Worlds Scientific Publishing Co. Pte. Ltd
3. Ronald E. Walpole, Sharon L. Myers, Keying Ye, "Probability & Statistics for Engineers and Scientists", 9th Edition, Pearson Education, New Delhi, 2012.

4. S. C. Gupta & V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi.

Reference Books & web resources

Mendenhall William, "Introduction to Probability and Statistics", 14th Edition, Duxbury Press, New Delhi, 2012.

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 Periods
1	PROBABILITY DISTRIBUTIONS:	
1.1	Conditional probability -Bayes" theorem	1
1.2	Random variables - Probability distribution for Discrete random variable, The cumulative distribution function	1
	Tutorial	1
1.3	Expected Value, Expected value of a function, Rules of Expectation, The variance of X, Rule of variance.	1
1.4	The Binomial Distribution	1
1.5	The Poisson Distribution	1
	Tutorial	1
1.6	Continuous random variables and Probability Distributions-Probability Density Functions – Probability distribution for continuous variable	1
1.7	Cumulative distribution function and Expected Values	1
1.8	The Normal Distribution	1
	Tutorial	1
1.9	Jointly Distributed Random Variables – Two discrete Random Variables – Independent random variables, Continuous distributions	1
1.10	Expected Values, Covariance, Correlation	1
1.11	Entropy - Entropy as Uncertainty - Systems and States - The Boltzmann-Planck Entropy - The Boltzmann-Gibbs-Shannon Entropy	2
	Tutorial	1
2	STATISTICS	
2.1	Linear correlation	2
2.2	Bivariate Correlation	1
	Tutorial	1

Module No.	Topic	No. Of Periods
2.3	Rank correlation	1
2.4	Linear Regression	1
2.5	Multiple and partial correlations	1
	Tutorial	1
3	TEST OF HYPOTHESIS	
3.1	Hypotheses and Test Procedures	1
3.2	Test about Population Mean, The one sample t-test	1
3.3	Test Concerning Population proportion	1
	Tutorial	1
3.4	P – Values – P-values for z-test, P-values for t-test.	1
3.5	z-test and confidence interval for difference between two population means	1
3.6	The two sample t-test and confidence interval	1
	Tutorial	1
3.7	Inference concerning a difference between two population proportion – A large sample test procedure	1
3.8	Inference concerning two population variance – F distribution – P values for F distribution – Confidence Interval	1
3.9	Goodness of fit: Chi-square distributions.	1
	Tutorial	1
4	NON-PARAMETRIC STATISTICS:	
4.1	Introduction- Signed rank test	1
4.2	Wilcoxon rank sum test	1
4.3	Kruskal Wallis test	1
4.4	Runs test	1
	Tutorial	1
5	THE ANALYSIS OF VARIANCE	
5.1	Single-Factor ANOVA	1
5.2	Two-Factor ANOVA	2
	Tutorial	1
5.3	Three-Factor ANOVA.	2

Module No.	Topic	No. Of Periods
	Tutorial	1
	Total	48

Course Designer(s):

1. Ms. H Sri Vinodhini, Assistant Professor of Mathematics, srivinodhini@tce.edu
2. Dr. P. Victor, Assistant Professor of Mathematics, pvmat@tce.edu
3. Dr. P. Krishnapriya, Assistant Professor of Mathematics, pkamat@tce.edu

22IT421	ALGORITHM DESIGN PRINCIPLES
----------------	------------------------------------

Category	L	T	P	Credit
PCC	3	0	0	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

Data structures

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	Analyze the best case, worst case and average case running time of algorithms using Asymptotic notation.	TPS4	A	60
CO2	Identify the appropriateness of brute force approach for the problems like sorting, searching etc.	TPS3	A	70
CO3	Develop algorithms to solve computational problems using design paradigms like divide and conquer, greedy and dynamic programming.	TPS3	A	70
CO4	Construct algorithms using design paradigms like Backtracking and branch and bound for a given problem.	TPS3	A	70
CO5	Make use of the complexity classes like NP-Complete, NP-hard and develop polynomial reductions for the real world problems	TPS3	A	70
CO6	Examine the appropriate design scenario and algorithmic design paradigms based on the application requirements.	TPS4	A	60

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	S	S	M	L									L		
CO2	S	S	M	L									S		
CO3	S	S	S	M	L	L						M	S	L	
CO4	S	S	S	M	L	L						M	S	L	
CO5	S	S	S	S	L	M						M	S		

CO6	S	S	S	S	S	M		L	M	M	L	M	S	S	M
-----	---	---	---	---	---	---	--	---	---	---	---	---	---	---	---

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory				Assignment 1				Theory				Assignment 2				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
CO1	5	10	5	10				50	5		10				30		2	5		10
CO2	5	5	5						-	-	-	-					2	5	6	
CO3	5	5	35				30		-	-	-	-					2	5	19	
CO4	-	-	-	-					10	10	35						2	5	12	
CO5	-	-	-	-					5	5	10						2		13	
CO6				10				20				10			70					10

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Algorithms: Fundamentals of Algorithmic Problem Solving – Analysis of Algorithm Efficiency – Running time analysis - Asymptotic Notations: O (Big-Oh), Θ (theta), Ω (Omega) Notations - Worst case and average case complexity - Mathematical analysis for Recursive and Non-recursive algorithms.

Brute force Approach: Sorting: Selection sort, Bubble sort, Insertion sort – Searching: Sequential search - Depth First and Breadth First Search

Divide-and-conquer: Divide and conquer methodology – Solving Recurrence relation using recurrence trees, repeated substitution, master theorem – Sorting: Quick sort, Merge sort– 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's 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: Classes P, NP, NP-complete - NP-completeness: reduction amongst problems: Knapsack problem, Traveling salesman Problem, Satisfiability Problem.

Text Book

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition, 2012.

Reference Books & web resources

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI Learning Private Limited, Third Edition, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2014.
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
1	Algorithms (5)	
1.1	Fundamentals of Algorithmic Problem Solving	1
1.2	Analysis of Algorithm Efficiency – Running time analysis	2
1.3	Asymptotic Notations - O (Big-Oh), Θ (theta), Ω (Omega) Notations, Worst case and average case complexity	1
1.4	Mathematical analysis for Recursive and Non-recursive algorithms	1
2	Brute Force Approach (4)	
2.1	Sorting : Selection sort, Bubble sort, Insertion sort	2
2.2	Searching: Sequential search	
2.3	Breadth First Search	1
2.4	Depth First Search	1
3	Divide-and-conquer (6)	
3.1	Solving Recurrence relation using recurrence trees, repeated substitution	1
3.2	Master theorem	1
3.3	Sorting: Quick sort, Merge sort	1
3.4	Binary search	1
3.5	Multiplication of Large Integers	2
3.6	Strassen's Matrix Multiplication.	
4	Greedy technique(4)	
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

5	Dynamic programming (6)	
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
6	Backtracking (4)	
6.1	n-Queens problem	1
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
7	Branch and bound (3)	
7.1	Assignment problem	1
7.2	Knapsack Problem	1
7.3	Travelling Salesman Problem	1
8	Limitations of algorithm power (4)	
8.1	Classes P, NP, NP-complete	1
8.2	NP-completeness: reduction amongst problems: Knapsack problem, Traveling salesman Problem	2
8.3	Satisfiability Problem	1
	Total	36

Course Designers:

- | | | |
|-----------------------|------------------------------------|----------------|
| 1. Dr.S.Padmavathi, | Professor, IT Department | spmcse@tce.edu |
| 2. Mrs.P.Vijaya Praba | Assistant Professor, IT Department | pvpit@tce.edu |

22IT431	COMPUTER NETWORKS
----------------	--------------------------

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

The domain of Internet has grown in a rapid pace from traditional circuit switched and packet switched small scale networks to modern high-speed mobile and wireless Internet. The broad objectives of the course on computer networks are to explore (i) the architecture and principles of computer networks, (ii) the protocols and their functionalities, (iii) the requirements for the future Internet and its impact on the computer network architecture.

Prerequisite

Nil

Course Outcomes

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

S.No	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the general principles of data communication and describe how computer networks are organized with the concept of layered approach.	TPS2	A	80
CO2	Simulate Flow control, Error control and Access control techniques at the Data link layer	TPS3	B	70
CO3	Design logical sub-address blocks with a given address block and implement various routing protocols at the Network Layer	TPS3	B	70
CO4	Interpret the various fields of TCP and UDP datagrams and implement protocols for reliable/unreliable, connection oriented/connectionless services at Transport layer	TPS3	B	70
CO5	Demonstrate the usage of various congestion control mechanisms to improve quality of service of the given network.	TPS3	B	70
CO6	Explain the working principle of various application layer protocols such as HTTP, FTP, DNS, SMTP, Telnet, Rlogin, SNMP etc.,	TPS2	A	80

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	M		
CO2.	S	M	L			L	L					L	S	L	L
CO3	S	M	L			L	L					L	S	L	L
CO4	S	M	L			L	L					L	S	L	L
CO5	S	M	L			L	L					L	S	L	L
CO6	M	L										L	M		

Assessment Pattern

CO	CAT1			CAT2			Assignment -1			Assignment -2			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	10	10												5	
CO2	5	10	25						50				5	5	15
CO3	5	10	25						50				5	5	15
CO4				10	10	25						40	5	5	10
CO5				5	10	25						40	5	5	10
CO6				5	10						20			5	

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Basics of Computer Networking: Layered Network Protocol Architectures –ISO/OSI, TCP/IP. Personal, Local, Metropolitan and Wide Area Networks, Components -NIC, Switches, Bridges, Hub and Routers, Topologies

Physical Layer: Digital and Analog Signals, Encoding and Decoding, Analog and Digital data Transmission techniques, Multiplexing, Spread spectrum.

Data Link Layer: Framing, Error control - Bit-parity, CRC, Checksum and Hamming Codes; Flow Control - Stop-and-Wait, Go-back-N, Selective Repeat. Performance analysis of ARQ protocols, Access Control -ALOHA, CSMA, CSMA-CD, CSMA-CA, Reservation, Polling Example protocols such as HDLC and PPP, ARP and RARP

Network Layer: Internet Protocol (IP) suite, IPv4 and IPv6 addressing and headers; Routing protocols- distance-vector and link-state approaches, Interior and Exterior Gateway Protocol concepts; Routing Algorithms - Dijkstra's algorithm and distributed Bellman-Ford algorithm; Example protocols: OSPF, RIP, BGP.

Transport Layer: Reliable end-to-end transmission protocols; UDP header; Details of TCP header and operation including options headers and congestion control; TCP variants such as Reno, Tahoe, Vegas, Compound and CUBIC.

Application Layer: Socket Interface and Socket programming; Example protocols such as DNS, SMTP, FTP, and HTTP.

Text Book

1. Behrouz A.Foruzan, "Data Communication and Networking", McGraw Hill Education, Fifth Edition, 2017

Reference Books & web resources

1. Larry L.Peterson and Bruce S. Davie, "Computer Networks – A systems Approach" Fifth Edition, Elsevier, 2019
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Sixth Edition, Pearson, 2012.
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 Periods
1	Basics of Computer Networking:	
1.1	Layered Network Protocol Architectures –ISO/OSI, TCP/IP.	3
1.2	Personal, Local, Metropolitan and Wide Area Networks,	1
1.3	Components -NIC, Switches, Bridges, Hub and Routers, Topologies	
2	Physical Layer:	
2.1	Digital and Analog Signals, Encoding and Decoding	2
2.2	Analog and Digital data Transmission techniques	2
2.3	Multiplexing, Spread spectrum.	2
3	Data Link Layer	
3.1	Framing	2
3.2	Error Detection – Bit Parity, CRC, Checksum	
3.3	Error Correction – Hamming Code	1
3.4	Flow Control - Stop-and-Wait, Go-back-N, Selective Repeat.	3
3.5	Access Control - ALOHA, CSMA, CSMA-CD, CSMA-CA, Reservation, Polling	3
3.6	Example protocols such as HDLC and PPP, ARP and RARP	1
4	Network Layer	
4.1	Internet Protocol (IP) suite	1
4.2	IPv4 and IPv6 addressing and headers;	2
4.3	Routing protocols- distance-vector and link-state approaches,	1
4.4	Interior and Exterior Gateway Protocol concepts; Routing Algorithms - Dijkstra's algorithm and distributed Bellman-Ford algorithm;	2
4.5	Example protocols: OSPF, RIP, BGP.	1
5	Transport Layer	
5.1	Reliable end-to-end transmission protocols; UDP header;	1
5.2	Details of TCP header and operation including options headers	1
5.3	Congestion Control	2
6	Application Layer	
6.1	Socket Interface and Socket programming	3
6.2	Example protocols such as DNS, SMTP, FTP, HTTP Telnet,	2

Module No.	Topic	No. of Periods
	Rlogin, SNMP	
	Total	36

Course Designer(s):

1. S.Muthuramalingam, Professor, Department of Information Technology , smrit@tce.edu
2. C.Jeyamala, Associate Professor, Department of Information Technology, jeyamala@tce.edu

22IT441	DATABASE MANAGEMENT SYSTEMS
----------------	------------------------------------

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

This course facilitates the student to understand the various functionalities of Database Management Systems such as the creation, maintenance, and manipulation of Databases for real-world applications. The course also emphasizes the need for the design of database systems with normalization and provides 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

COs	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain Database system concepts, architecture, and its environment.	TPS2	70	90
CO2	Implement SQL queries for the given ER Model/scenario.	TPS3	70	80
CO3	Construct PL/SQL program to perform various Query operations for a given database.	TPS3	70	80
CO4	Apply normalization techniques for the database design.	TPS3	70	80
CO5	Apply concurrency control, transaction processing, Recovery techniques, and file indexing for the given scenario	TPS3	70	80
CO6	Build a NoSQL model for real-world application.	TPS3	70	80

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	M	L											L		
CO2	S	M	L		S			M	M	M		L	M	M	M
CO3	S	M	L		S			M	M	M		L	M	M	M
CO4	S	M	L									L	M		L
CO5	S	M	L									L	M		L
CO6	S	M	L		S			M	M	M		S	M	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern																		
CO	CAT1			Assignment -I			CAT2			Assignment - II			Terminal					
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	10	10											5	10				
CO2	5	5	30										5		15			
CO3	5	5	30			50							5		15			
CO4							5		15			30		10				
CO5							5	15	30			40	5		15			
CO6							5	10	15			30			15			

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Databases and Databases Users: Characteristics of the Database Approach- Database Users-Actors on the scene, workers behind the scene.

Database Systems Concepts and Architecture-Data models, Schemas and Instances, - Three Schema Architecture and Data Independence-Database Languages and Interfaces- Database System environment, Centralized and Client/Server Architectures for DBMSs- Classification of Database Management Systems

Data Modeling: Relational Algebra, Relational Data Model -Entity Relationship (ER) Model, Entity Types, Entity Sets, Attributes, Types of Keys, Relationship Types, Structural Constraints- -Enhanced ER Model - Introduction

Database query language: Basic SQL: Data types –Types of Constraints, Views, Complex Queries – Joins, string, date, and correlated subquery- PL/SQL –Cursor, Trigger, Procedure, Function, Exception and Package

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

File Organization: Indexing - B+tree

Transaction Processing - ACID Properties – Schedules – Serializability – Transaction support in SQL

Concurrency control -Need for Concurrency – Concurrency control –Two-Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking

Recovery – Recovery based on deferred and immediate update – Shadow paging

NoSQL Database – CAP Theorem – Document-Based systems – MongoDB - Key value Stores –Column-Based Systems – Graph Databases.

Text Book

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020

Reference Books & web resources

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Databases and Databases Users: -	
1.1	Characteristics of the Database Approach	1
1.2	Database Users-Actors on the scene, workers behind the scene	
2	Database Systems Concepts and Architecture	
2.1	Data models, Schemas and Instances	1
2.2	Three Schema Architecture and Data Independence	
2.3	Database Languages and Interfaces-Database System environment	1
2.4	Centralized and Client/Server Architectures for DBMSs	
2.5	Classification of Database Management Systems	1
3	Data Modeling	
3.1	Relational Algebra	1
3.2	Relational Data Model	1
3.3	Entity Relationship (ER) Model, Entity Types, Entity Sets, Attributes	
3.4	Types of Keys, Relationship Types	1
3.5	Structural Constraints- -Enhanced ER Model - Introduction	1
4	Database query language:	
4.1	Basic SQL: Data types –Types of Constraints	1
4.2	Views	1
4.3	Complex Queries - Joins, string, date, and correlated subquery	2
4.4	PL/SQL - Cursor, Trigger	2

Module No.	Topic	No. of Periods
4.5	Procedure, Function	1
4.6	Exception and Package	1
5	Database Design Theory and Normalization:	
5.1	Functional Dependencies-Normal forms based on Primary keys	1
5.2	2NF-3NF- Boyce Codd Normal Form	1
5.3	Multivalued dependencies and Fourth Normal Form	1
5.4	Join dependencies and Fifth Normal Form	1
6	File Organization	
6.1	Indexing : B+tree	1
7	Transaction Processing	
7.1	ACID Properties – Schedules	1
7.2	Serializability	2
7.3	Transaction support in SQL	1
8.	Concurrency control	
8.1	Need for Concurrency – Concurrency control	1
8.2	Two-Phase Locking- Timestamp	1
8.3	Multiversion – Validation and Snapshot isolation	1
8.4	Multiple Granularity locking	1
9.	Recovery	
9.1	Recovery based on the deferred and immediate update	1
9.2	Shadow paging	1
10	NOSQL Database	
10.1	CAP Theorem – Document-Based systems – MongoDB	2
10.2	Key value Stores	1
10.3	Column-Based Systems – Graph Databases	2
	Total	36

Course Designer(s):

1. Dr.S.Sridevi, Associate Professor, Department of IT
2. Dr.K.V.Uma, Assistant Professor, Department of IT

sridevi@tce.edu
kvuit@tce.edu

22IT451	PROGRAMMING FOR INTERNET OF THINGS
----------------	---

Category	L	T	P	Credit
ESC	2	0	2	3

Preamble

This course focuses on understanding different architectures used for connecting devices to the internet across multiple networks and protocols in the Internet of Things environment. It also aims at giving the students a platform to sense, connect and actuate things through powerful interfaces and programs. The course familiarizes the students with methodologies and tools in IoT, and how it is integrated into Cloud Deployment platform for Business applications.

Prerequisite

NIL

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the different types of Architecture Models and Communication Protocols in IoT	TPS2	80	70
CO2	Practice Programming language in Arduino and Raspberry Pi to build a real-time automation application	TPS3	70	70
CO3	Use different types of Sensors and Actuators to build an automation application.	TPS3	70	70
CO4	Make use of different communication technologies like MQTT, REST and JSON to interface with web and mobile application.	TPS3	70	70
CO5	Experiment with Cloud Deployment platforms from hyperscalers to sense, monitor and visualize the data through Web Server.	TPS3	70	70
CO6	Examine different domain-based application practices to solve Business needs with IoT applications.	TPS3	70	70

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	PSO3
CO1	M	L					M						L		L
CO2	S	M	L		S			M	M	M		M	M	M	L
CO3	S	M	L		S			M	M	M		M	M	M	L
CO4	S	M	L		S			M	M	M		M	M	M	L
CO5	S	M	L		S			M	M	M		M	M	M	L
CO6	S	M	L		S			M	M	M		M	M	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory						Practical				Terminal		
	CAT 1			CAT 2			TEST			OCR	(Theory)		
TPS Scale	1	2	3	1	2	3	1	2	3		1	2	3
CO1	20	-	-	-	-	-	-	-	-	-	10	10	-
CO2	-	-	40	-	-	20	-	-	20	20	-	-	20
CO3	-	20	20	-	-	-	-	-	20	20	-	5	20
CO4	-	-	-	10	20	20	-	-	20	20	-	-	10
CO5	-	-	-	10	20	-	-	-	20	20	5	5	10
CO6	-	-	-	-	-	-	-	-	20	20	-	-	5

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Internet of Things: Origin and Architecture: Evolution - Internet of Things - reference architecture-Network Architecture-Device Architecture-Publish-Subscribe architecture-Industry4.0-RAMI.

IoT Communication Protocols: Wired Communication Protocols-Wireless Communication Protocols-Application Protocols - Transport layer protocols – TCP vs UDP, IP- IPv4 vs IPv6, MQTT vs AMQP, NETCONF vs RESTCONF.

Programming for IoT: Microcontrollers: C++ - Arduino, Microprocessors: Python - Raspberry Pi

Sensors and Actuators: Types of Sensors: Domain-Based Sensor, Gesture Tracking Sensors, Wearables, Drones, GPS, Types of Actuators: Drives & Motion Control/Pneumatics.

Communication Devices: Bluetooth, GSM (Twilio), Web/Mobile Application-Comparison of Development Boards, Lora.

Integration with Cloud: Wi-Fi – Node MCU-Web Server - Data Acquisition-Send/Receive Data-Remote Data Monitoring-Visualization.

IoT Platforms and Use case: Microsoft Azure, AWS, GCP, IBM Watson, Node-Red.

Use Case: Fleet Services-Financial Services-Dairy Farming- Fitness Trackers-IoT Connected Cars-Retail-Tourism-Logistics-Biometrics.

Text Book

1. Internet Of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, 2020
2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Pethuru Raj, Anupama C. Raman, Auerbach Publications; 1st edition, 2017

Reference Books & web resources

1. Internet Of Things - A Hands-On Approach, Arsheep Bahga, Vijay Madiseti, 2015
2. <http://www.instructables.com/>

3. <https://aws.amazon.com/iot/>
4. <https://azure.microsoft.com/en-in/services/iot-hub/>
5. <https://www.ibm.com/cloud/internet-of-things>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Internet of Things	
1.1	Origin and Architecture: Evolution	1
1.2	Internet of Things reference architecture	
1.3	Network Architecture	1
1.4	Device Architecture-Publish-Subscribe architecture	
1.5	Industry4.0-RAMI	1
1.6	IoT Communication Protocols	
1.7	Wired Communication Protocols	1
1.8	Wireless Communication Protocols	
1.9	Application Protocols	1
1.10	Transport layer protocols	
1.11	TCP vs UDP, IP- IPv4 vs IPv6	1
1.12	MQTT vs AMQP, NETCONF vs RESTCONF	1
2	Programming for IoT	
2.1	Microcontrollers: C++ - Arduino	1
2.2	Microprocessors: Python - Raspberry Pi	1
3	Sensors and Actuators	
3.1	Types of Sensors: Domain Based Sensor	1
3.2	Gesture Tracking Sensors	1
3.3	Wearables, Drones, GPS	1
3.4	Types of Actuators	1
4	Communication Devices	
4.1	Bluetooth, GSM (Twilio)	2
4.2	Web/Mobile Application	
4.3	Comparison of Development Boards	1
4.4	LoRA	3
5	Integration with Cloud	
5.1	Wi-Fi	1
5.2	NodeMCU-Web server	1
5.3	Data acquisition-Send/Receive Data	1
5.4	Remote Data Monitoring-Visualization	
6	IoT Platforms and Use Case	
6.1	Microsoft Azure, AWS,GCP,BM Watson , Node-Red	1
6.2	Use Case: Fleet Services-Financial Services	
6.3	Dairy Farming- Fitness Trackers-IoT Connected Cars	1
6.4	Retail-Tourism-Logistics-Biometrics	
	Total	24

List of Experiments:

The List of experiments can be applied to any domain inclusive of Industry 4.0, Health, Agriculture, Finance, Tourism, Connected Cars.

S.No	Topic	No. of Periods
1.	Implement Automation Projects using Tinker Cad.	1
2.	Installation of Arduino Ide and Environment Setup – Introduction to basic Actuators – LEDS, Buzzers	2
3.	Home Automation Sensors - Gas Sensor, Servo motor, PIR Sensor	2
4.	Medical Sensors – Pulse sensor, Temperature sensor	2
5.	Measurement Sensors - Ultrasonic Sensor, vibration sensor, flex sensor, Force sensor, IR Sensor,	2
6.	Agriculture-based sensor - Moisture sensor, Water level sensor, DHT sensor, turbidity sensor	2
7.	Communication Devices – Bluetooth, GSM, GPS	2
8.	Smart Lighting implementation using LoRa	3
8.	WiFi Module – Node MCU- integrate with sensors and actuators	2
9.	Installation of OS in Raspberry pi and programming in pi	1
10.	Interfacing sensor with Raspberry Pi, PI Camera	2
11.	Communication devices with Raspberry Pi – RFID	1
12.	Data collection using sensors and Retrieving Data From Cloud(Wi-Fi)	1
13.	Use any Online IoT Platform along with Node-Red	1
		24

Course Designer(s):

1. Dr.K. Indira,
2. Ms.C.V. Nisha Angeline,

kiit@tce.edu
cvnait@tce.edu

22IT491	PROJECT MANAGEMENT
----------------	---------------------------

Category	L	T	P	Credit
HSMC	3	0	0	3

Preamble

This course provides a comprehensive overview of the principles, processes, and practices of software project management. This course leverages essential knowledge, techniques and skills required to successfully manage projects of any type and size.

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	Explain the key components of a project plan	TPS2	70	80
CO2	Apply appropriate project planning and tracking tools	TPS3	70	70
CO3	Show the importance of a cost benefit analysis to the successful implementation of a project plan	TPS3	70	70
CO4	Interpret how to identify the lessons learned in a project closeout and review session	TPS2	70	80
CO5	Develop a project plan for the applications on Internet of Things, Society and Environment	TPS3	70	70
CO6	Apply suitable software project management technique for the given software project scenario	TPS3	70	70

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
CO2	S	M	L		S						S		M		L
CO3	S	M	L								S			L	L
CO4	M	L									S	L			L
CO5	S	M	L		S	M	M	S	S	S	S	L	M	L	L
CO6	S	M	L						S	S	S		M		S

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory						Theory						Terminal		
	CAT 1			Assignment 1			CAT 2			Assignment 2			Theory		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	10	10	-	-	-	-	-	-	-	-	-	-	5	5	-
CO2	5	20	10	-	-	50	-	-	-	-	-	-	5	5	-
CO3	5	20	20	-	-	50	-	-	-	-	-	-	5	5	20
CO4	-	-	-	-	-	-	10	10	-	-	-	-	-	5	-
CO5	-	-	-	-	-	-	5	20	10	-	-	50	5	5	10
CO6	-	-	-	-	-	-	5	20	20	-	-	50	-	5	20

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Project- Project Life cycle- Process Group-Project Management Software.

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 –Function Point Analysis- SDLC Auditing– Case study - Software management tools and techniques

Text Book

- Warburton. R & Kanabar. V, The Art and Science of Project Management, RW Press, RI, Second Edition, 2016.
- Project Management Institute. 2021. A Guide to the Project Management Body of Knowledge (PMBOK Guide). 7th ed. Newton Square, PA: Project Management Institute.
- Bob Hughes, Mike Cotterell, Software Project Management, Tata McGraw Hill, Third Edition, 2011.

5. Kanabar. V and Warburton, R, Fundamentals Project Management, Kaplan Press, New York, 2008.
6. Walker Royce, Software Project Management A Unified Framework, Pearson Education, 2004.
7. Pierre Bourque, Richard E. Fairley, and IEEE Computer Society. 2014. Guide to the Software Engineering Body of Knowledge (SWEBOK(R)): Version 3.0 (3rd. ed.). IEEE Computer Society Press, Washington, DC, USA.

Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours
1	Introduction-Project- Project Life cycle- Process Group	1
1.1	Project Management Software.	1
2	Project Initiation Phase	
2.1	Scoring Matrix	1
2.2	Project Charter – Role of charter – Creation of charter	1
2.3	Role of stakeholder – Identification of stakeholders	1
2.4	Stakeholders register and management strategy – Ranking the Stakeholder	1
3	Project Planning Phase	
3.1	Requirement Process Collection – Project Scope – Work breakdown structure	1
3.2	Define activities –Milestones - Estimate activity resources – Activity durations	1
3.3	Plan risk management – Identify and rank risks –Risk response plan – Risk contingency plan	2
3.4	Plan quality management –Quality roles and responsibilities – Define project quality – Measure project quality – Quality control – Quality management plan	2
3.5	Human resource plan – Communication management plan	1
4	Project cost estimation	
4.1	Analogous estimation – Parametric	1
4.2	Three point method – WBS method	1
4.3	Project Management Tools & Strategies – PERT, CPM and GANNT	3
5	Project Execution Phase	
5.1	Project staffing assignment – Project Manager Team assessment	1
5.2	Team feedback – Task distribution – Create issue logs	2
6	Project Monitoring, Controlling and Closing Phase	
6.1	Cost and Schedule variance Analysis	1
6.2	Work Performance Results – Change control	1
6.3	Quality Control – Risk register update	1
6.4	Lesson Learned	1
7	Software Project Management	
7.1	Software Metrics- Metrics Analysis Report - Version Change Control	2
7.2	Risk management	2
7.3	Quality management and assurance	1
7.3.1	Software Maintenance	1

7.4	Cost estimation – COCOMO model-	2
7.4.1	Function Point Analysis	
7.5	SDLC Auditing	2
	Total	36

Course Designer(s):

1. Dr.P.Karthikeyan,Asso.Professor,IT
2. S.Pudumalar,Asst.Professor,IT

karthikit@tce.edu
spmit@tce.edu

22IT471	COMPUTER NETWORKS LABORATORY
----------------	---

Category	L	T	P	Credit
PC	0	0	2	1

Preamble

The laboratory course on Computer Networks helps the students to gain practical understanding of networking concepts by simulating various protocols in GNS3 and LAN Trainer Kit. The course also enable the students to 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

S.No	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Develop client server applications using Remote Method Invocation (RMI)	TPS3	B	70
CO2	Develop client server applications using Socket Programming	TPS3	B	70
CO3	Analyse the performance of different topologies of Local Area Networks under varying load conditions and node failure	TPS3	B	70
CO4	Perform packet capture and interpret the various fields in different layers of TCP/IP stack	TPS3	B	70
CO5	Implement protocols for error correction/detection and flow control.	TPS3	B	70
CO6	Perform configuration of DHCP, DNS, routing tables and firewalls	TPS3	B	70

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	PS O1	PS O2	PS O3
CO1	S	M	L		M			M		M		M	S	M	M
CO2	S	M	L		M			M		M		M	S	M	M
CO3	S	M	L		M			M		M		M	S	M	M
CO4	S	M	L		M			M		M		M	S	M	M
CO5	S	M	L		M			M		M		M	S	M	M
CO6	S	M	L		M			M		M		M	S	M	M

S- Strong; M-Medium; L-Low

S.No	List of Experiments	COs	No of Hours
Socket Programming			
1.	Develop a remote service request-response application using RMI	CO1	2
2.	Implement a simple file transfer protocol (FTP) using connection- oriented and connectionless sockets	CO2	2
3.	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)	CO2	2
4.	Extend the single client – single server chatting application developed using connection-oriented sockets to a multiple client – single server chatting application using threads	CO2	2
5.	Develop a multicast chatting tool that will be used to communicate among a multicast group	CO2	2
6.	Develop a concurrent server that spawns several threads, one for each client requesting a specific service	CO2	2
7.	Implement sliding window and stop and wait techniques to establish flow control between a sender and receiver	CO5	2
Configuration and Simulation Exercises			
8.	Basic Networking commands	CO3	1
9.	Simulate Distance vector routing with and without Node failure scenarios	CO5	1
10.	Simulate Link State routing with and without Node failure scenarios	CO5	1
11.	Simulate a LAN based on Ethernet with a minimum of ten nodes and examine the performance under different load scenarios	CO3	2
12.	Simulate Address Resolution and reverse address resolution	CO5	1
13.	Configuration of DHCP and DNS servers	CO6	2
Packet Capture and Analysis			
14.	Study of frame format of IP, TCP and UDP datagrams and Traffic analysis	CO4	2

- 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/ LAN Trainer Kit
- 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 Designer(s):

1. S.Muthuramalingam, Professor, Department of Information Technology , smrit@tce.edu
2. C.Jeyamala, Associate Professor, Department of Information Technology, jeyamala@tce.edu

22IT481	DATABASE MANAGEMENT SYSTEMS LAB
----------------	--

Category	L	T	P	Credit
PCC	0	0	2	1

Preamble

This course aims to provide a strong foundation in database design concepts and to provide adequate exposure to 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 applications for real-world scenarios.

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	Design a database with integrity constraints and appropriate normal forms for real-world applications.	TPS3	80	90
CO2	Implement Data Manipulation Languages for a given application	TPS3	80	90
CO3	Apply complex SQL queries for a given application	TPS3	80	90
CO4	Apply various composite data types to execute PL/SQL block	TPS3	80	90
CO5	Implement Procedures, Functions, Triggers, Cursors, exceptions and Packages for the given application.	TPS3	80	90
CO6	Implement No SQL data model for a given application	TPS3	80	90

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

Cognitive Levels	Model Examination	Terminal Examination
Remember		
Understand	20	20
Apply	80	80
Analyse		
Evaluate		
Create		

LIST OF EXPERIMENTS

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

Course Designer(s):

1. S.Sridevi, Associate Professor, Department of IT
2. K.V.Uma, Assistant Professor, Department of IT

sridevi@tce.edu
kvuit@tce.edu

22IT511**INFORMATION SECURITY**

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

This course on Information Security focuses on the models, tools, and techniques for enforcement of security with emphasis on the use of cryptography. Upon completion of the course, the learners will be able to develop basic understanding of security, cryptography, system attacks and defences against them.

Prerequisite

Nil

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	Perform Encryption/ Decryption of text using symmetric and asymmetric crypto algorithms to provide confidentiality.	TPS3	80	65
CO2	Compute hash and digital signature for the given message to provide integrity and non-repudiation service.	TPS3	80	65
CO3	Examine the strength of any cryptographic algorithm by cryptanalysis.	TPS3	70	60
CO4	Explain different types of authentication and key agreement protocols.	TPS2	90	75
CO5	Use security protocols such as SSL, IP Sec etc., at different layers of TCP/IP stack to develop security solutions	TPS3	80	65
CO6	Identify security attacks and vulnerabilities in any information system and provide preventive measures and solutions in adherence with security standards	TPS4	70	60

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								M		
CO2	S	M	L		L								M		
CO3	S	S	M	L	L								S		
CO4	M	L											M		
CO5	S	M	L										M		
CO6	S	S	M	L	M			S	M	M		S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1				Assignment 1				CAT2				Assignment 2				Terminal			
	100				100				100				100				100			
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
CO1	8	8	34				50										10	30		
CO2			16				25										5	10		
CO3	9	9		16				25				18								10
CO4									16								10			
CO5									16	16	16				50		5	10		
CO6												18				50				10

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

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

Cryptography - Mathematics for Cryptography – Number Theory - Modulo Arithmetic - Euclidean and extended Euclidean Theorem - Chinese Remainder Theorem - Euler and Fermat theorem, Galois Fields, Primality Testing Methods

Symmetric Key Cryptosystems –Hill Cipher, Advanced Encryption Standard, Public Key Cryptography - RSA , Elliptic Curve Cryptosystems , Integrity – Message Authentication Code and Hash , Application of Hash in Blockchain Technologies, Digital Signatures.

Authentication and 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, Electronic Payments – SET Security at Transport Layer –SSL and TLS, Security at Network layer –IP Sec

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

Secure Software Development -Software Vulnerabilities – OWASP Web Application Security Concerns -Phishing, Buffer Overflows, Format String Attacks, Cross Site Scripting, SQL injection, DoS, DDoS, Session Hijacking and Pharming Attacks.

Non cryptographic Protocol Vulnerabilities –Viruses, Worms and Malwares -Case Studies

Text Book

1. Behrouz. A. Foruzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill , Third Edition, 2016.

Reference Books & web resources

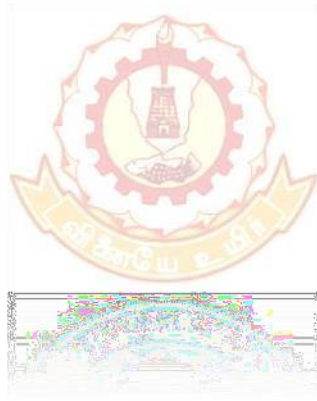
1. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, Seventh Edition, 2017.
2. Bernard L Menezes, and Ravinder Kumar "Cryptography, Network Security and Cyber Laws", Cengage Learning India Pvt Limited, 2018.
3. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Private Communication in Public World", Prentice Hall India, Second Edition, 2002.
4. William Stallings, "Network Security Essentials: Applications and Standards", Prentice Hall, Sixth Edition, 2016.
5. Man Young Rhee, "Internet Security Cryptographic Principles, Algorithms and Protocols", Wiley, First Edition, 2003.
6. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006.
7. https://onlinecourses.nptel.ac.in/noc22_cs90/preview

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Basics of Information Security	
1.1	Perspectives and Impact, Threats and vulnerabilities, Attacks, Security Services -CIA Triad and Security Models, Internet Law and Cyber Crimes, Security Standards	2
2	Cryptography	
	Mathematics for Cryptography – Number Theory	2
2.1	Modulo Arithmetic	
2.2	Euclidean and extended Euclidean Theorem, Chinese Remainder	
2.3	Theorem	
2.4	Galois Fields	2
2.5	Euler and Fermat theorem	1
2.6	Primality Testing Methods	
2.7	Symmetric Key Cryptosystems –Hill Cipher	2
2.8	Advanced Encryption Standard	3
2.9	Public Key Cryptography - RSA	2
2.10	Elliptic Curve Cryptosystems	2
2.11	Integrity – Message Authentication Code and Hash	2
2.12	Application of Hash in Blockchain Technologies,	1
2.13	Digital Signatures	1
3	Authentication and Key Exchange	
3.1	One way Authentication	1
3.2	Mutual Authentication	
3.3	Passwords and Dictionary Attacks	
3.4	Biometrics- Multifactor Authentication	1
	Key management	2
3.5	Digital certificates	
3.6	Public Key Infrastructure	
4	Security Protocols	
4.1	Security at Application Layer – PGP, Electronic Payments- SET	2
4.2	Security at Transport Layer –SSL and TLS,	1
4.3	SET Security at Network layer –IP Sec	1
5	Network Defense Tools	
5.1	Firewalls	1
5.2	Intrusion Prevention and Detection Systems	1
6	Secure Software Development	
	OWASP Web Application Security Concerns	
6.1	Phishing	1
6.2	Buffer Overflows	
6.3	Format String Attacks	
6.4	Cross Site Scripting	1
6.5	SQL injection,	1
6.6	DoS and DDoS	
6.7	Session Hijacking	1
6.8	Pharming Attacks	
7	Non cryptographic Protocol Vulnerabilities	
7.1	Viruses	2
7.2	Worms	
7.3	Malwares	
	Case Studies	
	Total	36

Course Designer(s):

1. Jeyamala.C, Associate Professor, jeyamala@tce.edu, Information Technology
2. Parkavi.R, Assistant Professor, rpit@tce.edu, Information Technology



22IT521**MACHINE LEARNING**

Category	L	T	P	Credit
PCC	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

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 reinforcement learning techniques for real life problems especially medical data set.	TPS3	70	65
CO6	Analyze the performance of various classifiers, regression models, clustering and reinforcement 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	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
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	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**Machine Learning:**

Introduction Basic Concepts - Probability, Linear Algebra, Convex Optimization
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).

Dimensionality Reduction:

Feature selection ,Regression – Types - Linear Regression -Polynomial Regression - Ridge
and LASSO (Least Absolute Shrinkage and Selection Operator) Regression - Error Rate
Estimation, Principal Component Analysis (PCA)-Linear Discriminant Analysis (LDA)-
Independent Component Analysis (ICA) -Partial Least Squares (PLS).

Supervised Learning :

Decision Trees, Bayesian Learning- Bayes Optimal Classifier, Naive Bayes,Nearest
Neighbour Models - Belief Network – SVM,Neural Networks - Basics, Early Models,
Perceptron Learning, Backpropagation.

Evaluation measures:

Hypothesis testing, Ensemble Methods, Bagging Adaboost Gradient Boosting, Diagnosis
and Regularization of Bias Vs Variance - Learning Curve.

Unsupervised Learning:

Clustering algorithms (K-means, hierarchical, spectral),Divisive and Agglomerative –
Gaussian Mixture Models – Expectation Maximization (EM) algorithm – Hidden Markov
Model (HMM),Anomaly Detection – Outlier Types, Techniques of Anomaly Detection.

Reinforcement Learning:

RL Model, Types of RL, Optional videos (RL framework, TD learning, Solution Methods,
Applications),Q Learning – SARSA (State-Action-Reward-State-Action) Algorithms- Case
study, Machine Learning Framework and Libraries-Matplotlib-NLTK–Pandas– Scikit learn

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

Module No.	Topic	No. of Periods
1	Machine Learning	
1.1	Introduction Basic Concepts - Probability	1
1.2	Linear Algebra	
1.3	Convex Optimization	
1.4	Introduction to Machine Learning– Components of learning	1
1.5	Inductive Learning Hypotheses	
1.6	Learning models – geometric models probabilistic models, logic models	1
1.7	Statistical Decision Theory	1
1.8	Bayesian Learning (ML, MAP, Bayes estimates, Conjugate priors)	2
2	Dimensionality Reduction	
2.1	Feature selection	1
2.2	Regression- Types-Linear Regression-Polynomial Regression	1
2.3	Ridge and LASSO (Least Absolute Shrinkage and Selection Operator) Regression - Error Rate Estimation	1
2.4	Principal Component Analysis (PCA)	1
2.5	Linear Discriminant Analysis (LDA)	1
2.6	Independent Component Analysis (ICA)	1
2.7	Partial Least Squares (PLS)	1
3	Supervised Learning	
3.1	Decision Trees	1
3.2	Bayesian Learning	1
3.3	Bayes Optimal Classifier	
3.4	Naive Bayes, Nearest Neighbour Models	1
3.5	Belief Network	1
3.6	SVM	1

Module No.	Topic	No. of Periods
3.7	Neural Networks - Basics, Early Models	1
3.8	Perceptron Learning	1
3.9	Backpropagation	1
4	Evaluation measures	
4.1	Hypothesis testing	1
4.2	Ensemble Methods	1
4.3	Bagging Adaboost Gradient Boosting	1
4.4	Diagnosis and Regularization of Bias Vs Variance	1
4.5	Learning Curve	
5	Unsupervised Learning	
5.1	Clustering algorithms (K-means, spectral), Divisive and Agglomerative	1
5.2	Gaussian Mixture Models	1
5.3	Expectation Maximization (EM) algorithm	1
5.4	Hidden Markov Model (HMM)	1
5.5	Anomaly Detection– Outlier Types	1
5.6	Techniques of Anomaly Detection	
6	Reinforcement Learning	
6.1	RL Model	1
6.2	Types of RL	
6.3	Optional videos (RL framework, TD learning, Solution Methods, Applications)	1
6.4	Q Learning	1
6.5	SARSA(State-Action-Reward-State-Action) Algorithms-Case study	1
6.6	Machine Learning Framework and Libraries- Matplotlib- NLTK – Pandas – Scikit-learn	2
	Total	36

Course Designer(s):

1. Dr.C.Deisy, Professor, IT

cdcse@tce.edu

2. Ms.P.VijayaPraba, Assistant Professor, IT

pvpit@tce.edu

22IT531 CLOUD COMPUTING

Category L T P Credit

PCC 3 0 0 3

Preamble

The objective of the course is to provide fundamental knowledge in distributed and service computing that extends the comprehensive view of cloud computing architecture, service models, deployment methods, resource scheduling, migration methodologies and cloud programming framework to meet the on-demand service.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcomes	TPS Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the key technologies, strengths, limitations, and applications of cloud computing.	TPS2	70	75
CO2	Apply the suitable virtualization concept for the given scenario.	TPS3	70	65
CO3	Categorize the cloud service types, architecture, contract negotiations needed for cloud service delivery and cloud software development.	TPS3	70	60
CO4	Identify the necessity, appropriate cloud architecture/model for deploying an application in a cloud environment based on the given requirements.	TPS3	70	65
CO5	Adapt the Resource Scheduling and Migration Methodologies based on VM Allocation.	TPS3	70	65
CO6	Examine the emerging technologies to incorporate in cloud computing platforms with appropriate programming models.	TPS4	70	75

Mapping with Programme 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			L	L	L		M	M	L	L
CO3	S	M	L		M			M	M	M	L	M	M	L	M
CO4	S	M	L		M	L		M	M	M	L	M	M	M	L
CO5	S	M	L		M			L	L	L		M	M	L	L
CO6	S	S	M	L	M			S	M	M		S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1				Assignment 1				CAT2				Assignment 2				Terminal			
	100				100				100				100				100			
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
CO1	5	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	-	-
CO2	5	15	20	-	-	-	50	-	-	-	-	-	-	-	-	-	2	5	12	-
CO3	5	15	20	-	-	-	50	-	-	-	-	-	-	-	-	-	2	5	12	-
CO4	-	-	-	-	-	-	-	-	5	10	20	-	-	-	20	-	2	5	12	-
CO5	-	-	-	-	-	-	-	-	5	10	20	-	-	-	30	-	2	5	12	-
CO6	-	-	-	-	-	-	-	-	5	10	15	-	-	-	-	50	-	5	12	-

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Basics of Cloud: Historical developments in computing- Definition of Cloud Computing- Essential Characteristics-Data center Design and Interconnection Network-Cloud Deployment Models-Benefits and Challenges-

Virtualization: Definition- Benefits 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: Cloud Reference Model-SPI Framework-Market Oriented Cloud Architecture-SLA-Billing and Accounting- Economics of Scaling.

Service Models: SaaS – Multi-tenant OpenSaaS - PaaS – Leveraging PaaS for productivity-IaaS – Improving performance, System and storage redundancy, Cloud based NAS devices, Advantages, Server types- IDaaS – AAA model-Single Sign-on, OpenID- Database as a Service-Monitoring as a Service-Communication as services- XaaS. Case study: Open stack.

Programming models: Fundamental aspects of parallel and distributed programming models: MPI, OpenMP, Cloud programming models: Hadoop, Map reduce, Spark .

Resource Allocation and Migrating: Resource Allocation and Task Scheduling Algorithms- Seven Steps Migration Methodology-Cloud Migration Strategies-Application Migration to Cloud-Database Migration to Cloud-Data Migration to Cloud.

Emerging Technologies: Mobile Cloud Computing - IoT Applications- Fog and Edge computing- Serverless Computing-Green Cloud Computing.

Text Book

1. Mehul Mahrishi Kamal Kant Hiran, Ruchi Doshi, Dr. Fagbola Temitayo, "Cloud Computing", BPB Publications, First Edition, 2019
2. Shailendra Singh, "Cloud Computing", Oxford University Press, First edition, 2018.
3. Rajkumar Buyya, Vecchiola, Selvi, "Mastering Cloud Computing", McGraw Hill Education, First edition, 2017.
4. Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, "Cloud Computing and Virtualization", Wiley, 2018.

Reference Books & web resources

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering cloud computing", Morgan Kaufman, 2013.
2. Dr. Kris Jamsa, —Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Jones and Bartlett learning, First edition, 2013.
3. Arshdeep Bahga, Vijay Madisetti, —Cloud Computing: A Hands-On Approach, CreateSpace Independent Publishing Platform, 1st edition, 2013.
4. https://onlinecourses.nptel.ac.in/noc21_cs14/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Basics of Cloud	
1.1	Historical developments in computing	1
1.2	Definition of Cloud Computing	1
1.3	Essential Characteristics	
1.4	Data center Design and Interconnection Network	1
1.5	Cloud Deployment Models	1
1.6	Benefits and Challenges	
2	Virtualization	
2.1	Definition	1
2.2	Benefits of Virtualization	
2.3	Types of Virtualization	1
2.4	Virtual Machine monitor	2
2.5	Virtual machine properties	
2.6	Interpretation and Binary translation	2
2.7	Types of VM: System VM, Process VM, HLL VM	
2.8	Hypervisors: Xen, KVM, VMware, Virtual Box, Hyper-V.	1
3	Cloud Architecture	
3.1	Cloud Reference Model	1
3.2	SPI Framework	
3.3	Market Oriented Cloud Architecture	1
3.4	SLA-Billing and Accounting	1
3.5	Economics of Scaling.	
4	Service Models	

Module No.	Topic	No. of Periods
4.1	SaaS – Multi-tenant, OpenSaaS	1
4.2	PaaS – leveraging PaaS for productivity-IaaS – Improving performance	1
4.3	System and storage redundancy, Cloud based NAS devices	1
4.4	IDaaS – AAA model-Single Sign-on, OpenID	1
4.5	Database as a Service	1
4.6	Monitoring as a Service	1
4.7	Communication as services	
4.8	XaaS	1
4.9	Case study: Open stack.	
5	Resource Allocation and Migrating	
5.1	Resource Allocation and Task Scheduling Algorithms	1
5.2	Seven Steps Migration Methodology	1
5.3	Cloud Migration Strategies	1
5.4	Application Migration to Cloud	1
5.5	Database Migration to Cloud-	1
5.6	Data Migration to Cloud	1
6	Programming models:	
6.1	Fundamental aspects of parallel and distributed programming models: MPI, OpenMP	2
6.2	Cloud programming models: Hadoop, Map reduce, Spark.	2
7	Emerging Technologies	
7.1	Mobile Cloud Computing	2
7.2	IoT Applications	
7.3	Fog and Edge computing	2
7.4	Serverless Computing	
7.5	Green Cloud Computing	1
	Total Lectures	36

Course Designer(s):

1. Dr.S.Padmavathi, Professor, Dept. . of IT spmcse@tce.edu
2. Dr.K.Indira, Assistant Professor, Dept of IT kiit@tce.edu

22IT551	WEB TECHNOLOGIES
----------------	-------------------------

Category	L	T	P	Credit
PCC	1	0	4	3

Terminal Exam Type: Practical

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 various web services and testing technologies.

Prerequisite

- NIL

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	Demonstrate essential software tools for webapplication development	TPS2	70	70
CO2	Use latest front-end technologies to build web applications that incorporate the latest user interface design trends and features	TPS3	70	70
CO3	Develop simple server-side applications using Node JS with DB	TPS3	70	70
CO4	Build applications using XML and JSON to store data in a sharable manner.	TPS3	70	70
CO5	Utilize diverse software testing methodologies	TPS3	70	70
CO6	Analyse and interpret the appropriate web services for the application requirements/industry scenarios	TPS4	70	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			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

CO	CAT 1						CAT 2						Model Lab & Record						Terminal					
	Theory						Theory												Practical					
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	30	10												10						10			
CO2	10		20												20						20			
CO3			20												20						20			
CO4							10	10	20						20						20			
CO5								10	10						20						20			
CO6							10		10	20					10						10			

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Web essentials: IDE/ Editors, Deployment, Console, NPM, Architecture Patterns, UI design, UI Prototyping tools using Figma.

Front end: HTML5, CSS3, Angular JS – data binding, controllers, scopes, dependency injection, filters, directives, services, factory, modules, components, animations. Debugging in front end- React JS Basics

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

XML: 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, parsing.

Application Testing & Web services: Testing Tools – Selenium- JMeter - **Web services** - SOAP, WSDL, RDF, RSS, REST – types, resources, methods

Text Books

1. Aristeidis Bampakos, "Angular Projects: Build modern web apps by exploring Angular 12 with 10 different projects and cutting-edge technologies, 2nd Edition", 2020.
2. iCode Academy, "Angular JS for Beginners", August 2017.
3. Mastering HTML, CSS & Javascript Web Publishing by Laura Lernay, Rafe Colburn, Jennifer Kyrnir, BPB Publications, 2016
4. Godbole, "Web Technologies", July 2017.

Learning Resources

1. <https://www.freecodecamp.org/>
2. <https://www.w3schools.com/>
3. <https://www.codecademy.com/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Web essentials	
1.1	IDE/ Editors, Deployment, Console	1
1.2	NPM	
1.3	MVC, MVVM	1
1.4	UI design, UI Prototype tools –using Figma	
2	Frontend	
2.1	HTML5, CSS3	1
2.2	AngularJS– databinding	
2.3	Controllers and scopes	
2.4	Dependency injection	
2.5	Filters, directives	1
2.6	Services, factory	
2.7	Modules, components	
2.8	Animations, Debugging in front end.	
3	Backend	
3.1	NodeJS–console	1
3.2	Events	
3.3	Modules-file system	
3.4	Express	
3.5	HTTP, net	1
3.6	OS,path, DNS	
3.7	DB–MySQL	
3.8	MongoDB	
4	Data transportation	
4.1	XML Basics, Structure, Elements, attributes	1
4.2	Namespaces, Working with DTD	
4.3	Schema, Grouping elements	
4.4	DOM	
4.5	XML Formatters, CSS–XSLT	1
4.6	XPATH, XQUERY	
4.7	JSON	
5	Web Application Testing	
5.1	Testing Tools – Selenium- JMeter	2
6	Web services	
6.1	SOAP, WSDL	1
6.2	RDF, RSS	
6.3	RESTful–types, Resources, methods	1
	Total Hours	12

List of Experiments:

Ex.No	Experiment Name	No. of Hours	Cos
1.	Prepare the UI Prototype using Figma	2	CO1
2.	Design a web application front-end using HTML, CSS, JS	2	CO2
3.	Design the front-end part of the application using Angular Js and React JS	4	CO2
4.	Experiment with code debugging	2	CO2
5.	Design Backend part of the Application Using Django Framework	4	CO2
6.	Develop the Back-end part of the application using SQL and MongoDB	4	CO3
7.	Practice with ExpressJS	3	CO3
8.	Practice with XML Formatters	4	CO4
9.	Practice with XML DTD	3	CO4
10.	Perform various testing such as functional, usability, interface using testing tools such as selenium	4	CO5
11.	Practice with CI/CD (Continuous Integration and Continuous Deployment)	4	CO5
12.	Improvement in the web application code after testing and customer feedback	4	CO5
13.	Practice with Web Services	4	CO6
14.	Implement the web service using your chosen programming language and web framework and interact with a database or other backend systems to retrieve or store data.	2	CO6
15.	Write a report summarizing your findings and providing a recommendation for which web service to use. Include details on the pros and cons of each service, any limitations you encountered, and any other relevant information.	2	CO6
Total Hours		48	

Course Designer(s):

1. Dr.S.Karthiga, Assistant Professor,
Department of Information Technology
2. Dr.M.Akila Rani, Assistant Professor,
Department of Information Technology

skait@tce.edu

marit@tce.edu

22IT571	INFORMATION SECURITY LAB
----------------	---------------------------------

Category	L	T	P	Credit
PCC	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.

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	Utilize symmetric and public key cryptography to offer confidentiality in simple application development	TPS3	80	70
CO2	Perform message and entity authentication using hashing and digital signatures	TPS3	80	70
CO3	Use standard crypto libraries for crypt analysis	TPS4	80	70
CO4	Configure and manage network defense tools like Firewalls and Intrusion Detection Systems	TPS3	80	70
CO5	Identify software vulnerabilities such as SQL injection and provide solutions for prevention and detection	TPS4	80	70
CO6	Analyze the network attacks and identify the malwares in the network	TPS4	80	70

Mapping with Programme 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	M	L
CO2	S	M	L		M			M	L			M	M	M	L
CO3	S	S	M	L	M			M	L			M	S	M	L
CO4	S	M	L		M			M	L			M	M	M	L
CO5	S	S	M	L	M			M	L	L		M	S	M	L
CO6	S	S	M	L	M			M	L	L		M	S	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Contents

Ex. No.	Topic	No. of Sessions	COs
1	Implementation and Crypt analysis of Hill Cipher	1	CO1/CO3
2	Develop a secure client server communication using symmetric key algorithms (Use Standard crypto Libraries)	1	CO1/CO3
3	Implement RSA cryptosystem with key management	1	CO1/CO3
4	Verify integrity of client server communication using Hashing techniques	1	CO2
5	Perform Man in the middle attack in Diffie Hellman Key Exchange protocol	1	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	1	CO5
8	Configuration of Firewalls in system environment / using OPNET or Cisco Packet Tracer or GNS3	1	CO4
9	Simulation of Virtual Private Network using OPNET or Cisco Packet Tracer or GNS3	1	CO4
10	Study of Transport Layer Security Protocol using Wireshark	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, Cross site scripting	1	CO6
Total Sessions		12	

Course Designer(s):

1. Dr.C.Jeyamala, Associate Professor, Department of IT
2. Mrs.R.Parkavi, Assistant Professor, Department of IT

jeyamala@tce.edu
rpit@tce.edu

22IT581**CLOUD COMPUTING LAB**

Category L T P Credit

PCC 0 0 2 1

Preamble

This laboratory course will make the students to experience the key techniques and concepts of web service creation, consuming service, cloud computing service, data processing platform and simulation computing platform. 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

COs	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Build RESTful web service and consume Service in client application.	TPS3	90	80
CO2	Develop and Implement applications using different cloud services.	TPS3	90	80
CO3	Apply parallel programming model to perform data intensive application.	TPS3	90	70
CO4	Build data intensive application in Hadoop Platform.	TPS3	90	80
CO5	Simulate a cloud environment to implement new schedulers by analyzing the parameters affecting performance.	TPS4	90	70
CO6	Develop and Implement applications using Dockers Containers	TPS3	90	80

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		M	L		S	L	L		S	M	M	L
CO2	S	M	L		M	L		S	L	L		S	M	M	L
CO3	S	M	L		L			S	L	L		S	M	L	L
CO4	S	M	L		M			S	L	L		S	S	L	M
CO5	S	S	M	L	M			S	L	L		L	S	L	L
CO6	S	M	L		M	L		S	M	M	M	S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Cognitive Levels	Model Examination	Terminal Examination
Remember	0	0
Understand	0	0
Apply	80	80
Analyze	20	20
Evaluate	0	0
Create	0	0

Course Contents and Lecture Schedule

Ex. No.	Topic	No. of Sessions	COs Mapping
1.	Study of Different Computing Paradigms with performance measures.	1	CO1
2.	Building RESTful web service and consume the service in the client application	1	CO1
3.	Building web application and hosts the necessary databases, services and authentication using different hosting platforms.	1	CO2
4.	Implementation of Database as a service for an application with CRUD operations.	1	CO2
5.	Implementation of an application using Single Sign On as identity management.	1	CO2
6.	Implementation of Storage as a service for an application using Dropbox.	1	CO2
7.	Implementation of Parallel Programming with MPI to perform Task Management.	1	CO3
8.	Implementation of Hadoop Single and Multi-Node cluster for an application data processing.	1	CO4
9.	Implementation of Apache Spark Deployment on top of HDFS for an application.	1	CO4
10.	Analyzing various Resource Scheduling Management using iFogSim.	1	CO5
11.	Simulation of Large Scale application based Data center and Users allocation in Cloud Analyst under various deployment configurations.	1	CO5
12.	Deployment of Restful Application in Docker/Kubernetes platform.	1	CO6
Total		12	

Course Designer(s):

1. Dr.S.Padmavathi, Professor, Dept of IT spmcse@tce.edu
2. Dr.K.Indira, Assistant Professor, Dept of IT kiit@tce.edu

22IT611**ENGINEERING ECONOMICS
AND FINANCIAL ACCOUNTING**

Category	L	T	P	Credit
HSS	3	0	0	3

Preamble

This course explains the basic principles of managerial economics, accounting and current business environment underlying business decision making. In the process of managing organizations, the managers at different levels should take appropriate economic decisions which will help in minimizing investment, operating and maintenance expenditures besides increasing the revenue, savings and such other gains of the organization. This course deals with how an engineer should deal with organisation's operational and non- operational data to take decisions of these kinds and also emphasize the quantitative and qualitative applications of economic principle to business analysis. The course explores the role of AI in financial sectors using few case studies.

Prerequisite

- NIL

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Understand the economic theories and concepts, demand and supply chain analysis to take economically sound managerial decisions.	TPS2	70	85
CO2	Prepare financial statements, common size statements, comparative statements for any given financial data.	TPS3	70	85
CO3	Determine the cut off production volume for a company to make profit by performing break even analysis with an understanding of various costs involved in the production cost centre.	TPS3	70	85
CO4	Choose the best project option from among a set of competing alternatives. .	TPS3	70	85
CO5	Apply the appropriate sources of finance and mobilize the right quantum of finance and use them in most profitable investment avenues.	TPS3	70	85
CO6	Build machine learning models for aiding economic policy design with a comprehension of the impact of AI in economic and finance theories.	TPS3	70	85

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT			Assignment			CAT			Assignment			Terminal					
	1			1			2			2								
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	8	10											5	5				
CO2	8	10	30			50							3	5	15			
CO3	4	10	20			50							2	5	15			
CO4							4	10	20			30	2	5	15			
CO5							8	10	20			20	3	5	5			
CO6							8	10	10			50	5	5				

CO6 COVERED THROUGH MINI PROJECT

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Demand & Supply Analysis Firms: Types, objectives and goals - Managerial economics - Decision analysis. Demand - Types of demand - Determinants of demand - Demand function - Demand elasticity- Demand forecasting - Supply - Determinants of supply - Supply function -Supply elasticity.

Financial Accounting: Functions of accounting, accounting principles. Preparation of financial statements -Balance sheet and related concepts - Profit & Loss Statement and related concepts - Comparative financial statements - Analysis & Interpretation of financial statements

Cost analysis and Marginal costing- Elements of cost- classification of cost-, Preparation of cost sheet and its applications-Depreciation-Break-Even Analysis - Profit/Volume Ratio (P/V Ratio)- Applications in make or buy decision.

Capital budgeting- Investments –Time value of money -Comparison of Project Alternatives: Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

Financial Markets: Sources of finance and financial institutions, Venture capital, various Business models.

Case studies in Machine Learning for Finance: Case Studies on prediction of real estate prices, market basket analysis and economic growth using Python and spreadsheet.

Reference Books & web resources

1. Panneerselvam R, Engineering Economics, PHI Learning Private Limited; 2nd edition, 2013.
2. M.C.Shukla, T.S.Grewal, "Advanced Accounts-Volume-I, 2010 Reprint, S. Chand & company Ltd., 2010.
3. Prasanna Chandra, "Financial Management-Theory and practice" seventh Reprint, Tata McGraw-Hill publishing company Limited, 2010.
4. V.L.Mote, Samuel Paul and G.S.Gupta, "Managerial Economics – concepts and cases", McGraw Hill Education (India), 2017.
5. P.S.Boopathi Manickam "Financial and Management Accounting" PSG publications 2009.
6. Don R. Hansen and Maryanne M. Mowen "Cost Management: Accounting and Control, Fifth Edition" Thomson, 2006.
7. Paramasivan.C, Subramanian.T, "Financial management" New Age international Publishers, 2014.
8. <https://nptel.ac.in/courses/110/101/110101131>: Financial Accounting, Dr. Varadraj Bapat, IIT Bombay.
9. <https://nptel.ac.in/courses/112/107/209> : NPTEL course on Engineering Economic Analysis

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	DEMAND & SUPPLY ANALYSIS	
1.1	Firms: Types, objectives and goals	1
1.2	Managerial Economics - Decision analysis	1
1.3	Demand - Types of demand - Determinants of demand - Demand function - Demand elasticity Demand forecasting	2
1.4	Supply - Determinants of supply - Supply function - Supply elasticity.	2
2	Financial Accounting	
2.1	Functions of accounting, accounting principles	1
2.2	Preparation of financial statements - Balance sheet and related concepts	3
2.3	Profit & Loss Statement and related concepts	2
2.4	Comparative financial statements - Analysis & Interpretation of financial statements	2
3	Cost analysis and Marginal costing	
3.1	Elements of cost- classification of cost	1
3.2	Preparation of cost sheet and its applications	2
3.3	Depreciation-Methods	2
3.4	Break-Even Analysis - Profit/Volume Ratio (P/V Ratio)- Applications in make or buy decision.	3
4	Capital budgeting	

Module No.	Topic	No. of Periods
4.1	Investments –Time value of money	2
4.2	Comparison of Project Alternatives: Risks and return evaluation of investment decision	2
4.3	Average rate of return - Payback Period	2
4.4	Net Present Value - Internal rate of return	2
5	Financial Markets	
5.1	Sources of finance and financial institutions	2
5.2	Venture capital, various Business models	2
6	Case studies in Machine Learning for Finance(Not limited to)	
6.1	Prediction of real estate prices	1
6.2	market basket analysis and economic growth. Using python and spreadsheet	1
	Total	36

Course Designer(s):

1. A.M.Abirami, Associate Professor, abiramiam@tce.edu, Information Technology
2. Pudumalar.S, Assistant Professor, spmit@tce.edu, Information Technology
3. Parkavi.R, Assistant Professor, rpit@tce.edu, Information Technology

22IT621

ARTIFICIAL INTELLIGENCE

Category	L	T	P	Credit
PCC	3	0	0	3

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, Natural language processing and Computer Vision systems.

Prerequisite

- NIL

Course Outcomes

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

CO Numb er	Course Outcome Statement	TCE Proficien cy Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the key characteristics of intelligent agents	TPS2	80	90
CO2	Find the optimal move for a given game using adversarial search	TPS3	80	80
CO3	Solve Constraint Satisfaction Problems such as Map Coloring , Job-Shop Scheduling etc Using backtracking search.	TPS3	80	80
CO4	Develop a conversational agent that uses natural language understanding and generation.	TPS3	80	70
CO5	Perform Image classification and Detection of objects with the knowledge of Computer Vision	TPS3	70	70
CO6	Examine various Search techniques , Deep learning, Computer Vision techniques for solving engineering problems in the fields of science, medicine, finance etc.	TPS4	70	70

Mapping with Programme Outcomes

COs	P O 1	P O 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	M	L											L		
CO2	S	M	L		M	L		L		L	L	M	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								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- The Structure of Agents, 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-Sudoku, tic-tac-toe, map coloring, cryptarithmic puzzle, Constraint Propagation: Inference in CSPs- Backtracking Search for CSPs.

Deep Learning: Simple Feedforward Networks- Computation Graphs for Deep Learning- Convolutional Neural Networks – Generalization- Recurrent Neural Networks- GANS- Transfer Learning

Natural Language Processing: Language Models – Grammar – Parsing – Augmented Grammars –Sentiment analysis -Deep Learning for NLP: Word Embeddings –Recurrent Neural Networks for NLP, Transformer models, speech recognition, chatbots, Voice assistants.

Computer Vision: Image processing-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>
8. <https://www.edx.org/course/artificial-intelligence-ai>

Course Contents and Lecture Schedule

Module No.	Topic	No. Of Hours
1.	Introduction to AI and Intelligent Agents	
1.1	The Foundations of Artificial Intelligence- The History of Artificial Intelligence- Risks and Benefits of AI	1
1.2	Intelligent Agents – Agents and Environments	1
1.3	The Structure of Agent	1
1.4	Ethics in AI	1
2.	Solving Problems by Searching	
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	1
2.3	Hill-climbing search- Simulated annealing -Local beam search	1
3.	Adversarial Search and Games	
3.1	Game Theory- Optimal Decisions in Games	1
3.2	Heuristic-Alpha-Beta Tree Search -Monte Carlo Tree Search	2
3.3	Stochastic Games -Limitations of Game Search Algorithms	2
4	Constraint Satisfaction Problem	
4.1	Defining Constraint Satisfaction Problems- Constraint Propagation	3
4.2	Inference in CSPs- Backtracking Search for CSPs	1
5	Deep Learning	
5.1	Simple Feedforward Networks- Computation Graphs for Deep Learning	1
5.2	Convolutional Neural Networks – Generalization- Recurrent Neural Networks	2
5.3	GANs-Transfer Learning	2
6	Natural Language Processing	
6.1	Language Models - Grammar - Parsing	1
6.2	Augmented Grammars – Sentiment Analysis	2
6.3	Deep Learning for NLP: Word Embeddings -Recurrent Neural Networks for NLP	3
6.4	Transformer Models: Speech Recognition, chatbots, voice assistants	2
7	Computer Vision	
7.1	Image Processing- Features Extraction	1
7.2	Classifying Images	2
7.3	Object Detection and Recognition	2
	Total periods	36

Course Designers:

- | | | | |
|----|-----------------|--------------------------|----------------|
| 1. | Dr.C.Deisy, | Professor, IT Department | cdcse@tce.edu |
| 2. | Dr.S.Padmavathi | Professor, IT Department | spmcse@tce.edu |

22IT651	MOBILE APPLICATION DEVELOPMENT
----------------	---------------------------------------

Category	L	T	P	Credit
PCC	1	0	4	3

Terminal Exam Type: Practical

Preamble

This course on Mobile Application Development will enable the student to gain knowledge and skills in developing mobile applications using Android. The student will learn about the fundamentals of mobile application development, including user interface design, database integration, web services, and mobile application testing. By the end of the course, the student will have the necessary skills and knowledge to develop mobile applications from scratch.

Prerequisite

- NIL

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	Incorporate UI components and delve into the fundamentals of UI design and development	TPS3	70	70
CO2	Make use of different types of services used in mobile application development	TPS3	70	70
CO3	Use various storage options available for Android applications, and explore the different multimedia components.	TPS3	70	70
CO4	Make use of linkify text to create clickable links in mobile applications integrating social media into applications.	TPS3	70	70
CO5	Experiment with the various hardware components and sensors.	TPS3	70	70
CO6	Examine the usage of XML, JSON parsing, Web services, Kotlin, React Native, Material Design and RSS Feed Reader in an application development	TPS4	70	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	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	M	L		M			L	L	L		L	M	L	L
CO5	S	M	L		M			L	L	L		L	M	L	L
CO6	S	S	M	L	M			L	L	L		L	M	L	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT 1						CAT 2						Model Lab & Record						Terminal					
	Theory						Theory												Practical					
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						10			
CO2	10	10	20												20						20			
CO3			30												20						20			
CO4							10	10	20						20						20			
CO5								20	20						20						20			
CO6										20					10						10			

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Introduction - History of Mobile Applications – Fundamentals of Multiplatform Mobile Application Development - Architecture - API's - ADE - Gradle

UI Design and Development – User Responsive Layouts - Views – Activity – Widgets & Notifications, Menus & Dialogues

Services - Types of services - Location based Services - Sending SMS – Broad cast receivers – Geo Coding & Maps - Telephony

Android Storage - Shared Pref – SQLite – Content provider - Firebase

Multimedia - Video – Audio– Graphics - Animation - Google Admob : Banner & Interstitial Ads

Linkify & Integrating with social Media– MatchFilter & TransformFilter - Integrating Google Sign in - Twitter - LinkedIn

Hardware Support - Camera & Microphone – Bluetooth – Wi-Fi - Sensor

Advanced Features – Google Play console - Performance Optimizations for Mobile apps - Xml Parsing, JSON Parsing, RSSFeedReader, Kotlin, React Native, Material Design, Game Development (Case Study)

Text Book

1. Barry Burd, "Android Application Development All-in-One For Dummies", August 4, 2020.
2. RetoMeier, "Professional Android Application Development 4", Wrox, 2012.
3. Dawn Griffiths, David Griffiths, "Head First Android Development", Shroff/O'Reilly 2nd Edition, 2017.

Reference Books & web resources

1. Android Development documentation <https://developer.android.com/docs>
2. Android Arsenal <https://android-arsenal.com>
3. Udacity <https://www.udacity.com/courses/android> .

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction	
1.1	History of Mobile Applications	1
1.2	Multiplatform Mobile Application Development	
1.3	Architecture	
1.4	API's, ADE & Gradle	
2	UI Design and Development	
2.1	Layout & Views	1
2.2	Activity, Widgets	
2.3	Notifications, Menus & Dialogues	1
3	Services	
3.1	Types of services, Location based Services	1
3.2	Sending SMS, Broad cast receivers	
3.3	Geo Coding & Maps, Telephony	1
4	Android Storage	
4.1	Shared Pref	1
4.2	SQLite	
4.3	Content provider	1
4.4	Firebase	
5	Multimedia	
5.1	Video & Audio	1
5.2	Graphics, Animation	
5.3	Google Admob : Banner & Interstitial Ads	
6	Linkify & Integrating with social Media	
6.1	MatchFilter & TransformFilter	1
6.2	Integrating Google Sign in - Twitter - LinkedIn	
7	Hardware Support	
7.1	Camera & Microphone	1
7.2	Bluetooth – Wi-Fi – Sensor	
8	Advanced Features	
8.1	Performance Optimizations for Mobile apps	1
8.2	Xml Parsing, JSON Parsing	
8.3	RSS Feed Reader	
8.4	Kotlin, React Native	1
8.5	Material Design, Game Development	
	Total Hours	12

List of Experiments:

Ex.No	Experiment Name	No. of Hours	COs
1.	Android Studio Installation and setting up of an Environment	2	CO1
2.	Practice with different layouts, views and explore the available Widgets in android	4	CO1
3.	Demonstrate and customize different types of menus.	4	CO1
4.	Practice with Intents in an Android application	4	CO1

5.	Demonstrate how to create dialogue boxes using the Dialog Fragment class and practice with different types notifications using the Notification Compat Builder class	4	CO1
6.	Experiment with Different Services in Android	5	CO2
7.	Practice with different Storage options in Android	6	CO3
8.	Practice with Android Multimedia and Google Admob	5	CO3
9.	Linkify and Integrating with Social Media Applications	5	CO4
10.	Explore the different Hardware support options for Android Applications - Camera/Bluetooth/WiFi/Sensor	5	CO5
11.	Experiment with the Advanced features in Android	4	CO6
Total Hours		48	

Course Designer(s):

1. Dr.S.Karthiga, Assistant Professor,
Department of Information Technology
2. Ms.C.V.Nisha Angeline, Assistant Professor,
Department of Information Technology

skait@tce.edu

cvnait@tce.edu



22IT681**DATA SCIENCE LAB**

Category	L	T	P	Credit
PCC	3	0	0	3

Preamble

This course will give insights of various tools and techniques from the disciplines of applied statistics, mathematics and computer science and to make better and informed decisions for various purposes by analysing a large amount of data.

Prerequisite

- Nil

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	Perform descriptive analytics, Data Visualization on the benchmark data sets	TPS3	70	80
CO2	Perform data analysis and Visualization using suitable libraries.	TPS4	70	70
CO3	Build a Classifier, Regression and Clustering model for the application chosen and do performance analysis.	TPS4	70	70
CO4	Perform Time Series Analysis and Image Classification on real time dataset.	TPS3	70	70
CO5	Develop any of the IR model for NLP applications.	TPS3	70	70
CO6	Develop mini project by integrating Web/Mobile platform for Data Science Application.	TPS4	70	70

Mapping with Programme 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		L	M	M	L
CO2	S	S	M	L	S			S	S	M		L	M	M	L
CO3	S	S	M	L	S			S	S	M		L	M	M	L
CO4	S	M	L		S			S	S	M		L	M	M	L
CO5	S	M	L		S			S	S	M		L	M	M	L
CO6	S	S	M	L	S			S	S	M		L	M	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Contents

Exp No.	Topic	No. of Sessions	COs
1.	Identification of Application and perform Descriptive Statistics	1	CO1
2.	Data Pre-processing and Data visualization	1	CO1
3.	Correlation and covariance measure analysis	1	CO2
4.	Build a Classification model	1	CO3
5.	Build a Linear and Logistic Regression model and do the performance analysis	2	Co3
6.	Build a Clustering model and calculate the Error measures and Bias.	1	CO3
7.	Time Series Analysis on real time dataset	1	CO4
8.	Image Pre-processing and classification	2	CO4
9.	IR Modelling and Text analysis	2	CO5
10.	Mini project using AI/ML/DL Algorithms (Create Web/Mobile Application)		CO6
Total Sessions		12	

List of problems/applications but not limited to:

- 1.Healthcare
- 2.Agriculture
- 3.Logistics
4. Energy Conservation
5. Business and Finance
6. Book reviews

Course Designer(s):

1. Dr C.Deisy, Professor, Department of IT
2. Dr. K.V.Uma, Assistant Professor ,Department of IT

cdcse@tce.edu
kvuit@tce.edu

22IT711

COGNITIVE SCIENCE

Category L T P Credit

ESC 2 0 0 2

Preamble

To understand contemporary theories, methods, and empirical findings about human cognition. To develop an ability to think scientifically about high-level cognitive processes.

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	Understand the philosophy about mind	TPS2	70	80
CO2	Illustrate the adaptive nature of cognition	TPS3	70	70
CO3	Compute contrast detection in cognitive neuroscience	TPS3	70	70
CO4	Apply the cognitive approach to identify the autism child early detection	TPS3	70	70
CO5	Apply cognitive behaviour for any two different games	TPS3	70	70
CO6	Analyse the classical philosophical issues of mind and cognitive impaired people along with case studies	TPS4	70	60

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Assessment 1								Assessment 2								Terminal (Theory)					
	CAT 1				Assignment1				CAT 2				Assignment2									
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	4	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	10	-	-	-	-
CO2	4	10	30	-	-	-	50	-	-	-	-	-	-	-	-	-	2	10	15	-	-	-
CO3	2	10	30	-	-	-	50	-	-	-	-	-	-	-	-	-	2	-	15	-	-	-
CO4	-	-	-	-	-	-	-	-	4	15	30	-	-	-	30	-	2	-	15	-	-	-
CO5	-	-	-	-	-	-	-	-	4	15	15	-	-	-	30	-	2	-	15	-	-	-
CO6	-	-	-	-	-	-	-	-	2	-	15	-	-	-	-	40	-	-	10	-	-	-

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Introduction and Philosophy: Foundation of Cognitive Science – Introduction to Mind – three classical philosophy about mind –philosophy of science - mind in cognitive Science – exploring the mental content – logic and science of mind

Psychology: The place of psychology within cognitive science – history of psychology – science of information processing

Neurosciences: Cognitive neuroscience – origin of cognitive neuroscience – sensation, association, perception and meaning – stages of perceptual representation –consciousness-emotions – a promise of future

Computational Intelligence: Machines and cognition – architectures of cognition – common Model for Cognition ,knowledge based systems.

Logical Decision Making: Basics – representation and reasoning under uncertainty – decision making under uncertainty – learning

Case Study: Game design –Military Agent Modelling – Diagnostic Criteria in early detection of physical and mental health issues – Real time applications of Cognitive Modelling.

Text Book

1. Ella Hunter, Cognitive Science and Technology, Willford Press, 2016
2. Wilson, Robert A., & Keil, Frank C. (eds.), The MIT Encyclopedia of the Cognitive Sciences (MITECS), MIT Press, 2001

Reference Books & web resources

1. Bowerman, Melissa and Stephen C. Levinson, Language Acquisition and Conceptual Development, Cambridge University Press 2001.
2. Sternberg, Robert J., Cognitive Psychology, 4th ed., Cengage Learning India, 2008.
3. Gardenfors, Peter, Conceptual Spaces: The Geometry of Thought, MIT Press, 2000
4. Jay Friedenberg and Gordon Silverman " Cognitive Science : An Introduction to the study of Mind" Sage Publications, 2006

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction and Philosophy	
1.1	Foundation of Cognitive Science	1
1.2	Introduction to Mind	
1.3	Three classical philosophy about mind	1
1.4	Philosophy of science	1
1.4	Mind in cognitive Science	
1.5	Exploring the mental content	1
1.6	Logic and science of mind	1

Module No.	Topic	No. of Periods
2	Psychology	
2.1	The place of psychology within cognitive science	1
2.2	History of psychology	1
2.3	Science of information processing	1
3	Neurosciences	
3.1	Cognitive neuroscience – origin of cognitive neuroscience	1
3.2	Sensation, association, perception and meaning	1
3.3	Stages of perceptual representation	
3.4	Consciousness	1
3.5	Emotions	1
3.6	A promise of future	
4	Computational Intelligence	
4.1	Machines and cognition	1
4.2	Architectures of cognition, Common Model for Cognition	1
4.3	Knowledge based systems	1
5	Logical Decision Making	
5.1	Basics, Representation and reasoning under uncertainty	1
5.2	Decision making under uncertainty	1
5.3	Learning	1
5.4	Language	
6	Case Study	
6.1	Game design	1
6.2	Military Agent Modelling	1
6.3	Diagnostic Criteria in early detection of physical and mental health issues	2
6.4	Real time applications of Cognitive Modelling	2
	Total	24

Course Designer(s):

1. Dr.D.Tamilselvi, Professor, IT
2. Ms.P.Vijaya Praba, Assistant Professor, IT

dtamilselvi@tce.edu
pvpit@tce.edu

22IT771**VIRTUALIZATION
TECHNOLOGIES LAB**

Category	L	T	P	Credit
PCC	0	0	2	1

Preamble

This course aims to provide practice on the installation of virtualization platforms to meet given requirements. The course also provides insights into Virtual Machine and image Management, Configuration of different hypervisors and Migration Techniques.

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	Configure Type-1/Type-2 hypervisors and create virtual machines	TPS 3	70	80
CO2	Implement cold/migration of Virtual machines and files from one host to another as per requirements	TPS 3	70	80
CO3	Perform Virtual Machines management activities such as Image resizing and conversion	TPS 3	70	80
CO4	Experiment with virtual switches such as OpenVSwitch and Linux bridge for virtual server environments	TPS 3	70	80
CO5	Demonstrate Storage virtualization techniques	TPS 3	70	80
CO6	Apply appropriate tools to deploy and manage applications in a virtual environment for an application	TPS 3	70	80

Mapping with Programme Outcomes

COs	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1.	S	M	L		L			S	L	L		S	S	L	M
CO2.	S	M	L		L			S	L	L		S	S	L	M
CO3	S	M	L		L			S	L	L		S	S	L	M
CO4	S	M	L		L			S	L	L		S	S	L	M
CO5	S	M	L		L			S	L	L		S	S	L	M
CO6	S	M	L		L			S	L	L		S	S	L	M

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Syllabus

S.No	List of Experiments	No. of Sessions	COs
1	a) Study on Virtualization types and tools	1	CO1
	b) Review of Linux commands		CO1
2	a) Creating a VM and adding Storage, Memory, and Network to a VM	1	CO1
	b) VM-VM ping, VM-Native Ping		CO1
3	Cold Migration of VM from one host to another	1	CO2
4	a) Installation of Citrix XenServer	1	CO2
	b) Live Migration of Virtual Machines using Xen Center		CO2
5	Transfer of files from one Virtual Machine to another	1	CO2
6	a) Installation of KVM and creation of Virtual instances	1	CO6
	b) KVM – Create Images from ISO, Image Resizing, and Image Conversion	1	CO3
7	a) Configuration of HyperV on Windows	1	CO6
	b) Creation of VM, Powershell commands, Management of VMs		CO3
8	Network Virtualization - OpenVswitch and Linux bridge	1	CO4
9	Installation of OpenStack and creation of Virtual machines	2	CO6
10	Creation of VHD on Windows and restoring on different host	1	CO5
	Total sessions	12	

Course Designer(s):

1. Dr. K Indira, Assistant Professor, IT
2. S. Thiruchadai Pandeewari,
Assistant Professor, IT

kiit@tce.edu
eshwarimsp@tce.edu

22IT781	Multimedia Lab
----------------	-----------------------

Category	L	T	P	Credit
PCC	0	0	2	1

Preamble

The course focuses on encouraging students to unleash their creativity and implement their own unique concepts in practical scenarios. The aim of this laboratory is to inspire students to gain expertise in different photo editing tools, 2D and 3D techniques, AR/VR and exhibit their mastery in creating multimedia presentations and to equip students with the skills to create innovative multimedia presentations with a high level of proficiency.

Prerequisite

None

Course Outcomes

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

COs	Course Outcomes	TCE Proficiency Scale	Expected Proficiency (%)	Expected Attainment Level (%)
CO1	Adapt a comprehension of the fundamental necessities of multimedia systems and the different file formats and tools available.	TPS3	70	80
CO2	Illustrate the utilization of image manipulation and text art techniques.	TPS3	70	80
CO3	Experiment diverse visual effects with audio editing tools for any given theme.	TPS3	70	80
CO4	Adapt creative skills in video content creation and editing	TPS3	70	80
CO5	Use 2D and 3D tools for various applications	TPS3	70	80
CO6	Use AR/VR tools for creating domain-based applications	TPS3	70	80

Mapping with Programme 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		S	M			S	M			M	M	L
CO3	S	M	L		S	M			S	M	L	M	M	L	L
CO4	S	M	L		S			M		M		M	M	L	L
CO5	S	M	L		S			M		M		S	M	L	L
CO6	S	M	L		S			M		M		S	M	L	L

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Contents

Ex. No.	Topic	No. of Sessions	COs Mapping
1	Study about basics of multimedia data types and tools	1	CO1
2	Use of Image manipulation and text art techniques [Photo Editing/Poster/Infographic/Logo/Design/Meme/Certificate/ Presentations]	2	CO2
3	Implementation of audio editing/ mixing of sound	1	CO3
4	Creation of Video Content [Live/Short film/Insta Reels/ YouTube Short]	1	CO4
5	Implementation of 2D [Animation/Gaming/Advertisement]	2	CO5
6	Use of 3D[Animation/Gaming/Industrial Modelling]	2	CO5
7	Study and Implementation of AR/VR tools for various domains.	3	CO6
Total Lecture Hours		12	

Theme areas not limited to

- Industrial IoT
- Asset Management
- Industrial Design
- Communication Design
- Supply Chain
- Energy Saving
- Agriculture
- Health Care
- Finance Management.

Course Designer(s):

1. S.Pudumalar, Assistant Professor IT,
2. C.V.Nisha Angeline, Assistant Professor, IT

spmit@tce.edu

cvnait@tce.edu

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

COs	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Demonstrate the visualization of network data through the use of social network analysis packages	TPS3	70	70
CO2	Utilize social network measures to analyze the web graph	TPS3	70	70
CO3	Illustrate the process of graph mining and cascading effects in social networks	TPS3	70	70
CO4	Examine social network behavior by analyzing network properties	TPS3	70	70
CO5	Employ social network theory and software packages to construct models for social networks	TPS4	70	60
CO6	Identify the appropriate network type for modelling real networked data	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	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
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

CO	CAT1			Assignment 1			CAT2				Assignment 2				Terminal			
	100			100			100				100				100			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	4	16													5			
CO2	4	16	20			50									5	5	10	
CO3	4	16	20			50									5	5	10	
CO4							4	6	20						5	5	10	
CO5							4	6	15	10				50		5	10	
CO6							4	6	15	10				50			10	10

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

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, Neighbourhood overlap, Bipartite graph, Homophily, Positive Negative Relationships.

Mining Graphs: Community and Cluster detection, Link Analysis - Random Walk, Page Rank algorithms, Hubs and Authorities, Link Prediction.

Cascading Networks: Diffusion in networks, Power law, Preferential Attachment Models, Small World Network.

Social Network Models: Granovetter Model, Schelling Model, Balance Theorem.

Case Study: Analyzing various social networks such as analyzing Facebook friendship networks, LinkedIn professional networks, research collaboration networks, epidemiological networks, influence networks in marketing.

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
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
1	Introduction	
1.1	Motivation	1
1.2	Web Graph	1
1.3	Types of Social Network	1
1.4	Social Network Datasets and formats	1
1.5	Social Network Data Visualization Tools - Networkx, Gephi, Pajek	2
2	Properties	
2.1	Connectedness	1

2.2	Clustering Coefficient, Distance Measures	1
2.3	Connected Components	1
2.4	Network Robustness	1
2.5	Degree and Closeness Centrality, Betweenness Centrality	2
2.6	Bipartite Graph, Homophily	1
2.7	Positive Negative Relationships	1
3	Mining Graphs	
3.1	Community and Cluster Detection	2
3.2	Link Analysis	2
3.3	Random Walk Algorithm	1
3.4	Page Rank Algorithm	2
3.5	Hubs and Authorities	2
3.6	Link Prediction	1
4	Cascading Networks	
4.1	Diffusion in Networks	1
4.2	Power Law	1
4.3	Preferential Attachment Models	1
4.4	Small World Network	2
5	Social Network Models	
5.1	Granovetter Model	1
5.2	Schelling Model	1
5.3	Balance Theorem	1
6	Applications	
6.1	Analyzing various social networks such as analyzing Facebook friendship networks, LinkedIn professional networks	2
6.2	Research collaboration networks, epidemiological networks, influence networks in marketing.	2
Total Lecture Hours		36

Course Designer(s):

1. Deisy.C, Professor, cdcse@tce.edu, Information Technology
2. Parkavi.R, Assistant Professor, rpit@tce.edu, Information Technology

22ITPB1	Business Analytics
----------------	---------------------------

Category	L	T	P	Credit
PSE	3	0	0	3

Preamble

The course aims to provide the detailed knowledge in Business Analytics for decision-making process. The course enables the learners to enhance their management and decision-making skills with selecting suitable data modelling and analytics tools and techniques.

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 fundamental concepts of Business Analytics.	TPS2	70	80
CO2	Use descriptive analytics to summarize and interpret the data.	TPS3	70	70
CO3	Demonstrate the performance of various predictive analytics techniques.	TPS3	70	70
CO4	Apply Excel Functions, queries, and Visualization in solving the business-related problems.	TPS3	70	70
CO5	Demonstrate the practical applications of social media analytics in marketing, brand management and social media strategy etc.	TPS3	70	70
CO6	Analyze the data using statistical and data analytic techniques for the real time business problems.	TPS4	70	60

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	M	L										L	M		L
CO2	S	M	L		S							M	M	M	L
CO3	S	M	L		M							M	M	M	L
CO4	S	M	L		S							S	M	M	L
CO5	S	M	L	L	S							S	M	M	L
CO6	S	S	M	L	S				S	S		S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT1			Assignment -I			CAT2				Assignment - II				Terminal			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	10	10			10										2	5		
CO2	5	5	30			50									2	5	10	
CO3		10	30			40									2	5	15	
CO4							5	5	20				30		2	5	15	
CO5							5	10	20				30		2		15	
CO6							5	10	10	10			20	20			5	10

Syllabus

Fundamentals of Business Analytics: Scope, Framework, Types of Data, Classification of Business Analytics, Trends of Business Analytics, and applications of Business Analytics

Descriptive Analytics: Populations and samples, Statistical notations, Measures of Dispersion, and Measures of Association, Statistical measures for summarizing the data, Analysis of Variance- ANOVA, mixed models ANOVA, MANOVA.

Predictive Analytics: Decision tree Classifier, Random Forest, moving average, Exponential smoothing, Trend, Cyclical and seasonality components, ARIMA (autoregressive integrated moving average), Seasonal Autoregressive Integrated Moving Average (SARIMA), Vector Autoregression (VAR), Forecasting using Prophet, Case Study

Social Media Analytics: Need, Key Performance Indicators - Digital Marketing: 7Ps of Marketing, Methods of Digital Marketing - SMA tools : Case Study with Google Analytics Tool

Analytics on Spreadsheets: Excel Formulas, Excel Functions, Data Queries, Spread Sheet – Add -Ins for Business Analytics (ChatGPT, AI based formula generator), Data Visualization, Case Study

Learning Resources

U.Dinesh Kumar , “Business Analytics: The Science of Data - Driven Decision Making”, Wiley, First Edition, 2017.

Galit Shmueli, Nitin R Patel, Peter C Bruce, “Data Mining for Business Intelligence: Concepts, Techniques and Applications in Microsoft Office Excel with XLMiner” Wiley, First Edition, 2008.

Foster Provost and Tom Fawcet, "Data Science for Business", O'Reilly Media, First Edition, 2013.

James R Evans, “Business Analytics – Methods, Models and Decisions,” Pearson, Second Edition, 2017.

https://onlinecourses.nptel.ac.in/noc23_mg54/preview - Business Analytics For Management Decision By Prof. Rudra P Pradhan, IIT Kharagpur.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Fundamentals of Business Analytics	
1.1	Scope, Framework, Types of Data	2
1.2	Classification of Business Analytics	1
1.3	Trends of Business Analytics and applications of Business Analytics	2
2	Descriptive Analytics	
2.1	Populations and samples	2
2.2	Statistical notations	1
2.3	Measures of Dispersion and Measures of Association	1
2.4	Statistical measures for summarizing the data	1
2.5	The Analysis of Variance- ANOVA, mixed models ANOVA, MANOVA.	2
3	Predictive Analytics	
3.1	Decision tree Classifier	2
3.2	Random Forest	1
3.3	Moving average	1
3.4	Exponential smoothing, Trend, Cyclical and seasonality components	2
3.5	ARIMA (autoregressive integrated moving average)	1
3.6	Seasonal Autoregressive Integrated Moving Average (SARIMA), Vector Autoregression (VAR)	2
3.7	Forecasting using Prophet	2
4	Social Media Analytics	
4.1	Need, Key Performance Indicators	1
4.2	Digital Marketing: 7Ps of Marketing	1
4.3	Methods of Digital Marketing	1
4.4	SMA tools	2
4.5	Case Study with Google Analytics Tool	2
5	Analytics on Spreadsheets	
5.1	Excel Formulas, Excel Functions	2
5.2	Data Queries, Spread Sheet	1
5.3	Add -Ins for Business Analytics (ChatGPT, AI based formula generator)	2
5.4	Data Visualization	1
	Total Hours	36

Course Designers:

- | | |
|------------------|-----------------|
| 1. Dr.S.Sridevi | sridevi@tce.edu |
| 2. Dr.K.V.Uma | kvuit@tce.edu |
| 3. Dr.S.Karthiga | skait@tce.edu |

Preamble

The course on Blockchain Technologies covers the technical aspects of public distributed ledgers, blockchain systems, crypto currencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and to build secure decentralized applications using Ethereum and Hyperledger Fabric.

Prerequisite

Nil

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	Demonstrate the need and usage of cryptographic algorithms in blockchain	TPS3	70	70
CO2	Explain the significance of blocks, proof-of-work, and consensus building in blockchain.	TPS2	80	80
CO3	Explain the functional/operational aspects of trading and mining using crypto currencies.	TPS2	80	80
CO4	Develop smart contracts to code business logic in Solidity.	TPS3	70	70
CO5	Develop decentralized applications for web 3.0 using Ethereum blockchain with node services like metamask, alchemy and frontend technologies like node.js	TPS3	70	70
CO6	Analyze the impact and challenges in Blockchain implementation in various domains like finance, Health care etc.	TPS4	70	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	S	M	L		L								M		
CO2	M	L			L			M					M		
CO3	M	L			L			M					M		
CO4	S	M	L		M								M		
CO5	S	M	L		S								M		
CO6	S	S	M	L	M	M		S	M	M		S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1			Assignment 1			CAT2				Assignment 2				Terminal			
	100			100			100				100				100			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1			24			20										5	10	
CO2	4	16			20										5	10		
CO3	4	16			20											10		
CO4	4	8	24			40	10	10	20							5	20	
CO5								20	20				50			5	20	
CO6										20				50				10

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus**Introduction to Blockchain and Cryptographic primitives**

Blockchain Technology- Architecture, Transactions and Blocks, P2P Systems, Types of Blockchain, , Applications of Collision-resistant hash functions – SHA 256, Digital signature - ECDSA, Public key cryptosystems for Authentication, zero-knowledge proof systems

Bitcoin Operation

Transactions in Bitcoin, Distributed Consensus atomic broadcast, Byzantine fault-tolerant consensus methods, Merkle Patricia Tree, Anonymity, Mining Mechanism – Proof of Work, Energy efficiency, Reward, Chain Policy, 51% Attack, Life of Blockchain application, Cryptocurrency as application of blockchain technology

Ethereum

Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers.

Develop Smart Contracts using Solidity – Datatypes, looping and branching constructs, Function modifiers, Access Specifiers, Inheritance and Polymorphism in smart contracts. Develop DAPPS for web 3.0 –Node Services – Alchemy, Infura, Frontend – HTML, Node.js, Ganache – Truffle suite – Creating Cryptocurrencies and Non Fungible Tokens

Hyperledger

Permissioned and Private Blockchains, Hyperledger and its components Hyperledger Fabric –Transactions life cycle, Deploying a chain code in test network

Blockchain – Use cases

Financial Services- KYC and Anti money Laundering,, Trade finance, Cross-border Payments, Healthcare, Digital Rights Management, Identity Management, Tax Payment and Land Registry Records, Supply Chain

Text Book

1. Lorne Lantz, Daniel Cawrey Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, O'Reilly, 2020
2. Elad Elrom, The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects, Apress, 2019

Reference Books & web resources

1. Andreas Antonopoulos , "Mastering Bitcoin: Programming the open blockchain", O'Reilly, Second Edition, 2021.
2. Melanie Swa, "Blockchain – Blueprint for New Economy", O'Reilly, Second Edition 2017
3. Andreas Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, Second Edition, 2018.
4. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, „Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019.
5. Josh Thompson, „Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.

6. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits
<https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>
7. Hyperledger Fabric - <https://www.hyperledger.org/use/fabric>
8. Bitcoin Notes - <https://www.ee.iitb.ac.in/~sarva/courses/EE465/Autumn2019.html>

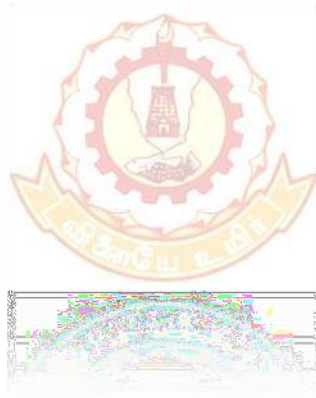
Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Blockchain and Cryptographic primitives	
1.1	Blockchain Technology- Architecture, Transactions and Blocks, P2P Systems, Types of Blockchain, ,	2
1.2	Applications of Collision-resistant hash functions – SHA 256	1
1.3	Digital signature -ECDSA, Public key cryptosystems for Authentication	1
1.4	Zero-knowledge proof systems	1
2	Bitcoin Operation	
2.1	Transactions in Bitcoin, Performing a transaction in Bitcoin testnets.	2
2.2	Distributed Consensus atomic broadcast, Byzantine fault-tolerant consensus method	2
2.3	Merkle Patricia Tree	1
2.4	Mining Mechanism – Proof of Work, Energy efficiency, Reward, Chain Policy	1
2.5	Life of Blockchain application, Cryptocurrency as application of blockchain technology	1
3	Ethereum	
3	Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers.	2
3.1	Develop Smart Contracts using Solidity – Datatypes, looping and branching constructs	1
3.2	Function modifiers, Access Specifiers	1
3.3	Inheritance and Polymorphism in smart contracts	1
3.4	Libraries in Solidity	1
3.5	Application Development in Solidity – Banking, Voting etc.,	3
3.6	Develop DAPPS for web 3.0 –Node Services – Alchemy, Infura, Frontend – HTML, Node.js, Ganache – Truffle suite – Creating Cryptocurrencies and Non Fungible Tokens	5
4	Hyperledger	
4.1	Permissioned and Private Blockchains, Hyperledger Project and its components	1
4.2	Transaction Lifecycle In Hyperledger Fabric	1
4.3	Deploying chaincodes in Testnetwork	2
	Blockchain – Usecases	
5.1	Financial Services- KYC and Anti money Laundering	1
5.2	Trade finance, Cross-border Payments	1
5.3	Healthcare	1
5.4	Digital Rights Management, Identity Management	1
5.5	Tax Payment and Land Registry Records	1
5.6	Supply Chain	1

Module No.	Topic	No. of Periods
	Total	36

Course Designer(s):

1. Jeyamala.C, Associate Professor, jeyamala@tce.edu, Information Technology
2. Parkavi.R, Assistant Professor, rpit@tce.edu, Information Technology



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

NIL

Course Outcomes

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

CO	COURSE OUTCOME	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the terminologies associated with Penetration testing, vulnerability assessment and various information security standards such as HIPAA, PCI-DSS, SOX, FISMA.	TPS2	80	80
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.	TPS3	70	65
CO3	Deploy measures for protecting computer systems against password cracking, keyloggers, Spywares and Rootkits	TPS3	70	65
CO4	Use appropriate tools and techniques to identify various vulnerabilities in web server and perform web application testing for prevention against OWASP application risks.	TPS3	70	65
CO5	Provide security solutions for protection against evading of firewalls and Intrusion Detection Systems	TPS3	70	65
CO6	Using appropriate tools and techniques to perform penetration testing for a Website and prepare a report.	TPS4	70	60

Mapping with Programme Outcomes

C Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	M	L											M		
CO2	S	M	L		L			M	L	L		L	M	M	L
CO3	S	M	L		M			M	L	L		L	S	M	L
CO4	S	M	L		M			M	L	L		L	S	M	L
CO5	S	M	L		M			M	L	L		L	S	M	L
CO6	S	S	M	L	M	L	L	M	L	L	L	L	S	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT 1				CAT 2				Model Lab & Record				Terminal (Theory)					
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	6
CO1	2	10											2	5	12			
CO2	4	10	15	15							10	10	2	5	12			
CO3	4	10	15	15							10	10	2	5	12			
CO4					4	15	15	15			10	10	2	5	12			
CO5					6	15	15	15			10	10	2	5		12		
CO6											10	10		5				

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Ethical Hacking - Scope and Limitations of Ethical Hacking Types of Penetration Testing Phases of Penetration Testing - Security Testing Methodology - Comparing Security Audit, Vulnerability Assessment, and Penetration Testing - Case Studies

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).

Footprinting - Footprinting through Search Engines, Web Services - Social Networking Sites- Website Footprinting - Email Footprinting - Network Footprinting - Footprinting through Social Engineering

Scanning Networks: Check for live systems and live ports - Scanning beyond IDS - Banner Grabbing - Scan for vulnerability - Scanning Pen Testing

System Hacking - Cracking Passwords - Types of Password Attacks - Sniffing and Spoofing - Escalating Privileges - Keyloggers and AntiKeyloggers - Spywares and AntiSpywares - Rootkits and Anti Rootkits

Web Hacking -Web Server Hacking- Web Server Attacks- Web Server Password Cracking, Web Server Penetration Testing - Injection Flaws, Broken Authentication, XML External Entity (XXE), Broken Access Control, 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) -Session Splicing - Unicode Evasion - Fragmentation Attack

Firewall Evasion Techniques - IP Address Spoofing - Bypass a Firewall - Tunneling Method - Protection against Firewall Evasion

Reference Books & web resources

1. EC-Council Certified Ethical Hacking Review Guide, Wiley India Edition, 2020.
2. HEIN SMITH , HILARY MORRISON, ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking, CreateSpace Independent Publishing Platform 2018
3. Rafay Baloch , Ethical Hacking and Penetration Testing Guidell, CRC Press, 2015
4. Patrick Engebretson, The Basics of Hacking and Penetration Testing, Elsevier, 2013.
5. <https://www.darkwiki.in/certified-ethical-hacker-v10-course-free-download/>
6. <https://www.skillsoft.com/course/ceh-v11-wireless-hacking-countermeasures/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Ethical Hacking	
1.1	Ethical Hacking	1
1.2	Scope and Limitations of Ethical Hacking	
1.3	Types of Penetration Testing	
1.4	Phases of Penetration Testing	1
1.5	Security Testing Methodology Comparing Security Audit,	
1.6	Vulnerability Assessment, and Penetration Testing	
1.7	Case Studies	1
2	Information Security Laws and Standards	
2.1	Payment Card Industry Data Security Standard (PCIDSS),	1
2.2	ISO/IEC 27001:2013,	
2.3	Health Insurance Portability and Accountability Act (HIPAA)	

Module No.	Topic	No. of Periods
2.4 2.5 2.6	Sarbanes Oxley Act (SOX) The Digital Millennium Copyright Act (DMCA) Federal Information Security Management Act (FISMA)	1
3	Footprinting	
3.1 3.2 3.3	Footprinting through Search Engines, Web Services Social Networking Sites	1
3.4 3.5 3.6 3.7	Website Footprinting Email Footprinting Network Footprinting Footprinting through Social Engineering	1
4	Scanning Networks	
4.1 4.2 4.3	Check for live systems and live ports Scanning beyond IDS Banner Grabbing	1
4.5 4.6	Scan for vulnerability Scanning Pen Testing	1
5	System Hacking	
5.1 5.2 5.3 5.4	Cracking Passwords Types of Password Attacks Sniffing and Spoofing Escalating Privileges	1
5.5	Keyloggers and AntiKeyloggers	1
5.6 5.7	Spywares and Anti Spywares Rootkits and Anti Rootkits	1
6	Web Hacking	
6.1 6.2	Web Server Hacking Web Server Attacks	1
6.3 6.4	Web Server Password Cracking Web Server Penetration Testing	1
6.5 6.6	Injection Flaws Broken Authentication	1
6.7 6.8	XML External Entity (XXE) Broken Access Control	1
6.9	Cross-Site Scripting (XSS) Attacks	1
6.10 6.11	Insecure Deserialization Using components with known vulnerabilities	1
6.12	Insufficient Logging and Monitoring	1
7	IDS Evasion Techniques	
7.1 7.2 7.3	Insertion Attack Evasion Denial-of-Service Attack (DoS)	1
7.4 7.5 7.6	Session Splicing Unicode Evasion Fragmentation Attack	1

Module No.	Topic	No. of Periods
8	Firewall Evasion Techniques	
8.1	IP Address Spoofing	1
8.2	Bypass a Firewall	
8.3	Tunneling Method	1
8.4	Protection against Firewall Evasion	1
Total		24

List of Experiments

Ex. No	Experiment	No of Hours	Cos
1	Performing footprinting using Google Hacking, website information, information about an archived website, to extract contents of a website, to trace any received email to fetch DNS information	4	CO1 , CO6
2	Use port scanning, network scanning tools,IDS tool, sniffing tool and generate reports	2	CO2, CO6
3	Use Password cracking, Dictionary attack., Encrypt and decrypt passwords, DoS attack,ARP poisoning in windows, Ifconfig, ping, netstat, traceroute, Steganography tools	4	CO3, CO6
4	SQL injection for website hacking, sessionhijacking	2	CO3, CO6
5	Hacking a website by Remote File Inclusion,Disguise as Google Bot to view hidden content of a website, to use Kaspersky for Lifetime without Patch	2	CO4, CO6
6	Creating a simple keylogger in python,creating a virus, creating a trojan	4	CO4, CO6
7	Cryptool to encrypt and decrypt password, implement encryption and decryption using Ceaser Cipher	2	CO5, CO6
8	Penetration Testing using Nmap and Metasploit	4	CO1, CO2, CO3, CO4, CO5, CO6
Total		24	

Course Designer(s):

1. Dr.S.Ilankumaran, AP / IT
2. Mr. P. Manojkumar, AP / IT

siit@tce.edu
pmkit@tce.edu

22ITPE1

PRIVACY AND SECURITY IN ONLINE SOCIAL MEDIA

Category	L	T	P	Credit
PSE	3	0	0	3

Preamble

The surge in Internet usage has led to a significant rise in online social media platforms such as Facebook, YouTube, and Twitter. Despite their widespread use, there is a notable lack of understanding regarding privacy and security issues associated with these platforms. This course aims to explore and analyze the multifaceted aspects of privacy and security concerns on online social media, encompassing computational, cultural, and psychological perspectives.

Prerequisite

Nil

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	Understand the working of online social networks	TPS2	70	70
CO2	Articulate the nuances of collecting data from Online Social Media and assess their trust and credibility	TPS3	70	70
CO3	Analyse information on privacy disclosures, and implement fraud detection counter measures	TPS3	70	70
CO4	Examine the counter measures to control information sharing in Online social networks	TPS3	70	70
CO5	Apply knowledge of identity management in Online social networks	TPS3	70	60
CO6	Evaluate the effectiveness of various security measures and strategies to critically assess open security issues in Online Social Networks	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	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	M	L										L	L		
CO2	S	M	L									L	M		
CO3	S	M	L		M							L	M		
CO4	S	M	L		M							L	M		
CO5	S	M	L		M							L	M		
CO6	S	S	M	L	M	M		S	M	M		S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1			Assignment 1			CAT2				Assignment 2				Terminal			
	100			100			100				100				100			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	4	16													2	5		
CO2	4	16	20			50									2	5	10	
CO3	4	16	20			50									2	10	10	
CO4							5	15	20	10					2	10	10	
CO5							5	15	20				50		2	10	10	
CO6										10				50				10

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Introduction: Online Social Networks, Data collection from social networks, Challenges, Opportunities, and pitfalls in online social networks, APIs, IPC Acts for Social Media.

Social Media Trust Analysis: Collecting data from Online Social Media, Trust, credibility, and reputations in social systems.

OSM Policing, Privacy, and Fraud Detection: Online social Media and Policing, Information privacy disclosure, revelation and its effects in OSM and online social networks, Phishing in OSM & Identifying fraudulent entities in online social networks.

Access Control Models: Access Control in Online Social Networks, Relationship-Based Access Control, Privacy Settings in Commercial Online Social Networks, Existing Access Control Approaches

Identity Management: Identity Management, Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-Presentation, Identity thefts, Open Security Issues in Online Social Networks

Applications: Privacy and security issues associated with various social media.

Learning Resources

1. Security and Privacy-Preserving in Social Networks, Chbeir Richard, Al Bouna, Bechara (Eds.), Springer, 2013.
2. The Routledge Handbook of Privacy and Social Media (1st ed.), Trepte, S., & Masur, P. (Eds.), Routledge, 2023.
3. Security and Trust in Online Social Networks, Barbara Carminati, Elena Ferrari, Marco VivianiMorgan & Claypool publications.
4. Security and Privacy in Social Networks, Editors: Altshuler, Y., Elovici, Y., Cremers, A.B., Aharoni, N., Pentland, A. (Eds.), Springer, 2013
5. Security and privacy preserving in social networks, Elie Raad & Richard Chbeir, Richard Chbeir & Bechara Al Bouna, 2013
6. Social Media Security: Leveraging Social Networking While Mitigating Risk, Michael Cross, 2013
7. SWAYAM - NPTEL Course, "Privacy and Security in Online Social Media", https://onlinecourses.nptel.ac.in/noc23_cs13/preview

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1	Introduction	1
1.1	Online Social Networks	
1.2	Data collection from social networks	1
1.3	Challenges, Opportunities, and pitfalls in online social networks	2
1.4	Online social networks- APIs	1
1.5	IPC Acts for Social Media	1

2	Social Media Trust Analysis	
2.1	Collecting data from Online Social Media,	2
2.2	Online social network - Trust,	1
2.3	Credibility, and reputations in social systems	2
3	OSM Policing, Privacy, and Fraud Detection	
3.1	Online social Media and Policing	2
3.2	Information privacy disclosure revelation and its effects in OSM and online social networks	2
3.3	Phishing in OSM	2
3.4	Identifying fraudulent entities in online social networks	2
4	Access Control Models	
4.1	Access Control in Online Social Networks	1
4.2	Relationship-Based Access Control	1
4.3	Privacy Settings in Commercial Online Social Networks	2
4.4	Existing Access Control Approaches	1
5	Identity Management	
5.1	Identity Management, Digital Identity	2
5.2	Identity Management Models: From Identity 1.0 to Identity 2.0	2
5.3	Identity Management in Online Social Networks	2
5.4	Identity as Self-Presentation, Identity thefts	2
5.5	Open Security Issues in Online Social Networks	2
6	Applications	
6.1	Privacy and security issues associated with various social media – Case Study	2
Total Lecture Hours		36

Course Designer(s):

1. Sujitha.S, Assistant Professor, ssiit@tce.edu, Information Technology
2. Parkavi.R, Assistant Professor, rpit@tce.edu, Information Technology

22ITPF1**DISTRIBUTED APPLICATION
DEVELOPMENT**

Category	L	T	P	Credit
PSE	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	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the concepts, components and key features of microservice application architectures	TPS2	70	80
CO2	Containerize an application by creating Docker config files and build processes to produce all the necessary Docker images	TPS3	70	70
CO3	Use appropriate patterns for the design of distributed systems subject to specific design and performance constraints	TPS3	70	70
CO4	Deploy and manage containerized application with kubernetes	TPS3	70	60
CO5	Examine the challenges in co-ordinating distributed transactions using appropriate techniques and algorithms.	TPS4	70	60
CO6	Perform Serverless application development with distributed databases such as Cassandra, DynamoDB at the backend	TPS3	70	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		S			S	S	S	M	S	M	M	M
CO 3	S	M	L		S			S	S	S		L	M	M	M
CO 4	S	M	L		S			S	S	S	M	S	M	M	M
CO 5	S	S	M	L								L	S		
CO 6.	S	M	L		S			S	S	S		L	M	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern:Cognitive Domain

CO	CAT1			Assignment -I			CAT2				Assignment - II				Terminal			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	10	15		-	-	-	-	-	-		-	-	-		5	10		
CO2	5	15	20	5	20	25	-	-	-		-	-	-		5	5	10	
CO3	5	10	20	5	20	25	-	-	-		-	-	-		5	5	10	
CO4	-	-	-	-	-	-	5	10	20		-	-	30		-	5	10	
CO5	-	-	-	-	-	-	5	10	10	10	-	-	20	10	-	-	5	10
CO6	-	-	-	-	-	-	-	10	20		-	-	40		-	5	10	

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Microservices Architecture - Characteristics – Monolith vs Microservice – Principles for modelling microservices from monolith applications- APIs – RESTful Standards – Case studies with Spring Boot and Nodejs

Containers – Containerization- Container Orchestration- Docker - Installation – Pulling and Running image using Containers – Registry - Docker files - Building custom docker images – Docker Networking-Docker Compose

Distributed Design Patterns - Single Node Patterns – Sidecar Patterns – Ambassadors - Adapters - **Serving Patterns** –Stateless services – Session tracked services – Caching layer – Sharding Services- Sharded Caching

Kubernetes: Architecture-Key Concepts-Pods-YAML configuration-Replication Controllers and replica sets-Microservice application deployment on Kubernetes-Services and Networking in Kubernetes

Distributed Computation – Master Election –Fault Tolerance - Fault Models –Distributed database concepts: Distributed Transactions-Handling Concurrent Data Manipulation - Commit Protocols – Voting Protocols

Serverless Computing - Serverless Platform Architecture – Characteristics – Function-as-a-Service – Backend as a service – Event driven Programming – Message queues – Serverless Databases – Key-Value Stores

Reference Books& web resources

1. Sam Newman, "Building Microservices: Designing Fine-Grained Systems", O'Reilly, Second Edition, 2021.
2. Nigel Poulton, "Quick Start Kubernetes-Hands on", 2023 Edition
3. Brendon Burns, "Designing Distributed Systems", O'Reilly Publication, First Edition, 2018

4. Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems : Principles and Paradigms", Pearson Education, Third Edition, 2017
5. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair , "Distributed Systems: Concepts and Design", Pearson Education, Fifth Edition, 2017
6. Maddy Staggler – "Beginning Serverless Computing: Developing with Amazon Web Services, Microsoft Azure and Google Cloud – Apress, 2018
7. Ben Stopford, " Designing Event-Driven Systems", O'Reilly Publication, May 2018

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Microservices Architecture	
1.1	Characteristics, Monolith vs Microservice	1
1.2	Principles for modelling microservices from monolith applications	1
1.3	APIs – RESTful Standards	2
1.4	Case studies with Spring Boot and Nodejs	
2	Containers	
2.1	Containerization- Container Orchestration	1
2.2	Docker - Installation – Pulling and Running image using Containers	1
2.3	Docker files - Building custom docker images	1
2.4	Docker Networking-Docker Compose	2
3	Distributed Design Patterns	
3.1	Single Node Patterns – Sidecar Patterns	1
3.2	Ambassadors - Adapters	2
3.3	Serving Patterns – Stateless services – Session tracked services	1
3.4	Caching layer – Sharding Services- Sharded Caching	2
4	Kubernetes	
4.1	Architecture-Key Concepts	1
4.2	Pods-YAML configuration	1
4.3	Replication Controllers and replica sets	2
4.4	Microservice application deployment on Kubernetes- Services and Networking in Kubernetes	2
5	Distributed Computation	

Module No.	Topic	No. of Periods
5.1	Master Election	2
5.2	Fault Tolerance - Fault Models	2
5.3	Distributed database concepts: Distributed Transactions	1
5.4	Handling Concurrent Data Manipulation	1
5.5	Commit Protocols – Voting Protocols	2
6	Serverless Computing	
6.1	Serverless Platform Architecture – Characteristics	1
6.2	Function-as-a-Service – Backend as a service	2
6.3	Event driven Programming – Message queues	2
6.4	Serverless Databases – Key-Value Stores	2
	Total	36

Course Designer(s):

1. Dr.S.Padmavathi, Professor, IT, spmcse@tce.edu
2. Mrs.S.Thiruchadai Pandeewari, Assistant Professor, IT, eswarimsp@tce.edu

22ITPG1 ASSISTIVE TECHNOLOGY DESIGN

Category	L	T	P	Credit
PSE	3	0	0	3

Preamble

This course gives the design and evaluation of Assistive Technologies with ethics, policies. 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

CO1	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the Fundamentals of disability, communicating with the disability people and their needs	TSP2	70	70
CO2	Understand the existing devices and technology used to assist the disability people	TSP2	70	70
CO3	Deploy the gap between people and devices	TSP3	70	70
CO4	Illustrate appropriate techniques to Find the issues in Human Interface Design, Product idea, physical and cognitive impairments	TSP3	70	60
CO5	Infer Client Centred Design for various disabilities	TSP4	70	70
CO6	Demonstrate Case studies for various disabilities design/modify/fabricate/devices to assist the people based on their needs	TSP4	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	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
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

CO	Assessment 1								Assessment 2								Terminal					
	CAT 1				Assignment1				CAT 2				Assignment2				(Theory)					
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	4	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	-	-	-	-
CO2	4	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	-	-	-	-
CO3	2	10	40	-	-	-	100	-	-	-	-	-	-	-	-	-	2	5	10	-	-	-
CO4	-	-	-	-	-	-	-	-	4	5	15	-	-	-	30	-	2	5	10	-	-	-
CO5	-	-	-	-	-	-	-	-	4	5	15	15	-	-	30	-	2	5	10	10	-	-
CO6	-	-	-	-	-	-	-	-	2	5	15	15	-	-	-	40	-	5	10	10	-	-

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Introduction about Physical and Mental abilities – Sensor Disabilities – Neuro developmental Disabilities – Loco motors and Multiple Disabilities - Disability and DSM 5 Manual - **Disability Communication and Etiquette** – Communicating / Interacting with people with disability – Common practices – people-first language exceptions – Practical takeaways – other frameworks – User Centered Design

Exploring the needs– Observing low, mid, high, and newer technologies applications through reflection, observation, and application. 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 - Intro to the Domains (augmentative/alternate 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 - Universal Design

Technologies for ability people– Independent Living – Software, Electronics – Mobility – Information Access- Physical, Sensory – Speech and communication– Assistive technology devices– Amplifying Devices – Alert Devices –Mobile Devices - Haptic Devices

Case Studies - Modify, customize, fabricate a range of low to medium tech assistive technology devices – Assistive devices for physical Mobility - wheelchairs for multiple disability -Visually Challenging People - Brailey and other gadgets to support for navigation and workplace - Hearing and Speech Impaired people - supporting gadgets - Mental health issues - cognitive and memory issues - Old Age People - Assistive Devices indoor and outdoor environments.

Text Book

1. Bryant, D. P. & Bryant, B. R. (2012). Assistive technology for people with disabilities. Upper Saddle River, New York: Pearson

Reference Books & web resources

1. Cook, Albert M., and Jan Miller Polgar. *Cook & Hussey's Assistive Technologies: Principles and Practice*. 3rd ed. Mosby Elsevier, 2007. ISBN: 9780323039079.

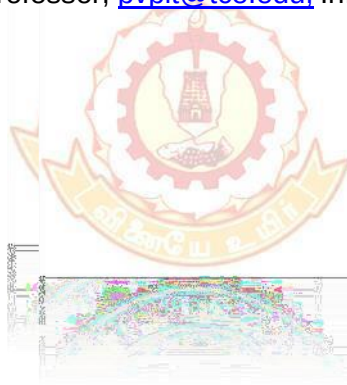
Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction about Physical and Mental abilities	
1.1	Sensor Disabilities	1
1.2	Neuro developmental Disabilities , Loco motors and Multiple Disabilities	2
1.3	Disability and DSM 5 Manual, Disability Communication and Etiquette	2
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	Technologies for ability people	
2.1	Independent Living-Software, Electronics, Mobility	2
2.2	Information Access- Physical, Sensory, Speech and communication	1
2.3	Assistive technology devices, Amplifying Devices, Alert Devices, Mobile Devices , Haptic Devices	2
3	Exploring the needs	
3.1	Observing low, mid, high, and newer technologies applications through reflection, observation and application	1
3.2	Bridging the gap between people and rehabilitation products	2
3.3	Designing beyond the norm to meet the needs of people, improving home environments for aged people	2
4	Client-centered design	
4.1	Intro to the Domains (augmentative communication, orthotics, prosthetics and robotics, seating and mobility, computer access)	2
4.2	Issues of Human Interface Design, Art, Aesthetics issues in adaptive design	2
4.3	Ideas to Product	1
4.4	Assistive technology for persons with cognitive impairments	2
4.5	Universal Design	2
5	Case Studies	
5.1	Modify,customize,fabricate a range of low to medium tech assistive technology devices	2
5.2	Assistive devices for physical Mobility	1

Module No.	Topic	No. of Periods
5.3	wheelchairs for multiple disability -Visually Challenging People	2
5.4	Brailey and other gadgets to support for navigation and workplace	1
5.5	Hearing and Speech Impaired people - supporting gadgets	1
5.6	Mental health issues - cognitive and memory issues	1
5.7	Old Age People - Assistive Devices indoor and outdoor environments.	1
	TOTAL	36

Course Designer(s):

1. Dr.D.Tamilselvi,Professor, dtamilselvi@tce.edu, Information Technology
2. Ms.P.Vijaya Praba, Assistant Professor, pvpit@tce.edu, Information Technology



22ITPJ1**MOBILE COMMUNICATION**

Category L T P Credit

PSE 3 0 0 3

Preamble

The course aims at exploring the concepts of mobile communications in Physical, MAC, Network and Transport layer level. It also explores the WLAN, GSM, LTE, 5G telecommunication system and Ad Hoc routing schemes. This course induces research practice through the team assignment on recent methods/protocols with simulation tools.

Prerequisite

Nil

Course Outcomes

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

S.No	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Experiment with the wireless multiplexing, modulation and spread spectrum techniques for the given scenario	TPS3	70	70
CO2	Choose the suitable wireless MAC mechanisms - SDMA, TDMA, FDMA and CDMA for solving the given problem	TPS3	70	70
CO3	Outline the working principle of Mobile IP and Mobile TCP	TPS2	70	80
CO4	Demonstrate the various functions of Wireless LAN and GSM, LTE, 5G telecommunication system	TPS2	70	80
CO5	Solve the given wireless ad hoc network routing problem with suitable routing schemes	TPS3	70	70
CO6	Apply anyone of the schemes in a given mobile communication network environment and study their performance through simulation tools such as NS3	TPS3	70	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.	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

Assessment Pattern

CO	CAT1			Assignment -1			CAT2			Assignment -2			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	10	10	10		40									5	10
CO2	10	10	30		50								5	10	10
CO3		20			10								5	10	
CO4							10	20			20		5	10	
CO5							10	20	40		10		5	5	10
CO6												70			10

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, PRMA, ISMA - CDMA - MACA, Comparisons

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, LTE, 5G

Wireless Ad Hoc Networks – Routing: Challenges - Table driven, On-demand, Power aware Routing schemes, QoS

Text Book

1. Jochen.H.Schiller, "Mobile Communications", Pearson, second edition 2008.

Reference Books & web resources

1. T.S.Rappaport, "Wireless Communications Principles and Practices", Pearson Education, Asia, NewDelhi, second edition, 2010
2. C.Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks- Architectures and Protocols", second Edition, 2004.
3. <https://archive.nptel.ac.in/courses/106/106/106106167/>

Course Content and Lecture Schedule

Module No	Topic	No. of Lecture Hours
1	Physical Layer	
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
2	Medium Access Control Layer	
2.1	CSMA/CD	1
2.2	SDMA, FDMA	1
2.3	TDMA - Aloha, Slotted Aloha	1
2.4	PRMA, ISMA	2
2.5	CDMA	1
2.6	MACA, Comparisons	1
3	Network and Transport Layer	
3.1	Mobile IP - Introduction	2

3.1.1	Packet Delivery	1
3.1.2	Agent Registration, Reply, Triangular Routing	2
3.2	Mobile TCP - Snooping TCP	1
3.3	Wireless LAN	1
3.3.1	Transmission Technologies, System Architecture	1
3.3.2	Physical Layer - IR, FHSS, DSSS	1
3.3.3	DFWMAC	2
4	Telecommunication System	
4.1	GSM - Introduction	1
4.1.1	Services, Architecture, Protocol Stack	1
4.1.2	Call Routing, Handover	1
4.2	LTE, 5G	2
5	Wireless Ad Hoc Networks	
5.1	Routing Challenges	1
5.2	Table Driven routing schemes	2
5.3	On-demand routing schemes	3
	Total	36

Course Designer(s):

- | | |
|-------------------------|-------------------|
| 1. Dr.S.Muthuramalingam | smrit@tce.edu |
| 2. Dr.P.Karthikeyan | karthikit@tce.edu |

22ITPK1**FULL STACK TECHNOLOGIES**

Category	L	T	P	Credit
PSE	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 also covers the 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	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Understand the Full stack components and develop responsive web pages using Bootstrap 4	TSP2	70	80
CO2	Develop dynamic and responsive single-page applications using React Js and React Router	TSP3	70	70
CO3	Use scalable state management solutions for complex React applications with seamless data flow and asynchronous behavior	TSP3	70	70
CO4	Build a full-fledged backend for a web application using Express Js	TSP3	70	70
CO5	Integrate MongoDB as the storage option in Full stack development ecosystem	TSP3	70	70
CO6	Design and implement RESTful APIs to facilitate communication between frontend and backend layers of an application	TSP3	70	70

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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
CO6	S	M	L		S			S				S	M	M	L

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			20								4		
CO2	10	10	20			30							4	5	15
CO3		10	30			50							4		
CO4							10	10	30			30	4	5	15
CO5								10	30			30	4	5	15
CO6							10					40		5	15

Syllabus

Introduction – Foundation Paradigms - Full Stack Development Stack and architecture - Responsive Web Design - Bootstrap4 Web UI components Basics - Grids - Themes - Bootstrap JS – jQuery selectors and events.

Front End Development with React JS - React JS Basics - React Router and Single Page Applications – Presentational and Container Components- Setting Up React Development Environment – React Forms – 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 Actions- React Animation - Redux Thunk

Back End Development - Express - Routing - Request Matching - Route parameters - Route Lookup – Handler Function - Request Object - Response Object - Middleware - GraphQL - Error Handling – MongoDB - CRUD Operations

Full Stack Integration - REST API - Connecting frontend and backend using AJAX and Fetch API - Authentication and authorization- Deployment strategies and hosting options – AWS – Heroku

Learning Resources

1. ALBERT TETTEH ADJEI , “Full Stack Web Development: Building End-to-End Web Applications with Modern Technologies: A Comprehensive Guide to End-to-End Development Technologies”, TechTales Chronicles 2023.
2. David Choi and Nate “Full-Stack React, TypeScript, and Node” , Apress Publishers, Year: 2020
3. Colin Ihrig, Adam Bretz, and Markus Oberlehner, “Full Stack JavaScript Development with MEAN” , Packt Publishing, Year: 2018
4. <https://reactjs.org/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction	
1.1	Foundation Paradigms	1
1.2	Full Stack Development Stack and architecture	1
1.3	Responsive Web Design	1

1.4	Bootstrap4 Web UI components Basics	1
1.5	Grids, Themes and Bootstrap JS	1
1.6	jQuery selectors and events.	1
2	Front End Development with React	
2.1	React Basics	2
2.2	React Router and Single Page Applications	1
2.3	Presentational and Container Components	1
2.4	Setting Up React Development Environment	1
2.5	React Forms and Components	1
2.6	React DOM	1
3	State Management and Redux	
3.1	State and Props	2
3.2	Lifecycle Methods	1
3.3	Introduction to Redux	2
3.4	Controlled Forms and form Validation	1
3.5	Uncontrolled Components	1
3.6	Flux Architecture	1
3.7	Redux Actions and Thunk	1
3.8	React Animations	1
4	Back End Development	
4.1	Express - Routing	1
4.2	Request Matching, Route parameters	
4.3	Route Lookup , Handler Function	1
4.4	Request Object - Response Object	1
4.5	Middleware, GraphQL	1
4.6	Error Handling	1
4.7	MongoDB	1
4.8	CRUD Operations	1
5	Full Stack Integration	
5.1	REST API	1
5.2	Connecting frontend and backend using AJAX and Fetch API	1
5.3	Authentication and authorization	1
5.4	Deployment strategies and hosting options - AWS - Heroku	2
	Total	36

Course Designer(s):

1. Dr.S.Karthiga, Assistant Professor, skait@tce.edu
Department of Information Technology
2. Ms.C.V.Nisha Angeline, Assistant Professor, Department of Information Technology
cvnait@tce.edu

22ITPL1**SOFTWARE DEFINED
NETWORKS**

Category	L	T	P	Credit
PSE	3	0	0	3

Preamble

This course aims to provide foundations of Software-defined Networking which includes architecture, evolution, challenges and benefits of SDN compared to traditional networking approach. This course delves into SDN's operational mechanisms, prominent controllers, OpenFlow basics and integration with virtualization and cloud technologies.

Prerequisite

Basics of Traditional Networking

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	Recognize the need for SDN in Cloud, Fog, IOT applications and modern Data Centers	TPS 2	70	70
CO2	Examine traditional and SDN based Network planes and operations	TPS 4	70	60
CO3	Configure an opensource controller and connect it with a network topology created with suitable SDN simulators such as Mininet	TPS 3	70	65
CO4	Implement Controller-Switch communication sessions using OpenFlow	TPS 3	70	65
CO5	Demonstrate the need for SDN in the context of Network Virtualization and Network Function Virtualization	TPS 3	70	65
CO6	Enhance Datacenter Networks, Campus Networks, Hospitality Networks, and Mobile Networks using SDN	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	S	M	L				S	S	S			S		M
CO3.	S	M	L		S			S	S	S			M	M	M
CO4.	S	M	L		S			S	S	S		L	M	M	M
CO5.	S	M	L					S	S	S			M		M
CO6.	S	M	L		M			S	S	S		L	M	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

COs	CAT 1				Assignment 1				CAT 2			Assignment 2			Terminal			
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	1	2	3	1	2	3	4
CO1	10	10	-	-	-	-	-	-	-	-	-	-	-	-	5	5	-	-
CO2	5	10	20	10	-	-	-	40	-	-	-	-	-	-	5	5	10	10
CO3	5	10	20	-	-	-	60	-	-	-	-	-	-	-	-	-	10	-
CO4	-	-	-	-	-	-	-	-	5	10	20	-	-	30	-	5	10	-
CO5	-	-	-	-	-	-	-	-	-	20	10	-	-	10	5	5	10	-
CO6	-	-	-	-	-	-	-	-	5	10	20	-	-	60	-	5	10	-

Syllabus

SDN Evolution & Needs – Overview of Traditional Networks - Traditional Switch Architecture – Internal Structure of a Router – Technological Shifts – Motivations and Challenges of SDN – Data Center Needs - Evolution of Switches and Control planes : ForCes –4D – Ethane – Ethane – Plane Separation - Control Plane Functions – Data Plane Functions

SDN Operations and Devices – Fundamental Characteristics of SDN – Anatomy of SDN Controller – Northbound API – Southbound API – SDN Switches – Alternate SDN Methods – OpenFlow : Overview – commands – Limitations.

SDN Controllers – ONOS – Ryu – Pox – Create simple network topologies with Mininet – Capture Network flow with Wireshark – Programming with Frenetic – SDN Security

SDN and NV/NFV – Needs for SDN in Cloud – Implications of Server Virtualization – Network Function Virtualization: Overview, Requirements, Benefits, Principles, Reference Architecture – Network Service Abstraction layer – Usecases – Network Virtualization: Resources, Conceptual Architecture – SDI

SDN Applications – Datacenter Networks – Hospitality Networks – Campus Networks –5G Networks : C-RAN Architecture , Role of SDN and NFV in C-RAN – Network Administration

Text Book

1. Paul Goransson and Chuck Black – Software Defined Networks-A Comprehensive Approach – Morgan Kaufmann.- 2016 – Second Edition
2. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015

Reference Books & web resources

1. Thomas D Nadeau and ken Gray- “SDN”- O’Reilly publication- First Edition- 2014
2. Road to SDN - <http://queue.acm.org/detail.cfm?id=2560327>
3. Routing Control - <http://www.cs.princeton.edu/~jrex/papers/rcp-nsdi.pdf>
4. ONOS - <https://onosproject.org/>
5. Open Networking - <https://www.opennetworking.org/onos/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	SDN Evolution & Needs	
1.1	Overview of Traditional Networks	1
1.2	Traditional Switch Architecture – Internal Structure of a Router	1
1.3	Technological Shifts – Motivations and Challenges of SDN – Data Center Needs	1
1.4	Evolution of Switches and Control planes : ForCes	1
1.5	4D - Ethane	1
1.6	Plane Separation - Control Plane Functions – Data Plane Functions	2
2	SDN Operations and Devices	
2.1	Fundamental Characteristics of SDN	1
2.2	Anatomy of SDN Controller – Northbound API – Southbound API – SDN Switches	2
2.3	Alternate SDN Methods	2
2.4	OpenFlow : Overview – commands – Limitations	2
3	SDN Controllers	
3.1	ONOS	1
3.2	Ryu – Pox	2
3.3	Create simple network topologies with Mininet	1
3.4	Capture Network flow with Wireshark	1
3.5	Programming with Frenetic	1
3.6	SDN Security	2
4	SDN and NV/NFV	
4.1	Needs for SDN in Cloud – Implications of Server Virtualization	1
4.2	Network Function Virtualization : Overview, Requirements, Benefits, Principles, Reference Architecture	2
4.3	Network Service Abstraction layer - Usecases	1
4.4	Network Virtualization : Resources, Conceptual Architecture	2
4.5	SDI	1
5	SDN Applications	
5.1	Datacenter Networks	1
5.2	Hospitality Networks - Campus Networks	3
5.3	5G Networks : C-RAN Architecture , Role of SDN and NFV in C-RAN	3
	Total	36

Course Designer(s):

1. Dr S. Padmavathi, Professor, Dept of IT spmcs@tce.edu
2. S. Thiruchadai Pandeewari, Assistant Professor, eshwarimsp@tce.edu
Dept of IT

22ITPM1	FOG COMPUTING	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

- 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 concepts, characteristics and architecture of Fog Computing paradigm.	TPS2	80	80
CO2	Identify the appropriate enabling technologies such as SDN, NFV and protocols for the given fog-based application	TPS3	80	70
CO3	Demonstrate the application of software definition in the networking for fog computing.	TPS3	80	70
CO4	Examine a suitable orchestration framework for a fog-based application	TPS4	80	65
CO5	Identify the suitable communication technologies and execution management functions of fog computing middleware based on the given design goal.	TPS3	80	70
CO6	Experiment with the use cases of fog computing in IoT and 5G systems	TPS3	80	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	PSO 3
CO1	M	L											L		
CO2	S	M	L									L	M		
CO3	S	M	L		L				L	L		L	M	L	
CO4	S	S	M	L	M	L			S	M		L	S	M	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

CO	CAT1			Assignment - I			CAT2				Assignment - II				Terminal			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	10	10													5	5		
CO2	10	10	20		10	20									5	5	5	
CO3	10	10	20		10	60										5	5	
CO4							5	10	10	10			40	10	5	5	10	10
CO5							5	10	20				10		5	5	10	
CO6								10	20				40			5	10	

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Computing Paradigms: Cloud - Fog - 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 - Fog Protocol -Fog Kit - Proximity Detection Protocols- DDS/RTPS computing protocols.

Orchestration of Network Slices: Network Slicing - Resource provisioning- Mobility Management - Generic Slicing framework - Slicing 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 - Federated Learning - Vehicular Networks - ML for Autonomous Driving Car - IoT Applications: Smart Agriculture, Retail Analytics, Logistics and Supply Chain Management, Healthcare Monitoring, Home Automation, Smart Transportation - Industrial IoT (IIoT) - 5G systems

Learning Resources

1. Buyya, Rajkumar, and Satish Narayana Srirama, 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, Khaled Almustafa, and Khalim Amjad Meerja. "Cloud based SDN and NFV architectures for IoT infrastructure." Egyptian Informatics Journal 20.1 (2019): 1-10.
5. Manzalini, Antonio, Cagatay Buyukkoc, Prosper Chemouil, Slawomir Kuklinski, Franco Callegati, Alex Galis, Marie-Paule Odiini 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 Periods
1	Computing Paradigms	
1.1	Cloud - Fog - Edge computing Concepts	1
1.2	Characteristics	
1.3	Services	
1.4	Challenges	1
1.5	Fog Computing Architecture	
1.6	Motivations	1
1.7	Performance Enhancements	
1.8	Enabling Technologies	1
1.9	Fog based applications	
2	Networking for Fog	
2.1	Fog Networking requirements	1
2.2	Challenges	
2.3	Software Definition of Networks	1
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
2.10	Fog Protocol - Fog Kit	1
2.11	Proximity Detection Protocols - DDS/RTPS computing protocols.	
3	Orchestration of Network Slices	
3.1	Network Slicing	1
3.2	Resource provisioning	1
3.3	Mobility Management	1
3.4	Generic Slicing framework	1
3.5	Slicing Management and Orchestration	2
3.6	State of the art Orchestration frameworks	1
4	Middleware for Fog	
4.1	Design Goals	1
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	Fog - Use cases	
5.1	Fog based real time sensor data analysis	1
5.2	Federated Learning	1
5.2	Vehicular Networks	1

5.3	ML for Autonomous Driving Car	1
5.3	IoT Applications: Smart Agriculture, Retail Analytics	1
5.4	Logistics and Supply Chain Management, Healthcare Monitoring	1
5.5	Home Automation, Smart Transportation - Industrial IoT (IIoT)	2
5.6	5G systems	
	Total	36

Course Designers:

1. Dr.S.Padmavathi, Professor, Information Technology spmcs@tce.edu
2. Dr.K.R.Premlatha, Assistant Professor, Information Technology krplit@tce.edu

22ITPN1

**INFORMATION SECURITY
AUDITING
AND MANAGEMENT**

Category L T P Credit
PSE 3 0 0 3

Preamble

This course aims to provide an intensive conceptual and introduction to auditing, it mainly focuses on concepts and applications related to IT audit as well as risks of information systems.

Prerequisite

- NIL

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the need of information security and auditing with general policies and procedures.	TPS2	80	85
CO2	Demonstrate the working of IT Governance and its functions in an organization.	TPS3	80	80
CO3	Conduct IT Auditing in domains like ERP implementation, Data Management etc.,	TPS3	80	80
CO4	Verify the correctness of audit objectives and audit procedures in IT auditing.	TPS4	80	70
CO5	Analyze the various forms of information security risks.	TPS4	80	70
CO6	Apply information security policies to secure Systems, Application programs, Computer operations, Communications, and Physical assets	TPS3	80	80

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					L	M	M	M		M		M
CO3	S	M	L					L	M	M	M		M		M
CO4	S	M	L					L	M	M	M		M		M
CO5	S	S	M	L	M			M	S	S	S	M	S	M	M
CO6	S	S	M	L	M			M	S	S	S	M	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT				Assignment				CAT				Assignment				Terminal			
	1				1				2				2							
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
CO1	8	20															2	5	5	
CO2	8	10	20				50										2	5	5	
CO3	4	10	20				50										2	5	5	
CO4									2	10	15	10				50	2	5	10	10
CO5									4	10	15	10				50	2	5	10	10
CO6									4	10	10							5	5	

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Auditing and Internal Control: Overview of Auditing, Standards, Role of the audit committee, Audit Risk, The IT Audit, Internal Control, Internal Control Objectives, Principles, and Models.

IT Governance: Information Technology Governance, Structure of the information technology function, disaster recovery planning, audit implications of IT outsourcing.

Auditing IT domains: Auditing Operating Systems, Auditing Networks, Data Management Approaches, Key Elements of the Database Environment, Databases in a Distributed Environment, Controlling and Auditing Data Management Systems, Access Controls. Controlling and Auditing the SDLC, Risks Associated with ERP Implementation, Implications for Internal Control and Auditing, Auditing Tools-CAATs.

Information Risk Management: Benefits of Risk management, Elements of Risks, Quantitative Risk analysis, Qualitative risk analysis, Risk management life cycle, Risk Mitigation.

Information Security Management: Computer Architecture and system security, Application program security. Computer operations security, Communication Security, Physical security.

Text Book

1. Chris Davis and Mike Schiller, "IT Auditing: Using Controls to protect Information Assets", Mc-Graw Hill, Second Edition, 2011
2. James A. Hall "Information Technology Auditing," Cengage Learning, Copyright, 4th Edition, 2016.
3. Global Technology Audit Guide (GTAG) 1: Information Technology Risk and Controls, 2nd Edition, 2012.

Reference Books & web resources

1. <http://www.isaca.org/knowledge-center/itaf-is-assurance-audit-/IT-Audit-Basics/Pages/IT-Audit-Basics-Articles.aspx>
2. http://intosaiitaudit.org/India_GeneralPrinciples.pdf
3. <http://opentuition.com/wp-content/blogs.dir/1/files/group-documents/15/1289480671-COMPUTERASSISTEDAUDITTECHNIQUES.pdf>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1	Auditing and Internal Control	
1.1	Overview of Auditing	2
1.2	Standards	1
1.3	Role of the audit committee	1
1.4	Audit Risk	1

1.5	The IT Audit	1
1.6	Internal Control	1
1.7	Internal Control Objectives, Principles, and Models.	1
2	IT Governance	
2.1	Information Technology Governance	1
2.2	Structure of the information technology function	1
2.3	Disaster recovery planning	1
2.4	Audit implications of IT outsourcing	1
3	Auditing IT domains	
3.1	Auditing Operating Systems	1
3.2	Auditing Networks	1
3.3	Data Management Approaches	1
3.4	Key Elements of the Database Environment	1
3.5	Databases in a Distributed Environment	1
3.6	Controlling and Auditing Data Management Systems	1
3.7	Access Controls	1
3.8	Controlling and Auditing the SDLC	1
3.9	Risks Associated with ERP Implementation	1
3.10	Implications for Internal Control and Auditing	1
3.11	Auditing Tools -CAATs	2
4	Information Risk Management	
4.1	Benefits of Risk management	1
4.2	Elements of Risks	1
4.3	Quantitative Risk analysis	1
4.4	Qualitative risk analysis	1
4.5	Risk management life cycle	2
4.6	Risk Mitigation	1
5	Information Security Management	
5.1	Computer Architecture and system security	1
5.2	Application program security	1
5.3	Computer operations security	1
5.4	Communication Security	1
5.5	Physical security	1
Total Lectures		36

Course Designer(s):

1. Parkavi.R, Assistant Professor, rpit@tce.edu, Information Technology
2. Sujitha.S, Assistant Professor, ssiit@tce.edu, Information Technology

22ITPP1

**AUGMENTED REALITY AND
VIRTUAL REALITY**

Category L T P Credit

PSE 2 0 2 3

Exam Type: Theory

Preamble

This course provides the basic principles about Augmented and Virtual Reality technologies, knowledge on developing AR/VR and interacting with the virtual environment through interactive devices and also facilitates the technologies involved in the development of AR/VR application.

Prerequisite

NIL

Course Outcomes

CO1	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the basic concepts of Augmented reality, Virtual reality, Mixed reality	TSP2	70	80
CO2	Design a scene which relates to any application including light, optics etc.,	TSP3	70	70
CO3	Track the system and Interact with the application using various interactive devices	TSP3	70	60
CO4	Develop an augmented reality application using Unity3D including context and content determination	TSP3	70	70
CO5	Create a VR application, render the scenes and apply all scientific principles in it such as vision, audio, etc.,	TSP3	70	70
CO6	Investigate case studies for Medical, Gaming and other emerging fields	TSP4	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	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1.	M	L			M	M						M	L		L
CO2.	S	M	L		S	S						M	L		L
CO3.	S	M	L		S	S						M	M		L
CO4.	S	M	L		S	S		L	M	M		S	M	L	L
CO5.	S	S	M	L	S	S		L	M	M		S	S	S	M
CO6.	S	S	M	L	S	S	M	M	S	S		S	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Theory								Practical					Terminal					
	CAT 1				CAT2				Test				OCR	(Theory)					
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4		1	2	3	4	5	6
CO1	4	10	-	-	-	-	-	-	-	-	-	-	-	6	5	-	-	-	-
CO2	4	10	30	-	-	-	-	-	-	-	20	-	20	2	5	10	-	-	-
CO3	2	10	30	-	-	-	-	-	-	-	20	-	20	2	5	10	-	-	-
CO4	-	-	-	-	4	-	20	-	-	-	20	-	20	2	5	10	-	-	-
CO5	-	-	-	-	4	10	20	-	-	-	20	-	20	6	-	10	-	-	-
CO6	-	-	-	-	2	10	20	10	-	-	20		20	2	-	10	10	-	-

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

AR VR Background: Working Principle of AR, A typical AR system, VR modern experiences, historical perspective, The Mixed Reality Continuum.

Geometry of virtual worlds: 3D transformations - Geometric modeling, Transforming rigid bodies, Light and Optics: Light propagation, Lenses and images.

Tracking and Interaction: Tracking -3D user interfaces- Interaction techniques for locomotion and manipulation

Augmented Reality: Augmented Reality- The Content - Connecting Context and Content in AR System, Various types of contents, Marker based and Marker less AR -AR Application Areas.

Virtual Reality: Software and Hardware Technology on Stereoscopic Display - Ethical and social implications, Spatial audio for immersive experience

Case studies: AR and VR Technology in Medical Field -Physical Exercises and Gaming-Film and TV Production- Architecture and Civil, Commercial and other emerging fields

Text Book

1. Steven M. LaValle, "Virtual Reality", University of Illinois, Published by Cambridge university, 2017.
2. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc., © 2003-2017.
3. Dieter Schmalstieg and Tobias Hollerer, "Augmented Reality: Principles & Practice", 2016

Reference Books

1. William R. Sherman, Alan Craig, "Understanding Virtual Reality, interface, Application and Design", Elsevier(Morgan Kaufmann), 2003.
2. David H. Eberly, "3D Game Engine Design", Elsevier, 2012.
3. John Vince, "Virtual Reality Systems", Pearson Education, 2007.
4. Alan B. Craig; William R. Sherman; Jeffrey D. Will, "Developing Virtual Reality Applications: Foundations of Effective Design", 2009
5. Cawood, "Augmented Reality: A Practical Guide", 2008

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	AR VR Background	
1.1	Working Principle of AR	1
1.1.1	A typical AR system	
1.2	VR Modern experiences	1
1.2.1	Historical perspective	
1.3	The Mixed Reality Continuum	1
2	Geometry of virtual worlds	
2.1	3D transformations	1
2.2	Geometric modeling	1
2.3	Transforming rigid bodies	1
2.4	Light and Optics: Light propagation	1
2.4.1	Lenses and images	
3	Tracking and Interaction	
3.1	Tracking	1
3.2	3D user interfaces	1
3.3	Interaction techniques for Locomotion	1
3.4	Manipulation	1
4	Augmented Reality	
4.1	Augmented Reality- The Content	1
4.1.1	Connecting Context and Content in AR System	1
4.1.2	Various types of contents	1
4.2	Marker based and Marker less AR	2
4.3	AR Application Areas	1
5	Virtual Reality	
5.1	Software and Hardware Technology on Stereoscopic Display	1

Module No.	Topic	No. of Periods
5.2	Ethical and social implications	1
5.3	Spatial audio for immersive experience	1
6	Case studies	
6.1	AR and VR Technology in Medical Field	1
6.2	Physical Exercises and Gaming	1
6.3	Film and TV Production	1
6.4	Architecture and Civil, Commercial and other emerging fields	1
	TOTAL	24

List of Experiments:

The List of experiments can be applied to any domain inclusive of Industry, Medical and Gaming but not limited to

Module No.	Topic	No. of Periods
1	Study of tools like Unity3D/Unreal, Vuforia and Blender.	2
2	Install Software and Choose the Project	2
3	Develop AR enabled simple applications using Marker based trigger.	4
4	Develop AR enabled simple applications using Marker less trigger.	4
5	Create the 3D model using Blender - Apply various lighting and shading effects to the downloaded objects from asset store.	4
6	Create three dimensional virtual environment using Unity / Unreal	4
7	User Interface for the Project in AR / VR	4
	TOTAL	24

Course Designer(s):

- | | | | |
|--------------------|----------------------|----------------------|------------------------|
| 1. D.Tamilselvi , | Professor, | dtamilselvi@tce.edu, | Information Technology |
| 2. P.Vijaya Praba, | Assistant Professor, | pvpit@tce.edu, | Information Technology |
| 3. M.Akila Rani, | Assistant Professor, | marit@tce.edu, | Information Technology |

22ITPQ1 C# AND .NET FRAMEWORK

Category	L	T	P	Credit
PSE	3	0	0	3

Preamble

both in basic and advanced levels. It will help them to develop applications (web-based application and web services) using C#.

This subject w

Prerequisite

- 22IT320-Object Oriented Programming

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the .Net framework components of CLR, CTS and JIT	TPS2	70	75
CO2	Implement the basic concepts of OOP and delegates, events using C# programming language	TPS3	70	70
CO3	Develop C# applications using Language Integrated Query and assembly components	TPS3	70	70
CO4	Construct different web applications, web services and able to retrieve data using ADO.Net	TPS3	70	70
CO5	Make use of Windows Communication Foundation, Windows Presentation Foundation, Windows Workflow Foundation	TPS3	70	70
CO6	Examine a simple project that incorporates all important features of .NET Framework	TPS4	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	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	M	L											L		
CO 2	S	M	L		M			M	M	M				L	L
CO 3	S	M	L		M			M	M	M				L	L
CO 4	S	M	L		M			M	M	M				L	L
CO 5	S	M	L		M			M	M	M				L	L
CO 6	S	S	M	L	M			M	M	M	L	L		L	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1						CAT2						Assignment 1		Assignment 2		Terminal					
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6	2	3	3	4	1	2	3	4	5	6
CO1	10	20											20				2	5				
CO2	10	20	20											40			2	5	15			
CO3			20											40			2	5	10			
CO4							10	20	20						30		2	5	15			
CO5							10	10	20						30		2	5	15			
CO6										10					30	10				10		

Attainment of course outcome 6 is evaluated through mini project which involves design and development of simple applications in .NET framework.

Some of the assignment problems include: (but not limited to)

1. Develop an online quiz application where students can take quizzes on various subjects.
2. Create an expense tracker application for students to track their expenses and manage budgets
3. Build a task management application for organizing and tracking tasks, assignments, and deadlines.
4. Build a hospital management system for managing patient records, appointments, and medical staff.
5. Create a weather forecast application that fetches weather data from an API and displays it to users.

Syllabus

The .Net framework: .Net Framework Architecture, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS), Microsoft Intermediate Language (MSIL), Just-In-Compiler, Framework Base Classes

C -Sharp Language: Language Syntax, Data Types, Identifiers, Variables, Constants, Literals, Array and Strings, Conditional Statements, Looping Structures- Delegates and Events - Generic Classes-Generic methods- Generic Interface

Other Attributes and Assembly: Implicitly Typed Local Variable- Anonymous Type- Lambda Expression- Language Integrated Query- Assemblies- Versioning- Attributes- Reflection.

Application Development on .NET: Windows based Applications - Accessing Data with ADO.NET, MVC Framework, and Entity Framework -Web applications with Web Forms- Razor application- Web Services

Overview of Advanced .Net features: Windows Communication Foundation - Windows Presentation Foundation- Windows Workflow Foundation- Case study: Synchronous and Asynchronous Programming

Text Book

1. Andrew Troelsen, "Pro C#5 and the .NET 4.5 Framework", Andrew Troelsen, Apress, Sixth Edition 2012
2. Herbert Schildt, "C# 4.0 The Complete Reference", McGraw-Hill, 2010.
3. Karli Watson, Christian Nagel, et al, Professional C# 4.0 and .NET 4, Wrox, 2010
4. John Sharp, Microsoft Visual C# Step by Step, 10th Edition 2022

Reference Book & Web resources

1. Joseph Albahari, Ben Albahari, C# 7.0 in a Nutshell, Publisher - O'Reilly Media, 2017
2. <https://msdn.microsoft.com>
3. <https://www.telerikacademy.com/alpha/csharp>
4. <http://www.csharphelp.com/index.html>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	The .Net framework	
1.1	.Net Framework Architecture	1
1.2	Common Language Runtime (CLR)	1
1.3	Common Type System (CTS), Common Language Specification (CLS)	1
1.4	Microsoft Intermediate Language (MSIL), Just-In - Compiler	2
1.5	Framework Base Classes	1
2	C -Sharp Language	
2.1	Language Syntax, Data Types, Identifiers, Variables, Constants, Literals, Array and Strings	3
2.2	Conditional Statements	1
2.3	Looping Structures	1
2.4	Delegates and Events	1
2.5	Generic Classes-Generic methods- Generic Interface	2
3	Other Attributes and Assembly	
3.1	Implicitly Typed Local Variable	1
3.2	Anonymous Type -Lambda Expression	1
3.3	Language Integrated Query	1
3.4	Assemblies- Versioning	1
3.5	Attributes-Reflection	1
4	Application Development on .NET	
4.1	Windows based Applications	1

Module No.	Topic	No. of Periods
4.2	Accessing Data with ADO.NET	2
4.3	MVC Framework	1
4.4	Entity Framework	1
4.5	Web applications with Web Forms	2
4.6	Razor application	1
4.7	Web Services	1
5	Overview of Advanced .Net features	
5.1	Windows Communication Foundation	1
5.2	Windows Presentation Foundation	1
5.3	Windows Workflow Foundation	1
5.4	Case study: Synchronous and Asynchronous Programming	1
5.5	Mini project	4
Total		36

Course Designer(s):

1. Ms.S.Sujitha, Assistant Professor, ssiit@tce.edu, Information Technology
2. Dr.G.Vennila, Assistant Professor, gvait@tce.edu, Information Technology

22ITRA1**ADVANCED CRYPTOGRAPHY**

Category L T P Credit

PEES 3 0 0 3

Preamble

The course on Advanced Cryptography aims to equip students with a profound understanding of complex cryptographic algorithms and protocols. The course enables the students to develop practical implementation skills, fostering the ability to apply cryptographic solutions to real-world scenarios that involves zero knowledge proof systems, secure two-party and multi-party computation. The course prepares individuals with the knowledge and skills on modern cryptography necessary for addressing contemporary challenges in secure communication and data protection.

Prerequisite

22IT520 Information Security

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	Appreciate the usage of number theory, probability and statistics in the development of modern crypto algorithms	TPS3	70	70
CO2	Construct privacy preserving security systems using Zero Knowledge and Oblivious transfer protocols	TPS3	70	70
CO3	Experiment fine grained access control systems using Identity Based Encryption and Attribute Based Encryption	TPS3	70	70
CO4	Illustrate cryptographic techniques for secure group communication and computation	TPS3	70	70
CO5	Explain the working principle of quantum computing and quantum cryptography	TPS2	80	75
CO6	Breakdown the recent research problems in real world applications like Digital cash, E-Voting and identify suitable cryptographic techniques to solve it	TPS4	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	S	M	L		L								M		
CO2	S	M	L		L			M					M		
CO3	S	M	L		L			M					M		
CO4	S	M	L		L			M					M		
CO5	M	L											M		
CO6	S	S	M	L	M	M		S	M	M		S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1			Assignment 1			CAT2				Assignment 2				Terminal			
	100			100			100				100				100			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	5	10	20			30											20	
CO2	5	10	20			30										5	10	
CO3		10	20			40											20	
CO4							10	10	20				40			5	10	
CO5								20								10		
CO6									20	20				60				20

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus**Primitives of Advanced Cryptography**

One way Functions (OWF)–Types, Trapdoor Functions, Hard core predicates of OWF. Pseudo Random Number Generators (PRNG), Pseudo-random Permutations (PRP), Pseudo-Random Functions (PRF).

Zero Knowledge Protocols

Chosen Ciphertext Security, Interactive proofs and zero-knowledge interactive proofs, Non-interactive zero-knowledge (NIZK) proofs, Applications in privacy and authentication.

Oblivious transfer

Oblivious transfer protocols and variations, Privacy-preserving data exchange using oblivious transfer, Differential Privacy.

Access control schemes

Identity Based Encryption (IBE), Key management in IBE systems, Benefits and challenges. Attribute-Based Encryption (ABE) – Access control and fine-grained encryption, Attribute-based access control policies, Hierarchical and lattice-based ABE.

Secret Sharing and Threshold Cryptography

Secret sharing schemes and applications - Shamir's Secret Sharing, Distributed key management and access control, Threshold encryption and decryption.

Multi Party Computation

Fundamentals of secure multiparty computation (MPC) – Homomorphic encryption, Two-party and multi-party secure computation, Yao's Millionaires' Problem and the Garbled Circuit protocol.

Quantum cryptography

Quantum computers, CRYSTALS-Kyber algorithm, Shor's quantum factoring algorithm, quantum key distribution and reconciliation.

Case study

Vulnerability analysis of authentication and data security in real world security based applications like e-voting and digital cash.

Reference Books & web resources

- Jonathan Katz and Yehuda Lindell, "Introduction to Modern Cryptography: Principles and Protocols", 3rd Edition, Chapman and Hall/CRC Press, 2020.
- Douglas R. Stinson, "Cryptography: Theory and Practice", 4th Edition, CRC Press, 2019.
- Dijiang Huang, Qiuxiang Dong and Yan Zhu, "Attribute-Based Encryption and Access Control", CRC Press, 2020
- Ronald Cramer, Ivan Bjerre Damgård and Jesper Buus Nielsen, "Secure Multiparty Computation and Secret Sharing", 1st Edition, Cambridge University Press, 2015
- Simon Singh, "The Code Book, the evolution of secrecy from Mary, Queen of Scots, to quantum cryptography", Doubleday 1999

6. Dan Boneh Presentation, NIST Computer Security Resource Center - [An Overview of Identity Based Encryption](#)

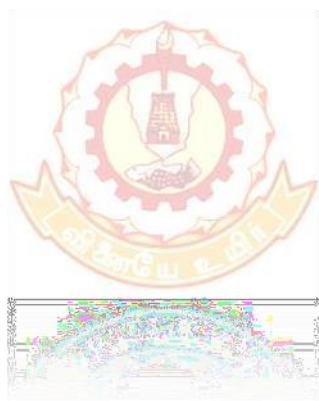
Course Contents and Lecture Schedule

Mod ule No.	Topic	No. of Periods
	Introduction to the course and course outcomes	1
1	Primitives of Advanced Cryptography (5)	
1.1	One way Functions(OWF) - types	1
1.2	Trapdoor Functions	1
1.3	Hard core predicates of OWF	1
1.4	Pseudo Random Number Generators (PRNG)	1
1.5	Pseudo-random Permutations (PRP), Pseudo-Random Functions (PRF)	1
2	Zero Knowledge Protocols (5)	
2.1	Chosen Ciphertext Security	1
2.2	Interactive proofs and zero-knowledge interactive proofs	1
2.3	Non-interactive zero-knowledge (NIZK) proofs	2
2.4	Applications in privacy and authentication	1
3	Oblivious transfer (3)	
3.1	Oblivious transfer protocols and variations	1
3.2	Privacy-preserving data exchange	1
3.3	Differential Privacy	1
4	Access control schemes (6)	
4.1	Identity Based Encryption (IBE)	1
4.2	Key management in IBE systems	1
4.3	Benefits and challenges	1
4.4	Attribute-Based Encryption (ABE)	1
4.5	Attribute-based access control policies	1
4.6	Hierarchical and lattice-based ABE	1
5	Secret Sharing and Threshold Cryptography (5)	
5.1	Secret sharing schemes and applications	1
5.2	Shamir's Secret Sharing	1
5.3	Distributed key management and access control	1
5.4	Threshold encryption and decryption	2
6	Multi Party Computation(5)	
6.1	Fundamentals of secure multiparty computation	1
6.2	Homomorphic encryption	1
6.3	Two-party and multi-party secure computation	1
6.4	Yao's Millionaires' Problem	1
6.5	Garbled Circuit protocol	1
7	Quantum cryptography (4)	
7.1	Quantum computers	1
7.2	CRYSTALS-Kyber algorithm	1

Module No.	Topic	No. of Periods
7.3	Shor's quantum factoring algorithm	1
7.4	Quantum key distribution and reconciliation	1
8	Research article discussion (2) Vulnerability analysis - authentication and data security systems	2
	Total	36

Course Designer(s):

1. Jeyamala C, Associate Professor, Dept. of IT, je Yamala@tce.edu
2. Suguna M, Associate Professor, Dept. of IT, mscse@tce.edu



22ITRB1**INFORMATION RETRIEVAL**

Category	L	T	P	Credit
PEES	3	0	0	3

Preamble

The course focuses on the representation, storage, organization, and access to information items using various IR algorithms and techniques. The course emphasizes the building of information retrieval systems for documents so as to retrieve relevant or useful information from them.

Prerequisite

- Nil

Course Outcomes

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

COs	Course Outcomes (CO)	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Differentiate different retrieval algorithms and evaluation techniques	TPS2	70	70
CO2	Illustrate various Information Retrieval models such as boolean, vector space and probabilistic models with its variants for the given textual data	TPS3	70	65
CO3	Examine the performance of the various IR models	TPS4	70	60
CO4	Simulate different classification and clustering algorithms for textual data using text operations	TPS3	70	65
CO5	Investigate the usage of various text search engines with web crawling and link analysis using suitable tools and techniques	TPS4	70	60
CO6	Develop simple information retrieval systems such as recommender systems, personalization, musical notes extraction using text and multimedia data	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	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1.	M	L										L	L		L
CO2.	S	M	L		S			S				L	M	M	L
CO3	S	S	M	L								L	S		L
CO4	S	M	L		S			S				S	M	M	L
CO5	S	S	M	L	S			S				S	S	M	L
CO6	S	M	L		S	S		S	S	S	S	S	M	S	S

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1				Assignment 1				CAT2				Assignment 2			Terminal					
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	4	5	6
CO1	5	10														2	8				
CO2	5	10	20				50									2	6	10			
CO3	10	10	20	10			30	20								2	6	10	5		
CO4									5	10	20					2	6	10			
CO5									5	10	20	10				2	6	10	5		
CO6											20				100	2	6				

Syllabus

Retrieval Models Basic Concepts – Nature of unstructured and semi-structured text - Retrieval Process – Classic Information Retrieval Models – Boolean Model, Vector Model, Probabilistic Model, Vector Space Model, Latent Semantic Indexing model, Bayesian Networks - Retrieval Evaluation

Query Languages Key Word based Querying – Query Operations – User Relevance Feedback – Local and Global Analysis

Indexing and Searching Inverted files – Suffix trees - Boolean Queries – Sequential Searching – Pattern Matching - Structural queries – Compression

Text Operations Data Standards and Data Quality - Legal, Policy and Ethics - Preprocessing – Document Categorization – Naïve Bayes Models, Document Clustering – k-means clustering, Word embedding – Encoding, Feature Extraction, Sequential Models - RNN

Web Information Retrieval Search Engines – Web Crawling – Link analysis – Page Ranking – Semantic Search

Multimedia Information Retrieval Data types and formats – Feature Extraction - Indexing and Retrieval

IR Systems Spam Filtering – Sentiment Analysis - Recommender Systems - Personalization – Search Advertising – Chatbots – Question Answering models - Text Summarization - Multimedia IR Systems

Learning Resources

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, Modern Information Retrieval, Pearson Education, 2nd edition, 2011.
2. C. Manning, P. Raghavan, and H. Schutze, Introduction to Information Retrieval, Cambridge University Press, 2008.
3. Stefano Ceri, Alessandro Bozzon, Web Information Retrieval, Springer, 2013.
4. Henk Blanken, Henk Ernst Blok, Ling Feng, Arjen Vries, Multimedia Retrieval, Springer, 2007.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Retrieval Models	
1.1	Basic Concepts	1
1.2	Nature of unstructured and semi-structured text	
1.3	Retrieval Process	1
1.4	Classic Information Retrieval Models	1

1.4.1	Boolean Model	
1.4.2	Vector Model	1
1.4.3	Probabilistic Model	
1.4.4	Vector Space Model	1
1.4.5	Latent Semantic Indexing model	1
1.4.6	Bayesian Networks	1
1.5	Retrieval Evaluation	1
2	Query Languages	
2.1	Key Word based Querying	1
2.2	Query Operations	1
2.3	User Relevance Feedback	1
2.4	Local and Global Analysis	1
3	Indexing and Searching	
3.1	Inverted files	1
3.2	Suffix trees	1
3.3	Boolean Queries	1
3.4	Sequential Searching	1
3.5	Pattern Matching	1
3.6	Structural queries	1
3.7	Compression	
4	Text Operations	
4.1	Data Standards and Data Quality - Legal, Policy and Ethics	2
4.2	Preprocessing	
4.3	Document Categorization	2
4.3.1	Naïve Bayes Models	
4.4	Document Clustering	
4.4.1	k-means clustering	
4.5	Word Embedding	3
4.5.1	Encoding	
4.5.2	Feature Extraction	
4.5.3	Sequential Models - RNN	
5	Web Information Retrieval	
5.1	Search Engines	1
5.2	Web Crawling	1
5.3	Link analysis	2
5.4	Page Ranking	2
5.5	Semantic Search	1
6	IR Systems	
6.1	Recommender Systems	4
6.2	Personalization	
6.3	Search Advertising	
6.4	Chatbots	
6.5	Text Summarization	
6.6	Multimedia IR Systems	

Total Lecture Hours	36
---------------------	----

Course Designer(s):

- | | |
|-----------------|-------------------|
| 1. A.M.Abirami | abiramiam@tce.edu |
| 2. S.Pudumalar | spmit@tce.edu |
| 3. M.Akila Rani | marit@tce.edu |

22ITRC1	QUANTUM MACHINE LEARNING
----------------	---------------------------------

Category	L	T	P	Credit
PEES	3	0	0	3

Preamble

This course delivers a comprehensive understanding of quantum computing basics, encompassing quantum mechanics and algorithms, prerequisites for exploring quantum machine learning. Students delve into quantum machine learning, enhancing their capacity to tackle real-world challenges effectively.

Prerequisite

Quantum Computing
22IT520 Machine Learning

Course Outcome

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain quantum computing basics: qubits, gates, and notation.	TPS2	70	70
CO2	Experiment various elementary quantum circuits using tools.	TPS3	70	65
CO3	Apply quantum algorithms to meet the requirements of Quantum Machine Learning (QML).	TPS3	70	65
CO4	Utilize quantum supervised and unsupervised algorithms like QSVM, QKNN, QPCA, and QKmeans.	TPS3	70	65
CO5	Implement quantum enhanced hybrid models using variational quantum circuits.	TPS3	70	65
CO6	Analyze performance of quantum machine learning techniques for various domains.	TPS4	70	60

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	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	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT1			Assignment -I			CAT2				Assignment - II				Terminal			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	10	10			10										2	5		
CO2	10	15	20			50									2	5	15	
CO3		15	20			40									2	5	15	
CO4							5	15	15				30			5	15	
CO5							5	15	15				30		2		10	
CO6							5	5		20				40	2		5	10

Syllabus

Quantum Computing Fundamentals: Math Basic, Classical vs Quantum computing, Quantum Bits (Qbits), Notation, and Representation of qubits on bloch sphere, Single and Multiple Qubit Gates.

Quantum Mechanics: Quantum States – Superposition & Entanglement, Quantum Evolution, Quantum Measurements, Bell's Inequality, Quantum Circuits, Quantum Error Correction.

Quantum Algorithms: Deutsch-Jozsa, Grover's Search Algorithm, Shor's Algorithm.

Quantum Supervised Learning: Fundamentals of QML, Data Encoding, Quantum Feature spaces and kernels, Variational Quantum Circuits, **Supervised Algorithms** - Quantum Linear Regression, Quantum SVM, Quantum KNN, Quantum Neural Network,

Quantum Unsupervised Learning: Quantum PCA, Quantum K-means, Quantum Hierarchical Clustering, Hybrid Quantum Classical Machine Learning.

Learning Resources

- Nielsen, M. A., & Chuang, I. L." Quantum computation and quantum information", Cambridge university press, 10th Edition, 2010.
- Wittek, Peter. Quantum machine learning: what quantum computing means to data mining. Academic Press, 1st Edition, 2014.
- Ganguly, Santanu. *Quantum machine learning: an applied approach*. New York: Apress, 1st Edition, 2021.
- NPTel: https://onlinecourses.nptel.ac.in/noc21_cs103/preview - Introduction to Quantum Computing: Quantum Algorithms and Qiskit, by Prof.PrabhaMandayam, Prof.Anupama Ray, Prof.Sheshashayee Raghunathan | IIT Madras, IBM Research, IBM Systems.
- Lecture notes and coding assignments - <https://github.com/qosf/qml-mooc> by Quantum Machine Learning MOOC, created by Peter Wittek from the University of Toronto.
- IBM quantum documentation: <https://docs.quantum.ibm.com/start>.
- PENNYLANE documentation: <https://docs.pennylane.ai/en/stable/>

Course Contents and Lecture Schedule

Module	Topic	No.of Periods
1.	Quantum Computing Fundamentals:	
1.1	Math Basics	1
1.2	Classical vs Quantum computing, Quantum Bits (Qbits)	1
1.3	Notation, and Representation of qubits on bloch sphere	1
1.4	Single and Multiple Qubit Gates	1
2.	Quantum Mechanics:	
2.1	Quantum States – Superposition & Entanglement	2
2.2	Quantum Evolution	2
2.3	Quantum Measurements	2
2.4	Bell's Inequality	1
2.5	Quantum Circuits and Operations	2
2.6	Quantum Error Correction	2
3.	Quantum Algorithms:	
3.1	Deutsch-Jozsa	2
3.2	Grover's Search Algorithm	2
3.3	Shor's Algorithm	2
4.	Quantum Supervised Learning:	
4.1	Fundamentals of QML	1
4.2	Data Encoding	1
4.3	Quantum Feature spaces and kernels	1
4.4	Variational Quantum Circuits	2
4.5	Quantum Linear Regression	1
4.6	Quantum SVM	1
4.7	Quantum KNN	1
4.8	Quantum Neural Network	2
5.	Quantum Unsupervised Algorithms	
5.1	Quantum PCA	1
5.2	Quantum K-means	1
5.3	Quantum Hierarchical Clustering	1
5.4	Hybrid Quantum Classical Machine Learning	2
	TOTAL HOURS	36

Course Designers:

Dr.C.Deisy, Professor, IT Department,
T. Saranya, Assistant Professor, IT Department,

cdcse@tce.edu
tsait@tce.edu

22ITRD1**NATURAL LANGUAGE
PROCESSING**

Category	L	T	P	Credit
PEES	3	0	0	3

Preamble

The course aims to provide text and speech processing by applying the most widely used and effective machine learning techniques, strategies and toolkits for natural language processing.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain natural language processing methods and strategies	TPS2	70	85
CO2	Use suitable text representation schemes for modelling the text documents	TPS3	70	75
CO3	Experiment suitable pre-processing techniques for text documents and audio files	TPS4	70	65
CO4	Apply machine learning techniques for text and speech processing	TPS3	70	75
CO5	Examine the strength and weakness of different text processing algorithms	TPS4	70	65
CO6	Develop applications using NLP toolkits and language models	TPS3	70	75

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		S			S				S	M	M	L
CO3	S	S	M	L	S	S	S	S	S	S	S	S	S	S	S
CO4	S	M	L		S			S		S		S	M	M	M
CO5	S	S	M	L	S			S	S	S		S	S	M	M
CO6	S	M	L		S	S	S	S	S	S	S	S	M	S	S

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Test 1				Assignment 1				Test 2				Assignment 2				Terminal			
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
CO1	3	5	10														2	5	6	
CO2	3	5	10				30										2	5	8	
CO3	2	5	10	20			20	20	2	5	10	10			30		2	5	8	6
CO4	2	5	20				30		2	5	20				20		2	5	8	
CO5									3	5	5	5			10		2	5	8	6
CO6									3	5	20				40		2	5	8	

Syllabus

Introduction Computational Linguistics - NLTK Toolkit - Building Corpus - Web Scraping - Tokenization, Stemming, Lemmatization, Synsets, Hypernyms, WordNet, Edit Distance

Text Representation Word Vectors - BagOfWords - TF-IDF - N-grams - Word2Vec, CBOW, Skip-gram, TF-IDF Weighted Word2Vec, Glove

Text Processing Regular Expressions - Document Similarity Measures - Cosine and cluster measures - Spelling correction - POS Tagging - Sequential Tagging - MaxEnt, CRF

Language Modelling - Word Sense Disambiguation - Word Embeddings - Named Entity Recognition - Topic Modelling

Deep Learning for NLP Perceptron - Back Propagation - Feed Forward Neural Network - Recurrent Neural Network - LSTM - Seq2Seq Models - Attention Mechanism - Transformer - BERT Model - GPT-3 - Zero-Shot learning -

Speech Processing Word Boundary Detection - Argmax Computation - HMM - APIs - TextToSpeech, SpeechToText

Applications- Sentiment Analysis - Stylometry - Document Clustering - Text Summarization - Spam detection - Resume mining - Natural Language Understanding (NLU) - Chatbot - Neuro-Symbolic AI

Learning Resources

1. Hobson Lane, Cole Howard, Hannes Hapke, "Natural Language Processing in Action ", 2nd edition, Manning Publications, 2021
2. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, "Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems", O'Reilly, 2020
3. Christopher D. Manning and Hinrich Schütze, "Foundations of Natural Language Processing", 6th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003
4. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2009.
5. Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", 2nd edition, MITPress Cambridge, MA, 2003
6. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
7. <https://www.fast.ai/2019/07/08/fastai-nlp/>
8. <https://www.coursera.org/specializations/natural-language-processing>
9. <https://indiconlp.org>
10. NPTEL/SWAYAM Course – Applied Natural Language Processing, R Ramaseshan, Chennai Mathematical Institute, India

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1	Introduction	
1.1	Computational Linguistics	1
1.2	NLTK Toolkit	1
1.3	Building Corpus	1

1.4	Web Scraping	1
1.5	Tokenization, Stemming, Lemmatization	1
1.6	Synsets, Hypernyms	1
1.7	WordNet, Edit Distance	1
2	Text Representation	
2.1	Word Vectors - BagOfWords	1
2.2	TF-IDF - N-grams	1
2.3	Word2Vec	1
2.4	CBOW, Skip-gram	1
2.5	TF-IDF Weighted Word2Vec, Glove	1
3	Text Processing	
3.1	Regular Expressions	1
3.2	Document Similarity Measures	1
3.3	Cosine and cluster measures	1
3.4	Spelling correction	1
3.5	POS Tagging - Sequential Tagging	1
3.6	MaxEnt, CRF	1
4	Language Modelling	
4.1	Word Sense Disambiguation	1
4.2	Word Embedding	1
4.3	Named Entity Recognition	1
4.4	Topic Modelling	1
5	Deep Learning for NLP	
5.1	Perceptron - Back Propagation - Feed Forward Neural Network	1
5.2	Recurrent Neural Network	1
5.3	LSTM	
5.4	Seq2Seq Models	1
5.5	Transformer - BERT Model, GPT-3	1
5.6	Zero-Shot Learning	1
6	Speech Processing	
6.1	Word Boundary Detection	1
6.2	Arg max Computation	1
6.3	HMM	1
6.4	APIs	1
6.5	Text To Speech	1
6.6	Speech To Text	1
7	Applications	
7.1	Sentiment Analysis - Stylometry	1
7.2	Document Clustering Text Summarization - Spam detection-Resume mining	2
7.3	Natural Language Understanding (NLU) - Chatbot	
7.4	Neuro-Symbolic AI	
Total Lecture Hours		36

Course Designer(s):

1. A M Abirami
2. S. Pudumalar
3. S. Karthiga

abiramiam@tce.edu
 spmit@tce.edu
 skait@tce.edu

22ITRE1	REINFORCEMENT LEARNING
----------------	-------------------------------

Category	L	T	P	Credit
PEES	3	0	0	3

Preamble

The course on reinforcement learning provides an emphasis on Markov Decision Process (MDP), Dynamic Programming, Monte- Carlo Methods, Temporal Difference Learning (TDL) and Function Approximation Methods. It also facilitates the student by interpreting the real-world problems and gaming by examining with appropriate open-source tools.

Prerequisite

Machine Learning

Course Outcome

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Describe theory underlying Reinforcement Learning (RL).	TPS2	70	70
CO2	Apply Markov Decision Processes (MDPs) to solve real world problems.	TPS3	70	65
CO3	Illustrate Policy Iteration, Value Iteration and Policy Evaluation in Dynamic Programming.	TPS3	70	65
CO4	Experiment Monte- Carlo prediction method, Monte- Carlo control method and Temporal Difference Learning (TDL) algorithms like Q Learning, SARSA for the real-world scenario.	TPS3	70	65
CO5	Apply Function Approximation Methods to find an optimal behaviour strategy.	TPS3	70	65
CO6	Compare the performance of Markov Decision Processes, Monte-carlo methods, Temporal Difference Learning (TDL) algorithms and Policy gradients for the given real time application .	TPS4	70	60

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	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	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT 1			Assignment - I			CAT 2				Assignment - II				Terminal			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	10	10			10										2	5		
CO2	5	5	30			50									2	5	10	
CO3		10	30			40									2	5	15	
CO4							5	10	20				30			5	15	
CO5							5	10	20				30		2		10	
CO6							5	5		20				40	2	5		15

Syllabus

Reinforcement Learning (RL): Elements, Framework and applications, Challenges, Action-Value Methods, Optimistic Initial Values, Upper-Confidence-Bound (UCB) Action Selection, Gradient Bandit, probably approximately correct (PAC) Learning Framework

Markov Decision Processes (MDPs): - The Agent- Environment Interface, Rewards, Returns, The Markov Property, Modelling, Markov Decision Processes, Value Functions, Optimal Value Functions, Bellman equation, Optimality and Approximation

Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Banach fixed point theorem, Efficiency of Dynamic Programming.

Monte- Carlo Methods: Prediction, Estimation of action values, control without exploring starts, Incremental Approach, Off – Policy Prediction

Temporal Difference Learning (TDL): - Prediction, Optimality, Q Learning, SARSA (State-Action-Reward-State-Action) Algorithms, Gaming

Function Approximation Methods: Gradient-Descent Methods, Eligibility trace for function approximation, Control with function approximation, Least squares, Eligibility Traces for Actor Critic Methods

Learning Resources

- Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", Second Edition, MIT Press, 2019.
- Csaba Szepesvari, "Algorithms for Reinforcement learning", Morgan and ClayPool Publishers, First Edition, 2010.
- Tom M Mitchell, "Machine Learning", McGraw-Hill, Indian Edition, 2017.
- Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach." Pearson Education Limited, 2016
- https://onlinecourses.nptel.ac.in/noc19_cs55 - Reinforcement learning by Prof. Balaraman Ravindran, IIT Madras
- <https://www.coursera.org/specializations/business-analytics> - Business Analytics by Eric Bradlow et al, University of Pennsylvania

Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours
1	Reinforcement Learning (RL)	
1.1	Elements, Framework and applications	1
1.2	Challenges	
1.3	Action-Value Methods	1
1.4	Optimistic Initial Values	1
1.5	Upper-Confidence-Bound (UCB) Action Selection	1
1.6	Gradient Bandit	1
1.7	Probably approximately correct (PAC) Learning Framework	
2	Markov Decision Processes (MDPs)	
2.1	The Agent- Environment Interface	1
2.2	Rewards, Returns	1
2.3	The Markov Property	1
2.4	Modelling	1
2.5	Markov Decision Processes	1
2.6	Value Functions, Optimal Value Functions	1
2.7	Bellman equation	1
2.8	Optimality and Approximation	1
3	Dynamic Programming	
3.1	Policy Evaluation, Policy Improvement	2
3.2	Policy Iteration, Value Iteration	1
3.3	Asynchronous Dynamic Programming	2
3.4	Banach fixed point theorem	1
3.5	Efficiency of Dynamic Programming	1
4	Monte- Carlo Methods	
4.1	Prediction, Estimation of action values	1
4.2	Control without exploring starts	1
4.3	Incremental Approach	1
4.4	Off – Policy Prediction	1
5	Temporal Difference Learning (TDL)	
5.1	Prediction	1
5.2	Optimality, Q Learning	1
5.3	SARSA (State-Action-Reward-State-Action) Algorithms	1
5.4	Gaming	2
6	Function Approximation Methods	
6.1	Gradient-Descent Methods	2
6.2	Eligibility trace for function approximation	1
6.3	Control with function approximation	2
6.4	Least squares	1
6.5	Eligibility Traces for Actor Critic Methods	1
	Total Hours	36

Course Designers:

- | | | |
|----|--|--|
| 1. | C.Deisy, Professor, IT Department | cdcse@tce.edu |
| 2. | S. Sridevi, Associate Professor, IT Department | sridevi@tce.edu |
| 3. | K.V.Uma, Associate Professor, IT Department | kvuit@tce.edu |

22ITQA1**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	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-Ismail, 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

Module No.	Topic	No. of Periods
1	Basic Concepts	
1.1	Probability	1
1.2	Linear Algebra	1
2	Introduction to Machine Learning	
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
3	Supervised Learning	
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
4	Evaluation measures	
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
5	Unsupervised Learning	
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
6	Neural Networks	

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

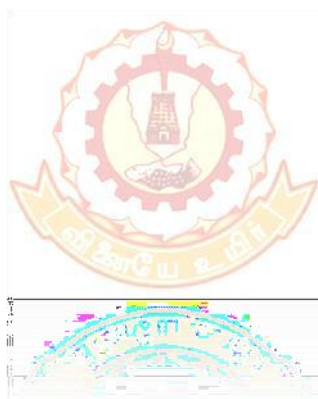
Course Designer(s):

1. Dr.C.Deisy, Professor, IT

cdcse@tce.edu

2. Ms.P.Vijaya Praba, Assistant Professor, IT

pvpit@tce.edu



22ITQB1**ARTIFICIAL INTELLIGENCE**

Category	L	T	P	Credit
EM	3	0	0	3

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				Assignment 2				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" , O'Reilly, 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.	Introduction to AI and Intelligent Agents	
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.	Solving Problems by Searching	
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.	Adversarial Search and Games	
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	Constraint Satisfaction Problem	
4.1	Defining Constraint Satisfaction Problems- Constraint Propagation	3
4.2	Inference in CSPs- Backtracking Search for CSPs	1
5	Deep Learning and Computer Vision	
5.1	Simple Feed forward Networks	2
5.2	Convolutional Neural Networks –Recurrent Neural Networks	3
5.3	GANs-Transfer Learning	2
	Computer Vision:	
5.4	Image Processing- Features Extraction	2
5.5	Classifying Images	2
5.6	Object Detection and Recognition	3
Total periods		36

Course Designers:

- | | | |
|--------------------|--------------------------|---------------|
| 1. Dr.C.Deisy, | Professor, IT Department | cdcse@tce.edu |
| 2. Dr.S.Padmavathi | Professor, IT Department | spmcs@tce.edu |

22ITQC1	SOCIAL NETWORK ANALYSIS	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					
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
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
1	Introduction	1
1.1	Motivation	
1.2	Web Graph	
1.3	Types of Social Network	1
1.4	Datasets and Formats	
1.5	SN Data Visualization Tools	2
2	Properties	
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
3	Mining Graphs	
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
4	Cascading Networks	
4.1	Diffusion in Networks	2
4.2	Power Law	1
4.3	Preferential Attachment Models	1
4.4	Small World Network	2
5	Social Network Models	
5.1	Granovetter Model	1
5.2	Schelling Model	1
5.3	Balance Theorem	1
6	Applications	
6.1	Link Prediction	1
6.2	Social media data Analysis	1
6.3	Behavioural Analysis	1
Total Lecture Hours		36

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 |

22ITQD1	Applied Data Science with Visualization	Category	L	T	P	Credit
		EM	3	0	0	3

Preamble

The course introduces concepts, methods, and real time applications of data science with visualization. It provides an emphasis on data processing techniques, rule mining, classification, and clustering techniques. It also facilitates the student by interpreting the real-world problems by examining with appropriate tools.

Prerequisite

Nil

Course Outcome

On 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	Demonstrate various Python constructs for data science	TPS3	70	65
CO2	Apply appropriate data preprocessing techniques for the given dataset	TPS3	70	65
CO3	Use Python libraries for data analysis and visualization	TPS3	70	65
CO4	Apply association rule mining algorithms to identify the association rules for the given dataset	TPS3	70	65
CO5	Apply supervised and unsupervised learning algorithms and demonstrate its performance	TPS3	70	65
CO6	Discuss information visualisation principles for dashboard design	TPS2	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	M	M	L
CO2	S	M	L		S							S	M	M	L
CO3	S	M	L		S							S	M	M	L
CO4	S	M	L		S							S	M	M	L
CO5	S	M	L		S							S	M	M	L
CO6	M	L			S							S	L	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT1			Assignment -I			CAT2			Assignment - II			Terminal Theory		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	5	5	10			20							2	5	10
CO2	5		20			30							2		15
CO3	5	5	20			30						20	2	5	10
CO4	5		20			20							2		15
CO5							5	10	60			80		5	15
CO6							10	15					2	10	

Syllabus**Introduction to Python Data Structures**

Data Science - Need, Applications, Difference between data analysis and data analytics. Python- Variables, data types, control structures, Operators, Simple operations, Array and its operations, Numpy operations, Matrix and its operations

Data preparation and pre-processing

Dealing missing values, Normalization, Transformation, statistical description about the data, Accessing the data, Summary of the data, Relationship between the data

Data Visualization:

Basic plotting Line plot, Bar plot, Pie Chart, Scatter Plot, Histogram, Stacked Bar Charts, Sub Plots, **Python libraries** Matplotlib, Seaborn, Plotly **Applied Visualization:** Box plot, Area Chart, Density plot, Heat map, Tree map

Association Rule Mining:

Frequent Itemset Mining Methods- Apriori, Frequent Pattern (FP) Tree - Mining Various Kinds of Association rules

Supervised Learning Algorithms

Decision Tree: ID3 Classifier, C4.5, CART, K-Nearest Neighbour, Performance Metrics

Unsupervised Learning Algorithms

Distance Functions, Dissimilarity between the mixed types of data, K-Means Algorithm, K-Medoids Algorithm

Information Visualization

Visual Perception and Cognition - Gestalt's Principles - Tufte's Principles - Applications of Principles of Information Visualization - Dashboard Design

Learning Resources

1. Jiawei Han, Jian Pei, Hanghang Tong "Data Mining: Concepts and Techniques", Morgan Kaufman, Fourth Edition, 2022.
2. Ian H.Witten, Eibe Frank, Mark.A. Hall, "Data Mining Practical Machine Learning Tools and Techniques", Elsevier, Fourth Edition, 2016.
3. AdelchiAzzalini, Bruno Scarpa, "Data Analysis and Data Mining: An Introduction", Oxford University Press, Third Edition, 2012.
4. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall India Learning Private Limited, Second edition, 2011.
5. <https://nptel.ac.in/courses/106/105/106105174/> - Data Mining by Prof. Pabitra Mitra, IIT Kharagpur
6. William McKinney , "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", Second Edition, O'Reilly Media, 2017.

Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours
1	Introduction to Python Data Structures	
1.1	Data Science - Need, Applications, Difference between data analysis and data analytics.	1
1.2	Python- Variables, data types, control structures	1
1.3	Operators, Simple operations, Array and its operations	1
1.4	NumPy operations, Matrix and its operations	2
2	Data preparation and pre-processing	
2.1	Dealing missing values, Normalization, Transformation	1
2.2	statistical description about the data, Accessing the data	1
2.3	Summary of the data, Relationship between the data	1
3	Data Visualization:	
3.1	Basic plotting Line plot, Bar plot, Pie Chart, Scatter Plot, Histogram, Stacked Bar Charts, Subplots	2
3.2	Python libraries: Matplotlib, Seaborn, Plotly	1
3.3	Applied Visualization: Box plot, Area Chart, Density plot, Heat map, Tree map	1
4	Association Rule Mining:	
4.1	Frequent Itemset Mining Methods- Apriori	2
4.2	Frequent Pattern (FP) Tree	2
4.3	Mining Various Kinds of Association rules	2
5	Supervised Learning Algorithms	
5.1	Decision Tree: ID3 Classifier	2
5.2	C4.5, CART	2
5.3	K-Nearest Neighbour	2
5.4	Performance Metrics	1
6	Unsupervised Learning Algorithms	
6.1	Distance Functions,	1
6.2	Dissimilarity between the mixed types of data	2
6.3	K-Means Algorithm	2

6.4	K- Medoids Algorithm	1
7	Information Visualization	
7.1	Visual Perception and Cognition	1
7.2	Gestalt's Principles	2
7.3	Tufte's Principles	
7.4	Applications of Principles of Information Visualization	1
7.5	Dashboard Design	1
	Total	36

Course Designers:

Dr.S.Sridevi, Associate Professor, IT Department

sridevi@tce.edu

Dr.A.M. Abirami, , Associate Professor, IT Department

abiramiam@tce.edu

Mrs.S.Pudumalar ,Assistant Professor, IT Department

spmrit@tce.edu

22ITQE1

Business Analytics

Category L T P Credit

EM 3 0 0 3

Preamble

The course aims to provide the detailed knowledge in Business Analytics for decision-making process. The course enables the learners to enhance their management and decision-making skills with selecting suitable data modelling and analytics tools and techniques.

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 fundamental concepts of Business Analytics.	TPS2	70	70
CO2	Apply Excel Functions, queries, and Visualization in solving the business-related problems.	TPS3	70	65
CO3	Use descriptive analytics to summarize and interpret the data.	TPS3	70	65
CO4	Demonstrate the performance of various predictive analytics techniques.	TPS3	70	65
CO5	Demonstrate the practical applications of social media analytics in marketing, brand management and social media strategy etc.	TPS3	70	65
CO6	Analyze the data using statistical and data analytic techniques for the real time business problems.	TPS4	70	60

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	M	L										L	L		L
CO2	S	M	L		S							M	M	M	L
CO3	S	M	L		M							M	M	M	L
CO4	S	M	L		S							S	M	M	L
CO5	S	M	L	L	S							S	M	M	L
CO6	S	S	M	L	S							S	S	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT1			Assignment -I				CAT2			Assignment - II				Terminal Theory					
TPS Scale	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	5	6
CO1	10	10			10										2	5				
CO2	5	5	30			50									2		15			
CO3		10	30			40									2		15			
CO4								5	5	30			30		2	5	15			
CO5								5	5	20			30		2	5	10			
CO6								5	5	20			20	20		5	15			

Syllabus

Fundamentals of Business Analytics: Scope, Framework, Types of Data, Classification of Business Analytics, Trends of Business Analytics, and applications of Business Analytics

Analytics on Spreadsheets: Excel Formulas, Excel Functions, Data Queries, Spread Sheet – Add -Ins for Business Analytics, Data Visualization

Descriptive Analytics: Populations and samples, Statistical notations, Measures of Dispersion, and Measures of Association, Statistical measures for summarizing the data

Predictive Analytics: Decision tree Classifier, Random Forest, Moving average, Exponential smoothing, Trend, Cyclical and seasonality components, ARIMA (autoregressive integrated moving average), Seasonal Autoregressive Integrated Moving Average (SARIMA), Vector Autoregression (VAR), Forecasting using Prophet

Social Media Analytics: Need, Key Performance Indicators - Digital Marketing: 7Ps of Marketing, Methods of Digital Marketing - SMA tools : Case Study with Google Analytics Tool

Learning Resources

U.Dinesh Kumar , “Business Analytics: The Science of Data - Driven Decision Making”, Wiley, First Edition, 2017.

Galit Shmueli, Nitin R Patel, Peter C Bruce, “Data Mining for Business Intelligence: Concepts, Techniques and Applications in Microsoft Office Excel with XLMiner” Wiley, First Edition, 2008.

Foster Provost and Tom Fawcet, "Data Science for Business", O'Reilly Media, First Edition, 2013.

James R Evans, “Business Analytics – Methods, Models and Decisions,” Pearson, Second Edition, 2017.

https://onlinecourses.nptel.ac.in/noc23_mg54/preview - Business Analytics For Management Decision By Prof. Rudra P Pradhan, IIT Kharagpur.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Fundamentals of Business Analytics	
1.1	Scope, Framework, Types of Data	2
1.2	Classification of Business Analytics	1
1.3	Trends of Business Analytics and applications of Business Analytics	2
2	Analytics on Spreadsheets	
2.1	Excel Formulas, Excel Functions	2
2.2	Data Queries, Spread Sheet – Add -Ins for Business Analytics	2
2.3	Data Visualization	2
3	Descriptive Analytics	
3.1	Populations and samples	2
3.2	Statistical notations	1
3.3	Measures of Dispersion and Measures of Association	2
3.4	Statistical measures for summarizing the data	2
4	Predictive Analytics	
4.1	Decision tree Classifier	2
4.2	Random Forest	1
4.3	Moving average	1
4.4	Exponential smoothing, Trend, Cyclical and seasonality components	2
4.5	ARIMA (autoregressive integrated moving average)	1
4.6	Seasonal Autoregressive Integrated Moving Average (SARIMA), Vector Autoregression (VAR)	2
4.7	Forecasting using Prophet	2
5	Social Media Analytics	
5.1	Need, Key Performance Indicators	1
5.2	Digital Marketing: 7Ps of Marketing	1
5.3	Methods of Digital Marketing	1
5.4	SMA tools	2
5.5	Case Study with Google Analytics Tool	2
	Total Hours	36

Course Designers:

1. Dr.S.Sridevi, Associate Professor, IT Department
2. Dr.K.V.Uma, Associate Professor, IT Department
3. Dr.S.Karthiga, Assistant Professor, IT Department

sridevi@tce.edu
kvuit@tce.edu
skait@tce.edu

**22ITQF1 STATISTICAL ANALYSIS AND
COMPUTING**

Category	L	T	P	Credit
EM	3	0	0	3

Preamble

The course helps you make sense of data by identifying patterns, relationships, and trends within it for making informed decisions in various fields, from science and engineering to business and finance.

Prerequisite

- NIL

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Perform data analysis using different probability distribution methods	TPS3	70	70
CO2	Perform statistical testing techniques and make inferences for the given dataset	TPS3	70	70
CO3	Use suitable regression techniques for any given dataset	TPS3	70	70
CO4	Apply different feature selection techniques for real datasets	TPS3	70	70
CO5	Demonstrate a fundamental understanding of the various Python constructs for data science	TPS2	70	80
CO6	Develop real-time applications using mathematical and statistical models	TPS3	70	70

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT			Assignment			CAT			Assignment			Terminal					
	1			1			2			2			Theory					
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	10	10	10			20							2	5	10			
CO2	10	10	20			40							2	10	15			
CO3	10	10	10			40		10	10				2	5	10			
CO4							10	10	25			10	2	5	10			
CO5							10	10			10		2	10				
CO6							5	5	5			80		5	5			

CO6 COVERED THROUGH MINI PROJECT**Syllabus**

Data Analysis and Probability Distributions Introduction to Data Analysis - Types of Data – Types of Variables - Central Tendency and Dispersion - Probability Distributions - Random variable, Variance, Covariance, Correlation Coefficient - Discrete Probability Distributions - Binomial, Poisson - Continuous Probability Distributions - Uniform, Exponential, Normal - Python functions for Distributions

Statistical Testing Sampling and Sampling distributions - Confidence Interval Estimation - Hypothesis Testing - Null and Alternative Hypothesis - Type 1 and Type 2 errors - One sample test, Two sample test - Analysis of Variance - 1 way ANOVA - 2 way ANOVA - F test - Turkey test, ANOVA for Randomized Design - Python functions for Statistical testing

Regression Analysis Linear Regression - Least Square Method, Coefficient of Determination, Significance Test - Estimation and Prediction - Residual Analysis - Multiple Linear Regression - Python functions for Regression Analysis - Maximum Likelihood Estimation (MLE) - MLE and Distributions - Logistic Regression - Confusion Matrix - ROC Curve - Regression Analysis Model Building - Linear vs Logistic Regression

Feature Selection Chi-square test - Fisher's score - Information Gain - Factor Analysis - Principal Component Analysis - Linear Discriminant Analysis - Python functions for feature selection

Text Book

1. Douglas Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers" 6th edition, Wiley, 2017

Reference Books & web resources

1. William McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", 2nd Edition, O'Reilly Media, 2017

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1.	Data Analytics and Probability Distributions	
1.1	Introduction to Data Analysis - Types of Data – Types of Variables	1
1.2	Central Tendency and Dispersion	1
1.3	Probability Distributions - Random variable, Variance, Covariance, Correlation Coefficient	1
1.4	Discrete Probability Distributions - Binomial, Poisson	2

1.5	Continuous Probability Distributions - Uniform, Exponential, Normal	2
1.6	Python functions for Distributions	1
2	Statistical Testing	
2.1	Sampling and Sampling distributions	1
2.2	Confidence Interval Estimation	1
2.3	Hypothesis Testing - Null and Alternative Hypothesis Type 1 and Type 2 errors	2
2.4	One sample test, Two sample test	1
2.5	Analysis of Variance - 1 way ANOVA - 2 way ANOVA- F test - Turkey test	3
2.6	ANOVA for Randomized Design	1
2.7	Python functions for Statistical testing	1
3	Regression Analysis	
3.1	Linear Regression- Least Square Method	1
3.2	Coefficient of Determination, Significance Test - Estimation and Prediction - Residual Analysis	2
3.3	Multiple Linear Regression - Python functions for Regression Analysis	2
3.4	Maximum Likelihood Estimation (MLE) - MLE and Distributions	2
3.5	Logistic Regression	1
3.6	Confusion Matrix - ROC Curve - Regression Analysis Model Building	1
3.7	Linear vs Logistic Regression	1
4.	Feature Selection	
4.1	Chi-square test- Fisher's score	1
4.2	Information Gain	1
4.3	Factor Analysis	2
4.4	Principal Component Analysis	2
4.5	Linear Discriminant Analysis	1
4.6	Python functions for feature selection	1
	Total Lectures	36

Course Designer(s):

1. A.M.Abirami Associate Professor, abiramiam@tce.edu, Information Technology
2. S.Karthiga , Assistant Professor, skit@tce.edu, Information Technology
3. Pudumalar.S, Assistant Professor, spmit@tce.edu, Information Technology

22IT1A1**MLOPS**

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

This course provides foundational knowledge and practical skills required for effective deployment of ML solutions. It deals with the key components of MLOps, traditional ML deployment methodologies, infrastructure considerations, version control strategies, CI/CD pipelines, and real-world case studies

Prerequisite

- NIL

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	Explain the fundamental concepts of MLOps including lifecycle, objectives and key components	TPS 2	70	70
CO2	Appraise the suitability of cloud versus on-premises infrastructure for ML Ops	TPS 4	70	70
CO3	Use Version control and collaboration techniques effectively on platforms such as Git, Git lab.	TPS 3	70	70
CO4	Design CI/CD pipelines for ML projects, integrating them with version control systems	TPS 3	70	70
CO5	Deploy ML models using suitable cloud-based tools	TPS 3	70	70
CO6	Integrate ML models with necessary storage and monitoring tools such as S3, CloudWatch	TPS 3	70	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	L		
CO2	S	S	M	L		L	L	L	M	M	L	L	S	L	M
CO3	S	M	L		M	L	L	L	M	M	L	L	M	M	M
CO4	S	M	L		M	L						L	M	M	
CO5	S	M	L		M	L	L	L	M	M	L	L	M	M	M
CO6	S	M	L		M	L	L	L	M	M	L	L	M	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Internal (Miniproject)						Terminal					
	1	2	3	4	5	6	1	2	3	4	5	6
TPS Scale												
CO1	-	-	-	-	-	-	5	5	-	-	-	-
CO2	-	-	10	20	-	-	-	5	10	10	-	-
CO3	-	-	10	-	-	-	5	5	10	-	-	-
CO4	-	-	20	-	-	-	-	5	10	-	-	-
CO5	-	-	20	-	-	-	-	5	10	-	-	-
CO6	-	-	20	-	-	-	-	5	10	-	-	-

Syllabus

MLOps Basics: ML Lifecycle Overview – MLOps: Definition, Objectives, Key Components – Traditional ML Deployment – Challenges – MLOps Workflow

Infrastructure for MLOps: Cloud vs. On-premises infrastructure for ML Ops - Storage options: Object storage, file storage, and databases - Containerization and orchestration for ML deployment – AutoML services

Version Control and Collaboration: Git – Git Workflow for ML Projects – Best practices for collaborating on ML Projects

CI/CD pipelines for ML: Design – Integration with Version control systems - Jenkins, GitLab: Overview, Setup – Configuring Automated Tests

Case Study: AWS Sagemaker – Overview – Components – Pre-built models – Integration with Storage, Serverless functions – Monitoring.

Learning Resources

1. Treveil M, Omont N, Stenac C, Lefevre K, Phan D, Zentici J, Lavoillotte A, Miyazaki M, Heidmann L. Introducing MLOps. O'Reilly Media; 2020 Nov 30.
2. MLOps Guide - <https://huyenchip.com/mlops/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	MLOps Basics	
1.1	ML Lifecycle Overview – MLOps: Definition, Objectives, Key Components	1
1.2	Traditional ML Deployment – Challenges	1
1.3	MLOps Workflow	1
2	Infrastructure for MLOps	
2.1	Cloud vs. On-premises infrastructure for ML Ops	1
2.2	Storage options: Object storage, file storage, and databases	1
2.3	Containerization and orchestration for ML deployment	1
3	Version Control and Collaboration	
3.1	Git – Git Workflow for ML Projects	1

Module No.	Topic	No. of Periods
3.2	Best practices for collaborating on ML Projects	1
4	CI/CD pipelines for ML	
4.1	Design – Integration with Version control systems	1
4.2	Jenkins, GitLab: Overview	1
4.3	Setup – Configuring Automated Tests	1
5	Case Study	
5.1	AWS Sagemaker – Overview – Components	1
5.2	Pre-built models	1
5.3	Integration with Storage, Serverless functions – Monitoring	1
	Total	14

Course Designer(s):

1. Mr.T.Sasikumar, tmsasikumar@gmail.com, Senior Technical Consultant, Thoughtworks, Chennai
2. Dr.S.Padmavathi, spmcse@tce.edu, Professor, IT,TCE
3. Mrs.S.Thiruchadai Pandeewari, eshwarimsp@tce.edu, APIT,TCE
4. Dr..K.R.Premalatha, krplit@tce.edu, APIT, TCE

Industry Expert Profile

Mr. T. Sasikumar is a full stack developer with **14+ years** of experience in leading multiple development teams building high performance enterprise platforms. Proficient in eXtreme Programming (XP) practices and Agile methodologies. Of late He is also playing the role of a data engineer building streaming platforms using Apache Kafka eco system.

22IT1B1 DATA PROCESSING AND VISUALIZATION USING BIG DATA TOOLS

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

The term "big data" has become increasingly common in discussions about IoT, machine learning, and artificial intelligence, largely due to the immense volume of data these technologies generate. This flood of data enables algorithms and tools to uncover patterns and insights, transforming raw data into decision support models. This course is designed to offer hands-on experience in big data techniques and technologies, specifically focusing on their application to various forms of real-time data.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the use of big data platforms for big data management	TPS2	70	85
CO2	Set up big data analytical environment for big data processing and management	TPS2	70	85
CO3	Apply Spark platform for big data applications like energy exploration, financial market analysis, fraud detection, medical records and image analysis	TPS3	70	75
CO4	Use Airflow platform for large scale data processing	TPS3	70	75
CO5	Use data visualization and interactive tools for exploratory data analysis and data insights	TPS4	70	65
CO6	Use big data platforms, machine learning algorithms and visualizations for real time applications	TPS4	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			S			S				M	L	M	L
CO2.	M	L			S			S				M	L	M	L
CO3	S	M	L		S			S				M	M	M	L
CO4	S	M	L		S			S				M	M	M	L
CO5	S	S	M	L	S			S				S	S	M	L
CO6	S	S	M	L	S	M	M	S	M	M	L	S	S	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Continuous Assessment Test						Terminal					
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	3					2	6				
CO2	2	3					2	6	10			
CO3			10				2	6	10			
CO4			10				2	6	10			
CO5			10	10			2	6	10	6		
CO6	5	5	30	10			2	6		6		

Syllabus

Introduction to Big Data Types - Characteristics - Big Data Analytics - Big Insights and Big Sheets

Big Data Processing Distributed Datasets - Data Integration - Data Processing - Inference - Dashboard - Data aware to Data Driven Organization - AI powered search and analytics

Big data Analytics Platforms

Spark - Features - Architecture – Workers, Cluster Managers, Driver Programs, Executors, Tasks - Environment Set up and Installation - Use cases - Data Analysis - PySpark, Spark SQL

Airflow - Features - Architecture - Big data orchestration - Environment Set up and Installation - Use cases - Integration with Big Data Platforms - Advantages and Disadvantages

Interactive Data Visualization and Tools Tableau **Applications** Geo spatial analytics, Multimodal data analytics

Learning Resources

1. Raj Kamal, Preeti Saxena, "Big Data Analytic:: Introduction to Hadoop, Spark and Machine Learning", McGraw Hill, 2019.
2. Jules S Damji, Brooke Wenig, Tathagata Das, "Learning Spark: Lightning-Fast Data Analytics", O'Reilly, 2nd Edition, 2020
3. Bas P Harensak, Julian Rutger de Ruiter, "Data Pipelines with Apache Airflow", Manning, 2021.
4. Hayden Van Der "Dashboard Playbook: Data Viz to Data Wiz: Tableau & Power BI", Reactive Publishing, 2023
5. <https://onlinemaps.surveyofindia.gov.in/PricingPolicy.aspx>
6. <https://tn.data.gov.in/dataset-group-name/gis>
7. <https://data.world/>
8. <https://www.kaggle.com/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Big	
1.1	Types	1
1.2	Characteristics	
1.3	Big Data Analytics	

Module No.	Topic	No. of Periods
1.4	Big Insights and Big Sheets	
2	Big Data Processing	
2.1	Distributed Datasets	1
2.2	Data Integration	
2.3	Data Processing	
2.4	Inference	
2.5	Dashboard	1
2.6	Data aware to Data Driven Organization	
2.7	AI powered search and analytics	
3	Big data Analytics Platforms - Spark	
3.1	Features	2
3.2	Architecture - Workers, Cluster Managers, Driver Programs, Executors, Tasks	
3.3	Environment Set up and Installation	3
3.4	Use cases	
3.5	Data Analysis - PySpark, Spark SQL	
4	Big data Analytics Platforms - Apache Airflow	
4.1	Features	2
4.2	Architecture	
4.3	Big data orchestration	2
4.4	Environment Set up and Installation	
4.5	Use cases	
4.6	Integration with Big Data Platforms	2
4.7	Advantages and Disadvantages	
5	Interactive Data Visualization and Tools	
5.1	Tableau	1
5.2	Applications - Geo spatial, multimodal data analytics	1
	Total Lecture Hours	16

Course Designer(s):

1. K Vijay Kumar, Scientist - E, Joint Director
CDAC Chennai
2. A M Abirami
3. K V Uma

vijayk@cdac.in

abiramiam@tce.edu

kvuit@tce.edu

22IT1C1 WEB APPLICATION SECURITY

Category L T P Credit
PEES 1 0 0 1

Preamble

The primary goal of application security is to fortify an application with robust and efficient security measures. These measures aim to reduce the likelihood of attackers being able to manipulate applications and gain unauthorized access to, steal, alter, or delete sensitive data.

Prerequisite

Nil

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	Understand the recent security breaches' impact on businesses and the role of security frameworks in ensuring web application security.	TPS2	70	75
CO2	Apply SSL/HTTP protocols and security response headers to secure web communication and address common vulnerabilities.	TPS3	70	70
CO3	Analyze OWASP Top 10 risks by identifying vulnerabilities like Broken Access Control, Injection, etc.	TPS4	70	65
CO4	Implement secure coding and prevention strategies to mitigate Server-Side Forgery and prevent AWS Buckets Takeovers.	TPS3	70	70
CO5	Evaluate the implemented security measures' effectiveness in mitigating web application risks using practical scenarios.	TPS4	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			S							S	L	M	L
CO2.	S	M	L		S			S				S	M	M	M
CO3.	S	S	M	L	S	S		S	M	M	M	S	S	S	M
CO4.	S	M	L		S			S				S	M	M	M
CO5.	S	S	M	L	S	S		S			M	S	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Internal						Terminal					
	(Mini-project)											
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1		10						10				
CO2			20					5	15			
CO3			10	10				10		15		
CO4			20					5	15			
CO5			20	10				10		15		

Syllabus

Introduction to Web Application Security: Overview - Security breaches - Security frameworks – Need for robust web application security.

Common Protocols and Security Response Headers: ESSL/HTTP protocols - Security response headers - Implementation.

OWASP Top 10 Overview: (Practical sessions) OWASP web application security risks – Broken Access Control, Crypto Failures, Injection, Insecure Design, Misconfigurations, Vulnerable & Outdated Components, Identification & Authentication Failures, Software & Data Integrity Failures, Log Failures

Secure Coding and Prevention Strategies: Mitigation Strategies: Server-Side Forgery Requests, Secure coding approaches, AWS Buckets Takeovers prevention, and Server Takeovers prevention - Shift Left security approach - Threat modelling in development lifecycle.

Text Book

1. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", O'Reilly Media, First Edition, 2023

Reference Books& web resources

1. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws," 2nd Edition, Wiley, 2011, ISBN: 1118026470/978-1118026472.
2. Stuart McClure, Joel Scambray, Kurtz, "Hacking Exposed 7: Network Security Secrets & Solutions", 7th Edition, McGraw-Hill Prof Med/Tech, 2012, ISBN 13: 9780071780285
3. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2011, ISBN-13: 9780132126953
4. OWASP Security Testing Guide
(https://www.owasp.org/index.php/File:OWASP_Testing_Guide_v2_pdf.zip)
5. OWASP: <http://www.owasp.org>
6. WASC: <http://www.webappsec.org/>
7. SANS: <http://www.sans.org>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Web Application Security	
1.1	Overview - Security breaches	1
1.2	Security frameworks – Need for robust web application security	1
2	Common Protocols and Security Response Headers	
2.1	ESSL/HTTP protocols	1
2.2	Security response headers - Implementation	1
3	OWASP Top 10 Overview	
3.1	OWASP web application security risks – Broken Access Control, Crypto Failures, Injection, Insecure Design, Misconfigurations	2
3.2	Vulnerable & Outdated Components, Identification & Authentication Failures	2
3.3	Software & Data Integrity Failures, Log Failures	1
4	Secure Coding and Prevention Strategies	
4.1	Mitigation Strategies: Server-Side Forgery Requests, Secure coding approaches	2
4.2	AWS Buckets Takeovers prevention, and Server Takeovers prevention	1
4.3	Shift Left security approach	1
4.4	Threat modelling in development lifecycle	1
	Total	14

Course Designer(s):

- | | |
|--|----------------|
| 1. Prateek Tiwari, Security head, Zomato | pt@zomato.com |
| 2. M.Suguna | msecse@tce.edu |
| 3. R Parkavi | rpit@tce.edu |

22ITGA1**DATABASE MANAGEMENT
SYSTEMS**

Category	L	T	P	Credit
IE	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	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain structured, unstructured data and Data Base Management Systems.	TPS2	70	80
CO2	Implement Java Database connectivity by executing DDL and DML commands for the given application.	TPS3	70	70
CO3	Illustrate the use of complex query languages to populate, update and retrieve the data from database.	TPS3	70	70
CO4	Use PL/SQL to perform various Query operations for a given database.	TPS3	70	70
CO5	Apply normalization techniques to design a database for a given application.	TPS3	70	70
CO6	Explain transaction, concurrency control mechanism.	TPS2	70	80

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		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		

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	10	
CO2	5	5	30			50							5		10
CO3	5	5	30			50							5		15
CO4							5		35			50	5	5	15
CO5								15	25			50		5	10
CO6							5	15						10	

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-Single row and Multi-row Subquery, Date and String functions. Database Connectivity-JDBC

Programming Language Extension to SQL (PL/SQL)– Fundamentals, Control Structures, PL/SQL – Cursor, Trigger, Function , Procedure ,Package and Exception.

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

Text Book

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, Seventh Edition, 2016

Reference Books & web resources

1. Nilesh Shah, "Database Systems using Oracle", 2nd edition, Prentice Hall of India Pvt Ltd, 2007
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 Periods
1	Database Systems Concepts and Data Modelling	
1.1	Structured data, unstructured data and Information	1
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
2	NOSQL Database	
2.1	NOSQL Key-Value Stores- Column-Based or Wide Column NOSQL Systems.	2
3	Database query language	
3.1	Basic SQL- Data types	2
3.2	Types of Constraints	1
3.3	Views	1
3.4	Simple Queries	3
3.5	Complex Queries- Single row and Multi-row Subquery	3
3.6	Date and String functions	2
3.7	Database Connectivity-JDBC	2
4	Programming Language Extension to SQL (PL/SQL)	
4.1	Control Structures	2

4.2	PL/SQL - Cursor	2
4.3	Trigger, Function	2
4.4	Procedure	1
4.5	Exception, Package	1
5	Database Design Theory and Normalization	
5.1	Functional Dependencies	1
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
6	Transaction, Concurrency Control, and Enterprise Architecture	
6.1	Properties of Transaction	1
6.2	Two Phase Locking	1
	Total Lectures	36

Course Designer(s):

1. Dr.S.Sridevi ,Associate Professor sridevi@tce.edu
2. Dr.K.V.Uma, Associate Professor kvuit@tce.edu
3. Ms.S.Pudumalar , Assistant Professor spmit@tce.edu

22ITGB1**KOTLIN PROGRAMMING**

Category	L	T	P	Credit
IE	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

- None

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	Apply the fundamentals of the Kotlin Programming language	TPS3	70	70
CO2	Make use of Functions and Lambdas expressions to solve a problem using Kotlin	TPS3	70	70
CO3	Apply OOP concepts using Kotlin for the given application	TPS3	70	70
CO4	Use Collections and Annotations to the given application	TPS3	70	70
CO5	Illustrate interoperability between Kotlin and Java and apply the regular expressions for the given application	TPS3	70	70
CO6	Develop professional applications using Kotlin language for any real time problem.	TPS3	70	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.	S	M	L		M								S	M	
CO2.	S	M	L		M								S	M	
CO3.	S	M	L		M								S	M	
CO4.	S	M	L		S								S	S	
CO5.	S	M	L		S								S	S	
CO6.	S	M	L		S			S	S	S		M	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	TEST 1			Assignment 1			TEST 2			Assignment 2			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	5	5	10										2	5	10
CO2	10	10	30			50							2	5	10
CO3			30			50			10				2	5	15
CO4							10	10	30			20	2	5	15
CO5							10	10	20			30	2	5	10
CO6												50			5

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

Text Book

1. Peter Späth, “Pro Android with Kotlin: Developing Modern Mobile Apps with Kotlin and Jetpack”, 2nd edition, 2022

Reference Books & web 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, 2nd edition, 2019.
4. <https://developer.android.com/kotlin/campaign/learn>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction	
1.1	History of Kotlin	1
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	Kotlin Functions	
2.1	Control Flows	1
2.2	Functions – Recursion Function	1
2.3	Kotlin Lamdas	2
2.4	Higher order function – Inline Functions	1
2.5	Arrays,Mutable Array	2
3	Kotlin OOPs	
3.1	Class and Object, Nested and Inner Class	
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	Collections & Annotation	
4.1	Kotlin Collections	1
4.2	List: listOf() , mutableListOf()	2
4.3	Kotlin ArrayList ,arrayListOf()	2
4.4	Map: mapOf() , Kotlin HashMap ,hashMapOf() ,mutableMapOf()	2
4.5	Set: setOf() ,mutableSetOf() , hashSetOf()	1
4.6	Reflection - Annotations	1
5	Java Interoperability & Regex	
5.1	Calling Java code from Kotlin	1
5.2	Calling Kotlin code from Java	1
5.3	Regular Expressions	1
5.4	Regex Patterns	1
	Total Lectures	36

Course Designer(s):

1. Dr.S.Karthiga, Assistant Professor, IT
2. Ms.C.V.Nisha Angeline, Assistant Professor, IT

skait@tce.edu
cvnait@tce.edu

22ITGC1**OBJECT ORIENTED
PROGRAMMING WITH JAVA**

Category	L	T	P	Credit
IE	3	0	0	3

Preamble

This course aims to provide students with broad theoretical and practical skills in object oriented programming. This course focuses on various OOP concepts such as Encapsulation, Inheritance and Polymorphism. It also focuses on various libraries for programming an interactive real world application.

Prerequisite

- None

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	Apply programming constructs like data types, operators, condition and looping control structures, arrays for the given problem	TPS3	70	70
CO2	Apply the object-oriented concepts such as encapsulation, inheritance and polymorphism for the given problem	TPS3	70	70
CO3	Apply JAR, package, and exception handling mechanism for the given problem.	TPS3	70	70
CO4	Use various libraries like String, I/O, Collection classes for the given problem.	TPS3	70	70
CO5	Develop interactive, user friendly applications through Event Handling for the given problem.	TPS3	70	70
CO6	Develop an application in Java through OOP concepts and its libraries for a real-time problem	TPS3	70	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.	S	M	L		M								S	M	
CO2.	S	M	L		M								S	M	
CO3.	S	M	L		M								S	M	
CO4.	S	M	L		S								S	S	
CO5.	S	M	L		S								S	S	
CO6.	S	M	L		S			S	S	S		M	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	TEST 1			Assignment 1			TEST 2			Assignment 2			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	5	5	10										2	5	10
CO2	10	10	30			50							2	5	10
CO3			30			50			10				2	5	15
CO4							10	10	30			20	2	5	15
CO5							10	10	20			30	2	5	10
CO6												50			5

Syllabus

Programming Constructs: Data types, Operators, Condition and Looping Control structures, Arrays

Object Oriented Programming Concepts: Encapsulation - Object and Class, Methods, Constructors, Inheritance, Polymorphism, Abstract class and Interfaces

Packages and Exception Handling: JAR Operations, 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, LinkedList, Iterator, ListIterator, StringTokenizer

Event Handling: AWT Components, Events, Listeners. Layouts

Text Book

1. Herbert Schildt, "Java : The Complete Reference", McGraw-Hill. Twelfth Edition, 2022.

Reference Books & web resources

1. Paul Deitel and Harvey Deitel, "Java How to Program (Early Objects)", Pearson, Eleventh Edition, 2018.
2. E.Balagurusamy, "Programming with Java", McGraw-Hill, Fifth Edition, 2014.
3. Kathy Sierra, "Head First Java", Shroff publications, Second edition, 2005.
4. <https://docs.oracle.com/javase/tutorial/index.html>

Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours
1	Programming Constructs	
1.1	Data types, Operators	1
1.2	Conditional and Looping Control structures	2
1.3	Arrays	1
2	Object Oriented Programming Concepts	
2.1	Encapsulation - Object and Class	2

2.2	Methods and Constructors	2
2.3	Inheritance	2
2.4	Polymorphism	2
2.5	Abstract class and Interfaces	2
3	Packages and Exception Handling	
3.1	JAR Operations	2
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
4	Libraries	
4.1	String Class and its methods	1
4.2	File I/O	1
4.3	Collection Framework	1
4.4	ArrayList, LinkedList	2
4.5	Iterator, ListIterator	1
4.6	StringTokenizer	1
5	Event Handling	
5.1	AWT Components	2
5.2	Events	2
5.3	Listeners, Layouts	2
	Total Lectures	36

Course Designer(s):

1. Dr.P.Karthikeyan, Associate Professor, IT
2. Ms.C.V.Nisha Angeline, Assistant Professor, IT

karthikit@tce.edu
cvnait@tce.edu

22ITGD1**SOFTWARE ENGINEERING**

Category	L	T	P	Credit
IE	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	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Compare various software process models and Devops practices.	TPS2	70	80
CO2	Identify functional and non-functional requirements for any given problem and document it systematically.	TPS3	70	70
CO3	Prepare design documents with standards for any given user requirements.	TPS3	70	70
CO4	Build optimal test cases using appropriate testing techniques.	TPS3	70	70
CO5	Illustrate the benefits upon usage of version controlling and tracking mechanisms in software development	TPS2	70	80
CO6	Develop an application using software engineering best practices and standards.	TPS3	70	70

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT			Assignment			CAT			Assignment			Terminal					
	1			1			2			2								
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	8	20											3	10				
CO2	8	10	20			50							3	5	20			
CO3	4	10	20			50			10			10	3	5	20			
CO4							8	10	25			30	3	5	10			
CO5							8	20					3	5				
CO6							4	10	5			60			5			

CO6 COVERED THROUGH MINI PROJECT

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Software Process: Traditional Process Models Vs Agile Methodologies, Software Quality Attributes, Roles and responsibilities of software project manager, Devops-lifecycle process, principles and practices.

Software Requirements Analysis: Requirement Gathering techniques – User story map - Functional Requirements - Non-functional Requirements, Use Cases –SRS Documentation.

Software Design: Design concepts, Design notations, Design techniques-UML diagrams, Data Flow Diagrams, Microservices architecture-Design guidelines, Design Tools, Documentation.

Software Development: Coding standards, code inspection, reviews and walkthroughs.

Software Testing: Testing process, Testing levels- Black box testing, White box testing, Unit testing, Integration testing, System testing, Test case generation.

Software Configuration and maintenance Management: Tasks- version control- tracking- VC tools- Git, CVS, Monotone, Bazaar- software release and maintenance, reverse engineering and reengineering.

Text Book

1. Software Engineering: A Practitioner's Approach By Roger S. Pressman and Bruce Maxim McGraw-Hill Higher International; ISBN-10: 1259872971; ISBN-13: 978-1259872976, 9 th Edition (09/2020) .

Reference Books& web resources

1. Rajib Mall, "Fundamentals of Software Engineering", PHI, 4th edition, 2014.
2. PankajJalote, An integrated approach to Software Engineering, Springer/Narosa.
3. Ian Sommerville, Software Engineering, Addison-Wesley 10th edition, 2015.
4. Orit Hazzan, Yael Dubinsky, "Agile software engineering II", Springer, 2014
5. Agile Project Management: Creating Innovative Products (2nd Edition) 2nd Edition by [Jim Highsmith](#).
6. P. Bourque and R.E. Fairley, eds., Guide to the Software Engineering Body of Knowledge, Version 3.0, IEEE Computer Society, 2014; www.swebok.org.
6. <https://www.edx.org/learn/software-engineering/>
7. <https://cloudacademy.com/blog/introduction-to-devops/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1.	Software Process	
1.1	Traditional Process Models Vs Agile Methodologies	2
1.2	Software Quality Attributes	1
1.3	Roles and responsibilities of software project manager	

1.4	Devops-lifecycle process	2
1.5	Devops principles and practices	1
2	Software Requirements Analysis	
2.1	Requirement Gathering techniques	1
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	Software Design	
3.1	Design concepts	1
3.2	Design notations	1
3.3	Design techniques	4
3.4	Design guidelines	1
3.5	Microservices architecture	1
3.6	Design Tools	1
3.7	Documentation	1
4.	Software Development	
4.1	Coding standards	1
4.2	code inspection ,reviews and walkthroughs	1
5.	Software Testing	
5.1	Testing process	1
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
6	Software Configuration and maintenance management	
6.1	Tasks	1
6.2	version control	
6.3	tracking ,tracking tools	1
6.4	Software release and maintenance	1
6.5	Reverse engineering and reengineering.	1
	Total Lectures	36

Course Designer(s):

1. Pudumalar.S, Assistant Professor, spmit@tce.edu, Information Technology
2. Ilankumaran.S, Assistant Professor, siit@tce.edu, Information Technology

22IT1A1**MLOPS**

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

This course provides foundational knowledge and practical skills required for effective deployment of ML solutions. It deals with the key components of MLOps, traditional ML deployment methodologies, infrastructure considerations, version control strategies, CI/CD pipelines, and real-world case studies

Prerequisite

- NIL

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	Explain the fundamental concepts of MLOps including lifecycle, objectives and key components	TPS 2	70	70
CO2	Appraise the suitability of cloud versus on-premises infrastructure for ML Ops	TPS 4	70	70
CO3	Use Version control and collaboration techniques effectively on platforms such as Git, Git lab.	TPS 3	70	70
CO4	Design CI/CD pipelines for ML projects, integrating them with version control systems	TPS 3	70	70
CO5	Deploy ML models using suitable cloud-based tools	TPS 3	70	70
CO6	Integrate ML models with necessary storage and monitoring tools such as S3, CloudWatch	TPS 3	70	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	L		
CO2	S	S	M	L		L	L	L	M	M	L	L	S	L	M
CO3	S	M	L		M	L	L	L	M	M	L	L	M	M	M
CO4	S	M	L		M	L						L	M	M	
CO5	S	M	L		M	L	L	L	M	M	L	L	M	M	M
CO6	S	M	L		M	L	L	L	M	M	L	L	M	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Internal (Miniproject)						Terminal					
	1	2	3	4	5	6	1	2	3	4	5	6
TPS Scale												
CO1	-	-	-	-	-	-	5	5	-	-	-	-
CO2	-	-	10	20	-	-	-	5	10	10	-	-
CO3	-	-	10	-	-	-	5	5	10	-	-	-
CO4	-	-	20	-	-	-	-	5	10	-	-	-
CO5	-	-	20	-	-	-	-	5	10	-	-	-
CO6	-	-	20	-	-	-	-	5	10	-	-	-

Syllabus

MLOps Basics: ML Lifecycle Overview – MLOps: Definition, Objectives, Key Components – Traditional ML Deployment – Challenges – MLOps Workflow

Infrastructure for MLOps: Cloud vs. On-premises infrastructure for ML Ops - Storage options: Object storage, file storage, and databases - Containerization and orchestration for ML deployment – AutoML services

Version Control and Collaboration: Git – Git Workflow for ML Projects – Best practices for collaborating on ML Projects

CI/CD pipelines for ML: Design – Integration with Version control systems - Jenkins, GitLab: Overview, Setup – Configuring Automated Tests

Case Study: AWS Sagemaker – Overview – Components – Pre-built models – Integration with Storage, Serverless functions – Monitoring.

Learning Resources

1. Treveil M, Omont N, Stenac C, Lefevre K, Phan D, Zentici J, Lavoillotte A, Miyazaki M, Heidmann L. Introducing MLOps. O'Reilly Media; 2020 Nov 30.
2. MLOps Guide - <https://huyenchip.com/mlops/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	MLOps Basics	
1.1	ML Lifecycle Overview – MLOps: Definition, Objectives, Key Components	1
1.2	Traditional ML Deployment – Challenges	1
1.3	MLOps Workflow	1
2	Infrastructure for MLOps	
2.1	Cloud vs. On-premises infrastructure for ML Ops	1
2.2	Storage options: Object storage, file storage, and databases	1
2.3	Containerization and orchestration for ML deployment	1
3	Version Control and Collaboration	
3.1	Git – Git Workflow for ML Projects	1

Module No.	Topic	No. of Periods
3.2	Best practices for collaborating on ML Projects	1
4	CI/CD pipelines for ML	
4.1	Design – Integration with Version control systems	1
4.2	Jenkins, GitLab: Overview	1
4.3	Setup – Configuring Automated Tests	1
5	Case Study	
5.1	AWS Sagemaker – Overview – Components	1
5.2	Pre-built models	1
5.3	Integration with Storage, Serverless functions – Monitoring	1
	Total	14

Course Designer(s):

1. Mr.T.Sasikumar, tmsasikumar@gmail.com, Senior Technical Consultant, Thoughtworks, Chennai
2. Dr.S.Padmavathi, spmcse@tce.edu, Professor, IT,TCE
3. Mrs.S.Thiruchadai Pandeewari, eshwarimsp@tce.edu, APIT,TCE
4. Dr..K.R.Premalatha, krplit@tce.edu, APIT, TCE

Industry Expert Profile

Mr. T. Sasikumar is a full stack developer with **14+ years** of experience in leading multiple development teams building high performance enterprise platforms. Proficient in eXtreme Programming (XP) practices and Agile methodologies. Of late He is also playing the role of a data engineer building streaming platforms using Apache Kafka eco system.

**22IT1B1 DATA PROCESSING AND
VISUALIZATION USING BIG
DATA TOOLS**

Category L T P Credit
PEES 1 0 0 1

Preamble

The term "big data" has become increasingly common in discussions about IoT, machine learning, and artificial intelligence, largely due to the immense volume of data these technologies generate. This flood of data enables algorithms and tools to uncover patterns and insights, transforming raw data into decision support models. This course is designed to offer hands-on experience in big data techniques and technologies, specifically focusing on their application to various forms of real-time data.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the use of big data platforms for big data management	TPS2	70	85
CO2	Set up big data analytical environment for big data processing and management	TPS2	70	85
CO3	Apply Spark platform for big data applications like energy exploration, financial market analysis, fraud detection, medical records and image analysis	TPS3	70	75
CO4	Use Airflow platform for large scale data processing	TPS3	70	75
CO5	Use data visualization and interactive tools for exploratory data analysis and data insights	TPS4	70	65
CO6	Use big data platforms, machine learning algorithms and visualizations for real time applications	TPS4	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			S			S				M	L	M	L
CO2.	M	L			S			S				M	L	M	L
CO3	S	M	L		S			S				M	M	M	L
CO4	S	M	L		S			S				M	M	M	L
CO5	S	S	M	L	S			S				S	S	M	L
CO6	S	S	M	L	S	M	M	S	M	M	L	S	S	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Continuous Assessment Test						Terminal					
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1	2	3					2	6				
CO2	2	3					2	6	10			
CO3			10				2	6	10			
CO4			10				2	6	10			
CO5			10	10			2	6	10	6		
CO6	5	5	30	10			2	6		6		

Syllabus

Introduction to Big Data Types - Characteristics - Big Data Analytics - Big Insights and Big Sheets

Big Data Processing Distributed Datasets - Data Integration - Data Processing - Inference - Dashboard - Data aware to Data Driven Organization - AI powered search and analytics

Big data Analytics Platforms

Spark - Features - Architecture – Workers, Cluster Managers, Driver Programs, Executors, Tasks - Environment Set up and Installation - Use cases - Data Analysis - PySpark, Spark SQL

Airflow - Features - Architecture - Big data orchestration - Environment Set up and Installation - Use cases - Integration with Big Data Platforms - Advantages and Disadvantages

Interactive Data Visualization and Tools Tableau **Applications** Geo spatial analytics, Multimodal data analytics

Learning Resources

1. Raj Kamal, Preeti Saxena, "Big Data Analytic:: Introduction to Hadoop, Spark and Machine Learning", McGraw Hill, 2019.
2. Jules S Damji, Brooke Wenig, Tathagata Das, "Learning Spark: Lightning-Fast Data Analytics", O'Reilly, 2nd Edition, 2020
3. Bas P Harensak, Julian Rutger de Ruiter, "Data Pipelines with Apache Airflow", Manning, 2021.
4. Hayden Van Der "Dashboard Playbook: Data Viz to Data Wiz: Tableau & Power BI", Reactive Publishing, 2023
5. <https://onlinemaps.surveyofindia.gov.in/PricingPolicy.aspx>
6. <https://tn.data.gov.in/dataset-group-name/gis>
7. <https://data.world/>
8. <https://www.kaggle.com/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Big	
1.1	Types	1
1.2	Characteristics	
1.3	Big Data Analytics	

Module No.	Topic	No. of Periods
1.4	Big Insights and Big Sheets	
2	Big Data Processing	
2.1	Distributed Datasets	1
2.2	Data Integration	
2.3	Data Processing	
2.4	Inference	
2.5	Dashboard	1
2.6	Data aware to Data Driven Organization	
2.7	AI powered search and analytics	
3	Big data Analytics Platforms - Spark	
3.1	Features	2
3.2	Architecture - Workers, Cluster Managers, Driver Programs, Executors, Tasks	
3.3	Environment Set up and Installation	3
3.4	Use cases	
3.5	Data Analysis - PySpark, Spark SQL	
4	Big data Analytics Platforms - Apache Airflow	
4.1	Features	2
4.2	Architecture	
4.3	Big data orchestration	2
4.4	Environment Set up and Installation	
4.5	Use cases	
4.6	Integration with Big Data Platforms	2
4.7	Advantages and Disadvantages	
5	Interactive Data Visualization and Tools	
5.1	Tableau	1
5.2	Applications - Geo spatial, multimodal data analytics	1
	Total Lecture Hours	16

Course Designer(s):

1. K Vijay Kumar, Scientist - E, Joint Director
CDAC Chennai
2. A M Abirami
3. K V Uma

vijayk@cdac.in

abiramiam@tce.edu

kvuit@tce.edu

22IT1C1 WEB APPLICATION SECURITY

Category L T P Credit
PEES 1 0 0 1

Preamble

The primary goal of application security is to fortify an application with robust and efficient security measures. These measures aim to reduce the likelihood of attackers being able to manipulate applications and gain unauthorized access to, steal, alter, or delete sensitive data.

Prerequisite

Nil

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	Understand the recent security breaches' impact on businesses and the role of security frameworks in ensuring web application security.	TPS2	70	75
CO2	Apply SSL/HTTP protocols and security response headers to secure web communication and address common vulnerabilities.	TPS3	70	70
CO3	Analyze OWASP Top 10 risks by identifying vulnerabilities like Broken Access Control, Injection, etc.	TPS4	70	65
CO4	Implement secure coding and prevention strategies to mitigate Server-Side Forgery and prevent AWS Buckets Takeovers.	TPS3	70	70
CO5	Evaluate the implemented security measures' effectiveness in mitigating web application risks using practical scenarios.	TPS4	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			S							S	L	M	L
CO2.	S	M	L		S			S				S	M	M	M
CO3.	S	S	M	L	S	S		S	M	M	M	S	S	S	M
CO4.	S	M	L		S			S				S	M	M	M
CO5.	S	S	M	L	S	S		S			M	S	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Internal						Terminal					
	(Mini-project)											
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1		10						10				
CO2			20					5	15			
CO3			10	10				10		15		
CO4			20					5	15			
CO5			20	10				10		15		

Syllabus

Introduction to Web Application Security: Overview - Security breaches - Security frameworks – Need for robust web application security.

Common Protocols and Security Response Headers: ESSL/HTTP protocols - Security response headers - Implementation.

OWASP Top 10 Overview: (Practical sessions) OWASP web application security risks – Broken Access Control, Crypto Failures, Injection, Insecure Design, Misconfigurations, Vulnerable & Outdated Components, Identification & Authentication Failures, Software & Data Integrity Failures, Log Failures

Secure Coding and Prevention Strategies: Mitigation Strategies: Server-Side Forgery Requests, Secure coding approaches, AWS Buckets Takeovers prevention, and Server Takeovers prevention - Shift Left security approach - Threat modelling in development lifecycle.

Text Book

1. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", O'Reilly Media, First Edition, 2023

Reference Books& web resources

1. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws," 2nd Edition, Wiley, 2011, ISBN: 1118026470/978-1118026472.
2. Stuart McClure, Joel Scambray, Kurtz, "Hacking Exposed 7: Network Security Secrets & Solutions", 7th Edition, McGraw-Hill Prof Med/Tech, 2012, ISBN 13: 9780071780285
3. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2011, ISBN-13: 9780132126953
4. OWASP Security Testing Guide
(https://www.owasp.org/index.php/File:OWASP_Testing_Guide_v2_pdf.zip)
5. OWASP: <http://www.owasp.org>
6. WASC: <http://www.webappsec.org/>
7. SANS: <http://www.sans.org>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Web Application Security	
1.1	Overview - Security breaches	1
1.2	Security frameworks – Need for robust web application security	1
2	Common Protocols and Security Response Headers	
2.1	ESSL/HTTP protocols	1
2.2	Security response headers - Implementation	1
3	OWASP Top 10 Overview	
3.1	OWASP web application security risks – Broken Access Control, Crypto Failures, Injection, Insecure Design, Misconfigurations	2
3.2	Vulnerable & Outdated Components, Identification & Authentication Failures	2
3.3	Software & Data Integrity Failures, Log Failures	1
4	Secure Coding and Prevention Strategies	
4.1	Mitigation Strategies: Server-Side Forgery Requests, Secure coding approaches	2
4.2	AWS Buckets Takeovers prevention, and Server Takeovers prevention	1
4.3	Shift Left security approach	1
4.4	Threat modelling in development lifecycle	1
	Total	14

Course Designer(s):

- | | |
|--|----------------|
| 1. Prateek Tiwari, Security head, Zomato | pt@zomato.com |
| 2. M.Suguna | msecse@tce.edu |
| 3. R Parkavi | rpit@tce.edu |

22ITGA1**DATABASE MANAGEMENT
SYSTEMS**

Category	L	T	P	Credit
IE	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	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain structured, unstructured data and Data Base Management Systems.	TPS2	70	80
CO2	Implement Java Database connectivity by executing DDL and DML commands for the given application.	TPS3	70	70
CO3	Illustrate the use of complex query languages to populate, update and retrieve the data from database.	TPS3	70	70
CO4	Use PL/SQL to perform various Query operations for a given database.	TPS3	70	70
CO5	Apply normalization techniques to design a database for a given application.	TPS3	70	70
CO6	Explain transaction, concurrency control mechanism.	TPS2	70	80

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		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		

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	10	
CO2	5	5	30			50							5		10
CO3	5	5	30			50							5		15
CO4							5		35			50	5	5	15
CO5								15	25			50		5	10
CO6							5	15						10	

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-Single row and Multi-row Subquery, Date and String functions. Database Connectivity-JDBC

Programming Language Extension to SQL (PL/SQL)– Fundamentals, Control Structures, PL/SQL – Cursor, Trigger, Function , Procedure ,Package and Exception.

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

Text Book

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, Seventh Edition, 2016

Reference Books & web resources

1. Nilesh Shah, "Database Systems using Oracle", 2nd edition, Prentice Hall of India Pvt Ltd, 2007
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 Periods
1	Database Systems Concepts and Data Modelling	
1.1	Structured data, unstructured data and Information	1
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
2	NOSQL Database	
2.1	NOSQL Key-Value Stores- Column-Based or Wide Column NOSQL Systems.	2
3	Database query language	
3.1	Basic SQL- Data types	2
3.2	Types of Constraints	1
3.3	Views	1
3.4	Simple Queries	3
3.5	Complex Queries- Single row and Multi-row Subquery	3
3.6	Date and String functions	2
3.7	Database Connectivity-JDBC	2
4	Programming Language Extension to SQL (PL/SQL)	
4.1	Control Structures	2

4.2	PL/SQL - Cursor	2
4.3	Trigger, Function	2
4.4	Procedure	1
4.5	Exception, Package	1
5	Database Design Theory and Normalization	
5.1	Functional Dependencies	1
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
6	Transaction, Concurrency Control, and Enterprise Architecture	
6.1	Properties of Transaction	1
6.2	Two Phase Locking	1
	Total Lectures	36

Course Designer(s):

1. Dr.S.Sridevi ,Associate Professor sridevi@tce.edu
2. Dr.K.V.Uma, Associate Professor kvuit@tce.edu
3. Ms.S.Pudumalar , Assistant Professor spmit@tce.edu

22ITGB1**KOTLIN PROGRAMMING**

Category	L	T	P	Credit
IE	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

- None

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	Apply the fundamentals of the Kotlin Programming language	TPS3	70	70
CO2	Make use of Functions and Lambdas expressions to solve a problem using Kotlin	TPS3	70	70
CO3	Apply OOP concepts using Kotlin for the given application	TPS3	70	70
CO4	Use Collections and Annotations to the given application	TPS3	70	70
CO5	Illustrate interoperability between Kotlin and Java and apply the regular expressions for the given application	TPS3	70	70
CO6	Develop professional applications using Kotlin language for any real time problem.	TPS3	70	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.	S	M	L		M								S	M	
CO2.	S	M	L		M								S	M	
CO3.	S	M	L		M								S	M	
CO4.	S	M	L		S								S	S	
CO5.	S	M	L		S								S	S	
CO6.	S	M	L		S			S	S	S		M	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	TEST 1			Assignment 1			TEST 2			Assignment 2			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	5	5	10										2	5	10
CO2	10	10	30			50							2	5	10
CO3			30			50			10				2	5	15
CO4							10	10	30			20	2	5	15
CO5							10	10	20			30	2	5	10
CO6												50			5

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

Text Book

1. Peter Späth, “Pro Android with Kotlin: Developing Modern Mobile Apps with Kotlin and Jetpack”, 2nd edition, 2022

Reference Books & web 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, 2nd edition, 2019.
4. <https://developer.android.com/kotlin/campaign/learn>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction	
1.1	History of Kotlin	1
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	Kotlin Functions	
2.1	Control Flows	1
2.2	Functions – Recursion Function	1
2.3	Kotlin Lamdas	2
2.4	Higher order function – Inline Functions	1
2.5	Arrays,Mutable Array	2
3	Kotlin OOPs	
3.1	Class and Object, Nested and Inner Class	
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	Collections & Annotation	
4.1	Kotlin Collections	1
4.2	List: listOf() , mutableListOf()	2
4.3	Kotlin ArrayList ,arrayListOf()	2
4.4	Map: mapOf() , Kotlin HashMap ,hashMapOf() ,mutableMapOf()	2
4.5	Set: setOf() ,mutableSetOf() , hashSetOf()	1
4.6	Reflection - Annotations	1
5	Java Interoperability & Regex	
5.1	Calling Java code from Kotlin	1
5.2	Calling Kotlin code from Java	1
5.3	Regular Expressions	1
5.4	Regex Patterns	1
	Total Lectures	36

Course Designer(s):

- | | |
|---|----------------|
| 1. Dr.S.Karthiga, Assistant Professor, IT | skait@tce.edu |
| 2. Ms.C.V.Nisha Angeline, Assistant Professor, IT | cvnait@tce.edu |

22ITGC1**OBJECT ORIENTED
PROGRAMMING WITH JAVA**

Category	L	T	P	Credit
IE	3	0	0	3

Preamble

This course aims to provide students with broad theoretical and practical skills in object oriented programming. This course focuses on various OOP concepts such as Encapsulation, Inheritance and Polymorphism. It also focuses on various libraries for programming an interactive real world application.

Prerequisite

- None

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	Apply programming constructs like data types, operators, condition and looping control structures, arrays for the given problem	TPS3	70	70
CO2	Apply the object-oriented concepts such as encapsulation, inheritance and polymorphism for the given problem	TPS3	70	70
CO3	Apply JAR, package, and exception handling mechanism for the given problem.	TPS3	70	70
CO4	Use various libraries like String, I/O, Collection classes for the given problem.	TPS3	70	70
CO5	Develop interactive, user friendly applications through Event Handling for the given problem.	TPS3	70	70
CO6	Develop an application in Java through OOP concepts and its libraries for a real-time problem	TPS3	70	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.	S	M	L		M								S	M	
CO2.	S	M	L		M								S	M	
CO3.	S	M	L		M								S	M	
CO4.	S	M	L		S								S	S	
CO5.	S	M	L		S								S	S	
CO6.	S	M	L		S			S	S	S		M	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	TEST 1			Assignment 1			TEST 2			Assignment 2			Terminal		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	5	5	10										2	5	10
CO2	10	10	30			50							2	5	10
CO3			30			50			10				2	5	15
CO4							10	10	30			20	2	5	15
CO5							10	10	20			30	2	5	10
CO6												50			5

Syllabus

Programming Constructs: Data types, Operators, Condition and Looping Control structures, Arrays

Object Oriented Programming Concepts: Encapsulation - Object and Class, Methods, Constructors, Inheritance, Polymorphism, Abstract class and Interfaces

Packages and Exception Handling: JAR Operations, 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, LinkedList, Iterator, ListIterator, StringTokenizer

Event Handling: AWT Components, Events, Listeners. Layouts

Text Book

1. Herbert Schildt, "Java : The Complete Reference", McGraw-Hill. Twelfth Edition, 2022.

Reference Books & web resources

1. Paul Deitel and Harvey Deitel, "Java How to Program (Early Objects)", Pearson, Eleventh Edition, 2018.
2. E.Balagurusamy, "Programming with Java", McGraw-Hill, Fifth Edition, 2014.
3. Kathy Sierra, "Head First Java", Shroff publications, Second edition, 2005.
4. <https://docs.oracle.com/javase/tutorial/index.html>

Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours
1	Programming Constructs	
1.1	Data types, Operators	1
1.2	Conditional and Looping Control structures	2
1.3	Arrays	1
2	Object Oriented Programming Concepts	
2.1	Encapsulation - Object and Class	2

2.2	Methods and Constructors	2
2.3	Inheritance	2
2.4	Polymorphism	2
2.5	Abstract class and Interfaces	2
3	Packages and Exception Handling	
3.1	JAR Operations	2
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
4	Libraries	
4.1	String Class and its methods	1
4.2	File I/O	1
4.3	Collection Framework	1
4.4	ArrayList,LinkedList	2
4.5	Iterator, ListIterator	1
4.6	StringTokenizer	1
5	Event Handling	
5.1	AWT Components	2
5.2	Events	2
5.3	Listeners, Layouts	2
	Total Lectures	36

Course Designer(s):

1. Dr.P.Karthikeyan, Associate Professor, IT
2. Ms.C.V.Nisha Angeline, Assistant Professor, IT

karthikit@tce.edu
cvnait@tce.edu

22ITGD1**SOFTWARE ENGINEERING**

Category	L	T	P	Credit
IE	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	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Compare various software process models and Devops practices.	TPS2	70	80
CO2	Identify functional and non-functional requirements for any given problem and document it systematically.	TPS3	70	70
CO3	Prepare design documents with standards for any given user requirements.	TPS3	70	70
CO4	Build optimal test cases using appropriate testing techniques.	TPS3	70	70
CO5	Illustrate the benefits upon usage of version controlling and tracking mechanisms in software development	TPS2	70	80
CO6	Develop an application using software engineering best practices and standards.	TPS3	70	70

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT			Assignment			CAT			Assignment			Terminal					
	1			1			2			2								
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	6
CO1	8	20											3	10				
CO2	8	10	20			50							3	5	20			
CO3	4	10	20			50			10			10	3	5	20			
CO4							8	10	25			30	3	5	10			
CO5							8	20					3	5				
CO6							4	10	5			60			5			

CO6 COVERED THROUGH MINI PROJECT

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Software Process: Traditional Process Models Vs Agile Methodologies, Software Quality Attributes, Roles and responsibilities of software project manager, Devops-lifecycle process, principles and practices.

Software Requirements Analysis: Requirement Gathering techniques – User story map - Functional Requirements - Non-functional Requirements, Use Cases –SRS Documentation.

Software Design: Design concepts, Design notations, Design techniques-UML diagrams, Data Flow Diagrams, Microservices architecture-Design guidelines, Design Tools, Documentation.

Software Development: Coding standards, code inspection, reviews and walkthroughs.

Software Testing: Testing process, Testing levels- Black box testing, White box testing, Unit testing, Integration testing, System testing, Test case generation.

Software Configuration and maintenance Management: Tasks- version control- tracking- VC tools- Git, CVS, Monotone, Bazaar- software release and maintenance, reverse engineering and reengineering.

Text Book

1. Software Engineering: A Practitioner's Approach By Roger S. Pressman and Bruce Maxim McGraw-Hill Higher International; ISBN-10: 1259872971; ISBN-13: 978-1259872976, 9 th Edition (09/2020) .

Reference Books& web resources

1. Rajib Mall, "Fundamentals of Software Engineering", PHI, 4th edition, 2014.
2. PankajJalote, An integrated approach to Software Engineering, Springer/Narosa.
3. Ian Sommerville, Software Engineering, Addison-Wesley 10th edition, 2015.
4. Orit Hazzan, Yael Dubinsky, "Agile software engineering II", Springer, 2014
5. Agile Project Management: Creating Innovative Products (2nd Edition) 2nd Edition by [Jim Highsmith](#).
6. P. Bourque and R.E. Fairley, eds., Guide to the Software Engineering Body of Knowledge, Version 3.0, IEEE Computer Society, 2014; www.swebok.org.
6. <https://www.edx.org/learn/software-engineering/>
7. <https://cloudacademy.com/blog/introduction-to-devops/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1.	Software Process	
1.1	Traditional Process Models Vs Agile Methodologies	2
1.2	Software Quality Attributes	1
1.3	Roles and responsibilities of software project manager	

1.4	Devops-lifecycle process	2
1.5	Devops principles and practices	1
2	Software Requirements Analysis	
2.1	Requirement Gathering techniques	1
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	Software Design	
3.1	Design concepts	1
3.2	Design notations	1
3.3	Design techniques	4
3.4	Design guidelines	1
3.5	Microservices architecture	1
3.6	Design Tools	1
3.7	Documentation	1
4.	Software Development	
4.1	Coding standards	1
4.2	code inspection ,reviews and walkthroughs	1
5.	Software Testing	
5.1	Testing process	1
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
6	Software Configuration and maintenance management	
6.1	Tasks	1
6.2	version control	
6.3	tracking ,tracking tools	1
6.4	Software release and maintenance	1
6.5	Reverse engineering and reengineering.	1
	Total Lectures	36

Course Designer(s):

1. Pudumalar.S, Assistant Professor, spmit@tce.edu, Information Technology
2. Ilankumaran.S, Assistant Professor, siit@tce.edu, Information Technology

22MA112	CALCULUS FOR ENGINEERS	Category	L	T	P	Credit
		BSC	3	1	0	4

Preamble

This course aims to provide technical competence of modeling engineering problems using calculus. In this course, the calculus concepts are taught geometrically, numerically, algebraically and verbally. Students will apply the main tools for analyzing and describing the behavior of functions of single and multi-variables: limits, derivatives, integrals of single and multi-variables to model and solve complex engineering problems using analytical methods and MATLAB.

Prerequisite

NIL

Course Outcomes

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

CO's	Course Outcomes	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Cognize the concept of functions, limits and continuity	TPS2	75	70
CO2	Compute derivatives and apply them in solving engineering problems	TPS3	70	65
CO3	Employ partial derivatives to find maxima minima of functions of multi variables	TPS3	70	65
CO4	Demonstrate the techniques of integration to find the surface area of revolution of a curve.	TPS3	70	65
CO5	Utilize double integrals to evaluate area enclosed between two curves.	TPS3	70	65
CO6	Apply triple integrals to find volume enclosed between surfaces	TPS3	70	65

Mapping with Programme Outcomes

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

S - Strong; M - Medium; L - Low

Assessment Pattern

Assessment	CAT 1 (%)			Assignment 1 (%)			CAT 2 (%)			Assignment 2 (%)			Terminal Exam (%)		
TPS COs	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
CO1	3	10	-	-	-	-	-	-	-	-	-	-	-	5	-
CO2	-	10	30	-	-	25	-	-	-	-	-	-	-	5	14
CO3	3	-	30	-	-	25	-	-	-	-	-	-	-	5	12
CO4	4	10	-	-	-	-	4	-	20	-	-	18	-	5	16
CO5	-	-	-	-	-	-	6	10	20	-	-	14	-	5	12
CO6	-	-	-	-	-	-	-	20	20	-	-	18	-	5	16
MATLAB				50						50					
Total	10	30	60	-	-	100	10	30	60	-	-	100	-	30	70

* Assignment 1: (i) Application Problems in CO2 and CO3(50%).

(ii) MATLAB Onramp& Introduction to symbolic Math with MATLAB (50%).

**Assignment 2: (i) Application Problems in CO4, CO5 and CO6 (50%).

(ii) Application problems using MATLAB. (50%).

***Terminal examination should cover all Course Outcomes in the appropriate TPS level.

Syllabus**DIFFERENTIAL CALCULUS**

Functions - New functions from old functions - Limit of a function - Continuity - Limits at infinity - Derivative as a function - Maxima and Minima of functions of single variable – Mean value theorem - Effect of derivatives on the shape of a graph - Application problems in engineering using MATLAB.

FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives – Chain rule - Maxima and minima of functions of two variables – Method of Lagrange's Multipliers - Application problems in engineering using MATLAB.

INTEGRAL CALCULUS

Fundamental theorem of Calculus – Indefinite integrals and the Net Change Theorem – Improper integrals – Area of surface of revolution -Application problems in engineering using MATLAB.

MULTIPLE INTEGRALS

Iterated integrals and Fubini's theorem -Double integrals over general regions -Double integrals in polar coordinates -Applications of double integrals (density, mass, moments & moments of inertia problems only)-triple integrals- triple integrals in cylindrical coordinates- triple integrals in spherical coordinates- change of variables in multiple integrals - Application problems in engineering using MATLAB.

Text Book

- 1) James Stewart, Daniel Clegg and Saleem Watson, "Calculus Early Transcendentals", 9e, Cengage Learning, New Delhi, 2019.

Reference Books& web resources

- 1) George B. Thomas, "Thomas Calculus: Early Transcendentals", 14th Edition, Pearson Publishers, New Delhi, 2018.
- 2) Howard Anton, IrlBivens and Stephen Davis, "Calculus: Early Transcendentals", 12thedition, John Wiley & Sons, 2021.
- 3) Kuldeep Singh, "Engineering Mathematics Through Applications", 2ndedition, Blooms berry publishing, 2019,
- 4) Kuldip S. Rattan, Nathan W. Klingbeil, Craig M. Baudendistel, "Introductory Mathematics for Engineering Applications", 2nd edition, John Wiley& Sons, 2021.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	DIFFERENTIAL CALCULUS	
1.1	Functions and New functions from old functions	1
1.2	Limit of a function and Continuity of a function	1
1.3	Limits at infinity	1
	Tutorial	1
1.4	Derivative as a function	1
1.5	Maxima and Minima of functions of single variable	1
	Tutorial	1
1.6	The Mean value theorem	1
1.7	Effect of derivatives on the shape of a graph of a function	2
	Tutorial	1
1.8	Application problems in engineering using MATLAB	1
2	FUNCTIONS OF SEVERAL VARIABLES	
2.1	Partial derivatives – Chain rule	2
2.2	Maxima and minima of functions of two variables	1
	Tutorial	1
2.3	Method of Lagrange's Multipliers	2
2.4	Application problems in engineering using MATLAB	1
	Tutorial	1
3	INTEGRAL CALCULUS	
3.1	Fundamental theorem of Calculus	2
3.2	Indefinite integrals and the Net Change Theorem	1
	Tutorial	1
3.3	Improper integrals	2
3.4	Area of surface of revolution	2
	Tutorial	1
3.5.	Application problems in engineering using MATLAB	1
4	MULTIPLE INTEGRALS	
4.1	Iterated integrals and Fubini's theorem	1
4.2	Double integrals over general regions	2
	Tutorial	1
4.3	Double integrals in polar coordinates	1
4.4	Applications of double integrals (density, mass, moments & moments of inertia problems only)	2
	Tutorial	1
4.5	Triple integrals	1
4.6	Triple integrals in cylindrical coordinates	1
	Tutorial	1
4.7	Triple integrals in spherical coordinates	2
	Tutorial	1
4.8	Change of variables in multiple integrals	2
4.9	Application problems in engineering using MATLAB	1
	Tutorial	1
	Total	48

Course Designer(s):

1. Dr.B.Vellaikannan, Professor, Mathematics, bvkmattce.edu
2. Dr.C.S.Senthilkumar, Assistant Professor, Mathematics, kumarstays@tce.edu
3. Dr.S.P.SuriyaPrabha, Assistant Professor, Mathematics, suriyaprabha@tce.edu
4. Dr.S.Saravanakumar, Assistant Professor, Mathematics, sskmat@tce.edu
5. Dr.M.Sundar, Assistant Professor, Mathematics, msrmat@tce.edu

22CHAA1	ENVIRONMENTAL SCIENCE
----------------	------------------------------

Category	L	T	P	Credit
BS	1		1	0

(Common to all branches)

Preamble

The objective of this course is to make the students learn the basic concepts of environment, ecology, and to create awareness on current environmental issues, and develop a sustainable environment by participating in various activities on conserving natural resources and protecting the environment.

Prerequisite

Nil

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency	Expected Attainment Level %
CO1	Describe the importance and progression of ecological system	TPS2	A	80
CO2	Explain the significance of natural resources	TPS2	A	80
CO3	Examine the effects of pollution on environment and human beings	TPS3	A	80
CO4	Practice the suitable solid waste management for segregation and reuse of waste	TPS3	A	80
CO5	Explain renewable energy resources for sustainable environment	TPS2	A	80
CO6	Perform Environment oriented group activities	TPS4	A	80

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT						Assignment#						Terminal***					
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
CO1		20					NA						Presentation on case study report					
CO2		20																
CO3			20															
CO4			20															
CO5		20																
CO6																		

Assignment: Marks will be given for the review I & II 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	60	30
2	Assignment marks (from Review I&II)	2×20 =40	20
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 rubber industry in Virudhunagar district
2. Solid waste and waste water management in TCE hostel.
3. Status of workers in fireworks industry in Sivakasi region
4. A study on impacts of tanneries on ground water and soil quality in Dindigul district.
5. Effect of pharmaceutical industry on groundwater quality in poikaraipatty village, AlagarKovil.
6. Environmental impacts of quarry industries in MelurTaluk.
7. Environmental effect of Kudankulam atomic power plant.
8. Effect on ground water and soil quality by dyeing industries in Tiruppur.
9. Effect of textile wastes in Karur District.
10. Segregation of waste and its recycling by Madurai Municipality at Vellakkal

Syllabus

Environment and Ecosystem - Multidisciplinary nature of environment- Ecosystem- Structure and Functions, Energy flow in ecosystem-Ecological succession- Natural resources -Over exploitation, Conservation. **Environmental pollution and control** - Environmental pollution – Types (Air, Water, Soil)and Effects–Control measures, Solid waste management, Environmental Impact Assessment.**Sustainable Environment**–Carbon footprint, Carbon and water neutrality, Sustainable development goals, Renewable energy resources (Solar, Wind, Tidal, Biomass), Atom economy,Carbon vs Hydrogen economy, Linear economy vs Circular economy, Environmental ethics – issues, solution

Awareness and activities:

- ✓ Lectures by Environmentalist
- ✓ Group meeting on water management
- ✓ Awareness on modern pollution control measures
- ✓ Drive on e-waste segregation and disposal
- ✓ Field visit to treatment systems
- ✓ Preparation of seed ball and plantation
- ✓ Slogan, Poster, Essay writing, Role play events

Text Book

1. Kaushik, A &Kaushik, C.P, Environmental Science and Engineering, 6thEdition, New Age International, 2018.
2. ErachBharucha, Text book of Environmental studies for Undergraduate courses, 2ndEdition, UGC, 2013.

Reference Books & web resources

1. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
2. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
3. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
4. www.indiaenvironmentportal.org.in
5. www.teriin.org
6. www.cpcp.nic.in
7. www.sustainabledevelopment.un.org
8. www.conserve-energy-future.com

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Environment and Ecosystem	
1.1	Multidisciplinary nature of environment	1
1.2	Structure and Function of Ecosystem. Energy flow in ecosystem – Universal energy flow model	2
1.3	Ecological succession	1
1.4	Natural resources - Over exploitation, Conservation	1

Module No.	Topic	No. of Periods
2	Environmental pollution and control	
2.1	Environmental pollution – Types(Air, Water, Soil) and Effects	2
2.2	Control measures: Air pollution (Bag filter, Cyclone separator, Electrostatic Precipitator)	1
2.3	Industrial waste water treatment – Primary, Secondary, Tertiary	1
2.4	Solid waste management	1
2.5	Environmental Impact Assessment – Components, Processes and methods	1
3	Sustainable Environment	
3.1	Concept of carbon credit and carbon foot print, Carbon and water neutrality	1
3.2	Sustainable development goals – An overview	1
3.3	Renewable energy resources – Solar, Wind, Tidal, Biomass	2
3.4	Sustainable environment: Atom economy, Carbon vs Hydrogen economy, Linear economy vs Circular economy,	1
3.5	Environmental ethics: Issues and solution	1
4	Awareness and activities	
4.1	Lectures by environmentalist	1
4.2	Awareness on modern pollution control measures	1
4.3	Group activity on waste management	1
4.4	Drive on e-waste segregation and disposal	1
4.5	Field visit to treatment systems	1
4.6	Plantation using seed ball	1
4.7	Slogan, Poster, Essay writing, Role play events	1
	Total	24

Course Designer(s):

1. Dr.M.Kottaisamy
2. Dr. V. Velkannan
3. Dr. M. Velayudham

hodchem@tce.edu
velkannan@tce.edu
mvchem@tce.edu

22CHAB1	CONSTITUTION OF INDIA
----------------	------------------------------

Category	L	T	P	Credit
AC	2	0	0	0

Preamble

On the successful completion of the course, the students will be able to explain the basic features and fundamental principles of Constitution of India. The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India’s legacy of “diversity”. It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own AICTE Model Curriculum for Mandatory Courses & Activities (Non-Credit) for Undergraduate Degree in Engineering & Technology ancient legal heritage and cultural values. No law can be “static” and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it “as one of the strongest court in the world”

Course Outcome:

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

CO1	Explain the meaning of the constitution law and constitutionalism and Historical perspective of the Constitution of India	Understand
CO2	Explain the salient features and characteristics of the Constitution of India, scheme of the fundamental rights and the scheme of the Fundamental Duties and its legal status	Understand
CO3	Explain the Directive Principles of State Policy, Federal structure and distribution of legislative and financial powers between the Union and the States, and Parliamentary Form of Government in India	Understand
CO4	Explain the amendment of the Constitutional Powers and Procedure, the historical perspectives of the constitutional amendments in India, and Emergency Provisions.	Understand
CO5	Explain the Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality,	Understand
CO6	Explain the scheme of the Fundamental Right to certain Freedom under Article 19, and Scope of the Right to Life and Personal Liberty under Article 21	Understand

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

Assessment Pattern

Bloom's category	Continuous Assessment Tests		Seminar
	1	2	-
Remember	40	40	0
Understand	60	60	100
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

References

1. Durga Das Basu, 'Introduction to The Constitution of India', LexisNexis Butterworths Wadhwa, 20th Edition, Reprint 2011.
2. Constitution of India, National Portal of India, Web link: <https://www.india.gov.in/my-government/constitution-india>

Course Designers:

1. Adapted from AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology, Volume-II, January 2018.

22CHAC1	ESSENCE OF INDIAN KNOWLEDGE	Category	L	T	P	Credit
		AC	2	0	0	0

Preamble

On the successful completion of the course, the students will be able to explain the concept of Indian Traditional Knowledge along with Indian Modern Knowledge. Traditional Knowledge Systems or Indigenous Knowledge Systems are a body of knowledge, which is very ancient and deep rooted. They have their origins in the remote past. Their systematisation and canonisation gave rise to the elite (the Greater Tradition) science. The nature of Traditional Knowledge System is diverse. It covers, among other things, literary, artistic and scientific works; songs, dances, medical treatments and practices; manufacturing and industry; and agricultural technologies and techniques. There is a dramatically growing national and international interest in incorporating Traditional Knowledge Systems, including Traditional Ecological Knowledge, into truly participatory approaches to development.

Course Outcome:

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

CO1	Explain the concept of Traditional Knowledge and Modern knowledge of India.	Understand
CO2	Explain the need and importance of protecting Traditional Knowledge, Knowledge sharing, and Intellectual property rights over Traditional Knowledge.	Understand
CO3	Explain about the use of Traditional Knowledge to meet the basic needs of human being.	Understand
CO4	Explain the rich biodiversity materials and knowledge preserved for practicing traditional lifestyle.	Understand
CO5	Explain the use of Traditional Knowledge in Manufacturing and Industry.	Understand
CO6	Explain about the cultural expression and modern applications of Traditional Knowledge	Understand

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

Traditional and Modern Knowledge: Two Worlds of Knowledge - Phase of Explorers, Sir Arthur Cotton and Irrigation, Smallpox Vaccination, Late Nineteenth Century, Voelcker, Howard and Agriculture, Havell and Indian Art; Indians at the Encounter - Gaekwad of Baroda and Technical Education, Science Education and Modern Industries, Hakim Ajmal Khan and Ayurveda, R. N. Chopra and Indigenous Drugs, Gauhar Jaan and Indian Classical Music; Linking Science and the Rural - Tagore's Sriniketan Experiment, Marthandam, the YMCA Model, Gandhi's Thoughts on Development, Nehru's View of Growth; Post-Independence Era - Modernization and Traditional Knowledge, Social Roots of Traditional Knowledge Activism, Global Recognition for Traditional Knowledge. **Global Mechanisms of Protection and Sharing:** For Recognition and Protection - United Nations Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO), International Labour Organization (ILO), UN Working Group on Indigenous Populations, Evolution of Other Organizations; Norms of Sharing - United Nations Environment Programme (UNEP), World Intellectual Property Organization (WIPO), World Trade

Organization (WTO); IPR and Traditional Knowledge - Theoretical Background, Positive Protections of TK, Defensive Strategies, IPR Facilitation for TK. **Traditional Knowledge for Basic Needs:** Indian Midwifery Tradition—The Dai System, Surface Flow Irrigation Tanks, Housing - A Human Right, Changing Priorities—Niyamgiri. **Biodiversity and Genetic Resources:** Jeevani - The Wonder Herb of Kanis, A Holistic Approach - FRLHT, Basmati - In the New Millennium, AYUSH-Based Cosmetics. **Traditional Knowledge in Manufacturing and Industry:** Drug Discovery, A Sweetener of Bengal, The Sacred Ring of Payyanur, Channapatna Toys. **Traditional Cultural Expressions:** Banarasi Saree, Music, Built and Tangible Heritage, Modern Yoga, Sanskrit and Artificial Intelligence, Climate Change and Traditional Knowledge.

Assessment Pattern

Bloom's category	Continuous Assessment Tests		Seminar (Internal Exam)
	1	2	-
Remember	40	40	0
Understand	60	60	100
Apply	0	0	0
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

This course assessment is fully internal. There is no terminal examination.

Learning Resources:

1. Nirmal Sengupta "Traditional Knowledge in Modern India Preservation, Promotion, Ethical Access and Benefit Sharing Mechanisms" Springer, 2019.
2. Amit Jha, "Traditional Knowledge System in India", Atlantic Publishers and Distributors Pvt Ltd, 2009.
3. Basanta Kumar Mohanta, Vipin Kumar Singh "Traditional Knowledge System and Technology in India", Pratibha Prakashan, 2012.
4. Kapil Kapoor, Michel Danino "Knowledge Traditions and Practices of India", Central Board of Secondary Education, 2012.
5. NPTEL video lecture on "Ayurvedic Inheritance of India", Video link: <https://nptel.ac.in/courses/121/106/121106003/#>.
6. Youtube video on "Introduction to Indian Knowledge Systems", Video link: <https://www.youtube.com/watch?v=LZP1StpYEPm>.
7. Youtube video on "12 Great achievements of Indian Civilization", Video link: <https://www.youtube.com/watch?v=xmogKGCmcIE>.

Course Designers:

- Dr.S.J.Thiruvengadam sjtece@tce.edu
- Dr.V.R.Venkatasubramani venthiru@tce.edu

22ES151	ENGINEERING EXPLORATION	Category	L	T	P	Credit
		ES	1	1	-	2

Preamble

The course Engineering Exploration provides an introduction to the engineering field. It is designed to help the student to learn about engineering and how it affects our everyday lives. On the successful completion of the course, students will be able to explain how engineering is different from science and technology and how science, mathematics and technology are an integral part of engineering design.

Prerequisite

NIL

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency	Expected Attainment
CO1	Explain technological & engineering development, change and impacts of engineering	TPS2	70	70
CO2	Draw a product in enough detail that others can accurately build it and write specification sheet for a given product	TPS3	70	70
CO3	Complete initial steps (Define a problem, list criteria and constraints, brainstorm potential solutions and document the ideas) in engineering design process	TPS3	70	70
CO4	Draw sketches to a design problem and provide a trade-off matrix	TPS3	70	70
CO5	Communicate possible solutions through drawings and prepare project report	TPS3	70	70
CO6	Apply the concept of engineering fundamentals in Civil and Mechanical, Engineering	TPS3	70	70

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	M	L	-	-	-	-	-	-	-	-	-	-
C02	S	M	L	-	-	-	-	-	-	-	-	-
C03	S	M	L	-	-	-	-	-	-	-	-	-
C04	S	M	L	-	-	-	-	-	-	-	-	-
C05	S	M	L	-	-	-	-	-	-	-	-	-
C06	S	M	L	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Worksheet-1			Worksheet-2			CAT			Terminal (Theory)		
TPS Scale	1	2	3	1	2	3	1	2	3	1	2	3
CO1	5	20						5			20	
CO2		5	20						5			20
CO3					5	20			10			20
CO4					5	20			10			20
CO5									10			10
CO6									10			10

Syllabus

What is Engineering: Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements **Engineering Design:** Problem definition, idea generation through brainstorming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement. **Defining problems and Brainstorming:** Researching design, sketching problem solving **Communicating solution:** Dimensioning orthographic drawing, perspective drawing **Modeling and Testing final output:** Product evaluation, reverse engineering, final project report. **Civil Engineering:** Structural forces structural analysis, bridge design components, structural design **Mechanical Engineering:** Types of motion, mechanical power system, mechanical power formula, mechanical design.

Reference Books

1. Ryan A.Brown, Joshua W.Brown and Michael Berkihiser: "Engineering Fundamentals: Design, Principles, and Careers", Goodheart-Willcox Publisher, Second Edition, 2014.
2. [Saeed Moaveni](#), 'Engineering Fundamentals: An Introduction to Engineering', Cengage learning, Fourth Edition, 2011.

Course Contents and Lecture Schedule

No.	Topic	No. of Periods
1.	What is Engineering	
1.1	Engineering Requirement	1
1.2	Knowledge within Engineering disciplines,	1
1.3	Engineering advancements	1
2	Engineering Design	
2.1	Problem definition,	1
2.2	idea generation through brainstorming and researching	1
2.3	solution creation through evaluating and communicating,	1
2.4	text/analysis	1
2.5	final solution and design improvement	1
3	Defining problems and Brainstorming:	
3.1	Researching design	1
3.2	sketching problem solving	2
4	Communicating solution	
4.1	Dimensioning orthographic drawing	1
4.2	perspective drawing	1
5	Modeling and Testing final output	
5.1	Product evaluation	1
5.2	reverse engineering	1
5.3	final project report	1
6	Civil Engineering	
6.1	Structural forces structural analysis	1
6.2	bridge design components	2
6.3	structural design	1
7	Mechanical Engineering	

No.	Topic	No. of Periods
7.1	Types of motion	1
7.2	mechanical power system	1
7.3	mechanical power formula	1
7.4	mechanical design	1
	Total	24

Course Designers:

1. Dr.S.J. Thiruvengadam sjtece@tce.edu
2. Dr. V.R.Venkatasubramani venthiru@tce.edu

22ES391	DESIGN THINKING	Category	L	T	P	Credit
		ESC	1	-	4	3

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#	Course Outcomes	TPS Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Identify a specific social need to be addressed	TPS 3	70	80
CO2	Identify stakeholder’s requirements for the societal project	TPS 3	70	80
CO3	Develop measurable criteria in which design concepts can be evaluated	TPS 3	70	80
CO4	Develop prototypes of multiple concepts using user’s feedback	TPS 3	70	80
CO5	Select the best design solution among the potential solutions with its functional decomposition	TPS 5	70	80

Mapping with Programme 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
Continuous Assessment			
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
End-Semester Examination			
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.

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.	Project Identification: 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.	Specification Development			
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.	Conceptual Design			
3.1	Conduct of Functional Decomposition	1	2	CO4
3.2	Brainstroming of possible solutions	1	2	CO4
3.3	Creation of Prototypes for Multiple Concepts	1	2	CO4
3.4	Refinement of design Specification on users' feedback		2	CO4
3.5	Evaluation of Potential Solutions	1	2	CO5
3.6	Selection of best design		2	CO5
Total		12	34	

Course Designers:

1. Dr.S.J.Thiruvengadam sjtece@tce.edu

GUIDELINES FOR PROJECT COURSES

Project I, Project II, Project III and Project IV

B.E. / B.Tech. DEGREE PROGRAMME

**FOR THE STUDENTS ADMITTED IN THE
ACADEMIC YEAR 2022-23 ONWARDS**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
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

THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI 625015

GUIDELINES FOR PROJECT COURSES

In the curriculum of 2022 B.E./B.Tech. Programmes, 12 credits have been assigned for **Project work in the specific discipline**. The curriculum was designed based on around 4 focus/broad areas. This has been split into **4 project courses** namely Project I, Project II, Project III and Project IV in semesters 5,6, 7 and 8 respectively.

Choice of Focus Areas: HoDs are requested to provide choice for the students to choose one of the broad/focus areas to carry out project work in 5, 6, 7 and 8th semesters. The number of students in each broad/focus areas shall be based on the faculty and infrastructure availability.

Project Continuity and Switching: The students shall be given a big project in the chosen broad/focus area so that it can be spread over all four semesters with specific outcomes at each semester. In case, a student wants to switch from one focus area to other area. It has to be approved by the Head of the Department and project coordinator.

Internal Marks: Three reviews shall be conducted in each semester to monitor the progress of the project. Review 1; 10 Marks, Review 2: 15 Marks, Review 3: 15 Marks. Total = 40 Marks.

Viva Voce Examinations: For external examinations, HoD shall appoint two examiners in each focus/broad area to conduct the Viva Voce examination in semesters 5, 6 and 7. Project guides are also one of the examiners, along with the two examiners appointed by the HoD. External exam will be conducted for 60 Marks.

Final Viva Voce Examination: In 8th Semester, Viva Voce will be conducted by an external examiner, HoD / HoD Nominee as internal examiner and Project Guides. External exam will be conducted for 60 Marks.

This structured approach ensures that students engage in a comprehensive project experience throughout their undergraduate studies, with regular monitoring of progress and formal evaluation through viva voce examinations. It also allows for flexibility by permitting students to switch focus areas with appropriate approvals.

அலகு I: மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமணப் பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II: மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV: தமிழர்களின் திணைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V: இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book

and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22TAAA1 HERITAGE OF TAMILS

1. Language and Literature: Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.
2. Heritage - Rock art paintings to modern art - Sculpture: Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.
3. Folk and Martial arts - Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.
4. Thina concept of Tamils – Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.
5. Contribution of Tamils to Indian National Movement and Indian Culture: Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)

(Publishedby: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

அலகு I: நெசவு மற்றும் பாணைத் தொழில்நுட்பம்: 3
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III: உற்பத்தித் தொழில் நுட்பம்: 3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV: வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு V: அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3
அறிவியல் தமிழின் வளர்ச்சி -கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

PAPER – 2 22TAAB1 TAMILS AND TECHNOLOGY

1. **Weaving and Ceramic Technology:** Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.
2. **Design and Construction Technology:** Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.
3. **Manufacturing Technology:** Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and gold- Coins as source of history - Minting of Coins – Beads making- industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beads - Archeological evidences - Gem stone types described in Silappathikaram.
4. **Agriculture and Irrigation Technology:** Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.
5. **Scientific Tamil & Tamil Computing:** Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services)

- Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)
(Publishedby: The Author)
 11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text
Bookand Educational Services Corporation, Tamil Nadu)
 12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference
Book.

GUIDELINES FOR PROJECT COURSES

Project I, Project II, Project III and Project IV

B.E. / B.Tech. DEGREE PROGRAMME

**FOR THE STUDENTS ADMITTED IN THE
ACADEMIC YEAR 2022-23 ONWARDS**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
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

THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI 625015

GUIDELINES FOR PROJECT COURSES

In the curriculum of 2022 B.E./B.Tech. Programmes, 12 credits have been assigned for **Project work in the specific discipline**. The curriculum was designed based on around 4 focus/broad areas. This has been split into **4 project courses** namely Project I, Project II, Project III and Project IV in semesters 5,6, 7 and 8 respectively.

Choice of Focus Areas: HoDs are requested to provide choice for the students to choose one of the broad/focus areas to carry out project work in 5, 6, 7 and 8th semesters. The number of students in each broad/focus areas shall be based on the faculty and infrastructure availability.

Project Continuity and Switching: The students shall be given a big project in the chosen broad/focus area so that it can be spread over all four semesters with specific outcomes at each semester. In case, a student wants to switch from one focus area to other area. It has to be approved by the Head of the Department and project coordinator.

Internal Marks: Three reviews shall be conducted in each semester to monitor the progress of the project. Review 1; 10 Marks, Review 2: 15 Marks, Review 3: 15 Marks. Total = 40 Marks.

Viva Voce Examinations: For external examinations, HoD shall appoint two examiners in each focus/broad area to conduct the Viva Voce examination in semesters 5, 6 and 7. Project guides are also one of the examiners, along with the two examiners appointed by the HoD. External exam will be conducted for 60 Marks.

Final Viva Voce Examination: In 8th Semester, Viva Voce will be conducted by an external examiner, HoD / HoD Nominee as internal examiner and Project Guides. External exam will be conducted for 60 Marks.

This structured approach ensures that students engage in a comprehensive project experience throughout their undergraduate studies, with regular monitoring of progress and formal evaluation through viva voce examinations. It also allows for flexibility by permitting students to switch focus areas with appropriate approvals.

22ITRF1	SPATIO – TEMPORAL DATA MINING
----------------	--------------------------------------

Category	L	T	P	Credit
PEES	3	0	0	3

Preamble

The objective of the course is to equip students with foundational knowledge and advanced techniques for analyzing and extracting valuable insights from data that varies across both spatial and temporal dimensions. It also emphasizes spatio-temporal classification, clustering, and data management to develop efficient algorithms that accurately analyse, group, and manage large-scale datasets involving both spatial and temporal dimensions.

Prerequisite

Machine Learning

Course Outcome

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Describe theory underlying Spatio Temporal data mining (RL).	TPS2	70	70
CO2	Apply various Spatio-Temporal data processing techniques to solve real world problems.	TPS3	70	65
CO3	Illustrate various Spatio-Temporal Data Management and Query Processing.	TPS3	70	65
CO4	Experiment various Spatio- Temporal supervised and unsupervised learning algorithms for the real-world scenario.	TPS3	70	65
CO5	Apply pattern detection algorithms to find the outlier and change detection.	TPS3	70	65
CO6	Compare the performance of various spatio – temporal preprocessing techniques, classification, and clustering algorithms for the given real time application.	TPS4	70	60

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	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	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern: Cognitive Domain

CO	CAT 1			Assignment - I			CAT 2				Assignment - II				Terminal			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	10	10			10										2	5		
CO2	5	5	30			50									2	5	10	
CO3		10	30			40									2	5	15	
CO4							5	10	20				30			5	15	
CO5							5	10	20				30		2		10	
CO6							5	5		20				40	2	5	15	

Syllabus

Spatio-Temporal Data Mining: Need, importance, Differences between traditional data mining and spatio-temporal data mining, data types - Spatial Data, Temporal data, non- spatio temporal data, Moving Object Data, sensor data, GIS, Models for capturing spatio-temporal data - Object-based models, Field-based models, Network models, Issues and Challenges, applications

Spatio - Temporal Data preprocessing techniques: Data Cleaning, Noise Reduction, Spatial and Temporal Aggregation, Coordinate Transformation and Standardization, Data Reduction Techniques, Auto-correlation Estimations, Feature Engineering for Spatio-Temporal Data, Encoding Temporal and Spatial Sequences – Fourier transform and wavelet transform, Case study

Spatial and Temporal Data Management: Spatial indexing method -quadtree, kd tree, Temporal indexing method- R Tree, T Tree, Spatial Query Processing, Temporal Query Languages for real time data

Supervised and Unsupervised Learning Algorithms: Long Short-Term Memory (LSTM) Networks, Spatio-Temporal Graph Neural Networks, Spatio-Temporal Self-Organizing Maps (ST-SOM), Fuzzy clustering, t-SNE (t-Distributed Stochastic Neighbour Embedding), case study

Pattern Detection: Need, Dynamic Time Warping (DTW), Temporal Event Detection using Graphs, meta learning, spatio – temporal transformers

Learning Resources

Roger S. Bivand, Edzer J. Pebesma, and Virgilio Gómez-Rubio, “Applied Spatial Data Analysis with R [ASDAR]”, 2nd Edition, Springer, 2013.

Burrough P.A. and McDonnell R.A., “Principles of Geographical Information Systems”, 3rd Edition, Oxford University Press, New York, 2007.

Chatfield C. “The Analysis of Time Series: An Introduction”, 6th edition, Chapman and Hall, London, 2003.

Longley P. and Batty M., “Spatial Analysis: Modelling in a GIS Environment”, 1st Edition, Wiley Publisher, 1997.

Wikle, C.K., Zammit-Mangion, A., and Cressie, N. "Spatio-Temporal Statistics with R", 1st Edition, Chapman & Hall/CRC, Boca Raton, FL, 2019.

Waller, Lance A., 1965-; Gotway, Carol A., "Applied spatial statistics for public health data", 1st Edition, Wiley Publisher, 2004

NPTEL Course on "Spatial Informatics" by Dr. SOUMYA KANTI GHOSH, IIT Kharagpur, <https://archive.nptel.ac.in/courses/106/105/106105219/>

Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours
1	Spatio-Temporal Data Mining	
1.1	Need, importance, Differences between traditional data mining and spatio-temporal data mining	1
1.2	data types - Spatial Data, Temporal data, non- spatio temporal data, Moving Object Data, sensor data, GIS	2
1.3	Models for capturing spatio-temporal data - Object-based models, Field-based models, Network models	2
1.4	Issues and Challenges, applications	1
2	Spatio - Temporal Data preprocessing techniques	
2.1	Data Cleaning, Noise Reduction, Spatial and Temporal Aggregation	2
2.2	Coordinate Transformation and Standardization, Data Reduction Techniques	1
2.3	Auto-correlation Estimations	1
2.4	Feature Engineering for Spatio-Temporal Data	1
2.5	Encoding Temporal and Spatial Sequences – Fourier transform and wavelet transform,	2
2.6	Case study	1
3	Spatial and Temporal Data Management	
3.1	Spatial indexing method -quadtree, kd tree	2
3.2	Temporal indexing method- R Tree, T Tree	2
3.3	Spatial Query Processing,	3
3.4	Temporal Query Languages for real time data	3
4	Supervised and Unsupervised Learning Algorithms	
4.1	Long Short-Term Memory (LSTM) Networks	1
4.2	Spatio-Temporal Graph Neural Networks	1
4.3	Spatio-Temporal Self-Organizing Maps (ST-SOM)	1
4.4	Fuzzy clustering	2
4.5	t-SNE (t-Distributed Stochastic Neighbour Embedding),	1
5	Pattern Detection	
5.1	Need, Dynamic Time Warping (DTW)	1
5.2	Temporal Event Detection using Graphs	2
5.3	meta learning	1
5.4	spatio – temporal transformers	1
5.5	Case Study	1
	Total Hours	36

Course Designers:

1. Dr.S. Sridevi, Associate Professor, IT Department sridevi@tce.edu
2. Mrs.T.Saranya, Assistant Professor, IT Department tsait@tce.edu

22ITRG1	VIRTUALIZATION TECHNOLOGIES
----------------	------------------------------------

Category	L	T	P	Credit
PEES	3	0	0	3

Preamble

This course aims to provide foundational knowledge and skills required to design, implement, and manage virtualized environments effectively. Also, necessary concepts and technologies to implement and manage virtualized and containerized solutions are covered.

Prerequisite

Nil

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	Review virtualization techniques and its significance in modern IT infrastructures	TPS 2	70	75
CO2	Perform VM management activities such as image creation, building , image conversion and resizing	TPS 3	70	70
CO3	Utilize necessary security measures for protecting host and Virtual machine	TPS 3	70	70
CO4	Deploy and manage containerized applications using Kubernetes	TPS 3	70	70
CO5	Examine networking concepts in virtualized environments, including VLANs and SDN	TPS 4	70	70
CO6	Make use of virtualization and containerization-based solutions for the given scenario	TPS 3	70	70

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		S			L	L	L			M	M	L
CO3.	S	M	L										M		
CO4.	S	M	L		S			L	L	L		M	M	M	L
CO5.	S	S	M	L	M								S	L	
CO6.	S	M	L		S			L	L	L		M	M	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT 1			CAT 2				ASSIGNMENT 1			ASSIGNMENT 2				TERMINAL			
TPS Scale	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4
CO1	5	15	-	-	-	-	-	-	10	-	-	-	-	-	2	5	-	-
CO2	5	15	30	-	-	-	-	-	-	80	-	-	-	-	2	5	10	-
CO3	5	15	10	-	-	-	-	-	-	10	-	-	-	-	2	5	10	-
CO4	-	-	-	5	10	-	-	-	-	-	-	-	60	-	2	5	10	-
CO5	-	-	-	5	10	30	15	-	-	-	-	-	-	20	2	5	10	10
CO6	-	-	-	5	10	10	-	-	-	-	-	-	20	-	-	5	10	-

Syllabus

Virtualization Basics : Techniques to design virtual machine monitors - Virtualization Techniques : CPU, Memory, I/O, Storage – Case studies : Xen, KVM/QEMU - Amazon:EC2- VM Creation, Accessing & Working, :AWS-S3 Storage Creation and Accessing, ISO to Image Creation -Image building - Image conversion - Image resizing.

Virtual Machine Management: Datacenter : Provision, monitoring and management – VM Live Migration – VM Checkpointing and Cloning – VM forking - High Availability Techniques – CaseStudy : Snowflock

VM Security: User Accounting Server authentication- SSL certificates - Host system Protection - Virtual machine security architecture-Security Parameters-Accounting Techniques.

Containerization : Overview - Comparison with virtual machines - Docker: Basics and commands- Key challenges in managing containers at scale – Kubernetes: Overview, architecture Deploying applications with Kubernetes

Network Virtualization: Virtual LANs (VLANs), virtual switches - Software-defined networking (SDN) Security in Virtualized and Containerized Environments - Isolation and security measures - Best practices for securing virtual machines and containers

Emerging Technologies: Virtualization at the edge - Implications for IoT and edge computing - Serverless architecture and its relationship with containers - Emerging trends in container technologies - Case study: NVIDIA NGC

Text Book

1. Matthew Portnoy, "Virtualization essentials", John Wiley & Sons, 2023
2. Le, Dac-Nhuong, Raghvendra Kumar, Gia Nhu Nguyen, and Jyotir Moy Chatterjee. Cloud computing and virtualization. John Wiley & Sons, 2018.

Reference Books & web resources

1. James Strong, Vallery Lancey, Networking and Kubernetes: A Layered approach, O'Reilly, 2021
2. Docker Foundations: <https://docs.docker.com/get-started/#foundations-of-docker>
3. Kubernetes Basics: <https://kubernetes.io/docs/tutorials/kubernetes-basics/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Virtualization Basics	
1.1	Techniques to design virtual machine monitors	2
1.2	Virtualization Techniques : CPU, Memory, I/O, Storage	1
1.3	Case studies : Xen, KVM/QEMU	2
1.4	AWS EC2-VM Creation, Accessing & Working, :AWS-S3 Storage	1
1.5	ISO to Image Creation -Image building - Image conversion - Image resizing.	2
2	Virtual Machine Management	
2.1	Datacenter : Provision, monitoring and management	1
2.2	VM Live Migration – VM Checkpointing and Cloning	1
2.3	VM forking - High Availability Techniques	1
2.4	CaseStudy: Snowflock	1
3	VM Security	
3.1	User Accounting Server authentication- SSL certificates	1
3.2	Host system Protection	1
3.3	Virtual machine security architecture	1
3.4	Security Parameters-Accounting Techniques.	1
4	Containerization	
4.1	Overview - Comparison with virtual machines	1
4.2	Docker basics and commands	2
4.3	Key challenges in managing containers at scale – Kubernetes: Overview, architecture	3
4.4	Deploying applications with Kubernetes	3
5	Network Virtualization:	
5.1	Virtual LANs (VLANs), virtual switches	1
5.2	Software-defined networking (SDN)	3
5.3	Security in Virtualized and Containerized Environments -	1

Module No.	Topic	No. of Periods
5.4	Isolation and security measures - Best practices for securing virtual machines and containers	1
6	Emerging Technologies	
6.1	Virtualization at the edge	1
6.2	Implications for IoT and edge computing	1
6.3	Serverless architecture and its relationship with containers - Emerging trends in container technologies – Case study	3
	Total	36

Course Designer(s):

1. Dr S. Padmavathi, Professor, Department of Information Technology spmcse@tce.edu
2. S.Thiruchadai Pandeewari, Assistant Professor, Department of Information Technology eshwarimsp@tce.edu

22ITPR1	SOFTWARE TESTING
----------------	-------------------------

Category	L	T	P	Credit
PSE	3	0	0	3

Preamble

The course covers software testing concepts, principles, methods and tools. The purpose of this course is to build necessary skills to design and perform testing at the unit and application level of software

Prerequisite

- Nil

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	Perform traditional testing activities like test cases design & authoring and defect management	TPS3	70	80
CO2	Implement BDD principles in agile testing projects	TPS3	70	80
CO3	Use automation frameworks like Junit and Selenium to perform unit testing and functional testing	TPS3	70	80
CO4	Design and execute API test cases using tools like Postman	TPS3	70	80
CO5	Perform performance testing, mobile app testing using appropriate tools	TPS3	70	80
CO6	Employ AI driven testing tools to perform tasks like automating test cases/scripts generation, test data synthesis and test optimization	TPS3	70	80

Mapping with Programme Outcomes

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

	CAT 1				CAT 2			Assignment 1				Assignment 2			Terminal			
TPS Scale	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4
CO1	10	20	-	-	-	-	-	-	-	20	-	-	-	-	10	10	-	-
CO2	5	10	20	-	-	-	-	-	10	30	-	-	-	-	5	5	10	-
CO3	5	10	20	-	-	-	-	-	-	40		-	-	-		10	10	
CO4	-	-	-	-	5	10	20	-	-	-	-	-	15	20	-	5	10	-
CO5	-	-	-	-	5	10	20	-	-	-	-	-	15	20	-	5	10	-
CO6	-	-	-	-	10	10	10	-	-	-	-	-	30	-	5		5	-

Syllabus

Software Development and Testing: Testing in Traditional Models: Waterfall, V-Model, Spiral – STLC – Test Process – Test Design techniques – Test Cases Authoring – Bug Life cycle – Defect Management – Test Metrics – Test Standards : ISO 25000

Agile Testing: Principles – Test quadrants – Behaviour-driven development – User story testing – Generating examples, parameterizing examples, building parameter table – CI/CD - Cucumber

Test Automation Frameworks: Unit Testing: Assertions, Annotations – TestNG, Junit/Pyunit – Functional Testing : Selenium IDE, Selenium Webdriver, Mocha – Performance Testing : Jmeter – Mobile Testing : Appium – Test scripts generation for simple workflows

API Testing: API Test cases – HTTP messages – Request/ response headers – Status Codes – Postman: Overview, Variables, Query Parameters – Read/Write JSON – Integration of API testing with CI/CD pipeline

Testing Alapps: Goals – Key aspects – Lifecycle of AI Apps – Metamorphic Testing – Model back testing – Coverage guided fuzzing.

Testing and AI: Self-healing tests – Low code /No code Test automation platforms – Test data synthesis – Test Optimization – Ethics

Text Book

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", AddisonWesley Professional, 2009
3. Srinivasan Desikan, Gopalasamy Ramesh, "Software Testing – principles and practices", Pearson Education, First Edition, 2009
4. Krishna Rungta, "Selenium Learn in one day", published on Amazon digital services, 2017
5. Testing AI/ML based systems - <https://www.wipro.com/holmes/testing-of-ai-ml-based-systems/>

Reference Books & web resources

1. Junit 5 - <https://junit.org/junit5/docs/current/user-guide/>
2. Mocha - <https://mochajs.org/#getting-started>
3. Appium - <https://appium.io/docs/en/2.1/quickstart/test-js/>
4. Jmeter - <https://jmeter.apache.org/usermanual/index.html>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Software Development and Testing	
1.1	Testing in Traditional Models: Waterfall, V-Model, Spiral	2
1.2	STLC – Test Process – Test Design techniques – Test Cases Authoring	2
1.3	Bug Life cycle – Defect Management – Test Metrics – Test Standards	2
2	Agile Testing	
2.1	Principles – Test quadrants	1
2.2	Behaviour-driven development – User story testing	2
2.3	Generating examples	1
2.4	Parameterizing examples	1
2.5	Building parameter table	1
2.6	CI/CD	1
2.7	Cucumber	1
2.8	Defect Management - Root cause Analysis	1
3	Test Automation Frameworks	
3.1	Unit Testing: Assertions, Annotations TestNG, Junit/Pyunit	2
3.2	Functional Testing : Selenium IDE, Selenium Webdriver, Mocha	2
3.3	Performance Testing : Jmeter	2
3.4	Mobile Testing : Appium – Test scripts generation for simple workflows	2
4	API Testing	
4.1	API Test cases – HTTP messages – Request/response headers – Status Codes	2
4.2	Postman: Overview, Variables, Query Parameters – Read/Write JSON	2
4.3	Integration of API testing with CI/CD pipeline	2
5	Testing AI apps	
5.1	Goals – Key aspects – Lifecycle of AI Apps – Metamorphic Testing	2
5.2	Model back testing – Coverage guided fuzzing.	2
6	Testing and AI	

Module No.	Topic	No. of Periods
6.1	Self-healing tests – Low code /No code Test automation platforms	1
6.2	Test data synthesis	1
6.3	Test Optimization— Ethics	1
	Total	36

Course Designer(s):

1. Ms.S.Thiruchadai Pandeewari,AP,IT,eshwarimsp@tce.edu
2. Ms.S.Pudumalar, AP,IT,spmit@tce.edu

CURRICULUM AND DETAILED SYLLABI

FOR

B.Tech. INFORMATION TECHNOLOGY DEGREE PROGRAMME

INDUSTRY SUPPORTED COURSES

FOR THE STUDENTS ADMITTED IN THE

ACADEMIC YEAR 2022-23 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

22IT2A1	Generative AI	Category	L	T	P	Credit
		PEES	2	0	0	2

Preamble

This course provides an in-depth exploration of generative artificial intelligence techniques, focusing on algorithms and models that can create data similar to input data. Students will learn about various generative models, their applications, and practical implementation through programming assignments and projects.

Prerequisite

22IT160 – Problem Solving using Computers

22IT520 – Machine Learning

Course Outcomes

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

CO Number	Course Outcomes	TCE	Expected	Expected
		Proficiency	Level of	Attainment
		Scale	Proficiency	Level %
			in %	
CO1	Explain the fundamental principles and applications of generative models	TPS 2	70	70
CO2	Apply GAN architectures, adversarial training, and variants like DCGANs, WGANs, and CGANs to generate synthetic data	TPS 3	70	65
CO3	Demonstrate the use of generative models in domains like image generation, text generation, and music composition	TPS 3	70	65
CO4	Implement generative models using popular frameworks like TensorFlow or PyTorch.	TPS 3	70	65
CO5	Apply knowledge of generative AI's limitations and demonstrate ethical considerations for its responsible use	TPS 3	70	65
CO6	Develop critical thinking skills for evaluating and improving generative models.	TPS 4	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	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L											L		
CO2	S	M	L									M	M		
CO3	S	M	L		S			M		M	M	M	M	M	L
CO4	S	M	L		S			M		M	M	M	M	M	L
CO5	S	M	L									M	M		
CO6	S	S	M	L	S			M		M	M	M	M	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern:

CO	Internal				Terminal			
	Mini Project				Theory			
TPS Scale	1	2	3	4	1	2	3	4
CO1		10				15		
CO2			10			10	15	
CO3			20				20	
CO4			40				15	
CO5			10				15	
CO6				10				10

Syllabus

Introduction to Generative AI: Historical overview of generative modeling - Types of generative models: GANs, VAEs, autoregressive models- Probabilistic modeling and generative processes - Generative vs. discriminative models: differences and use cases – Prompt engineering - Evaluation metrics.

Generative Adversarial Networks (GANs): Generator and discriminator architectures in GANs - Training process: adversarial training, Nash equilibrium - Variants of GANs: DCGANs, WGANs, CGANs

Variational Autoencoders (VAEs): Encoder and decoder architectures in VAEs - Latent space representation and sampling techniques - Loss functions for training VAEs: reconstruction loss, KL divergence

Applications of GANs and VAEs: Image generation and synthesis using GANs - Data generation and augmentation with VAEs - Text-to-image synthesis, image in-painting, and style transfer - Building a simple GAN or VAE model in TensorFlow or PyTorch

Training and Fine-Tuning Generative Models: Hyperparameter tuning for generative models - Transfer learning and pre-training techniques - Regularization methods for preventing over-fitting - Generating images, text or audio using pre-trained generative models - Demonstrating the impact of hyperparameters on model performance

Ethics and Challenges in Generative AI: Bias and fairness issues - Privacy concerns in generating synthetic data - Adversarial attacks and defenses

Future Trends in Generative AI: Retrieval Augmented Generation (RAG), Multi-modal generative models: combining text, image, and audio generation - Integration of generative AI with other AI fields like reinforcement learning

Learning Resources

1. Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models, Joseph Babcock, Raghav Bali, 2021.
2. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, David Foster, 2019
3. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron, 2016
4. Coursera - "Build Basic Generative Adversarial Networks (GANs)"

Course Contents and Lecture Schedule

Module No.	Topic	No. of Hours
1	Introduction to Generative AI	
1.1	Historical overview of generative modeling	1
1.2	Types of generative models: GANs, VAEs, autoregressive models	
1.3	Probabilistic modeling and generative processes	1
1.4	Generative vs. discriminative models: differences and use cases - Evaluation metrics.	
2	Generative Adversarial Networks (GANs)	
2.1	Generator and discriminator architectures in GANs	1
2.2	Training process: adversarial training, Nash equilibrium	2
2.3	Variants of GANs: DCGANs, WGANs, CGANs	1
3	Variational Autoencoders (VAEs)	
3.1	Encoder and decoder architectures in VAEs	1
3.2	Latent space representation and sampling techniques	1
3.3	Loss functions for training VAEs: reconstruction loss, KL divergence	1
4	Applications of GANs and VAEs	
4.1	Image generation and synthesis using GANs	2
4.2	Data generation and augmentation with VAEs	2
4.3	Text-to-image synthesis, image in-painting, and style transfer	2
4.4	Building a simple GAN or VAE model in TensorFlow or PyTorch	2
5	Training and Fine-Tuning Generative Models	
5.1	Hyperparameter tuning for generative models	1
5.2	Transfer learning and pre-training techniques	1
5.3	Regularization methods for preventing over-fitting	1
5.4	Generating images or text using pre-trained generative models	2
5.5	Demonstrating the impact of hyperparameters on model performance	2
6	Ethics and Challenges in Generative AI	
6.1	Bias and fairness issues	2
6.2	Privacy concerns in generating synthetic data	
6.3	Adversarial attacks and defenses	
7	Future Trends in Generative AI	
7.1	Multi-modal generative models: combining text, image, and audio generation	2
7.2	Integration of generative AI with other AI fields like reinforcement learning	
Total Lecture Hours		28

Course Designer(s):

- | | |
|---|--|
| 1. Mr.Mari Ganesh Kumar, Applied Scientist II, Amazon | marigk@amazon.com |
| 2. Dr.M.Suguna | mscse@tce.edu |
| 3. Mrs.S.Sujitha | ssiit@tce.edu |
| 4. Dr.S.Sridevi | sridevi@tce.edu |

22IT2B1	SOFTWARE VULNERABILITY ANALYSIS AND MITIGATION TECHNIQUES
----------------	--

Category	L	T	P	Credit
PEES	1	0	2	2

Preamble

Software vulnerabilities are critical points of failure within applications that malicious actors exploit to compromise security, often resulting in data breaches, financial losses, and reputational damage. This course provides a foundational understanding of software vulnerability analysis and techniques for mitigating these threats. It equips students with knowledge of common vulnerabilities, frameworks for secure coding, and methods to strengthen security through vulnerability identification and prevention strategies.

Prerequisite

Nil

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	Explain the causes and impacts of vulnerabilities in web and mobile applications, highlighting the need for robust security frameworks across both platforms.	TPS2	70	75
CO2	Apply relevant security protocols (e.g., SSL/TLS) and configure response headers to mitigate risks in both web and mobile applications.	TPS3	70	70
CO3	Analyze applications to identify security flaws, referencing the OWASP Top 10 for both web and mobile vulnerabilities, such as Insecure Data Storage and Injection.	TPS4	70	65
CO4	Implement secure coding practices and apply a "Shift Left" approach to prevent security risks, focusing on unauthorized access prevention for web and mobile data storage.	TPS3	70	70
CO5	Evaluate the effectiveness of security measures in web and mobile applications through vulnerability assessments, making improvements based on testing outcomes.	TPS4	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			S							S	L	M	L
CO2	S	M	L		S			S				S	M	M	M
CO3	S	S	M	L	S	S		S	M	M	M	S	S	S	M
CO4	S	M	L		S			S				S	M	M	M
CO5	S	S	M	L	S	S		S			M	S	S	S	M

S-Strong; M-Medium; L-Low

AssessmentPattern

CO	Internal				Terminal			
	Written Test				Practical			
TPS Scale	1	2	3	4	1	2	3	4
CO1		10						
CO2		10	10				25	
CO3			10	10				25
CO4		10	10				25	
CO5			20	10				25

Syllabus

Software Vulnerability Analysis: Security breaches - Security frameworks – Case Studies on High Profile Data Breach, Insecure data storage, Insecure APIs, Weak Authentication and Authorization, Insecure Direct Object References

Common Protocols and Security Response Headers: SSL/HTTP protocols - Security response headers - Implementation.

OWASP Top 10 Overview: (Practical sessions) OWASP web application security risks – Broken Access Control, Crypto Failures, Injection, Insecure Design, Misconfigurations, Vulnerable & Outdated Components, Identification & Authentication Failures, Software & Data Integrity Failures, Log Failures

Tools and scanners for Vulnerability Analysis: Burp Suite, OWASP ZAP, and mobile-specific tools like MobSF

Secure Coding and Prevention Strategies: Mitigation Strategies: Server-Side Forgery Requests, Secure coding approaches, AWS Buckets Takeovers prevention, and Server Takeovers prevention - Shift Left security approach - Threat modelling in development lifecycle.

TextBook

1. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", O'Reilly Media, First Edition, 2023

ReferenceBooks&webresources

1. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws," 2nd Edition, Wiley, 2011, ISBN:1118026470/978-1118026472.
2. "Practical Mobile Forensics" by Heather Mahalik, Rohit Tamma, and Satish Bommisetty Publisher: Packt Publishing, Fourth Edition, 2022
3. Stuart McClure, Joel Scambray, Kurtz, "Hacking Exposed 7: Network Security Secrets & Solutions", 7th Edition, McGraw-Hill Prof Med/Tech, 2012, ISBN13:9780071780285
4. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2011, ISBN-13:9780132126953
5. OWASP Security Testing Guide
(https://www.owasp.org/index.php/File:OWASP_Testing_Guide_v2_pdf.zip)
6. OWASP: <http://www.owasp.org>
7. WASC: <http://www.webappsec.org/>
8. SANS: <http://www.sans.org>

CourseContentsandLectureSchedule

Module No.	Topic	No. of Periods
1	Introduction to Web Application Security	
1.1	Overview - Security breaches	1
1.2	Security frameworks – Need for robust web application security	1
1.3	Case Studies on High Profile Data Breach, Insecure data storage, Insecure APIs, Weak Authentication and Authorization, Insecure Direct Object References	2
2	CommonProtocolsandSecurityResponseHeaders	
2.1	ESSL/HTTPprotocols	1
2.2	Securityresponseheaders-Implementation	1
3	OWASP Top10 Overview	
3.1	OWASP web application security risks – Broken Access Control, Crypto Failures, Injection, Insecure Design, Misconfigurations	1
3.2	Vulnerable & Outdated Components, Identification & Authentication Failures	1
3.3	Software & Data Integrity Failures, Log Failures	2
4	Secure Coding and Prevention Strategies	
4.1	Mitigation Strategies: Server-Side Forgery Requests, Secure coding approaches	1
4.2	AWS Buckets Takeovers prevention, and Server Takeovers prevention	1
4.3	Shift Left security approach	1
4.4	Threat modeling in development life cycle	1
	Total	14

Practical

	Topic	No. of Periods
1	OWASP Top 10 Vulnerabilities – Experimentation	
1.1	OWASP web application security risks – Broken Access Control, Crypto Failures,	2
	Injection, Insecure Design, Misconfigurations	1
1.2	Vulnerable & Outdated Components,	2
	Identification & Authentication Failures	1
1.3	Software&DataIntegrityFailures,Log Failures	2
2	Tools and scanners for Vulnerability analysis	
2.1	Vulnerability Analysis with Burp Suite	2
2.2	Vulnerability Analysis with OWASP ZAP	2
2.3	Vulnerability Analysis with MoBSF	2
	Total	14

CourseDesigner(s):

1. PrateekTiwari, Security head, Zomato
2. M.Suguna
3. C. Jeyamala

pt@zomato.com
 mscse@tce.edu
jeyamala@tce.edu

22IT1D1	BUILD ENTERPRISE APPLICATIONS USING LOW CODE PLATFORMS
----------------	---

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

This course explores how low-code technology enables professionals—from developers to business analysts—to create robust, scalable applications with minimal coding. By simplifying complex development processes, low-code platforms accelerate digital transformation, allowing enterprises to respond swiftly to market demands, improve operational efficiency, and enhance customer experiences.

Prerequisite

NIL

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	Apply core low-code principles using components to create foundational applications and workflows	TPS 3	70	70
CO2	Apply various app types to basic real-time applications that meet specific business requirements.	TPS 3	70	70
CO3	Develop an app from scratch, publishing and managing the application for end-user deployment.	TPS 3	70	70
CO4	Develop and configure a Model-Driven App to deliver a data-driven business solutions	TPS 3	70	70
CO5	Design and implement automated workflows to streamline business processes.	TPS 3	70	70
CO6	Apply all the principles to address practical business use cases through low-code solutions.	TPS 3	70	70

Mapping with Programme Outcomes

COs	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	S	M	L		S							S	M	M	L
CO2	S	M	L		S							S	M	M	L
CO3	S	M	L		S							S	M	M	L
CO4	S	M	L		S							S	M	M	L
CO5	S	M	L		S							S	M	M	L
CO6	S	M	L		S							S	M	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Internal						Terminal					
	Mini Project											
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1	-	-	10	-	-	-	5	5	5	-	-	-
CO2	-	-	10	-	-	-	5	5	5	-	-	-
CO3	-	-	10	-	-	-	5	5	10	-	-	-
CO4	-	-	20	-	-	-	5	5	10	-	-	-
CO5	-	-	20	-	-	-	5	5	10	-	-	-
CO6	-	-	30	-	-	-	-	-	10	-	-	-

Syllabus

Introduction to Low-Code Applications: Overview of Low-Code Platforms, Microsoft Power Platform, Business Use Cases, Microsoft Cloud Setup

MS Power Apps: Introduction to Power Apps, Types of apps- Canvas, Model-Driven, Portals Real time Applications

Canvas Apps Development : Canvas Apps, Basic Customizations, Building from Scratch, Connecting to Data Sources, UI Customizations, Implementing Functions & Formulas, Publishing & Managing the Application

Model-Driven Apps Development : Model-Driven Apps, Advanced Configuration & Customization, Connecting with Dataverse for Data Storage, Publishing & Managing Model-Driven Apps

MS Power Automate: Power Automate & Flows, Integration with Other Microsoft Services, Advanced Features: Conditions, Loops, and Switch Cases, Integration with Power Apps

Learning Resources

1. <https://learn.microsoft.com/en-us/>
2. <https://community.powerplatform.com/>
3. <https://learn.microsoft.com/en-us/power-apps/>

Course Contents and Lecture Schedule

Module No	Topic	No. of Lecture Hours	Course Outcomes
1.	Introduction to Low-Code Applications		CO1
1.1	Overview of Low-Code Platforms	1	
1.2	Microsoft Power Platform		
1.3	Business Use Cases		
1.4	Microsoft Cloud Setup	1	
2.	MS Power Apps		CO2
2.1	Introduction to Power Apps	1	
2.2	Types of apps- Canvas, Model-Driven,Portals		

2.3	Real time Applications		
3	Canvas Apps Development		
3.1	Canvas Apps	1	CO3
3.2	Basic Customizations		
3.3	Building from Scratch	2	
3.4	Connecting to Data Sources		
3.5	UI Customizations	1	
3.6	Implementing Functions & Formulas		
3.7	Publishing & Managing the Application	1	
4	Model-Driven Apps Development		
4.1	Model-Driven Apps,	1	CO4
4.2	Advanced Configuration & Customization		
4.3	Connecting with Dataverse for Data Storage	1	
4.4	Publishing & Managing Model-Driven Apps	1	
5	MS Power Automate		
5.1	Power Automate & Flows	1	CO5
5.2	Integration with Other Microsoft Services		
5.3	Handling Advanced Features	1	
5.4	Integration with Power Apps	1	
	Total Lecture Hours	14	

Course Designers:

- | | |
|--------------------------|---------------------------------------|
| 1. Mr. Venkat Aravamudan | venkat@rortechologies.onmicrosoft.com |
| 2. Dr.S.Muthuramalingam | smrit@tce.edu |
| 3. C.V.Nisha Angeline | cvnait@tce.edu |

22IT1E1	SERVER OBSERVABILITY FRAMEWORK
----------------	---

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

Server Observability Framework provide an in-depth understanding of the strategies, tools, and best practices for ensuring that server infrastructure is both observable and manageable. The course will explore the principles of observability metrics, logs, and trace and to effectively integrate them into server environments.

Prerequisite

- None

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the significance of Server Observability	TPS2	70	80
CO2	Perform Application Hosting in the Cloud environment	TPS3	70	70
CO3	Use OpenTelemetry tool for Server Observability	TPS3	70	70
CO4	Integrate OpenTelemetry tool for analyzing Web server and applications	TPS4	70	65
CO5	Use OpenTelemetry tool for observing Web server and applications	TPS4	70	65
CO6	Explain the use of AI techniques in Server Observability	TPS2	70	70

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Continuous Assessment				Terminal			
	Mini Project							
TPS SCALE	1	2	3	4	1	2	3	4
CO1	5	5			5	5		
CO2		10	10			5	10	
CO3		10	10			5	10	
CO4			10	10		5	15	5
CO5			10	10		5	15	5
CO6	5	5			5	5		

Syllabus

Observability - Core pillars of Observability - Observability Tools and Technologies - Importance of Observability

Java App Deployment in Web Server - Role of Web Server - Setting Up Server Environment - Application Deployment - Cloud Hosting

OpenTelemetry Basics - OpenTelemetry architecture overview, Understanding SDK and API components, Instrumentation concepts

Integrating OpenTelemetry to Java Application - Basic Instrumentation in Java

- Automatic Instrumentation - Context Propagation and Distributed Tracing- Collecting Metrics with OpenTelemetry - Deploying and Testing the OpenTelemetry Integration

Implementation - Metrics Collection – Tracing - Logging Integration- Instrumentation - Monitoring and Alerting – Case Study

Cloud-native Monitoring Services – Overview of Cloud Provider Services - CloudWatch, Azure Monitor, Google Cloud Monitoring

AI-based Observability - Use cases - Anomaly Detection, Proactive Monitoring

Learning resources

1. <https://github.com/open-telemetry/opentelemetry-demo>
2. <https://www.udacity.com/course/cloud-developer>

Course Contents and Lecture Schedule

Module No	Topic	No. of Periods
1.	Observability	
1.1	Core pillars of Observability	1
1.2	Observability Tools and Technologies	1
1.3	Importance of Observability	

22ITRH1

**EDGE COMPUTING FOR
SMART SYSTEMS**

Category	L	T	P	Credit
PEES	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 Outcomes	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 storage techniques and platforms 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	Perform Task offloading among Fog/Edge devices and the cloud.	TPS 3	70	60
CO5	Make use of EdgeML for data analytics applications.	TPS 3	70	65
CO6	Perform real-time data integration and analysis for edge computing applications.	TPS 3	70	65

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	L	S			M	M	M	L	M	M	M
CO5	S	M	L		S			M	M	M	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 - Azure IoT Hub-AWS IoT Platform

Edge Storage and Data Processing: Design of Key-Value Stores – Apache Cassandra – Consistency Solutions - Spark Fundamentals – Installation of Apache Spark – Data processing with Spark

App Deployment in Edge: Containerization with Docker-Kubernetes

Workload offloading – Mathematical formulations for Task offloading – Task offloading techniques

Edge Intelligence : Traditional IoT Platform – Issues – ML on Cloud vs ML on Edge EdgeML – Advantages – Applications – Workflow of Edge ML - ML-based Predictive Analytics at Edge

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), 2017
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

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods	CO
1	Computing Paradigms		
1.1	Cloud vs Fog vs Edge computing Concepts	2	CO1
1.2	Characteristics-Services - Challenges	1	CO1
1.3	Fog/Edge Computing : Architecture - Motivations	1	CO1

Module No.	Topic	No. of Periods	CO
1.4	Performance Enhancements - Enabling Technologies	1	CO1
1.5	Overview of Edge-based applications	1	CO1
2	IoT, Edge and Fog		
2.1	Introduction to IoT platform	1	CO2
2.2	Communication Protocols: MQTT – CoAP	1	CO2
2.3	Kafka	1	CO2
2.4	Azure IoT Hub	1	CO2
2.5	AWS IoT Platform	1	CO2
3	Edge Storage and Data Processing		
3.1	Design of Key-Value Stores	1	CO2
3.2	Apache Cassandra Consistency Solutions	1	CO2
3.3	Consistency Solutions	1	CO2
3.4	Spark Fundamentals	1	CO2
3.5	Installation of Apache Spark	1	CO2
3.6	Data processing with Spark	2	CO2
4	App Deployment in Edge		
4.1	Containerization with Docker	2	CO3
4.2	Kubernetes	1	CO3
5	Workload offloading		
5.1	Mathematical formulations for Task offloading	1	CO4
5.2	Task offloading techniques based on DL methods	2	CO4
6	Edge Intelligence for IoT		
6.1	Traditional IoT Platform – Issues	1	CO5
6.2	ML on Cloud vs ML on Edge	2	CO5
6.3	EdgeML – Advantages – Applications	1	CO5
6.4	Workflow of Edge ML	2	CO5
6.5	ML-based Predictive Analytics at Edge	2	CO5
7	Use cases		
7.1	Fog-based real-time sensor data analysis	1	CO6
7.2	Vehicular Networks	1	CO6
7.3	5G systems	1	CO6
	Total lectures	36	

Course Designer(s):

1. Dr. S. Padmavathi, Professor, IT, spmcse@tce.edu
2. Mrs S. Thiruchadai Pandeewari, Assistant Professor, IT, eshwarimsp@tce.edu

22ITRJ1**AI FOR CYBERSECURITY**

Category L T P Credit

PEES 3 1 0 3

Preamble

This course explores Cybersecurity principles and the transformative application of Artificial Intelligence and Machine Learning to enhance threat detection, analysis, and response. The ethical implications and risks associated are analysed with both traditional and intelligent security practices. The goal is to equip learners with the knowledge and critical thinking skills to develop resilient and ethical Cybersecurity solutions for evolving threats.

Prerequisite

- 22IT510 Information security
- 22IT520 Machine Learning

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	Detail the fundamental principles and practices of Cybersecurity, including threat landscapes, security controls, and risk management frameworks.	TPS2	80	75
CO2	Apply digital forensics principles and techniques to investigate cyber incidents, collect and report digital evidence	TPS 3	70	70
CO3	Respond to various cyber incidents, implement incident response plans, and ensure business continuity and disaster recovery.	TPS 3	70	70
CO4	Develop expert systems using knowledge representation techniques for threat detection and response	TPS 3	70	70
CO5	Apply AI and Machine Learning techniques to address specific Cybersecurity use case scenarios, enhancing detection, analysis, and response capabilities.	TPS 3	70	70
CO6	Assess the ethical implications and potential risks associated with Cybersecurity practices, digital forensics investigations, and the deployment of AI and ML in this domain.	TPS 4	70	65

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1			Assignment 1			CAT2				Assignment 2				Terminal			
	100			100			100				100				100			
TPS Scale	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4
CO1	10	10			20											10		
CO2	10	10	25			40										5	10	
CO3		10	25			40										5	15	
CO4							5	10	20				30				15	
CO5								10	20				40			5	15	
CO6							5	10		20				30		5		15

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Introduction to Cybersecurity - Core concepts - Security principles and goals, Cyber threats - Types - OWASP security risks, Attack vectors, Threat vectors, Security controls, Risk management frameworks - NIST CSF, ISO 27001, Major cyber attacks.

Digital Forensics – Principles, Types of digital evidence, Forensic process, Legal and ethical considerations – Laws and regulations, Admissibility of evidence and chain of custody, Evidence acquisition, Analysis techniques - File system, log and registry analysis, Memory forensics. Case studies - Investigation of Network intrusion, Insider threat, and Compromised server.

Cyber incidents – Lifecycle of cyber incident response – Preparation, detection and analysis, containment, eradication, recovery and lessons, Incident response – Roles and responsibilities, communication, escalation procedures. Business continuity and Disaster recovery- Planning, backup, recovery procedures and testing, Tabletop exercise on incident response.

Expert systems - Knowledge representation - Logic and inferences, Knowledge base for cyber security threats, RETE Graph, Forward and backward chaining for Cybersecurity scenarios. Case studies - SIEM correlation engines, phishing detection.

AI and Machine learning – AI/ML for threat detection – anomaly and user behaviour prediction using SVM and Isolation forest algorithms. Malware analysis and classification using random forest and CNN algorithms. Vulnerability score prediction and prioritization using XGBoost. Issues and challenges in automated AIML application for Cybersecurity. Practical sessions - Building AI/ML based security model using Python frameworks.

Ethical considerations - Privacy, data protection, responsible disclosure, Forensics - Data integrity, witness responsibilities, Building Responsible AI models.

Risks – Human error, misconfiguration, insider threat, Forensics – data breaches and tampering, AI/ML - adversarial attacks, reliance on automation.

Reference Books & web resources

1. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Pearson Education, Fourth Edition, 2018.
2. OWASP Foundation, "OWASP Top 10 - 2021: The 10 Most Critical Web Application Security Risks", OWASP Foundation, 2021(<https://owasp.org/www-project-top-ten/>).
3. Bill Nelson, Amelia Phillips, Christopher Steuart, and Andrew McWhorter, "Guide to Computer Forensics and Investigations", Cengage Learning, Sixth Edition, 2019.
4. Dipanjan Sarkar, Raghav Bali, and Tushar Sharma, *Practical Machine Learning with Python: A Problem-Solver's Guide to Building Real-World Intelligent Systems*, Apress, 2017.

5. Clarence Chio and David Freeman, "Deep Learning for Security", O'Reilly Media, 2018.
6. Patrick Lin, Simon Rogerson, and Johnny Soraker, "Cybersecurity Ethics: An Introduction", Routledge, 2020.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Cybersecurity	
1.1	Core concepts - security principles and goals	1
1.2	Cyber threats - types	1
1.3	Attack vectors and threat vectors, security controls	1
1.4	Risk management frameworks	1
1.5	Case studies - Major cyber attacks	1
2	Digital forensics	
2.1	Principles, Types of digital evidence	1
2.2	Digital forensics process	1
2.3	Legal and ethical considerations	1
2.4	Admissibility and chain of custody	1
2.5	Digital evidence acquisition	1
2.6	Forensic analysis techniques	1
2.7	Use case discussions	1
3	Network vulnerabilities and security.	
3.1	Network protocols, vulnerabilities and exploitation	1
3.2	Patch management, configuration hardening	1
3.3	Assessment using tools and reporting	1
3.4	Security measures - Firewalls, IDS	1
3.5	Access control and encryption techniques	1
3.6	Hands-on session - Vulnerability assessment	1
4	Cyber incidents	
4.1	Cyber Incident Response Lifecycle	1
4.2	Preparation and detection to recovery and lessons	
4.3	Developing Incident Response Plans	1

Module No.	Topic	No. of Periods
4.4	Handling Different Types of Incidents	1
4.5	Planning, backup, recovery procedures and Testing	1
4.6	Tabletop exercise on incident response	1
5	AI/ML Solutions for Cybersecurity	
5.1	AI/ML for threat detection	1
5.2	Malware analysis and classification	1
5.3	Vulnerability score prediction and prioritization	1
5.4	SIEM enhancement using AI/ML algorithms	1
5.5	Issues and challenges	
5.6	Lab session - Implement basic AI/ML security model	2
6	Ethical considerations and Risk management	
6.1	Privacy, data protection, responsible disclosure	1
6.2	Data integrity, witness responsibilities	1
6.3	AI/ML - Bias, fairness	1
6.4	Accountability, potential for misuse	1
6.5	Human error, misconfiguration, insider threat	1
6.6	Data breaches and tampering	1
6.7	AI/ML - adversarial attacks, reliance on automation	1
	Total	36

Course Designer(s):

1. Dr.M.Suguna, Associate Professor, Dept. of IT
2. Dr.C.Deisy, Professor and Head, Dept. of IT

mscse@tce.edu
hodit@tce.edu

22IT1F1	AI-DRIVEN WORKFLOW AND ETL AUTOMATION
----------------	--

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

Modern data teams rely on visual pipeline designers, event-driven automation engines and scriptable modules to ingest, transform and route data, and then enrich it with AI-based decisioning. This course guides students through building real-world ETL workflows using node-based designers, lightweight code snippets and pre-built model connectors, culminating in fully monitored, production-ready pipelines.

Prerequisite

- NIL

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	Apply the components and lifecycle of automated data pipelines, including visual-node ingestion, transformation steps and embedded model-driven enrichment.	TPS 3	70	70
CO2	Illustrate and configure end-to-end ETL workflows by combining node-based flows with custom script modules.	TPS 3	70	70
CO3	Develop anomaly-detection and text-processing inference steps within pipelines to validate and enhance data quality.	TPS 3	70	70
CO4	Illustrate multi-step workflows with dynamic triggers, branching logic, retry policies and error-handling guards.	TPS 3	70	70
CO5	Apply and secure runtime AI model calls and webhook-driven notifications through custom connectors.	TPS 3	70	70
CO6	Illustrate pipeline execution via logs and dashboards, analyse performance metrics, and optimize for reliability, throughput and cost efficiency.	TPS 3	70	70

Mapping with Programme Outcomes

COs	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	S	M	L									M	S	M
CO2	S	M	L									M		
CO3	S	M	L		S			M	M	M		M	M	M
CO4	S	M	L	L	S			M	M	M	L	M	M	M
CO5	S	M	L		S			M	M	M	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	Internal						Terminal					
	Mini Project											
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1	-	-	10	-	-	-	5	5	5	-	-	-
CO2	-	-	10	-	-	-	5	5	5	-	-	-
CO3	-	-	10	-	-	-	5	5	10	-	-	-
CO4	-	-	20	-	-	-	5	5	10	-	-	-
CO5	-	-	20	-	-	-	5	5	10	-	-	-
CO6	-	-	30	-	-	-	-	-	10	-	-	-

Syllabus

Foundations of Automated Workflows & ETL : Introduction to automated data workflows: lifecycle overview , Data ingestion patterns: streaming vs batch ,Transform steps: mapping, joins, aggregations, Automated enrichment using embedded models

Visual Pipeline Design & Scripting Modules:Building node-based data flows, Embedding script blocks for custom logic, Connecting to relational and file-based sources, Test and debug the ingest-transform-load pipeline

In-Pipeline AI: Quality Assurance & Enrichment: Anomaly detection operators using node and script-based techniques, Text-processing tasks (tokenization, cleaning) , Automated feature-extraction snippets

Orchestration & Runtime Control: Workflow scheduling and event triggers, Branching, loops, retries, and SLA guards, Dynamic workflows with parameters and conditional paths

Model Integration & Webhook-Driven Actions: Packaging inference tasks as callable operators , Runtime credential management (tokens, secrets, secure APIs) , Trigger-based alerts and downstream notifications

Monitoring, Logging & Optimization: Centralized observability dashboards, Throughput and latency tuning, Cost-effective resource allocation

Case Study: Walkthrough of a retail-analytics pipeline: Sales Performance Analysis, Customer Segmentation & Behavior Tracking, Inventory Optimization, Pricing Intelligence & Competitor Monitoring, Store Footfall and Layout Analytics

Learning Resources

1. Data Engineering with Python: Work with Massive Datasets to Design Data Models and Automate Data Pipelines Using Python (2nd Edition), Paul Crickard, Packt Publishing, 2023
2. Fundamentals of Data Engineering: Plan and Build Robust Data Systems, Joe Reis & Matt Housley, O'Reilly Media, 2022
3. <https://docs.n8n.io>
4. <https://hub.knime.com>

Course Contents and Lecture Schedule

Module No.	Topic	No of Periods	CO
1	Foundations of Automated Workflows & ETL		
1.1	Introduction to automated data workflows: lifecycle overview	1	CO1
1.2	Data ingestion patterns: streaming vs batch	1	CO1
1.3	Transform steps: mapping, joins, aggregations, Automated enrichment using embedded models		CO1
2	Visual Pipeline Design & Scripting Modules		
2.1	Building node-based data flows	1	CO2
2.2	Embedding script blocks for custom logic	1	CO2
2.3	Connecting to relational and file-based sources		CO2
2.4	Test and debug the ingest-transform-load pipeline	1	CO2
3	In-Pipeline AI: Quality Assurance & Enrichment		
3.1	Anomaly detection operators using node and script-based techniques	1	CO3
3.2	Text-processing tasks (tokenization, cleaning)		CO3
3.3	Automated feature-extraction snippets	1	CO3
4	Orchestration & Runtime Control		
4.1	Workflow scheduling and event triggers	1	CO4
4.2	Branching, loops, retries, and SLA guards	1	CO4
4.3	Dynamic workflows with parameters and conditional paths	1	CO4
5	Model Integration & Webhook-Driven Actions		
5.1	Packaging inference tasks as callable operators	1	CO5
5.2	Runtime credential management (tokens, secrets, secure APIs)	1	CO5
5.3	Trigger-based alerts and downstream notifications		CO5
6	Monitoring, Logging & Optimization		
6.1	Centralized observability dashboards	1	CO5
6.2	Throughput and latency tuning, Cost-effective resource allocation		CO5
7	Case Study		
7.1	Walkthrough of a retail-analytics pipeline	1	CO6
7.2	Sales Performance Analysis, Customer Segmentation & Behaviour Tracking, Inventory Optimization, Pricing Intelligence & Competitor Monitoring, Store Footfall and Layout Analytics		CO6
	Total Lecture Hours	14	

Course Designers:

- | | |
|----------------------------|-----------------------|
| 1. Mr.Ajmeer Kaja Mohideen | ajmeercec04@gmail.com |
| 2. Dr.S.Muthuramalingam | smrit@tce.edu |
| 3. Ms.C.V.Nisha Angeline | cvnait@tce.edu |

Ajmeer Kaja Mohideen, who serves as an Advisor at Tarcin Robotics LLP, a technology firm based in Madurai, Tamil Nadu. He specializes in IT consulting, technical support, web development, educational consulting, training, and computer networking.

22IT1H1	FLUTTER TECHNOLOGIES
----------------	-----------------------------

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

This course enables the students to learn Flutter and Dart from the ground up, step-by-step and help them build engaging native mobile apps for both Android and iOS

Prerequisite

- NIL

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	Review the benefits of Dart Language	TPS 2	70	70
CO2	Model the architecture of Dart and Flutter	TPS 3	70	70
CO3	Use various Components to design the UI of the app.	TPS 3	70	70
CO4	Make use of various web services and Firebase to deploy the app	TPS 3	70	70
CO5	Utilize various debugging tools to handle errors and to perform Unit Testing	TPS 3	70	70
CO6	Apply Flutter concepts for societal or business requirements	TPS 3	70	70

Mapping with Programme Outcomes

COs	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	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	L	S			M	M	M	L	M	M	M
CO5	S	M	L		S			M	M	M	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	Internal			Terminal		
	Mini Project					
TPS Scale	1	2	3	1	2	3
CO1	-	10	-	5	10	-
CO2	-	-	10	5	5	5
CO3	-	-	10	5	5	10
CO4	-	-	20	5	5	10
CO5	-	-	20	5	5	10
CO6	-	-	30	-	-	10

Syllabus

Hybrid App development Introduction : Challenges - Benefits - Dart Language architecture: The Language - Core Libraries - Packages -Development- Platforms of Dart

Flutter high level architect : Architectural Layer - Reactive user interfaces - State management -Platform Embedding- Flutter Versions

UI Components : Widgets - Free Styling- Enums- Multiple Constructors- scaffold - Container-stack- Layout - Gestures - Navigation - Routing-Adding Forms

Web Services : Writing flutter app on web - Launching DART DEV Tools - DART Web Service API -Accessing REST API - JSON - Serialization - Firebase

Testing : Debugging Tools - OEM Debugger -Build modes : Error Handling - Integration Testing

Use Cases: Healthcare – Telemedicine apps, Education – E-learning platforms, HRMS – Employee portals, Inventory – Stock tracking

Learning Resources

1. Flutter for Cross-Platform App Development, Temidayo Adefioy, Orange Education, 2024
2. Building Cross-Platform Apps with Flutter and Dart: Build scalable apps for Android, iOS, and web from a single codebase, Deven Joshi, BPB Publications, 2023
3. <https://dart.dev/>
4. <https://flutter.dev/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods	CO
1.	Hybrid App development Introduction		
1.1	Introduction : Challenges, Benefits	1	CO1
1.2	Dart Language architecture		CO1
1.3	The Language		CO1
1.4	Core Libraries	1	CO1

1.5	Packages		CO1
1.6	Development		CO1
1.7	Platforms of Dart		CO1
2.	Flutter high-level architect		
2.1	Architectural Layer	2	CO2
2.2	Reactive user interfaces		CO2
2.3	State management		CO2
2.4	Platform Embedding		CO2
2.5	Flutter Versions		CO2
3	UI Components		
3.1	Widgets	1	CO3
3.2	Free Styling		CO3
3.3	Enums	1	CO3
3.4	Multiple Constructors		CO3
3.5	Scaffold	1	CO3
3.6	Container,stack,Layout		CO3
3.7	Gestures	1	CO3
3.8	Navigation and Routing		CO3
3.9	Adding Forms		CO3
4	Web Services		
4.1	Writing Flutter app on the web	2	CO4
4.2	Launching DART DEV Tools		CO4
4.3	DART Web Service API		CO4
4.4	Accessing REST API		CO4
4.5	JSON		CO4
4.6	Serialization		CO4
4.7	Firebase		CO4
5	Testing		
5.1	Debugging Tools	2	CO5
5.2	OEM Debugger		CO5
5.3	Build modes		CO5
5.4	Error Handling		CO5
5.5	Integration Testing		CO5
6	Use Cases		
6.1	Healthcare – Telemedicine apps	1	CO6
6.2	Education – E-learning platforms		CO6
6.3	HRMS – Employee portals	1	CO6
6.4	Inventory – Stock tracking		CO6
	Total Lectures	14	

Course Designers:

- | | |
|--------------------------|-----------------------------------|
| 1. Mr. Sivanesh Selvan | sivanesh.selvan@surveysparrow.com |
| 2. Dr.S.Muthuramalingam | smrit@tce.edu |
| 3. Ms.C.V.Nisha Angeline | cvnait@tce.edu |

Sivanesh Selvan- Lead Product Developer - Level 2 at SurveySparrow

Sivanesh Selvan has a varied work experience, beginning in 2017. In 2018, they began working at Amphisoft Technologies Pvt. Ltd., as a Product Engineer, and then as a Product Engineer Intern. In 2021, they began working at SurveySparrow as a Product Developer and then as a Senior Product Developer.

22IT1G1	GENERATIVE MODELING FOR INDUSTRIAL APPLICATIONS (COMMON TO CSE, IT AND CSBS)	Category	L	T	P	Credit
		PEES	1	0	0	1

Preamble

This course explores and evaluates the industrial applications of advanced generative modeling techniques, with a focus on how these methods can enhance efficiency, innovation, and automation across various sectors. This includes examining the use of generative models in healthcare, finance and industrial applications.

Prerequisite

Nil

Course Outcomes

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

CO1	Course Outcome 1 (CO1)	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Describe the core concepts, mathematical foundations and real-world uses of generative models.	TPS2	70	70
CO2	Examine the core mathematical principles and architectural differences of generative models such as VAEs, GANs, and Autoregressive Models.	TPS4	70	60
CO3	Apply appropriate generative models to practical tasks such as image synthesis, text generation, and time series forecasting based on their characteristics and strengths.	TPS3	70	65
CO4	Apply advanced optimization techniques and evaluation metrics to fine-tune pre-trained generative models and assess their quality and performance effective	TPS3	70	65
CO5	Analyze generative modeling techniques to solve domain-specific problems in healthcare, finance, and natural language processing.	TPS4	70	60
CO6	Apply strategies for scaling and deploying generative models to handle large datasets and real-time applications, including integration with large language models (LLMs)	TPS3	70	65

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	M	L										L		

CO2	S	S	M	L	S	M	M	M	M		S	S	S	M
CO3	S	M	L		M	M					M	M	S	L
CO4	S	M	L		M	M					M	M	S	L
CO5	S	S	M	L	S	M	M	M	M		S	S	S	M
CO6	S	M	L		M	M					M	M	S	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Internal				Terminal			
	Mini -Project				Theory			
TPS Scale	1	2	3	4	1	2	3	4
CO1		20			5	5		
CO2				20		5		20
CO3			20			5	15	
CO4			10				10	
CO5				20				20
CO6			10			5	10	

* Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

Generative Modeling: Discriminative and generative models, explicit vs implicit generative models, Probability distributions, Concept of latent variables, inference in latent variables

Generative Model Architectures:

Variational Autoencoders (VAEs): Deep dive into VAEs, their mathematical Foundations, and applications, Architectural Variations: Convolutional VAEs, recurrent VAEs, hierarchical VAEs

Generative Adversarial Networks (GANs): Explore advanced GAN architectures like StyleGAN, and BigGAN.

Transformers in generative models: GPT, BERT, and their variants, Time Series Forecasting, combining generative models with large language models (LLMs)

Techniques for optimization and Evaluation Metrics: Fine-tuning pre-trained models, Advanced evaluation metrics for generative models, Techniques for assessing model quality and performance

Applications in Specialized Domains: Healthcare: Use of generative models for medical imaging, drug discovery, and personalized medicine.

Finance: Applications in fraud detection, algorithmic trading, and risk management.

Natural Language Processing (NLP): Advanced text generation, summarization, translation, and conversational agents.

Industrial applications: defect detection in manufacturing, product design automation, and predictive maintenance

Scalability and Deployment: Strategies for scaling generative models for large datasets and real-time applications, Deployment of generative models in production environments using cloud platforms.

Learning Resources

1. Shaun Wassell, "Generative AI for Python Developers", Pearson, First Edition, 2024.
2. Joseph Babcock and Raghav Bali, "Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs GANs, LSTMs, Transformer models", Packt Publishing, First Edition, 2021.
3. Akshay Kulkarni, Adarsha Shivananda, Anoosh Kulkarni, Dilip Gudivada, "Applied Generative AI for Beginners", Apress, First Edition, 2023.
4. Amit Bahree, "Generative AI in Action", Manning Publications, First Edition, 2024.
5. NPTEL- "Programming with Generative AI", by Prof. Viraj Kumar, IISc Bangalore, https://onlinecourses.nptel.ac.in/noc25_cs137/preview,
6. Coursera – "Build Basic Generative Adversarial Networks (GANs)", Sharon Zhou, <https://www.coursera.org/learn/build-basic-generative-adversarial-networks-gans>,

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Generative Modeling	
1.1	Discriminative and generative models, explicit vs implicit generative models	1
1.2	Probability distributions, Concept of latent variables, inference in latent variables	
2	Generative Model Architectures:	
2.1	Variational Autoencoders (VAEs): Deep dive into VAEs, their mathematical Foundations, and applications	1
2.2	Architectural Variations: Convolutional VAEs, recurrent VAEs, hierarchical VAEs	2
2.3	Generative Adversarial Networks (GANs): Explore advanced GAN architectures like StyleGAN, and BigGAN	1
2.4	Transformers in generative models: including GPT, BERT, and their variants, Time Series Forecasting	2
2.5	Combining generative models with large language models (LLMs)	1
2.6	Techniques for optimization and Evaluation Metrics: Fine-tuning pre-trained models	1
2.7	Advanced evaluation metrics for generative models, Techniques for assessing model quality and performance	
3	Applications in Specialized Domains	
3.1	Healthcare: Use of generative models for medical imaging, drug discovery, and personalized medicine	1

Module No.	Topic	No. of Periods
3.2	Finance: Applications in fraud detection, algorithmic trading, and risk management.	1
3.3	Natural Language Processing (NLP): Advanced text generation, summarization, translation, and conversational agents	1
3.4	Industrial applications: defect detection in manufacturing, product design automation, and predictive maintenance	
4	Scalability and Deployment	
4.1	Strategies for scaling generative models for large datasets and real-time applications	1
4.2	Deployment of generative models in production environments using cloud platforms.	1
	Total	14

Course Designer(s):

1. Dr Suresh Rajappa, Global Data Leader, KPMG,USA sureshrajappa@kpmg.ca
2. Dr S Sridevi, Professor, IT Department sridevi@tce.edu
3. Dr J Felicia Lilian, Assistant Professor, CSBS department jflcse@tce.edu
4. Mrs S Jeniba, Assistant Professor, CSE department sjacse@tce.edu

Dr. Suresh Rajappa currently serves as a Global Data Leader and Chief Data Officer at KPMG, Dallas, USA, driving global data strategy, architecture, and monetization, achieving revenue growth and scalability while leading a 10x team expansion through innovation, analytics, and digital transformation.

22ITVA1	EMOTIONAL INTELLIGENCE IN DIGITAL ERA	Category	L	T	P	Credit
		VAC	0	0	0	0

Preamble

The rising prevalence of mental health issues in children, adolescents, and young adults has become an escalating public health issue, impacting approximately 10%-20% of young people on a global scale. The digital age has brought both benefits and challenges to well-being. Students learn on using technology to enhance well-being and flourishing, shifting from a solely problem-focused approach to a more holistic view of human experience

Syllabus

Introduction to Emotional Intelligence : Emotional Intelligence Introduction, Science behind driving emotions, Impact on Decision Making, Amygdala hijack, happiness and positive psychology, effects of positive and negative thoughts on the brain, Happiness as a Policy Issue, Measuring Happiness Globally, Policies to Increase Happiness, Well Being with PERMA(Positive emotion, Engagement, Relationships, Meaning and Accomplishment)Model, Case Studies discussion and activities.

The Effects of Media on Cognition: Social media and young adults, The influence of social media on mental health, Social Media effect on Neuro science and brain impacts to behavioral changes, The role of social media in addiction - The impact of media on human psychology, Case Studies on Media addiction, Algorithm driven content with Attention Engineers.

Living with Technology: The role of technology in our everyday lives, role of AI in human emotion recognition, Technology vs Mental Health: Finding Balance, Case Studies for the impact of advertisement on everyday lives, Affective Computing, Computational model mimics humans' ability to predict emotions, Case Studies

Strategies for implementing positive psychology: Prosocial Behavior - Psychological Factors Directing Helping Behavior, Understanding Altruism and Egoism, Dissecting neural mechanisms of prosocial behavior, Case Studies for Brain (Thoughts, Feelings and Behavior) and success stories of empirical studies, Modeling Emotions, WHO, WFMH Organization for Mental Health

Outcomes and Deliverable

Emotional Intelligence and Positive psychology interventions in the digital era can lead to improved mental and emotional well-being, reduced negative emotions, and increased happiness, optimism, and life satisfaction. Digital platforms and technologies facilitate access to these interventions and can be used to build connections, reduce stigma, and promote positive psychological outcomes like resilience and self-growth

Text Book Reference

1. https://ocw.mit.edu/ans7870/9/9.00SC/MIT9_00SCF11_text.pdf

Additional Readings

1. Ben-Shahar, Tal. Happier: Learn the Secrets to Daily Joy and Lasting Fulfillment. McGraw-Hill, 2007. ISBN: 9780071492393. [Preview with [Google Books](#)]

2. <https://web.education.unimelb.edu.au/assets/pospsych/Positive%20psychology%20and%20the%20internet%20A%20mental%20health%20opportunity.pdf>
3. <https://ppc.sas.upenn.edu/learn-more/perma-theory-well-being-and-perma-workshops>
4. https://www.hbs.edu/ris/Publication%20Files/Happiness%20runs%20in%20a%20circular%20motion_1d986896-2f38-4578-ad93-e90bd82b07fd.pdf
5. <https://med.stanford.edu/content/dam/sm/phs-MCK/documents/cdev.13549.pdf>
6. <https://pmc.ncbi.nlm.nih.gov/articles/PMC8169714/>
7. <https://www.media.mit.edu/projects/sleepstim/overview/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Positive Psychology	
1.1	Emotional Intelligence Introduction, Science behind driving emotions, Impact on Decision Making	2
1.2	Amygdala hijack, happiness and positive psychology, effects of positive and negative thoughts on the brain	1
1.3	Happiness as a Policy Issue, Measuring Happiness Globally, Policies to Increase Happiness	1
1.4	Well Being with PERMA(Positive emotion, Engagement, Relationships, Meaning and Accomplishment)Model	1
1.5	Case Studies discussion and activities	2
2	The Effects of Media on Cognition	
2.1	Social media and young adults, The influence of social media on mental health	2
2.2	Social Media effect on Neuroscience and brain impacts to behavioral changes	2
2.3	The role of social media in addiction - The impact of media on human psychology	1
2.4	Case Studies on Media addiction, Algorithm driven content with Attention Engineers	2
3	Living with Technology	
3.1	The role of technology in our everyday lives, role of AI in human emotion recognition	2
3.2	Technology vs Mental Health: Finding Balance, Case Studies for the impact of advertisement on everyday lives	2
3.3	Affective Computing, Computational model mimics humans' ability to predict emotions	2
3.4	Case Studies	2
4	Strategies for implementing positive psychology: Prosocial Behaviour	

CURRICULUM AND DETAILED SYLLABI

FOR

B.Tech. INFORMATION TECHNOLOGY DEGREE PROGRAMME

Programme Electives

FOR THE STUDENTS ADMITTED IN THE

ACADEMIC YEAR 2023-24 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

22ITPS1**GAME DESIGN**

Category	L	T	P	Credit
PSE	3	0	0	3

Preamble

This course is an introduction to game design with a focus on concept development, design decomposition, and prototyping. Students are familiarized with the methods, concepts, techniques, and literature used in the design of games. Using design theory, analysis, physical prototyping, play testing, and iteration students learn how to translate game ideas, themes, and metaphors into game play.

Prerequisite

NIL

Course Outcomes

CO	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Understand the concepts of basic game design to design game levels that incorporate elements of fun and player choices.	TPS2	70	70
CO2	Implement core game mechanics and animations to enhance overall gameplay experience.	TPS3	70	70
CO3	Apply analytical techniques to design and compare single-player, multiplayer, cooperative, and rule-based games.	TPS3	70	70
CO4	Develop prototypes of serious games addressing domains such as military training, healthcare, and education.	TPS3	70	70
CO5	Examine and apply insights from case studies to model different player behaviours and game types.	TPS4	70	70
CO6	Formulate a game development strategy integrating design, marketing, and business perspectives.	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	PSO 1	PSO 2	PSO 3
CO1	M	M	L		S							M	M	L
CO2	S	M	L		S							M	M	L
CO3	S	M	L		S							M	M	L
CO4	S	M	L		S							M	M	L
CO5	S	M	L		S							M	M	L
CO6	S	M	L		S							M	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Assessment 1								Assessment 2								Terminal					
	CAT 1				Assignment1				CAT 2				Assignment2				(Theory)					
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	4	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	10	-	-	-	-
CO2	4	10	30	-	-	-	50	-	-	-	-	-	-	-	-	-	2	10	-	-	-	-
CO3	2	10	30	-	-	-	50	-	-	-	-	-	-	-	-	-	2	10	15	-	-	-
CO4	-	-	-	-	-	-	-	-	4	15	30	-	-	-	30	-	2	-	15	-	-	-
CO5	-	-	-	-	-	-	-	-	4	15	10	5	-	-	20	10	2	-	10	5	-	-
CO6	-	-	-	-	-	-	-	-	2	-	10	5	-	-	-	40	-	-	10	5	-	-

Syllabus

Introduction to Game Design: History of games - Types of Games –Game level design: Game logic- User input - Physics and motion - Elements of fun -Interesting choices - Interactive narratives – Games Engine types

Game Design Mechanics: - Game Engines and Frameworks –Dynamics – Aesthetics of Games - Animation in Games - Character control with animation - Game feel - Game controllers - Physical simulation - Single player games - Multiplayer games–Developing strategies –Randomness and Player Choice - Decision making - Rules and discovery

Scripting in Unity: – Introduction- Unity Editor- Meshes and Materials- Lighting Techniques- Particle Effects- Game Objects- Creating and Activating- Game Physics- Rigid body, Colliders, Triggers-MonoBehaviour: methods, Psychological Aspects- Game Aesthetics

Game Design Case Studies - Strategy games - Action games - Adventure and Arcade games - Card Games - Casual games -Serious Games-Cognitive and Stroke Rehabilitation Games - Medical and Educational Applications- Ethics in Game Design-Anti cheats

Game Development: Narratology-Brain storming - Lowfidelity Prototype - Digital Prototype - Small Project - Designs - Decisions - Choices - User Interface Design –Exploring Generative AI during development - Marketing and business

Learning Resources

1. Fullerton, Tracy. Game Design Workshop: A Play centric Approach to Creating Innovative Games. Publishers: CRC Press (2nd Edition 2008) ISBN: 9780240809748
2. Brathwaite, Brenda, and Ian Schreiber. Challenges for Game Designers: Non-digital Exercises for Video Game Designers. Publishers: Cengage Learning, (2008) ISBN: 9781584505808.
3. Salen, Katie, and Eric Zimmerman. Rules of Play: Game Design Fundamentals. MIT Press, (2003) ISBN: 9780262240451.
4. Costikyan, Greg, and Drew Davidson, eds. Tabletop Analog Game Design. Publisher Lulu.com, (2011) ISBN: 9781257870608.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction of Game Design	
1.1	History of games	1
1.2	Types of Games	
1.3	Game Level design	1
1.4	Game Logic User Input	1
1.5	Physics and motion - Elements of fun	1

Module No.	Topic	No. of Periods
1.6	Interesting choices - interactive narratives, Games Engine types	
2	Game Design Mechanics	
2.1	Game Engines: Frameworks and Dynamics	2
2.2	Aesthetics - Animation in Games, Character control with animation	2
2.3	Game feel - game controllers - physical simulation - single player game - multiplayer game - strategies	2
2.4	Planning for Randomness – Trade off in decision making - Rules and discovery - cooperative games	2
3	Scripting in Unity	
3.1	Introduction: Unity Editor	2
3.2	Meshes and Materials	1
3.3	Lighting Techniques-Particle Effects	1
3.4	Game Objects: Creating and Activating	2
3.5	Game Physics:- Rigid body, Colliders, Triggers	2
3.6	Mono Behaviour: methods, psychological aspects and game aesthetics	2
4	Case Studies of Game Design	
4.1	Strategy games - Action games – Adventure games	1
4.2	Arcade games - Card Games -Casual games - Music games -	1
4.3	Racing games - role playing games	1
4.4	Simulation games - sports games	1
4.5	Serious Games- Cognitive and Stroke Rehabilitation Games, Medical and Educational Applications	1
4.6	Ethics in Game Design – Anti cheats	1
5	Game Development	
5.1	Narrotology- Brain storming	2
5.2	Low fidelity Prototype - Digital Prototype	1
5.3	Small Project - Designs	2
5.4	Decisions - Choices	1
5.5	User Interface - Exploring Generative AI during development	1
5.6	Marketing and business	1
	Total	36

Course Designer(s):

1. Dr. D. Tamilselvi
2. Dr. S. Sumathi

dtamilselvi@tce.edu
ssmit@tce.edu

22ITPT1***CLOUD PRODUCT AND
PLATFORM ENGINEERING**

Category	L	T	P	Credit
PSE	3	0	0	3

Common to CSE, IT and CSBS branches*Preamble**

The Cloud Product and Platform Engineering course is designed to equip students with the technical skills required for success in today's technology-driven industries. This course provides a comprehensive, practice-oriented foundation in modern cloud-native software engineering, data intelligence, AI systems design and Security. Through hands-on learning, students will gain expertise that aligns with current industry standards and employer expectations. By mastering these essential domains, graduates will be well-prepared to pursue rewarding careers and excel in placement opportunities across leading technology organizations.

Prerequisite

- Fundamentals of Databases, Full-stack Application development and Cloud Computing.

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Implement Agile frameworks such as Scrum and Kanban to manage product lifecycles	TPS3	70	80
CO2	Integrate DevOps tools - including Git, CI/CD pipelines, containers, and monitoring platforms - to orchestrate cloud-native deployments in compliance with the AWS Well-Architected Framework.	TPS3	70	80
CO3	Derive actionable insights from data using appropriate ML techniques, Big Data tools and cloud platforms.	TPS4	70	80
CO4	Perform Data modelling and ETL pipelining using PySpark and cloud data warehouse platforms like AWS Redshift	TPS3	70	80
CO5	Develop AI agents using Transformer-based architectures, Retrieval Augmented Generation and reinforcement learning techniques.	TPS3	70	80
CO6	Review Threat models such as STRIDE and OWASP for IOT and Cloud based applications	TPS2	70	90

Mapping with Programme Outcomes

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

CO5	S	M	L		S		M		L	L	S	M	M	M
CO6	M	L			S		M		L	L	S	L	M	M

Assessment Pattern

	CAT 1				CAT 2			Assignment 1				Assignment 2			Terminal			
TPS Scale	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4
CO1	10	10	10	-	-	-	-	-	-	-	-	-	-	-	2	5	10	-
CO2	5	10	20	-	-	-	-	-	-	50	-	-	-	-	2	5	10	-
CO3	5	10	10	10	-	-	-	-	-	40	10	-	-	-	-	5	10	10
CO4	-	-	-	-	5	10	25	-	-	-	-	-	-	40	2	5	10	-
CO5	-	-	-	-	5	10	25	-	-	-	-	-	-	50	2	5	10	-
CO6	-	-	-	-	10	10	-	-	-	-	-	-	10	-	2	5	-	-

List of Assignment Exercises :

Term 1 :

- Product Lifecycle Management with JIRA
- Deploy App with containerization.
- Implement CI/CD pipeline with Jenkins
- Load & clean raw data from CSV/JSON, Upload to S3 using Python
- Perform EDA - Train ML model (Scikit/XGBoost), Deploy via MLFlow, AutoML
- Create dashboards with Plotly/Matplotlib, Train classification/regression models
- AWS Cloud Developer and Data Engineering Certification courses.

Term 2:

- ETL job with PySpark & SparkSQL (Demo based on time)
- Create pipeline in ADF/Glue, Create dashboards, Monitor with Grafana
- Design ER diagram, Build star schema, Model normalized vs denormalized datasets
- Implement Q-learning in OpenAI Gym,
- Prompt testing via APIs
- AgentDesign with LangChain
- Static analysis, Threat modeling, Risk assessment on real case (e.g., smart home device)
- AWS GenAI Foundations and Security Foundation Certification courses.

Syllabus

Cloud Product Engineering:

Product Lifecycle - Agile: Scrum, Kanban, Monolith vs Microservices, 12-Factor App Design

Cloud Platform Engineering:

DevOps: Concepts & Tools - Git, Containers, CI/CD, Azure Devops - Prometheus - Ansible - Grafana, AWS Well Architected Framework.

Applied ML with Big Data and Cloud

ML Basics: NumPy, Pandas, Dataframes, Apache Parquet Exploratory Data Analysis - Matplotlib, Plotly. Foundational ML Models - Regression, Classification, Clustering. Big Data Processing - Hadoop - HDFS and Mapreduce, Spark, PySpark, SparkSQL, SparkML, Spark Streaming, Cloud Storage - AWS S3, AWS SageMaker

Hyperscalar Data Processing and Visualization

ER Model (Enterprise Data) - Normalization - Data Warehouse - Dimensional Modelling - Star/Snowflake Schema, Data Lakes, ETL - ELT jobs - ETL job with PySpark & SparkSQL -

AWS Redshift - Logging - Tracing - Intelligence - AWS (Kinesis, Glue) - GCP (Dataflow, BigQuery) - Quicksight - ELK Stack.

AI Engineering:

Reinforcement learning - Q-Learning- OpenAI Gym - Transformers - GPT - Prompting - RAG - Langchain - Agentic AI - Agent Design – MLFlow – GCP Vertex AI

Security:

STRIDE / OWASP - Architecture Review - IOT / Cloud Security - Auth, Access Control, OS Injection, DoS, Sniffing

Learning Resources

1. Kim, G., Humble, J., Debois, P., Willis, J., & Forsgren, N. (2021). The DevOps handbook: How to create world-class agility, reliability, & security in technology organizations. It Revolution..
2. 12 Factor App Design : <https://12factor.net/>
3. Scrum Guide: <https://scrumguides.org/scrum-guide.html>
4. A practical Guide to build AI Agents: <https://cdn.openai.com/business-guides-and-resources/a-practical-guide-to-building-agents.pdf>
5. Reis, J. & Housley, M., "Fundamentals of Data Engineering: Plan and Build Robust Data Systems", O'Reilly Media, 1st ed., 2022.
6. Foster, D., "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play", O'Reilly Media, 2nd ed., 2023.
7. Reinforcement Learning: An Introduction by Richard S. Sutton and Andrew G. Barto, Second Edition MIT Press, Cambridge, MA, 2018
8. Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT, and other LLMs, by Ben Auffarth, 2024 Kindle Edition
9. MLOps : <https://mlflow.org/docs/latest/index.html>
10. Vertex AI: <https://cloud.google.com/vertex-ai/docs>
11. McMahon, A., & Choudrie, S. "Zero Trust Security: An Enterprise Guide", Wiley, 1st ed., 2022.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Cloud Product Engineering	
1.1	Product Lifecycle and Agile Methods: Scrum & Kanban	1
1.2	Monolith vs. Microservices Architecture	1
1.3	12-Factor App Design Principles	1
2	Cloud Platform Engineering	
2.1	DevOps Concepts, Git, and Version Control	2
2.2	Containers, CI/CD Pipelines, Azure DevOps	2
2.3	Infrastructure Monitoring: Prometheus, Ansible, Grafana	4
2.4	AWS Well-Architected Framework Overview	1
3	Applied ML with Big Data and Cloud	
3.1	ML Basics: NumPy, Pandas, DataFrames, Apache Parquet	2
3.2	Exploratory Data Analysis – Matplotlib, Plotly	1
3.3	Foundational ML Models – Regression, Classification, Clustering	2
3.4	Big Data Processing: Hadoop, HDFS, MapReduce	1
3.5	Spark Ecosystem – PySpark, SparkSQL, Spark ML	2
3.6	Cloud Storage & Deployment – AWS S3, SageMaker	1
4	Hyperscalar Data Processing and Visualization	
4.1	Enterprise Data Modelling – ER, Normalization, Data Warehouse	1
4.2	Dimensional Modelling – Star/Snowflake Schema	1
4.3	Data Lakes and ETL/ELT Jobs (Python, PySpark, SparkSQL)	2

4.4	Cloud Data Services – AWS Redshift, Kinesis, Glue / GCP BigQuery	2
4.5	Visualization and Intelligence – QuickSight, ELK Stack	1
5	AI Engineering	
5.1	Reinforcement Learning – Q-Learning and OpenAI Gym	1
5.2	Transformers – GPT, Prompting, RAG	1
5.3	LangChain, Agentic AI and Agent Design	1
5.4	MLFlow and GCP Vertex AI	1
6	Security	
6.1	STRIDE / OWASP and Architecture Review	1
6.2	IoT and Cloud Security	1
6.3	Authentication & Access Control	1
6.4	OS Injection, DoS, Sniffing	1
	Total	36

Course Designer(s):

- | | |
|---|--------------------|
| 1. Wipro WEE | |
| 2. S.Thiruchadai Pandeewari, Asst. Prof, IT | eshwarimsp@tce.edu |
| 3. Dr B.Subbulakshmi, Asst. Prof, CSE | bscse@tce.edu |
| 4. Dr M.Nirmala Devi, Asst. Prof(Sr. Gr), CSE | mnit@tce.edu |
| 5. Dr K.R. Premlatha, Asst.Prof, IT | krplit@tce.edu |
| 6. M. Venkatesh, Asst. Prof, CSBS | mvhca@tce.edu |
| 7. D. Sakthi Priya, Asst. Prof, AMCS | dspds@tce.edu |

22ITRK1**DEEP LEARNING**

Category L T P Credit

PEES 3 0 0 3

Preamble

This course provides an in-depth understanding of deep learning concepts and architectures such as CNNs, RNNs, and generative models. It focuses on essential techniques in optimization, regularization, and hyper parameter tuning to enhance model performance and evaluation. Students will also gain practical exposure to applying deep learning across diverse real-world domains.

Prerequisite

Fundamentals of Linear Algebra, Probability Theory and Machine Learning.

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 in %
CO1	Apply the core principles of deep learning, including neural networks, activation functions, and loss functions.	TPS3	70	65
CO2	Examine the variants of Convolutional Neural Networks (CNNs) by examining their architectures, evaluating their key components, and exploring their real-world applications.	TPS4	70	60
CO3	Illustrate regularization, optimization, and data augmentation techniques to enhance model performance and generalization.	TPS3	70	65
CO4	Demonstrate hyperparameter tuning and model evaluation strategies to optimize deep learning models for improved accuracy and efficiency.	TPS3	70	65
CO5	Investigate Recurrent Neural Networks (RNNs) and their advanced variants for effective sequence and temporal data modeling.	TPS4	70	60
CO6	Use generative models and transformer architectures for data generation, representation learning, and attention-based applications.	TPS3	70	65

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	Assessment 1 (Theory)								Assessment 2 (Theory)								Terminal					
	CAT 1				Assignment 1				CAT 2				Assignment 2				(Theory)					
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	5	10	15	-	-	-	30	-	-	-	-	-	-	-	-	-	2	5	10	-	-	-
CO2	5	10	-	25	-	-	-	40	-	-	-	-	-	-	-	-	2	-	-	15	-	-
CO3	5	10	15	-	-	-	30	-	-	-	-	-	-	-	-	-	2	-	10	-	-	-
CO4	-	-	-	-	-	-	-	-	5	10	15	-	-	-	30	-	2	5	10	-	-	-
CO5	-	-	-	-	-	-	-	-	5	10	-	25	-	-	-	40	2	-	-	15	-	-
CO6	-	-	-	-	-	-	-	-	5	10	15	-	-	-	30	-	-	5	15	-	-	-

Syllabus

Introduction to Deep Learning: Overview and Motivation for Deep Learning – Applications – Artificial Neural Networks and Biological Neurons – Deep Feedforward Networks – Backpropagation Algorithm – Activation Functions: ReLU, Leaky ReLU, Swish – Loss and Cost Functions.

Convolutional Neural Networks (CNNs): Convolution and Pooling Operations – Backpropagation in CNNs – Popular CNN Architectures: LeNet, AlexNet, VGG, ResNet – Transfer Learning and Fine-Tuning Pretrained Models.

Regularization and Generalization in Deep Learning: Overfitting and Underfitting: Concepts and Effects – Dropout – Batch and Layer Normalization – Regularization Techniques (L1, L2) – Data Augmentation: Geometric Transformations, Color Augmentation, Noise Injection.

Optimization and Hyper parameter Tuning: Gradient Descent: Theory and Applications – Variants: SGD, Momentum, RMSprop, Adam – Learning Rate Scheduling and Early Stopping – Hyperparameter Tuning: Grid Search, Random Search – Model Evaluation: Accuracy, Precision, Recall, F1-Score, ROC-AUC.

Sequence Modeling: Recurrent Neural Networks (RNNs) – Backpropagation Through Time (BPTT) – Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU) – Applications in Sequential and Temporal Data- Attention Mechanism - Transformers: Encoder and Decoder.

Unsupervised Learning and Generative Models: Auto Encoder – Basic & Variational Autoencoders (VAEs) - Generative Adversarial Networks (GANs) and Variants (WGAN, Cycle GAN)– Introduction to Vision Transformers (ViT)- Applications in Image and Data Generation

Learning Resources

1. Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola, “Dive into Deep Learning”, Cambridge University Press, 2023.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning” (Adaptive Computation and Machine Learning Series), MIT Press, 2016.
3. Aurelien Geron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”, O'Reilly Media, 2019.
4. François Chollet, “Deep Learning with Python”, Manning Publications, 2021.
5. Charu Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer, 2023.
6. https://onlinecourses.nptel.ac.in/noc25_cs106/preview - Deep Learning by Prof. Mitesh M. Khapra, Prof. Sudarshan Iyengar | IIT Madras, IIT Ropar.
7. Workbook-<https://www.byhand.ai/t/workbook>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Deep Learning	
1.1	Overview and Motivation for Deep Learning – Applications	1
1.2	Artificial Neural Networks and Biological Neurons	1
1.3	Deep Feedforward Networks	1
1.4	Backpropagation Algorithm	1
1.5	Activation Functions: ReLU, Leaky ReLU, Swish	1
1.6	Loss and Cost Functions	1
2	Convolutional Neural Networks (CNNs)	
2.1	Convolution and Pooling Operations	1
2.2	Backpropagation in CNNs	2
2.3	Popular CNN Architectures: LeNet, AlexNet, VGG, ResNet	2
2.4	Transfer Learning and Fine-Tuning Pretrained Networks	1
3	Regularization and Generalization in Deep Learning	
3.1	Overfitting and Underfitting: Concepts and Effects	1
3.2	Dropout	1
3.3	Batch and Layer Normalization	1
3.4	Regularization Techniques (L1, L2)	1
3.5	Data Augmentation: Geometric Transformations, Color Augmentation, Noise Injection.	2
4	Optimization and Hyper parameter Tuning	
4.1	Gradient Descent: Theory and Applications – Variants: SGD, Momentum, RMSprop, Adam	2
4.2	Learning Rate Scheduling and Early Stopping	1
4.3	Hyperparameter Tuning: Grid Search, Random Search	1
4.4	Model Evaluation: Accuracy, Precision, Recall, F1-Score, ROC-AUC.	2
5	Sequence Modeling	
5.1	Recurrent Neural Networks (RNNs)	1
5.2	Backpropagation Through Time (BPTT)	1
5.3	Long Short-Term Memory (LSTM)	1
5.4	Gated Recurrent Units (GRU)	1
5.5	Applications in Sequential and Temporal Data.	1
5.6	Attention Mechanism, Transformers: Encoder and Decoder.	1
6	Generative Models and Transformers	
6.1	Auto Encoder – Basic & Variational Autoencoders (VAEs)	2
6.2	Generative Adversarial Networks (GANs) and Variants (WGAN, CycleGAN)	1
6.3	Introduction to Vision Transformers (ViT)	1
6.4	Applications in Image and Data Generation	2
	Total	36

Course Designers

1. Dr.C.Deisy, Professor, IT
2. Dr.S.Sridevi, Professor, IT
3. Mrs.R.Saraswathi Meena, Assistant Professor, IT

cdcse@tce.edu
sridevi@tce.edu
rsmca@tce.edu

22ITRL1**SECURITY OPERATIONS**

Category L T P Credit

PEES 3 0 0 3

Preamble

This course on Security Operations introduces learners to the principles, frameworks, and tools used in managing and responding to cyber security incidents. It emphasizes the role of Security Operations Centres (SOCs), threat intelligence, and automation in safeguarding digital assets and ensuring organizational resilience.

Prerequisite

Information Security

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	Explain the architecture, frameworks, and functional components of a Security Operations Center (SOC)..	TPS2	80	70
CO2	Analyze and classify threats, vulnerabilities, and security incidents using threat intelligence and detection techniques	TPS4	70	70
CO3	Use SIEM and log analysis tools to correlate events, detect anomalies, and generate alerts for potential security breaches.	TPS3	70	70
CO4	Apply structured processes and playbooks for incident response, evidence collection, and digital forensics	TPS3	70	70
CO5	Recommend strategies to enhance organizational resilience through continuous monitoring, compliance, and business continuity planning	TPS4	70	70
CO6	Design and document an integrated Security Operations workflow incorporating automation, threat intelligence, and incident response mechanisms	TPS4	70	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	PSO1	PSO2	PSO3
CO1	M	L										M		
CO2	S	S	M	L	M	L	S	M	M		M	S	M	L
CO3	S	M	L		S						M	S	M	
CO4	S	S	M	L	S		S		M		M	S	M	L
CO5	S	S	M	L	S							S	M	
CO6	S	S	M	L	S		S	M	M		M	S	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1				Assignment 1				CAT2				Assignment 2				Terminal			
	100				100				100				100				100			
TPS Scale	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
CO1		15																5		
CO2		10	15	20			25	25										5	10	10
CO3		10	30				50											5	10	
CO4										15	15				20			5	10	
CO5										15	15	15			20	20		5	10	10
CO6											10	15			20	20		5		10

Syllabus**Introduction to Security Operations**

Overview of Security Operations Center (SOC), Roles and Responsibilities of SOC Analysts. Key Concepts: Threats, Vulnerabilities, and Risks, SOC Architecture and Frameworks (NIST, ISO 27035), SOC Maturity Models and Metrics, Security Monitoring and Log Management.

Case Studies

Ransomware Attack on Colonial Pipeline (2021), SolarWinds Supply Chain Compromise (2020), Microsoft Exchange Server Zero-Day Exploits (2021), CrowdStrike (2024)

Threat Intelligence and Detection

Threat Intelligence Lifecycle, Types and Sources of Threat Intelligence, Indicators of Compromise (IoC) and Indicators of Attack (IoA), Detection Techniques – Signature-based, Anomaly-based, Behavior-based Intrusion Detection and Prevention Systems (IDS/IPS), Malware Analysis Basics, Tools: Suricata

Incident Handling and Response

Phases of Incident Response (Preparation, Identification, Containment, Eradication, Recovery, Lessons Learned), Incident Classification and Prioritization, Playbooks and Runbooks, Evidence Collection and Chain of Custody, Case Study: Ransomware and Phishing Incident Response, Tools: The Hive

Security Information and Event Management (SIEM) and Automation

SIEM Fundamentals and Architecture, Log Correlation, Alerting, and Reporting, SIEM Tools: Splunk, ELK Stack, SOAR (Security Orchestration, Automation, and Response) Concepts, Use Cases for SIEM and SOAR Integration

Post-Incident Analysis and Compliance

Post-Incident Review and Root Cause Analysis, Threat Hunting and Continuous Improvement, Digital Forensics Overview, Security Metrics and Reporting to Management, Legal, Ethical, and Compliance Aspects (GDPR, ISO 27001, NIST CSF), Business Continuity and Disaster Recovery, Tools: Autopsy

Learning Resources

1. Joseph Muniz, Aamir Lakhani Omar Santos, The Modern Security Operations Center, Addison Wesley Professional, 2021
2. Roberto Martinez, Incident Response with Threat Intelligence, Packt Publishing, 2022
3. Gerard Johansen, Digital Forensics and Incident Response: Incident response tools and techniques for effective cyber threat response, Third Edition, Packt Publishing, 2022
4. Daniel Shoemaker, Anne Kohnke, Ken Sigler, The Cybersecurity Body of Knowledge, CRC Press, Taylor & Francis Ltd, 2022
5. <https://letsdefend.io/>
6. <https://tryhackme.com/path/outline/soclevel1>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Security Operations	
1.1	Overview of Security Operations Center (SOC)	1
1.2	Roles and Responsibilities of SOC Analysts	
1.3	Threats, Vulnerabilities, and Risks	1
1.4	SOC Architecture and Frameworks (NIST, ISO 27035)	1
1.5	SOC Maturity Models and Metrics	1
1.6	Security Monitoring and Log Management	
1.7	Cyber Attacks – Case Studies	2
2	Threat Intelligence and Detection	
2.1	Threat Intelligence Lifecycle Types and Sources of Threat Intelligence	1
2.2	Detection Techniques – Signature-based, Anomaly-based, Behavior-based	2
2.3	Intrusion Detection and Prevention Systems (IDS/IPS)	1
2.4	Malware Analysis Basics	2
3	Incident Handling and Response	
3.1	Phases of Incident Response (Preparation, Identification, Containment, Eradication, Recovery, Lessons Learned)	2
3.2	Incident Classification and Prioritization	1
3.3	Playbooks and Runbooks	2
3.4	Evidence Collection and Chain of Custody	2
3.5	Ransomware and Phishing Incident Response	2
4	Security Information and Event Management (SIEM) and Automation	
4.1	SIEM Fundamentals and Architecture	1
4.2	Log Correlation, Alerting, and Reporting	1
4.3	SIEM Tools: Splunk, ELK Stack	2
4.4	SOAR (Security Orchestration, Automation, and Response) Concepts	2
4.5	Use Cases for SIEM and SOAR Integration	2
	Post-Incident Analysis and Compliance	
5.1	Post-Incident Review and Root Cause Analysis	2
5.2	Threat Hunting and Continuous Improvement	1
5.3	Digital Forensics Overview, Security Metrics and Reporting to Management,	2
5.4	Legal, Ethical, and Compliance Aspects (GDPR, ISO 27001, NIST CSF)	1
5.5	Business Continuity and Disaster Recovery	1
	Total	36

Course Designer(s):

1. Jeyamala.C, Associate Professor, jeyamala@tce.edu, Information Technology
2. Parkavi.R, Assistant Professor, rpit@tce.edu, Information Technology
3. Sujitha S, Assistant Professor, ssiit@tce.edu, Information Technology

22IT1J1**AGENTIC AI**

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

This course introduces the principles, patterns, tools, and frameworks of Agentic Artificial Intelligence (AI) - a new class of autonomous systems built using modern LLM-based technologies. Also, the course involves the design and deploy of real-world intelligent agents emphasis is on Agentic reasoning, autonomy, and collaborative decision-making using current-generation tools.

Prerequisite

- Nil

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the evolution, core concepts, and industrial relevance of Agentic AI, distinguishing it from traditional AI system	TPS2	70	85
CO2	Describe the architecture and lifecycle of AI agents, including environment interaction, memory, reasoning loops, and tool integration.	TPS2	70	85
CO3	Apply reasoning techniques such as ReAct, Tree of Thoughts, and Reflexion to design agents capable of autonomous decision-making and problem-solving.	TPS3	70	75
CO4	Implement retrieval-augmented generation (RAG) and memory management methods to enhance agent knowledge and contextual understanding.	TPS3	70	75
CO5	Analyze the behavior and coordination mechanisms of multi-agent systems using frameworks like CrewAI, AutoGen, and LangChain.	TPS4	70	65
CO6	Investigate agent performance, and safety, ethical, and responsible AI considerations, following international guidelines such as the OECD AI Principles.	TPS4	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	PS O1	PS O2	PS O3
CO1	M	L						S			L	L	M	L
CO2	M	L						S			L	L	M	L
CO3	S	M	L		S			S			L	M	M	L
CO4	S	M	L		S			S			L	M	M	L
CO5	S	S	M	L	S			S			L	S	M	L
CO6	S	S	M	L				S			L	S	M	L

Assessment Pattern

CO	Internal Mini project						Terminal					
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1		10					2	6				
CO2		10					2	6				
CO3			20				2	6	10			
CO4			20				2	6	10			
CO5			10	10			2	6	10	6		
CO6			10	10			2	6	10	6		

Syllabus

Introduction to Agentic AI - Definition and evolution of Agentic AI, Difference between traditional AI and autonomous agents, Use cases- coding, planning, customer support, robotics, Overview of frameworks-LangChain, CrewAI, OpenDevin

Architecture of AI Agents - Agent lifecycle, Components- Environment, Memory, Tools, Reasoning Loop, Single vs Multi-agent systems, Reflexion and Self-critique loops

Reasoning Mechanisms - Prompt-chaining, Zero-/Few-shot prompting, ReAct (Reason + Act), Tree of Thoughts (ToT), Self-Refine and Reflexion

Memory, Knowledge, and RAG - Types of memory-short-term, long-term, vector stores, Retrieval-Augmented Generation (RAG), Knowledge grounding and tool use

Multi-Agent Collaboration- Multi-agent frameworks -CrewAI, AutoGen, Communication and coordination strategies, Emergent behavior and collective reasoning

Evaluation, Safety & Ethics -Valuating agent performance-Accuracy, Latency, Cost, Safety risks: hallucination, prompt injection, deceptive alignment, Ethical principles: OECD AI Principles, Responsible AI

Case Study : AI agents automating marketing, sales, and financial forecasting , Smart city traffic management using multi-agent coordination, Work flow automation.

Learning Resources

1. Michael Lanham , AI Agents in Action ,Manning Publications, 2025.
2. <https://www.coursera.org/learn/generative-ai-prompt-engineering-for-everyone>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Agentic AI	
1.1	Definition and evolution of Agentic AI	2
1.2	Difference between traditional AI and autonomous agents	
1.3	Use cases- coding, planning, customer support, robotics	
1.4	Overview of frameworks-LangChain, CrewAI, OpenDevin	
2	Architecture of AI Agents	
2.1	Agent lifecycle	2
2.2	Components- Environment, Memory, Tools	
2.3	Reasoning Loop, Single vs Multi-agent systems	
2.4	Reflexion and Self-critique loops	
3	Reasoning Mechanisms	
3.1	Prompt-chaining, Zero-/Few-shot prompting	2
3.2	ReAct (Reason + Act), Tree of Thoughts (ToT),	

Module No.	Topic	No. of Periods
3.3	Self-Refine and Reflexion	
4	Memory, Knowledge, and RAG	
4.1	Types of memory-short-term, long-term, vector stores	3
4.2	Retrieval-Augmented Generation (RAG),	
4.3	Knowledge grounding and tool use	
5	Multi-Agent Collaboration	
5.1	Multi-agent frameworks -CrewAI, AutoGen	2
5.2	Communication and coordination strategies	
5.3	Emergent behavior and collective reasoning	
6	Evaluation, Safety & Ethics	
6.1	Valuating agent performance-Accuracy, Latency, Cost,	2
6.2	Safety risks: Hallucination, prompt injection, deceptive alignment	
6.3	Ethical principles: OECD AI Principles, Responsible AI	
7	Case Study	
7.1	AI agents automating marketing, sales, and financial forecasting , Smart city traffic management using multi-agent coordination, Work flow automation	1
	Total Lecture Hours	14

Course Designer(s):

- | | |
|---|-------------------|
| 1. K Vijaykumar ,
Scientist-E, Joint Director, HoD, Software
Engineering Group, CDAC, Chennai | vijayk@cdac.in |
| 2. A M Abirami | abiramiam@tce.edu |
| 3. K V Uma | kvuit@tce.edu |

**22IT1L1 E COMMERCE: TECHNOLOGY
AND DIGITAL MARKETING**

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

Digital Marketing plays a vital role in the e-commerce sector by integrating technology, data analytics, and creativity to engage customers effectively. This course equips IT students with practical skills in using digital tools, automation, and analytics to drive online business growth. It bridges the gap between technology and marketing, preparing learners for careers in e-commerce and IT-enabled marketing services.

Prerequisite

- NIL

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	Illustrate the application of digital marketing concepts to meet the needs of modern enterprises.	TPS 3	70	70
CO2	Apply knowledge of digital marketing roles and designations in real-world organizational contexts.	TPS 3	70	70
CO3	Implement suitable tools and technologies to perform various digital marketing functions.	TPS 3	70	70
CO4	Demonstrate digital marketing strategies to address business challenges across multiple sectors.	TPS 3	70	70
CO5	Apply digital marketing campaigns using analytics tools for performance improvement.	TPS 3	70	70
CO6	Demonstrate the application of digital marketing concepts to meet the needs of modern enterprises.	TPS 3	70	70

Mapping with Programme Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	S	M	L				M	M	M		S	M		M
CO2	S	M	L				M	M	M		S	M		M
CO3	S	M	L				M	M	M		S	M		M
CO4	S	M	L				M	M	M		S	M		M
CO5	S	M	L				M	M	M		S	M		M
CO6	S	M	L				M	M	M		S	M		M

Assessment Pattern

CO	Internal						Terminal					
	Mini Project											
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1	-	-	10	-	-	-	5	5	5	-	-	-
CO2	-	-	10	-	-	-	5	5	5	-	-	-
CO3	-	-	10	-	-	-	5	5	10	-	-	-
CO4	-	-	20	-	-	-	5	5	10	-	-	-
CO5	-	-	20	-	-	-	5	5	10	-	-	-
CO6	-	-	30	-	-	-	-	-	10	-	-	-

Syllabus**Digital Marketing Foundations:**

Evolution of marketing in the digital era, Role of IT and data in marketing transformation, E-commerce Ecosystem: Players and processes. Types of E-Commerce: B2B, B2C, C2C, B2G. E-commerce Channels: Marketplaces, branded websites, social commerce. Ethical and privacy considerations.

Business Strategy & Impact:

Strategic objectives and performance metrics(KPIs), Branding and lead generation, Customer journey and retention, POEM framework (Paid, Owned, Earned Media), Integration of marketing analytics in business decision-making

Digital Marketing Channels and Practices:

Search Engine Optimization (SEO) & Search Engine Marketing (SEM/PPC). Social Media Marketing (SMM) & Content Marketing. Email and Mobile Marketing (WhatsApp). Introduction to AI, automation, and chatbots in marketing.

Marketing Analytics and Optimization:

Foundations of web analytics, Data interpretation and KPI measurement (Reach, CTR, ROI), Campaign evaluation and optimization, Dashboard reporting, Data-driven strategy improvement, Case-based learning in e-commerce analytics

Career Roles and Industry Alignment:

Digital marketing structure and responsibilities, Skill mapping to professional roles, Application of academic frameworks using learning simulations and tools, Integration of marketing concepts in IT-enabled environments, Ethical and sustainable marketing practices

Case Study:

E-Commerce Growth through SEO and paid campaigns for visibility, Social media engagement for brand awareness, Email automation for customer retention, Analytics-driven optimization for sales enhancement.

Learning Resources

1. Kamat and Kamat, Digital Marketing, Himalaya Publishing House, 2023
2. D. Ryan, Marketing Strategies for Engaging the Digital Generation, Kogan Page Publishers, 2014
3. V. Ahuja, Digital Marketing, Oxford University Press, 2015

Course Contents and Lecture Schedule

Module	Topic	Hour
1	Digital Marketing Foundations	
1.1	Evolution of marketing in the digital era, Role of IT and data in marketing transformation	1
1.2	E-commerce Ecosystem: Players and processes. Types of E-Commerce: B2B, B2C, C2C, B2G. E-commerce Channels: Marketplaces, branded websites, social commerce.	1
1.3	Ethical and privacy considerations	
2	Business Strategy & Impact	
2.1	Strategic objectives and performance metrics, Branding and lead generation	1
2.2	Customer journey and retention	1
2.3	POEM framework (Paid, Owned, Earned Media)	
2.4	Integration of marketing analytics in business decision-making	1
3	Digital Marketing Channels and Practices	
3.1	Search Engine Optimization (SEO) & Search Engine Marketing (SEM/PPC).	1
3.2	Social Media Marketing (SMM) & Content Marketing	1
3.3	Email and Mobile Marketing (WhatsApp).	1
3.4	Introduction to AI, automation, and chatbots in marketing.	
4	Marketing Analytics and Optimization	
4.1	Foundations of web analytics and Data interpretation, KPI measurement (Reach, CTR, ROI), Campaign evaluation and optimization	1
4.2	Dashboard reporting and Data-driven strategy improvement	1
4.3	Case-based learning in e-commerce analytics	
5	Career Roles and Industry Alignment	
5.1	Digital marketing structure and responsibilities, Skill mapping to professional roles	1
5.2	Application of academic frameworks using learning simulations and tools	
5.3	Integration of marketing concepts in IT-enabled environments, Ethical and sustainable practices.	1
6	Case Study: Practical Application	
6.1	E-Commerce Growth through SEO and paid campaigns for visibility	1
6.2	Social media engagement for brand awareness	
6.3	Email automation for customer retention	1
6.4	Analytics-driven optimization for sales enhancement	
	Total Lecture Hours	14

Course Designers:

1. Mr.Jegannathan Nadarajan, Ariv Executions info@arivexe.com
2. Ms.C.V.Nisha Angeline cvnait@tce.edu
3. Dr.G.Vennilla gvait@tce.edu
4. Mrs.A.Indirani aiica@tce.edu

22IT1M1**MULTI-PLATFORM MOBILE APP
DEVELOPMENT**

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

Modern app developers rely on cross-platform frameworks, rapid prototyping tools, and unified codebases to deliver seamless user experiences across Android, iOS, and the web. This course guides students through building real-world mobile applications using Expo. Learners will also gain hands-on experience with EAS for automated builds and deployments, culminating in fully functional, production-ready mobile apps.

Prerequisite

- NIL

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	Demonstrate the architecture and workflow of Expo.	TPS 3	70	70
CO2	Apply development tools such as Xcode, Android Studio, and Metro for cross-platform app development.	TPS 3	70	70
CO3	Use Expo Router and file-based routing to build and navigate mobile applications.	TPS 3	70	70
CO4	Demonstrate concepts of UI design and state management to create interactive user	TPS 3	70	70
CO5	Illustrate techniques for API integration, error handling, and app deployment using EAS.	TPS 3	70	70
CO6	Apply professional and industry practices to develop, test, and deploy cross-platform mobile applications using modern tools.	TPS 3	70	70

Mapping with Programme Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	S	M	L				M	M	M		S	M		M
CO2	S	M	L				M	M	M		S	M		M
CO3	S	M	L				M	M	M		S	M		M
CO4	S	M	L				M	M	M		S	M		M
CO5	S	M	L				M	M	M		S	M		M
CO6	S	M	L				M	M	M		S	M		M

Assessment Pattern

CO	Internal						Terminal					
	Mini Project											
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1	-	-	10	-	-	-	5	5	5	-	-	-
CO2	-	-	10	-	-	-	5	5	5	-	-	-
CO3	-	-	10	-	-	-	5	5	10	-	-	-
CO4	-	-	20	-	-	-	5	5	10	-	-	-
CO5	-	-	20	-	-	-	5	5	10	-	-	-
CO6	-	-	30	-	-	-	-	-	10	-	-	-

*MINI PROJECT WILL BE ASSESSED AS PRACTICAL MODULE

Syllabus

Developer Tools & Workflow: Xcode and Android Studio configuration, Metro bundler operations, Debugging tools, Hot reload and live reload, Emulator and device testing

App Structure & Routing: Creating first Expo app, File-based routing with Expo Router, Nested and dynamic routes, Navigation and linking, Router notation

UI Design & State Management: Core UI components, Styling and layout with Flexbox, Event handling, State and props, Context API and Redux integration

API Integration & Error Handling: Fetching data using Axios and Fetch, Asynchronous programming, RESTful API consumption, Error and network handling, JSON parsing

EAS & Deployments: Introduction to Expo Application Services, Build configuration, App signing and versioning, OTA updates, Publishing to Play Store and App Store

Case Study: Walkthrough of a Cross-Platform Fitness App Deployment, EAS Build Configuration and Signing, Versioning and Channel Management, OTA Update Implementation, Automated Testing and QA, Publishing and Update Maintenance

Learning Resources

1. <https://docs.expo.dev/>
2. <https://reactnative.dev/>
3. <https://github.com/expo/expo>

Course Contents and Lecture Schedule

Module	Topic	Hour
1	Developer Tools & Workflow	
1.1	Xcode and Android Studio configuration	1
1.2	Metro bundler operations, Debugging tools	1
1.3	Hot reload and live reload, Emulator and device testing	
2	App Structure & Routing	
2.1	Creating first Expo app	1
2.2	File-based routing with Expo Router	1
2.3	Nested and dynamic routes, Navigation and linking	
2.4	Router notation	1
3	UI Design & State Management	
3.1	Core UI components, Styling and layout with Flexbox	1
3.2	Event handling, State and props	
3.3	Context API and Redux integration	1

4	API Integration & Error Handling	
4.1	Fetching data using Axios and Fetch	1
4.2	Asynchronous programming, RESTful API consumption	1
4.3	Error and network handling, JSON parsing	1
5	EAS & Deployments	
5.1	Introduction to Expo Application Services	1
5.2	Build configuration, App signing and versioning	1
5.3	OTA updates, Publishing to Play Store and App Store	
6	Case Study	
6.1	Walkthrough of a Cross-Platform Fitness App Deployment,	1
6.2	EAS Build Configuration and Signing, Versioning and Channel Management, OTA Update Implementation, Automated Testing and QA, Publishing and Update Maintenance	
	Total Lecture Hours	14

Course Designers:

- | | |
|--------------------------------------|--|
| 1. Mr. Gokulkrishna R, SurveySparrow | gokulkrishna@gmail.com |
| 2. Dr.S.Muthuramalingam | smrit@tce.edu |
| 3. Ms.C.V.Nisha Angeline | cvnait@tce.edu |
| 4. Dr.G.Vennilla | gvait@tce.edu |

22IT1N1 SOFTWARE DESIGN PATTERNS

Category	L	T	P	Credit
PEES	1	0	0	1

Preamble

This course introduces the fundamentals of building scalable and reusable design systems. It focuses on design tokens, UI components, documentation, and collaboration workflows. Through the *Head First Design* approach, students gain practical experience in developing and deploying a mini design system for real-world applications.

Prerequisite

Fundamentals of Software Engineering, Web Development

Course Outcomes

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

CO	Course Outcome	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Apply the foundational principles of design systems to analyze their role in achieving consistency, scalability, accessibility, and efficiency across digital products.	TPS3	70	75
CO2	Deconstruct existing interfaces to categorize and map design elements into atomic levels tokens, components, and patterns for systematic reuse.	TPS3	70	75
CO3	Apply appropriate design patterns such as Factory, Singleton, and Observer to develop scalable and reusable UI components with dynamic behavior.	TPS3	70	75
CO4	Implement reusable modules integrating design tokens, theming, accessibility, and internationalization to ensure inclusive and adaptable design systems.	TPS3	70	75
CO5	Utilize atomic design and iterative reflection practices to construct a cohesive mini design system prototype aligned with real-world standards.	TPS3	70	75
CO6	Apply evaluation techniques to assess design pattern choices, identify anti-patterns, and refine system architecture.	TPS3	70	75

Mapping with Programme Outcomes

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

Assessment Pattern

CO	Internal			Terminal		
	Mini-Project					
TPS Scale	1	2	3	1	2	3
CO1	-	-	10	5	-	10
CO2	-	-	10	5	-	10
CO3	-	-	20	3	5	10
CO4	-	-	20	2	5	10
CO5	-	-	20	3	5	10
CO6	-	-	20	2	5	10

Syllabus

Foundations of Design Systems Definition – Objectives – Importance of Design Systems – Case Studies: Material Design, Carbon, Atlassian – Benefits: Consistency, Scalability, Efficiency, Accessibility – Anatomy of Design Systems: Tokens, Components, Patterns, Guidelines - Maintainability - Versioning, Release discipline, Backward compatibility, Governance

Atomic Design Principles: Concept of Atoms, Molecules, Organisms – Component Hierarchy and Composition – Deconstructing Real Websites – Systematic Thinking in Reuse

Design patterns for scalable components: Creational Patterns: Factory – Singleton – Builder – Application to Reusable Component Generation-Shared Resource Management-Behavioral Patterns: Strategy – Observer – Command – Theming and Behavior Customization – Dynamic UI Updates – Reversible Design Actions - Dependency Injection

Implementation and Integration Practices

Reusable Module Development – Design Tokens and Shared Configuration – Theming and Parameterization in Frontend & Backend – Accessibility Standards – Internationalization (i18n) Practices – Reflection and Iteration through Practice Labs

Evaluation and Best Practices

Pattern Selection Guidelines – Decision Trees and Trade-off Analysis – Common Anti-patterns (Overuse of Singleton, Complex Factories) – Case Reflections and Iteration Methods

Learning Resources

1. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra. *Head First Design Patterns*. O'Reilly Media, 2021 (2nd Edition).
2. Jenifer Tidwell, Charles Brewer, and Aynne Valencia. *Designing Interfaces: Patterns for Effective Interaction Design*. O'Reilly Media, 2020 (3rd Edition)
3. Material Design Guidelines – <https://material.io/design>
4. Carbon Design System (IBM) – <https://carbondesignsystem.com>
5. Atlassian Design System – <https://atlassian.design>
6. W3C Accessibility Standards (WCAG 2.1) – <https://www.w3.org/WAI/standards-guidelines/wcag/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Foundations of Design Systems	
1.1	Definition – Objectives – Importance of Design Systems	1
1.2	Case Studies: Material Design, Carbon, Atlassian – Benefits: Consistency, Scalability, Efficiency, Accessibility	1
1.3	Anatomy of Design Systems: Tokens, Components, Patterns, Guidelines	1

Module No.	Topic	No. of Periods
1.4	Maintainability - Versioning, Release discipline, Backward compatibility, Governance	1
2	Atomic Design Principles	
2.1	Concept of Atoms, Molecules, Organisms- Component Hierarchy and Composition	1
2.2	Deconstructing Real Websites – Systematic Thinking in Reuse	1
3	Design patterns for scalable components	
3.1	Creational Patterns: Factory – Singleton – Builder – Application to Reusable Component Generation-Shared Resource Management-	1
3.2	Behavioral Patterns: Strategy – Observer – Command – Theming and Behavior Customization – Dynamic UI Updates – Reversible Design Actions – Dependency Injection	1
4	Implementation and Integration Practices	
4.1	Reusable Module Development – Design Tokens and Shared Configuration – Theming and Parameterization in Frontend & Backend	2
4.2	Accessibility Standards – Internationalization (i18n) Practices	1
4.3	Reflection and Iteration through Practice Labs	1
5	Evaluation and Best Practices	
5.1	Pattern Selection Guidelines- Decision Trees and Trade-off Analysis	1
5.2	Common Anti-patterns (Overuse of Singleton, Complex Factories)- Case Reflections and Iteration Methods	1
	Total	14

Course Designer(s):

- | | |
|--|--|
| 1. S.Dinesh Kumar, Lead Consultant,
ThoughtWorks Chennai | dineshks@thoughtworks.com |
| 2. Mohanraj Muthuraman, Senior
Consultant, ThoughtWorks Chennai | mohanraj.m@thoughtworks.com |
| 3. S.Padmavathi, Professor, IT, | spmcse@tce.edu |
| 4. S.Pudumalar, Assistant Professor, IT | spmit@tce.edu |
| 5. S.Thiruchadai Pandeewari, Assistant Professor,IT | eshwarimsp@tce.edu |

22IT2C1 ZERO TRUST ARCHITECTURE

Category	L	T	P	Credit
PEES	2	0	0	2

Preamble

This course introduces the Zero Trust Architecture framework, emphasizing continuous verification and least-privilege access to enhance cyber security. It covers core principles, identity management, authentication mechanisms, and compliance models. Learners will gain the expertise to design and implement secure, resilient enterprise environments.

Prerequisite

- Fundamentals of Cybersecurity and Cloud Computing

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	Apply core Zero Trust principles to secure network environments.	TPS3	70	70
CO2	Implement identity, authentication, and authorization controls.	TPS3	70	70
CO3	Design Zero Trust models using micro-segmentation and SASE.	TPS3	70	70
CO4	Evaluate organizational Zero Trust maturity and compliance.	TPS4	70	70
CO5	Integrate Zero Trust strategies into existing infrastructures.	TPS3	70	70
CO6	Assess Zero Trust effectiveness through KPIs and risk evaluation.	TPS4	70	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	PS O1	PS O2	PS O3
CO1	S	M	L		S						M	S	M	
CO2	S	M	L		S						M	S	M	
CO3	S	M	L		S						M	S	M	
CO4	S	S	M	L	S		S	M	M		M	S	M	L
CO5	S	M	L		S						M	S	M	
CO6	S	S	M	L	S		S	M	M		M	S	M	L

Assessment Pattern

CO	Internal						Terminal					
	Mini Project											
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6
CO1			15					5	10			
CO2			15					5	10			
CO3			15					5	10			
CO4			10	10					10	10		
CO5			15					5	10			
CO6			10	10					10	10		

Syllabus

Zero Trust Fundamentals and Principles of Zero Trust: The need for Zero Trust, Core principles: Never trust, always verify, Zero Trust Architecture (ZTA) components and ecosystem, Policy enforcement points, micro-segmentation, and data-centric security. Standards and Frameworks Supporting Zero Trust: NIST SP 800-207 Zero Trust Architecture, US DoD Zero Trust Strategy, India's National Cyber Security Strategy

Identity, Authorization, and Authentication (Human and Non-Human Users): Identity management fundamentals, Authentication and authorization mechanisms, Identity lifecycle for human users, Managing machine identities, service accounts, and APIs, Role-Based Access Control (RBAC) and Attribute-Based Access Control (ABAC) in Zero Trust

Zero Trust Architecture Patterns: Network, identity, and application-centric Zero Trust models; Hybrid and cloud-native implementations; Micro-segmentation, software-defined perimeter, and SASE integration; Continuous verification and least-privilege enforcement.

Zero Trust Maturity Model and Compliance: Overview of Zero Trust Maturity Models, Stages of maturity: Traditional, Advanced, Optimal, Alignment with compliance and regulatory frameworks, Assessing and measuring Zero Trust readiness.

Implementation Strategy and Review: Steps for adopting Zero Trust in existing infrastructure, Tools and technologies supporting ZTA, Policy development, monitoring, and continuous validation, Case studies on Zero Trust Architecture implementation

Zero Trust Assessment and Evaluation: Setting KPIs for Zero Trust; Evaluating security posture and access controls, Conducting risk and compliance assessments, Tools for readiness measurement and continuous improvement.

Learning Resources

1. Cindy Green-Ortiz, Brandon Fowler, David Houck, Hank Hensel, Patrick Lloyd, Andrew McDonald, Jason Frazier, "Zero Trust Architecture", 2023 (Cisco Press)
2. Garbis, Jason, and Jerry W. Chapman, "Zero trust security: An enterprise guide", 2021 (CA: Apress)
3. Madsen, Tom, "Zero-trust–An Introduction", 2024 (River Publishers)

Course Contents and Lecture Schedule

Module No	Topic	No. of Periods
1	Fundamentals and Principles of Zero Trust	
1.1	Evolution of network security and the need for Zero Trust	2
1.2	Core principles: Never trust, always verify, Zero Trust Architecture components and ecosystem	
1.3	Policy enforcement points, micro-segmentation, and data-centric security	2
1.4	Standards and Frameworks Supporting Zero Trust: NIST SP 800-207 Zero Trust Architecture, US DoD Zero Trust Strategy, India's National Cyber Security Strategy	2
2	Identity, Authorization, and Authentication (Human and Non-Human Users)	
2.1	Identity management fundamentals	2
2.2	Authentication and authorization mechanisms	
2.3	Identity lifecycle for human users, Managing machine identities, service accounts, and APIs	1
2.4	Role-Based Access Control (RBAC) and Attribute-Based Access Control (ABAC) in Zero Trust	1
3	Zero Trust Architecture Patterns	
3.1	Network, identity, and application-centric Zero Trust models	2

3.2	Hybrid and cloud-native implementations	
3.3	Micro-segmentation, software-defined perimeter, and SASE integration	2
3.4	Continuous verification and least-privilege enforcement.	1
4	Zero Trust Maturity Model and Compliance	
4.1	Overview of Zero Trust Maturity Models	2
4.2	Stages of maturity: Traditional, Advanced, Optimal	
4.3	Alignment with compliance and regulatory frameworks, Assessing and measuring Zero Trust readiness	2
5	Implementation Strategy and Review	
5.1	Steps for adopting Zero Trust in existing infrastructure	1
5.2	Tools and technologies supporting ZTA	1
5.3	Policy development, monitoring, and continuous validation	1
5.4	Case studies on Zero Trust Architecture implementation	1
6	Zero Trust Assessment and Evaluation	
6.1	Setting KPIs for Zero Trust	1
6.2	Evaluating security posture and access controls, Conducting risk and compliance assessments	2
6.3	Tools for readiness measurement and continuous improvement	2
Total Lecture Hours		28

Course Designers

- | | |
|------------------------------------|--|
| 1. Mr. Rakesh, Scientist – E, CDAC | rakesht@cdac.in |
| 2. Dr.R.Parkavi | rpit@tce.edu |
| 3. Ms.S.Sujitha | ssiit@tce.edu |
| 4. Dr.C.Jeyamala | jeyamala@tce.edu |