2017 SCHEME

SCHEME – I TO VIII SEMESTERS

SEMESTER: I
Physics Group

SL NO	COURSE CODE	COURSE TITLE	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	17MAT11	ENGINEERING MATHEMATICS – I	BS^	MAT	4	1			50	50	100	4.5
2	17PHY12	ENGINEERING PHYSICS	BS^	PHY	4	1			50	50	100	4.5
3	17CIV13	ENGINEERING MECHANICS	EC$	CV	4	1			50	50	100	4.5
4	17EME14	ELEMENTS OF MECHANICAL ENGINEERING & WORKSHOP PRACTICE	EC$	ME	4		2		50	50	100	5.0
5	17ELE15	BASIC ELECTRICAL ENGINEERING	EC$	EEE	4	1	1		50	50	100	5.0
6	17PHL16	ENGINEERING PHYSICS LAB	BS^	PHY			3		50	50	100	1.5
7	17CIP17	CONSTITUTION OF INDIA & PROFESSIONAL ETHICS	HU@	HUM	2				100+	-	-	-
8	17ENG18	COMMUNICATIVE ENGLISH	HU@	HUM	2				100+	-	-	-
								TOTAL	**300**	**300**	**600**	**25**

Chemistry Group

SL NO	COURSE CODE	COURSE TITLE	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	17MAT11	ENGINEERING MATHEMATICS –I	BS^	MAT	4	1			50	50	100	4.5
2	17CHE12	ENGINEERING CHEMISTRY	BS^	CHE	4	1			50	50	100	4.5
3	17CCP13	COMPUTER CONCEPTS & C PROGRAMMING	EC$	CS/IS	4	1			50	50	100	4.5
4	17CED14	COMPUTER AIDED ENGINEERING DRAWING	EC$	ME	2		4		50	50	100	4.0
5	17ELN15	BASIC ELECTRONICS ENGINEERING	EC$	ECE	4	1			50	50	100	4.5
6	17CPL16	COMPUTER PROGRAMMING LAB	EC$	CS/IS			3		50	50	100	1.5
7	17CHL17	ENGINEERING CHEMISTRY LAB	BS^	CHE			3		50	50	100	1.5
8	17CIV18	ENVIRONMENTAL STUDIES	HU@	HUM	2				100+	-	-	-
TOTAL									**350**	**350**	**700**	**25**

SEMESTER: II
Physics Group

SL NO	COURSE CODE	COURSE TITLE	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	Total	
1	17MAT21	ENGINEERING MATHEMATICS – II	BS^	MAT	4	1			50	50	100	4.5
2	17PHY22	ENGINEERING PHYSICS	BS^	PHY	4	1			50	50	100	4.5
3	17CIV23	ENGINEERING MECHANICS	EC$	CV	4	1			50	50	100	4.5
4	17EME24	ELEMENTS OF MECHANICAL ENGINEERING & WORKSHOP PRACTICE	EC$	ME	4		2		50	50	100	5.0
5	17ELE25	BASIC ELECTRICAL ENGINEERING	EC$	EEE	4	1	1		50	50	100	5.0
6	17PHL26	ENGINEERING PHYSICS LAB	BS^	PHY			3		50	50	100	1.5
7	17CIP27	CONSTITUTION OF INDIA & PROFESSIONAL ETHICS	HU@	HUM	2				100+	-	-	-
8	17ENG28	COMMUNICATIVE ENGLISH	HU@	HUM	2				100+	-	-	-
								TOTAL	**300**	**300**	**600**	**25**

SEMESTER: II
Chemistry Group

SL. NO	COURSE CODE	COURSE TITLE	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	CREDITS
1	17MAT21	ENGINEERING MATHEMATICS –II	BS^	MAT	4	1			50	50	100	4.5
2	17CHE22	ENGINEERING CHEMISTRY	BS^	CHE	4	1			50	50	100	4.5
3	17CCP23	COMPUTER CONCEPTS & C PROGRAMMING	EC$	CS/IS	4	1			50	50	100	4.5
4	17CED24	COMPUTER AIDED ENGINEERING DRAWING	EC$	ME	2		4		50	50	100	4.0
5	17ELN25	BASIC ELECTRONICS ENGINEERING	EC$	ECE	4	1			50	50	100	4.5
6	17CPL26	COMPUTER PROGRAMMING LAB	EC$	CS/IS			3		50	50	100	1.5
7	17CHL27	ENGINEERING CHEMISTRY LAB	BS^	CHE			3		50	50	100	1.5
8	17CIV28	ENVIRONMENTAL STUDIES	HU@	HUM	2				100+	-	-	-
								TOTAL	350	350	700	25

III SEMESTER												
SL. NO.	SUBJECT CODE	SUBJECT NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	17MAT31	ENGINEERING MATHEMATICS –III	BS	MAT	3	2	-	-	50	50	100	4
2	17CS32	DESIGN OF ANALOG AND DIGITAL CIRCUITS	PC	CSE	4	-	-	-	50	50	100	4
3	17CS33	DATA STRUCTURES	PC	CSE	4	-	-	-	50	50	100	4
4	17CS34	DISCRETE MATHEMATICAL STRUCTURES	PC	CSE	3	2	-	-	50	50	100	4
5	17CS35	COMPUTER ORGANIZATION AND MICROPROCESSOR	PC	CSE	3	-	2	-	50	50	100	4
6	17CSE36	OBJECT ORIENTED PROGRAMMING	PC	CSE	3	-	2	-	50	50	100	4
7	17CSL37	DATA STRUCTURES LAB	PC	CSE	-	-	2	-	50	50	100	1
8	17CSL38	DESIGN OF ANALOG AND DIGITAL CIRCUITS LAB	PC	CSE	-	-	2	-	50	50	100	1
		TOTAL							400	400	800	26

SL. NO.	SUBJECT CODE	SUBJECT NAME	COURSE TYPE	TEACHING DEPT	L#	T#	P#	S#	CIE*	SEE**	TOTAL	CREDITS
1	17CSO39	ROBOTICS ENGINEERING-LEGO MINDSTORM & TETRIX	OE	CSE	2	0	4		50	50	100	4

INTRODUCTION TO UNIX SHELL PROGRAMMING will be offered as an add on course in the 3rd semester.

SEMESTER: IV

SL. NO.	SUBJECT CODE	SUBJECT NAME	COURSE TYPE	TEACHING G DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	17MAT41	ENGINEERING MATHEMATICS –IV	BS	MAT	3	2	-	-	50	50	100	4
2	17CS42	DESIGN AND ANALYSIS OF ALGORITHMS	PC	CSE	3	-	2	-	50	50	100	4
3	17CS43	DATABASE MANAGEMENT SYSTEMS	PC	CSE	4	-	-	-	50	50	100	4
4	17CS44	APPLICATION DEVELOPMENT USING JAVA	PC	CSE	3	-	2	-	50	50	100	4
5	17CS45	OPERATING SYSTEM	PC	CSE	3	-	2	-	50	50	100	4
6	17CSL46	WEB TECHNOLOGIES LAB	PC	CSE	-	-	2	-	50	50	100	1
7	17CSL47	DBMS LAB	PC	CSE	-	-	2	-	50	50	100	1
8	17CSL48	MICROPROCESSOR LAB	PC	CSE	-	-	2	-	50	50	100	1
TOTAL									400	400	800	23

INTRODUCTION TO USER INTERFACE DESIGN – offered as an add-on Certification course in 4th Semester.

SEMESTER – V												
SL. NO.	SUBJECT CODE	SUBJECT NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	17CS51	COMPUTER NETWORKS	PC	CSE	4	-	-	-	50	50	100	4
2	17CS52	SOFTWARE ENGINEERING	PC	CSE	3	-	-	-	50	50	100	3
3	17CS53	DATA MINING	PC	CSE	3	-	2	-	50	50	100	4
4	17CSE54X	PROGRAM ELECTIVE – A	PE	CSE	3	-	2	-	50	50	100	4
5	17CS55	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS	PC	CSE	4	-	-	-	50	50	100	4
6	17CS56	FORMAL LANGUAGES AND AUTOMATA THEORY	PC	CSE	4	-	-	-	50	50	100	4
7	17CSL57	COMPUTER NETWORKS LAB	PC	CSE	-	-	2	-	50	50	100	1
8	17CSL58	PYTHON PROGRAMMING LAB	PC	CSE	-	-	2	-	50	50	100	1
TOTAL									400	400	800	25

PROGRAM ELECTIVE – A (V SEMESTER)

SL. No.	SUBJECT CODE	SUBJECT NAME	L#	T#	P#
1.	17CSE541	INTRODUCTION TO C# PROGRAMMING	3	-	2*
2.	17CSE542	ADVANCED ALGORITHMS	3	-	2*
3.	17CSE543	INTRODUCTION TO EMBEDDED SYSTEMS	3	-	2*
4.	17CSE544	UNIX SYSTEM PROGRAMMING	3	-	2*
5.	17CSE545	OBJECT ORIENTED MODELLING AND DESIGN	3	-	2*
6.	17CSE546	ADVANCED JAVA PROGRAMMING	3	-	2*
7.	17CSE547	ADVANCED OPERATING SYSTEMS	3	-	2*
8.	17CSE548	HUMAN COMPUTER INTERACTION	3	-	2*
9.	17CSE549	ADVANCED WEB PROGRAMMING	3	-	2*

SEMESTER – VI												
SL NO	SUBJECT CODE	SUBJECT NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			
					$L^{\#}$	$T^{\#}$	$P^{\#}$	$S^{\#}$	CIE*	SEE**	TOTAL	CREDITS
1	17CS61	BIG DATA ANALYTICS	PC	CSE	4	-	-	-	50	50	100	4
2	17CS62	CRYPTOGRAPHY AND NETWORK SECURITY	PC	CSE	4	-	-	-	50	50	100	4
3	17CS63	SOFTWARE PROJECT MANAGEMENT AND FINANCE	PC	CSE	3	-	-	-	50	50	100	3
4	17CS64	COMPUTER GRAPHICS	PC	CSE	3	-	2	-	50	50	100	4
5	17CSE65X	PROGRAM ELECTIVE –B	PE	CSE	3	-	2	-	50	50	100	4
6	17CSO66X	OPEN ELECTIVE – 1	OE	OTHER	4	-	-	-	50	50	100	4
7	17CSL67	BIG DATA LAB	PC	CSE	-	-	2	-	50	50	100	1
8	17CSL68	COMPUTER GRAPHICS LAB	PC	CSE	-	-	2	-	50	50	100	1
9	17CSL69	MOBILE APPLICATION DEVELOPMENT LAB	PC	CSE	-	-	2	-	50	50	100	1
TOTAL									450	450	900	26

PROGRAM ELECTIVE – B (VI SEMESTER)

SL. NO.	SUB CODE	SUBJECT NAME	L#	T#	P#
1	17CSE651	ADVANCED DATA BASE MANAGEMENT SYSTEMS	3	-	2
2	17CSE652	ADVANCED COMPUTER ARCHITECTURE	3	-	2
3	17CSE653	INTERNET OF THINGS	3	-	2
4	17CSE654	CYBER SECURITY AND DIGITAL FORENSIC	3	-	2
5	17CSE655	INTRODUCTION TO MACHINE LEARNING	3	-	2
7	17CSE656	INFORMATION STORAGE AND MANAGEMENT	4	-	-
8	17CSE657	INTRODUCTION TO DATA SCIENCE	3	-	2
6	17CSE658	BUILDING ENTERPRISE APPLICATIONS	3	-	2
9	17CSE659	ADVANCED ALGORITHMS	3	-	2

OPEN ELECTIVE – 1 (VI SEMESTER)

SL. NO.	SUBJECT CODE	SUBJECT NAME	L#	T#	P#
1	17CSO661	INTRODUCTION TO BUILDING ENTERPRISE APPLICATIONS	4	-	-
2	17CSO662	INTRODUCTION TO PYTHON PROGRAMMING	4	-	-
3	17CSO663	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	4	-	-
4	17CSO664	ALGORITHMS FOR DIGITAL IMAGE & VIDEO PROCESSING	4	-	-
5	17CSO665	OBJECT ORIENTED MODELLING AND DESIGN	4	-	-
6	17CSO666	INTRODUCTION TO JAVA PROGRAMMING	4	-	-
7	17CSO667	INTRODUCTION TO SYSTEMS SIMULATION AND MODELLING	4	-	-
8	17CSO668	INTRODUCTION TO COMPUTER GRAPHICS	4	-	-

SEMESTER: VII												
SL. NO.	SUBJECT CODE	SUBJECT NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	17CS71	HIGH PERFORMANCE COMPUTING	PC	CSE	3	-	-	-	50	50	100	3
2	17CS72	CLOUD COMPUTING	PC	CSE	3	-	-	-	50	50	100	3
3	17CS73	COMPILER DESIGN	PC	CSE	3	-	2	-	50	50	100	4
4	17CSH74	ENTREPRENEURSHIP DEVELOPMENT & IPR	HU	CSE	4	-	-	-	50	50	100	4
5	17CSE75X	PROGRAM ELECTIVE – C	PE	CSE	4	-	-	-	50	50	100	4
6	17CSO76X	OPEN ELECTIVE – 2	OE	OTHER	4	-	-	-	50	50	100	4
7	17CSL77	HIGH PERFORMANCE COMPUTING LAB	PC	CSE	-	-	2	-	50	50	100	1
8	17CSL78	PRODUCT DEVELOPMENT LAB	PC	CSE	-	-	2	-	50	50	100	1
9	17CSP79	PROJECT WORK-I	PR	CSE	-	-	2	-	50	50	100	1
10	$17CSI / S / P710	INTERNSHIP/RESEARCH PROJECT/VIRTUAL STARTUP	IN / SS /MP	CSE	-	-	-	8	50	50	100	2
11	^17CSP711	TECHNICAL SEMINAR	PC	CSE	-	-	-	8	50^	50^^	100	-
TOTAL									550	550	1100	27

PROGRAM ELECTIVE -C (VII SEMESTER)

SL. NO.	SUB CODE	SUBJECT NAME	L#	T#	P#
1	17CSE751	INTRODUCTION TO DEEP LEARNING	3	-	2
2	17CSE752	BLOCK CHAIN TECHNOLOGY	4	-	-
3	17CSE753	WIRELESS SENSOR NETWORKS	4	-	-
4	17CSE754	SOFT COMPUTING	4	-	-
5	17CSE755	QUANTUM COMPUTING	4	-	-
6	17CSE756	SYSTEM SIMULATION AND MODELLING	3	-	2
7	17CSE757	GAME THEORY	4	-	-
8	17CSE758	SOFTWARE TESTING	4	-	-
9	17CSE759	USER INTERFACE DESIGN	4	-	-

OPEN ELECTIVE –2(VII SEMESTER)

SL. NO.	SUB CODE	SUBJECT NAME	L#	T#	P#
1	17CSO761	INTRODUCTION TO CYBER SECURITY	4	-	-
2	17CSO762	INTRODUCTION TO SOFTWARE TESTING	4	-	-
3	17CSO763	INTRODUCTION TO BUSINESS INTELLIGENCE AND ITS APPLICATIONS	4	-	-
4	17CSO764	INTRODUCTION TO MOBILE COMPUTING	4	-	-

SEMESTER: VIII												
SL. NO	SUBJECT CODE	SUBJECT NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	17CS81	GREEN COMPUTING	PC	CSE	3	-	-	-	50	50	100	3
2	17CS82	CYBER LAWS AND ETHICS	HU	CSE	4	-	-	-	50	50	100	4
3	17CSE83X	PROGRAM CORE ELECTIVE –	PE	CSE	4	-	-	-	50	50	100	4
4	17CSP84	MAJOR PROJECT	PR	CSE	-	-	26	-	50	50	100	12
TOTAL									**200**	**200**	**400**	**24**

PROGRAM ELECTIVE -D (VIII SEMESTER)

SL. NO.	SUBJECT CODE	SUBJECT NAME	L#	T#	P#	S#
1	17CSE831	ADVANCED ARTIFICIAL INTELLIGENCE	4	-	-	-
2	17CSE832	AGILE SOFTWARE DEVELOPMENT	4	-	-	-
3	17CSE833	INTRODUCTION TO NATURAL LANGUAGE PROCESSING	4	-	-	-
4	17CSE834	VIRTUAL REALITY	4	-	-	-
5	17CSE835	PATTERN RECOGNITION	4	-	-	-
6	17CSE836	CYBER PHYSICAL SYSTEMS	4	-	-	-
7	17CSE837	OPERATIONS RESEARCH	4	-	-	-
8	17CSE838	MOBILE COMPUTING	4	-	-	-

NOTE :

*** - EVALUATION FOR THE INTERNAL MARKS WILL BE BASED ON PRACTICAL ORIENTED ASSIGNMENTS / COURSE PROJECT / MINIPROJECT / TESTS. IN ADDITION, AS A COMPONENT OF TEACHING METHODS THE COURSE CONTENT WILL BE DELIVERED BY DEMOS AND OR ACTUAL HANDS ON ACTIVITY BY THE STUDENTS IN THE LAB/CLASSROOM.**

^ - GUIDE , ^^ - DEPARTMENTAL COMMITTEE, $ - TO BE COMPLETED DURING ANY ONE OF THE SUMMER VACATION FOR ABOUT 6 WEEKS.

NOTE: PAPER PUBLICATION IS MANDATORY FOR INTERNSHIP AND PROJECT SUBMISSION.

NOTE: STUDENTS ARE FREE TO CHOOSE ANY MOOC BASED COURSE, EITHER FROM THE LIST GIVEN ABOVE OR ANY OF THEIR CHOICE; PROVIDED THE COURSE WAS NOT OFFERED TO THEM IN ANY OF THEIR PREVIOUS SEMESTERS.

BS - BASIC SCIENCE, EC-ENGG. CORE, PC-PROGRAM CORE, PE-PROGRAM CORE ELECTIVE, OE-OPEN ELECTIVE, HU-HUMANITIES, PR-PROJECT, SS-SELF STUDY, I-INTERNSHIP, MP-MINOR PROJECT. *CONTINUOUS INTERNAL EVALUATION, ** SEMESTER END EXAMINATION, # L- LECTURE, T- TUTORIAL, P- PRACTICAL, S-SELF STUDY NOTE: ONE HOUR OF LECTURE = 1 CREDIT, TWO HOURS OF TUTORIALS = 1.0 CREDIT, TWO HOURS OF PRACTICALS = 1 CREDIT, FOUR HOURS OF SELF-STUDY = 1 CREDIT.

Course Content for VII - Semester of 2017 Scheme

Department: *Computer Science and Engineering*	***Course Type:*** *Program Core*
Course Title*: High Performance Computing*	***Course Code:*** *17CS71*
L-T-P*:3-0-0*	***Credits:*** *03*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course covers the theoretical principles of massively parallel approach to high-performance computing using multiprocessing systems and/or combination of GPU hardware.

PREREQUISITES

- Knowledge on basics of Computer Organization

COURSE OBJECTIVES

- Provide an overview of existing High-Performance Computing (HPC) software and hardware,
- Present basic software design patterns for high performance parallel computing,
- Introduce CUDA for parallel computing on the Graphics Processing Unit (GPU).

COURSE CONTENTS

UNIT -I **8 Hours**

Introduction to High Performance Computers, Memory Hierarchy, CPU Design: Reduced Instruction Set Computers, Multiple Core Processors, Vector Processors.

Self-Study: Parallel Semantics, Distributed Memory Programming.

UNIT -II **8 Hours**

Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs.

Self-Study: Tips for Designing Asynchronous Programs, OpenMP: A Standard for Directive Based Parallel Programming.

UNIT-III **8 Hours**

Programming using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations.

Self-Study: Groups and Communicators.

UNIT-IV **8 Hours**

Introduction: GPUs as Parallel Computers, Architecture of a Model GPU, Why More Speed or Parallelism? Parallel Programming Languages and Models, Overarching Goals. History of GPU Computing: Evolution of Graphics Pipelines, GPU Computing. Introduction to CUDA: Data Parallelism, CUDA Program Structure, A Matrix-Matrix Multiplication Example, Device Memories and Data Transfer.

Self-Study: Kernel Functions and Threading.

UNIT-V **7 Hours**

CUDA Threads: CUDA Thread Organization, Using blockIdx and threadIdx, Synchronization and Transparent Scalability, Thread Assignment, Thread Scheduling and Latency Tolerance. CUDA Memories: Importance of Memory Access Efficiency, CUDA Device Memory Types, A Strategy for Reducing Global Memory Traffic.

Self-Study: Memory as a limiting Factor to Parallelism.

Self-Study Evaluation:

- The topics are integral part of the course.
- No formal lectures will be held for the self-study topics.
- The course coordinator may provide reading materials for self-study topics (optional).
- The topics prescribed under self-study in curriculum are part of CIE and SEE.

TEXT BOOKS

1. Rubin H Landau, Oregon State University, http://science.oregonstate.edu/ Rubin/.
2.Ananth Grama,AnshulGupta,Vipinkumar, George Karypis, Introduction to parallel computing, second edition, 2003, Pearson education publishers.
3. David B Reference Books: Wen-mei W. Hwu, "Programming Massively Parallel Processors on Approach", First edition, Elsevier and nvidia publishers 2010.

REFERENCE BOOKS

1. Thomas Rauber and GudulaRunger Parallel Programming for Multicore and cluster systems, Springer International Edition, 2009.
2. Hennessey and Patterson Computer Architecture: A quantitative Approach, Morgan Kaufman Publishers, 2011.
3. Michael J. Quin "Parallel Programming in C with MPI and Open MP", McGraw Hill.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Problem Solving Assignment

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of Course, the student will be able to:

COS	Description	Blooms Level
CO 1	Explain the technologies and architectures used for parallel computing	**L2**
CO 2	Design and develop parallel programs using Open-MP programming interface	**L4**
CO 3	Elaborate the principles and architecture of message-passing programming paradigm for solving real world problems	**L1**
CO 4	Understand the concept of Graphical Processing Units and their architecture	**L2**
CO 5	Analyze the features of GPUs, their functionalities and also Design parallel applications using CUDA-C	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs)													PSO1	PSO2	PSO3
CO\PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										1		
CO2	1	2	3												
CO3	3	1	1	2	3										
CO4	1	2	3	1	1								3	1	
CO5	3	3	3	1	3			1	1				3	1	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

***Department**: Computer Science and Engineering*	***Course Type**: Programming Core*
***Course Title**: Cloud Computing*	***Course Code:** 17CS72*
L-T-P:3-0-0	***Credits:** 03*
***Total Contact Hours:**39Hours*	***Duration of SEE:** 3 Hours*
***SEE Marks**: 50*	***CIE Marks:** 50*

COURSE DESCRIPTION

This course provides introduction to cloud computing and cloud service providers. This course also provides introduction to Virtualization technology which is the base for cloud computing. The course also discusses the application of cloud computing in different fields.

PREREQUISITES

Data Base Management Systems, Basics of Programming

COURSE OBJECTIVES

- To introduce the cloud computing
- The various services provided by the cloud
- Introduction to virtualization techniques and different type of virtualization
- Application of cloud computing in different fields

COURSE CONTENTS

UNIT -I **7Hours**

Introduction: Cloud Computing at a glance, Historical developments, Building cloud computing environments, Computing platforms and technologies, **Cloud computing architecture**: Introduction, Cloud reference model, Types of clouds, Economics of cloud, Open challenges.*Text 1: Chapter 1,4*

UNIT -II **8 Hours**

Introduction to Cloud Computing and AWS :Basic AWS concepts, Benefits of using AWS over traditional data center , Accessing AWS services, AWS overview ,Creating a new AWS account ,Deleting an AWS account ,AWS free tier ,Root user versus non-root user ,AWS dashboard ,Components of the AWS dashboard ,Core AWS services ,AWS soft limits ,Disaster recovery with AWS .**Getting Familiar with Identityand Access Management**:Understanding AWS root user, Elements of IAM, Introduction to AWS CLI, Group, IAM role, Policy, STS.**Monitoring with CloudWatch**: How Amazon CloudWatch works, Elements of Amazon Cloud Watch, **Elastic Beanstalk**: Elastic Beanstalk components, Getting started using Elastic Beanstalk.

Text 2 :Chapter 2, 3,7,16

UNIT-III **8 Hours**

Cloud resource virtualization:Virtualization, Layering and virtualization, Virtual machine monitors, Virtual machines, Performance and security isolation, Full virtualization and paravirtualization. **Virtual Private Cloud** : AWS VPC ,Subnet, IP addressing, Creating a VPC , (VPC with a single public subnet ,VPC with private and public subnets),Security, VPC networking components .**Getting Started with Elastic Compute Cloud** : Introduction to EC2 , EC2 instance lifecycle ,Instance launch ,Instance stop and start ,Instance reboot ,Instance retirement, Instance termination ,AMI ,Root device types,EC2 instance virtualization types ,Creating an EC2 instance ,Changing EC2 instance type ,Connecting to the EC2 instance .Introduction to Kubernetes.

Text 3 :5 , Text 2: 4,5 and Reference 3

UNIT-IV **9 Hours**

Simple Storage Service,Glacier, and CloudFront : Amazon S3 , Creating a bucket , Understanding objects , S3 storage classes, **Other AWS Storage Options(in brief),AWSRelation Database Services** :Amazon RDS components, RDS engine types , Creating an Amazon RDS MySQL DB instance , Monitoring RDS instances, Creating a snapshot ,Restoring a DB from a snapshot ,Changing a RDS instance type, Connecting to an Amazon RDS DB instance, **AWS DynamoDB - A NoSQL Database Service** : Introducing DynamoDB, DynamoDB components , Primary key, Secondary indexes, DynamoDB Streams , Naming rules and data types. **Amazon Simple Queue Service**:Why to use SQS?How queues work? Main features of SQS,**Simple Notification Service**: Introduction to Amazon SNS.

Text 2: Chapter 8,9 ,10,11,12,13

UNIT-V **7Hours**

Cloud platforms in Industry: Google AppEngine,MicrosoftAzure,**Cloud Applications**: Scientific Applications:Healthcare,Biology,Geoscience,Business and consumer Applications:CRM and ERP,Productivity,SocialNetworking,MediaApplications,Multiplayer Online Gaming.

Text Book 1: Chapter 9,10

TEXT BOOKS

1. RajkumarBuyya,ChristianVecchiola, S. ThamaraiSelvi ,"Mastering Cloud Computing",, McGraw Hill Education,2013 , ISBN -9781259029950(chapter 1,4,9,10).
2. VipulTankariya ,BhavinParmar , "AWS Certified Developer - Associate Guide" , Packet Publishing Ltd, BIRMINGHAM ,UK ,2017 (chapter 2,3,4,5,7, 8,9 ,10,11,12,13,16)
3. Dan.C.Marinesscu , "Cloud computing Theory and Practice",Morgan Kaufmann ,2018, ISBN- 9789351070948 (chapter 5)

REFERENCE BOOKS

1. Cloud Computing A Practical Approach, Anthony T. Velte ,Toby J. Velte,Robert Elsenpeter, McGraw-Hill Education Edition 2010.
2. Distributed and Cloud Computing From Parallel Processing to the Internet of Things, Kai Hwang,Geoffrey C. Fox, Jack J. Dongarra, Morgan Kaufmann(Elsevier) 2012
3. https://aws.amazon.com/kubernetes/

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Demonstration of AWS tools

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of Course, Student will be able to:

COS	Description	Blooms Level
CO 1	Describe the fundamentals of Cloud Computing and Identify the appropriate cloud services for a given application.	**L1**
CO 2	Analyze the Cloud infrastructure Amazon Cloud	**L4**
CO 3	Illustrate how virtualization, and Cloud can be set up practically to achieve a better computing environment.	**L3**
CO 4	Learn cloud storage technologies and relevant distributed file systems, NoSQL databases and storage.	**L3**
CO 5	Identify problems, and explain, analyze, and evaluate various cloud computing solutions.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs)													PSO1	PSO2	PSO3
CO\PO	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	3											3		
CO2		3	3		3								3		
CO3	2	3	3	2	3								3		
CO4		3	3	2	3	2	2							2	
CO5					3	1		3	3	3	1	3			1

Department: *Computer Science and Engineering*	***Course Type****: Programme Core*
Course Title*: Compiler Design*	***Course Code****: 17CS73*
L-T-P: 3-0-2	***Credits****: 4*
Total Contact Hours*: 52 Hours*	***Duration of SEE****: 3 Hours*
SEE Marks*:50*	***CIE Marks****: 50*

PREREQUISITES

- Student must have knowledge of assembly level programming.
- Student must be familiar with Formal Languages and Automata Theory.

COURSE OBJECTIVES

- To identify features of phases of the compiler, learn the design aspects and tools.
- To design a parser automaton, construct a parser table and do the program translation.
- To analyse various optimization techniques, create optimized programs and to extend it for green compilation and power optimization.

COURSE CONTENTS

UNIT – I **09 Hours**

Introduction to compilers: Language processors, the structure of a compiler, Lexical Analysis, Syntax analysis, Semantic analysis, Intermediate Code generation, Optimization, Code generation, Compiler construction tools, The Science of building a compiler, Applications of compiler technology, **Lexical Analysis**: The role of lexical analyzer, A simple approach to the design of lexical analyzer, Lex tool.

UNIT – II **11 Hours**

Syntax Analysis & Parsing: Top down parsing. Recursive descent parsing, Computation of FIRST & FOLLOW sets LL(1) grammar, Bottom up parsing- shift reduce parser & conflicts, Simple LR, The canonical collection of LR(0) items, LR Parsing algorithm, Constructing SLR parsing tables, LR(1) items, Constructing canonical LR(1) parsing tables, Constructing LALR parsing tables, efficient construction of LALR parsing table, Using ambiguous grammars – precedence, associativity, dangling else problem, Parser generators, YACC.

UNIT – III **11 Hours**

Syntax Directed Translation & Intermediate code generation: Syntax directed translation schemes & implementations, Intermediate code, Syntax trees, DAG for expressions, Three address code, quadruples, triples, Translation of expressions, Control flow, Backpatching, Switch statements, Intermediate code for procedures.

UNIT – IV **10 Hours**

Runtime Environment and Code generation: Static VS Dynamic storage, stack allocation scheme, Design issues in code generation, Basic blocks and flow graphs; Optimization in the basic blocks; implementation of simple code generator, code generation algorithm; Peep hole optimization; register allocation and assignments; optimal code generation for expressions.

UNIT – V **11 Hours**

Machine Independent Optimization: The sources of optimization, common subexpression, copy propagation, dead code elimination, code motion; Data flow analysis, reaching definitions, live variables, constant propagation, partial redundancy elimination; Loops in flow graph, depth first, back edges & reducibility; region based analysis and the algorithm; Symbolic analysis; Optimization for power management, Green compilers, use of tools.

TEXT BOOK

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, Compilers : Principles, Techniques and Tools, Second Edition, Pearson Education, 2007.

REFERENCE BOOKS

1. Allen I.Holub, Compiler Design in C, PHI, 1990.
2. Jean Paul Tremblay and Paul G. Sorenson, The Theory and Practice of Compiler Writing, BS Publications, 2008.
3. K.C. Louden, Compiler Construction:Principles and Practice,Cengage Publications,2002.
4. WissamChedid, Chansu Yu, and Ben Lee, Power Analysis and Optimization Techniques for Energy Efficient Computer Systems, Electrical Engineering &Computer Science Faculty Publications118, 2005, http://engagedscholarship.csuohio.edu/enece_facpub/118
5. Ulrich Kremer, Low Power/Energy Compiler Optimizations, Dept. of Computer Science, Rutgers University, 2005, online https://www.cs.rutgers.edu/~uli/CRC04.pdf .

Other Materials:

1. Leland L. Beck, System Software, 3rd Edition, Addison Wesley, 1997.
2. https://nptel.ac.in/courses/106108052/

Self Study Component: Loaders And Linkers : Basic Loader Functions, Design of an Absolute Loader, A Simple Loader, Machine Dependent Loader Features, Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; **Macro Processor:** Basic Macro Processor Functions, Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures.

TEACHING METHODS

- Lecture using Black board and chalk
- PowerPoint presentations
- Problem solving exercises
- Self study/ Course Project Assignment

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of the two)	30
Rubrics for the evaluation of Self-study/Course Project component	20
Total	50
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES:

At the end of course, student will be able to

CO	Description	Blooms Level
CO 1	Explain Compilers & its phases, lexical analysis and demonstrate use of LEX tools.	**L2**
CO 2	Compute LR(0), LR(1) and LALR sets of items, construct a parse table for a given grammar and show the use of YACC tool.	**L4**
CO 3	Perform syntax directed translation and generate intermediate code.	**L3**
CO 4	Implement runtime procedures and code generation managing optimization in the code generation phase.	**L4**
CO 5	Perform machine independent optimizations and develop optimizations for power management.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3		3	1	1						3	2	
CO2	3	3	3		3		1						3	3	
CO3	2	3	3		2		1						2	3	
CO4	2	2	3		2	2	3						3	3	
CO5	3	2	3		3	3	3						3	2	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Entrepreneurship Development ,Management and IPR*	***Course Code:****17CSH74*
L-T-P:*4-0-0*	***Credits:****04*
Total Contact Hours:*52 Hours*	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

PREREQUISITES

- Students should have knowledge on the current business trends and technology.

COURSE OBJECTIVES

- To Define the role of supporting agencies, entrepreneurs and IPR
- To Describe the various process involved in establishing start-ups and applying the patents.
- To Demonstrate the knowledge on how to prepare the Project Report.
- To Examine the principles of Intellectual Property Rights
- To Analyse the importance of patents, trademarks and copyrights.

COURSE CONTENTS

UNIT- I **08 Hours**

Introduction to Entrepreneur:

Introduction-meaning and importance of entrepreneurship, entrepreneur, types, characteristics, entrepreneur process, role of entrepreneurs in economic development, problems faced by entrepreneurs, scope in India

UNIT- II **12 Hours**

MSME and Supporting Agencies:

Micro, Small and medium enterprises, Definition of MSMEs as per MSME act, characteristics of small enterprises, need and advantages of small enterprises, Steps in setting up of small enterprises, Institutional support to MSMEs-State supporting agencies-TECSOK, KIADB, KSSIDC, KSFC, National Schemes-MSME-DI, NSIC, SIDBI

UNIT -III **10 Hours**

How to prepare Project report:

Preparation of Project reports, control variables in project, project lifecycle, project report, need, project identification, project selection, components of project report, formulation of report, planning commission guidelines, project appraisal, feasibility study-market, financial, technical and economic, PERT and CPM, errors in report

UNIT -IV **12 Hours**

Introduction to Intellectual Property:

Introduction: Meaning, Relevance, Business Impact, Protection of Intellectual Property, Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications Bio-diversity and IPR Competing Rationales for Protection of Intellectual Property Rights, Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization(WIPO).

UNIT- V **10 Hours**

Introduction to Patents and Trademark:

Patents-What is a patent, history of patent, Criteria for patent, types of patents, Indian patent act, patents for computer software, business models, incremental innovation, patent infringement

Trademarks-role, as a marketing tool, trademark rights, types, use of trademarks, trademark act, trademark registration in India

Copyrights-meaning, copyright protection in India, enforcement measures, copyright.

MINIPROJECT:

A Case study on "Success and Failure of an Entrepreneurs/ Entrepreneurship needs to be presented by a team of students with areport on the Case study and this needs to be considered for internal assessment.

TEXT BOOKS

1. Dynamics of Entrepreneurial Development and Management-Vasanth Desai, Himalaya Publishing
2. Entrepreneurship and Management, S Nagendra and Manjunath VS, Pearson Publications
3. Managing Intellectual Property, Vinod V. Sople, PHI, 3rd Edition, 2012
4. Intellectual Property-Copyrights, trademarks and patents, Richard Stim, Cengage learning, 2011
5. Dr. B. L. Wadhera, Law Relating to Intellectual Property, Universal law Publishing Co. Ltd. 2009.

REFERENCE BOOKS

I. Aswani Kumar Bansal, Law of Trademarks in India.
II. Intellectual Property Rights, Handbook/Notes.
III. Course materials for one year P.G. Diploma in IPR from NLSIU, Bangalore by Mr. T. Ramakrishna.
IV. Case studies from internet sources.

TEACHING METHODS

- PPTs
- Hands-on Sessions Based Teaching

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics evaluation for the Case Study presentation	10
Seminar will be conducted	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

CO	Description	Blooms Level
CO1:	Define the role of supporting agencies, entrepreneurs and IPR in the context of protecting the IPs	**L2**
CO2:	Describe the various process involved in establishing start-ups and applying the patents	**L1**
CO3:	Demonstrate the knowledge on how to prepare the Project Report and other documentations.	**L4**
CO4:	Examine the principles of Intellectual Property Rights and its importance to become a successful entrepreneur.	**L4**
CO5:	Analyse the importance of patents, trademarks and copyrights.	**L4**

Mapping of Course Outcome to Programme Outcome* & PSO**

	Course Outcomes mapping to program outcomes												Program Specific Outcomes (PSOs)		
Pos/ Cos	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1				**2**		**2**	**2**	**3**	**2**	**3**	**2**	**1**			3
CO2				**2**		**2**	**2**	**3**	**2**	**3**	**2**	**1**			3
CO3				**2**		**2**	**2**	**3**	**2**	**3**	**2**	**1**			3
CO4				**2**		**2**	**2**	**3**	**2**	**3**	**2**	**1**			3
CO5				**2**		**2**	**2**	**3**	**2**	**2**	**2**	**1**			3

***Strong -3, Medium – 2, Weak** -1

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: High Performance Computing Lab*	***Course Code:****17CSL77*
L-T-P:*0-0-2*	***Credits:****01*
Total Contact Hours:*36 Hours*	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

The HPC lab is aimed at reinforcing the concepts of Parallel Programming Techniques applicable for the various strains of High-performance architectures: Multicore, Multiprocessor, Message processing based Distributed computing, and Heterogenous processing ensembles.

PREREQUISITES

- Knowledge of Advanced Computer Architectures
- Ability to design and analyse Numerical Processing algorithms, Vector Processing, Searching, Sorting and String functions.

COURSE OBJECTIVES

- Provide systematic and comprehensive treatment to the Highly Integrated development Environments for HPC program development and testing.
- Provide facility with the tools useful in performance analysis of HPC facilities.
- Introduce the concepts of Heterogeneous Computing platforms: CPU + GPU architectures.
- Introduce the concepts of program development for Multi-core Shared memory architectures.
- Introduce the concepts of High-Performance Computing as a service on Cloud platforms (utilizing HP computing resources and storage made available through a Cloud platform).

COURSE CONTENTS:

Brief description of lab exercises and assignments:

Topic	Problem statements / domains
GPU programming. (4 Labs)	Device Query, Vector Addition, Matrix Multiplication, Tiled Matrix Multiplication, Picture Scaling, Image Blur, Image Grayscaling. 1D, 2D, and 3D Stencil Operations. Histogramming, Convolution, Scan, Reduction.
OpenMP (4 Labs)	Vector Addition, Matrix Multiplication, Tiled Matrix Multiplication, Picture Scaling, Image Blur, Image Grayscaling. 1D, 2D, and 3D

	Stencil Operations. Histogramming, Convolution, Scan, Reduction
Open MPI programming (3 Labs)	DAXPY, Matrix Multiply, Calculation of pi using worksharing and reduction, Producer consumer problem, Molecular dynamics simulation problem.
Cloud Management Platforms (3 Labs)	Cluster configuration, Resource Provisioning, Storage Management

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20 Marks
Lab Record Writing	10 Marks
Lab Internals Test	20 Marks
Total	**50 Marks**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Students will be able to

CO	Description	Blooms Level
CO 1	Design and implement high performance versions of standard single threaded algorithms	**L3**
CO 2	Demonstrate the architectural features in the GPU and MIC hardware accelerators	**L3**
CO 3	Design programs to extract maximum performance in a multicore, shared memory execution environment processor	**L4**
CO 4	Develop programs using OPENMP, MPI and CUDA	**L4**
CO 5	Design and deploy Parallel programs on Processor clusters, configuring clusters and cloud storage.	**L4**

Mapping of Course Outcomes (COs) to Program Outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
PO/CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	1											3		
CO2	3	3	1		3								3		
CO3	3	3	2		3								3		
CO4	3	3	2	3	3								3		
CO5	3	3	3		3								3		

Department: *Computer Science And Engineering*	***Course Type:*** *Programme Core*
Course Title*: Product Development Lab*	***Course Code:****17CSL78*
L-T-P:0-0-2	***Credits:****01*
Total Contact Hours:20 Hours	***Duration Of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

This lab aims at teaching students on how to work in open source projects efficiently and gain benefits from it. Students will learn about teamwork, continuous integration and also encourage diversity in open source projects.

COURSE OBJECTIVES

- To develop an understanding in students F/OSS ecosystem, its history and current practices.
- To enable students to analyze the opportunities and challenges the F/OSS presents.
- To expand student's knowledge and improve their success by providing them with leading edge software required to achieve better academic, career and personal growth.
- To encourage diversity in open source projects.

COURSE OUTCOMES

Students will be able to:

- Understand and appreciate the advantages of using F/OSS in developing projects.
- Compare the different Software tools and Technologies available and choose the one best suited for their project development purpose.
- Develop their skills by sharing their work and critiquing the work done by others.
- Explain to others the nature of open source software, particularly how it differs from proprietary software.
- Become a contributing member of a software development community.
- Choose an appropriate license for open source things in general and to explain what can and cannot be done with software that has a specific license.
- Explain how software licensing works in general, what choices of license exist.

DELIVERABLES

- Documentation as proof towards contributions to open source communities and/or projects.

ASSIGNMENTS NORMALLY INCLUDE

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Conducting analysis/Modeling/Simulation/Experiment/Design/Feasibility;
- Implementing the selected topic
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Demo and Seminar, as oral Presentation before a Departmental Committee

ASSESSMENT METHODS

Parameter	Marks
Initial Seminar	10 Marks
Product Design and Demo	30 Marks
Report	10 Marks
Total	**50 Marks**
Final Exam will be conducted for 100 marks (SEE)	

Department: *Computer Science And Engineering*	***Course Type:*** *Programme Core*
Course Title*: Project Work-I*	***Course Code:****17CSP79*
L-T-P:0-0-2	***Credits:****01*
Total Contact Hours:20 Hours	***Duration Of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

The project work will be assigned to the students towards the end of 6th semester and will start working on those projects at the commencement of their 7th semester. The topic of the project will be decided as per the developments taking place in the field of Computer Science and Engineering.

COURSE OBJECTIVES

The objective of Project Work I is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.

The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Seminar, as oral Presentation before a Departmental Committee.

COURSE OUTCOMES

Students will be able to:

- Survey and study of published literature on the assigned topic
- Complete the preliminary approach to the Problem relating to the assigned topic;
- Complete Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;

ASSESSMENT METHODS

Parameter	Marks
Initial Seminar	10
Product Design and Demo	30
Report	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

Course Content for Program Elective – C

VII - Semester

Department : *Computer Science and Engineering*	***Course Type :*** *Programme Elective*
Course Title: *Introduction to Deep Learning*	***Course Code:*** *17CSE751*
L-T-P: *3-0-2*	***Credits:****04*
Total Contact Hours: *52Hrs*	***Duration of SEE :*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

PREREQUISITES:

- Students must have basic knowledge of Machine learning algorithms and techniques.
- Students must have very good understanding of Engineering Mathematics and related theories.

COURSE OBJECTIVES:

- To get knowledge of artificial neural networks and deep learning methods, deep neural network architectures and optimization techniques.
- To analyse the algorithms for backpropagation, optimization and training of deep neural networks and determine the parameter settings.
- To work with TensorFlow/Keras, design solutions for real life applications and create applications using deep learning neural networks.

COURSE CONTENTS:

UNIT – I **10 Hours**

Foundations of Neural Networks and Deep Learning: The relationship between AI and deep learning, Gradient-Based Optimization, Constrained Optimization, Stochastic Gradient Descent. Neural Networks, The Perceptron, Multilayer Feed-Forward Networks, Activation Functions, Loss Functions, Training Neural Networks.

UNIT – II **12 Hours**

Fundamentals of Deep Networks: Common Architectural Principles of Deep Networks – Parameters, Layers, Activation Functions, Loss Functions, Optimization algorithms, Hyper-parameters. Major Architectures of Deep Networks: Unsupervised Pretrained Networks (UPNs), Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks.

UNIT – III **10 Hours**

Deep Networks: Modern Practices: Deep Feedforward Networks, Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation, Regularization for Deep Learning, Optimization for Training Deep Models.

UNIT – IV **10 Hours**

Deep Learning with TensorFlow: Introduction to TensorFlow,Process of coding a Deep learning program in TensorFlow, Basics of Keras&TensorFlow by application, Distributed system architecture.

UNIT – V **10 Hours**

Application domain: Basic classification with MNIST dataset – Hand written digit recognition, Binary Classification of IMDB Dataset – Movie Ratings, Text Classification of IMDB vocabulary using CNN, Text generation using LSTM, Regression application of Boston House Pricing,Deep learning for Computer Vision, Implementing Deep dream, Magenta (AI Music Generation).

TEXT BOOKS:

1. Josh Patterson and Adam Gibson, "Deep Learning A Practitioner's Approach", O'Reilly, First Edition, 2017.
2. Ian Goodfellow,YoshuaBengio and Aaron Courville, "Deep Learning", An MIT Press book, 2016.
3. François Chollet, "Deep Learning with Python", Manning Publications Co, First edition, 2018.

OTHER REFERENCES:

1. **TensorFlow Tutorial – Deep Learning Using TensorFlow, online [available]:** https://www.tensorflow.org/tutorials/
2. **Andy, Python TensorFlow Tutorial – Build a Neural Network, online [available]: http://adventuresinmachinelearning.com/python-tensorflow-tutorial/**
3. **Jason Brownlee, 8 Inspirational Applications of Deep Learning, July 2016, online [available]:** https://machinelearningmastery.com/inspirational-applications-deep-learning/

TEACHING METHODS:

- Lecture (PPT)
- Programming Assignments/seminar
- Course Project

ASSESSMENT METHODS:

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project	10
Seminar	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COS):

At the completion of this course, the student will be able to:

COs	Description	Blooms Level
CO 1	Explain the concepts of deep learning and Neural Networks.	L2
CO 2	Demonstrate the architectural principles of Deep Learning Networks.	L3
CO 3	Explore the training and use of deep Learning networks with tools / techniques and modern practices.	L2
CO 4	Analyze the development methods of Deep Learning and Neural networks.	L4
CO 5	Create the deep learning system to solve real world problems.	L4

Mapping of Course outcomes (COs) to Program outcomes (POs) & PSOs

	Program Outcomes*												PSOs**		
POs / 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	3	3											3		
CO2	3	3											3		
CO3	3	3	3		3							2	3		
CO4	2	2	3	2	3							2	3		
CO5	3	3	3	3	3			3	2	3	3	3	2	2	2

*3: Strong, 2:Medium, 1: Weak**3: Highly related 2: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Block Chain Technologies*	***Course Code:*** *17CSE752*
L-T-P:*4-0-0*	***Credits:****04*
Total Contact Hours:*52 Hours*	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

The widespread popularity of digital crypto-currencies has led to the foundation of Block Chain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Block Chain have now spread from crypto-currencies to various other domains, including business process management, smart contracts, IoT and so on. This covers both the conceptual as well as application aspects of Block Chain. This includes the fundamental design and architectural primitives of Block Chain, the system and the security aspects, along with various application domains.

PREREQUISITES:

- Student should have prior basic knowledge on C++ , Data Structures and OOP Concepts
- Students should be able to develop a webpage by the use of Java Script.

COURSE OBJECTIVES

- Understand how Block Chain systems (mainly Bitcoin and Ethereum) work
- Understand emerging abstract concepts of Block Chain Technology.
- Design, build, and deploy smart contracts and distributed applications,
- Attain awareness of security aspects of bit coin and Block Chain technology.

COURSE CONTENTS

UNIT- I **10 Hours**

INTRODUCTION TO BLOCKCHAIN

Classical Block Chain data structure; Foundational technologies: Hashing, Cryptography, Mining, Key Exchange, Smart contracts, Bitcoin Transactions, public vs permissioned. Block Chain data structures: Merkle Tree, Patricia Tree Hashing Applications, Key distribution, Diffie Hellman problems, PKE and RSA algorithms.

UNIT- II **10 Hours**

SOLIDITY AND DAPPS

Ethereum Clients, Go- EthereumClients(geth),Python Ethereum Client (pyethapp), Ethereum Languages, Solidity, TestRPC, Mist Ethereum Wallet,MetaMask,Web3 JavaScript API, Ethereum Accounts.

Smart Contract, Structure of a Contract, Setting up and Interacting with the Contract using Geth client, Compiling and Developing Contract, Transactions and Calls, Interacting with the Contract, Gas ,Logs, Events, Setting up and Interacting with a Contract using Mist Wallet, Compiling and Developing Contract, Interacting with the Contract, Smart Contract Examples.

UNIT -III **12 Hours**

CONSENSUS ALGORITHMS AND CLASSICAL RESULTS

Block Chain Scalability, Double-Spending Problem, Why consensus is harder in Block Chain? Classical Results, Byzantine Fault Tolerance(PBFT in detail), Proof-of-Work Vs Proof-of-Stake, Consistency, Availability & Partition Tolerance (CAP), Turing Completeness, Greedy Heaviest-Observed Sub-Tree (GHOST), Sybil Attack, Mining Pools and Centralization, Zero knowledge Proof(ZeroCoin).

UNIT- IV **10 Hours**

NEXT GENERATION OF BLOCKCHAINS

HyperLedger: Fabric/Sawtooth- Introduction to generic block Chains and smart contracts. Building applications with HyperLedger Fabric/Sawtooth. Comparison between HyperLedger and Ethereum.

IoTA: Introduction to the Tangle. Concepts of Merkle trees to be applied. Path traversal and development using Javascript Libraries.

UNIT -V **10 Hours**

BITCOIN AND BLOCKCHAIN SECURITY

Securing Bit-coin and Block Chain, Security practices for your wallet, Types of wallets, Hardware wallets, Workings of a hardware wallet, Types of physical Bit-coins, The survival of crypto-currencies.

COURSE PROJECT

Students will have to design and build a first Block Chain, create wallets and send signed transactions using Block Chain using any language of their choice. GROUPS: Students need to form a group of 4 students. All members will collectively submit a single copy of all works.

TEXT BOOKS

1. ArshdeepBahga, Vijay Madisetti, "Block Chain Applications- A Hands-on Approach", VPT; 1 Edition, 2017
2. KirankalyanKulkarni, "Learn Bitcoin and Block Chain", Packt Publishing, 2018.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy, 1st Edition , O'Reilly Publications, 2015.

REFERENCE BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Wattenhofer, The Science of the Blockchain
3. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
4. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
5. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
6. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts

TEACHING METHODS

- Lecture (Power Point presentations/ Black board teaching (if needed))
- Regular review of students by asking questions based on topics covered in the class.

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics evaluation for the Course Project will be conducted	10
Programming Assignment will be conducted	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

CO	Description	Blooms Level
CO 1	Identify the importance of Cryptocurrency, BlockChain technology and Applications	**L1**
CO 2	Demonstrate the usage of the Ethereum based BlockChain platform	**L3**
CO 3	Setting up and Interacting with the Smart Contracts	**L4**
CO 4	Understand the advanced BlockChain, security concerns of BlockChain Technology, Bitcoins	**L2**
CO 5	Design, build, and deploy a distributed application.	**L4**

Mapping of Course Outcome to Programme Outcome* & PSO**

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
Pos/ Cos	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO3
CO1	3	2	2		2								2	2	
CO2	3	2	2		2								2	2	
CO3	3	2	2		2								2	2	
CO4	3	2	2		2								2	2	
CO5	3	2	2		2					2	1	1	2	2	1

*Strong -3, Medium – 2, Weak -1

Department: *Computer Science and Engineering*	***Course Type:****Programme Elective*
Course Title*: Wireless Sensor Networks*	***Course Code:*** *17CSE753*
L-T-P *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course covers the concepts of Wireless Sensor Networks and its Applications. Various MAC protocols, Network Topologies and Sensor node designs are discussed in the course.

PREREQUISITES

Students should have the knowledge of Computer Networks

COURSE OBJECTIVES

- To enable the students to understand the design of Sensor Nodes.
- To provide a better understanding of applications of WSN.
- To understand the functions of MAC and Routing Protocols in WSN.

COURSE CONTENTS

UNIT -I **10 Hours**

Overview of wireless sensor networks: Challenges for Wireless Sensor Networks, Applications Enabling Technologies for Wireless Sensor Networks.

UNIT -II **10 Hours**

Architectures : Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles of WSNs, Gateway Concepts

UNIT -III **12 Hours**

Networking sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing.

UNIT -IV **10 Hours**

Infrastructure establishment: Topology Control, Time Synchronization, Localization and Positioning, Sensor Tasking and Control: task driven sensing, Roles of sensor nodes and utilities, sensor selection.

UNIT -V **10 Hours**

Sensor network platforms and tool: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators.

TEXT BOOKS

1. Holger Karl & Andreas Willig, " Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

REFERENCES BOOKS

1. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3. Ananthram Swami, Qing Zhao, Yao-Win Hong, Lang Tong "Wireless Sensor Networks- Signal Processing and Communications Perspectives@ Wiley India, 2007.

Other References materials:

1. www.uta.edu/utari/acs/networks/WirelessSensorNet
2. https://www.researchgate.net/publication/4223145_Architectures_for_Wireless_Sensor_Networks
3. http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02
4. https://nptel.ac.in/course.php

TEACHING METHODS

1. Lecture using Black board and chalk
2. Presentations
3. Flipped classroom

ASSESSMENT METHODS

Parameter	Marks
Three internals (Average of best of two)	30
Rubrics for the evaluation of course project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COS	Description	Blooms Level
CO 1	Describe the overview, challenges of Wireless Sensor Networks and its applications w.r.t technologies	L2
CO 2	Analyze the various architectures of Wireless Sensor Networks.	L4
CO 3	Demonstrate the various methods involved in deploying and configuring wireless sensors networks.	L3
CO 4	Illustrate how the usage of various routing protocols and manipulating data for wireless sensor networks	L4
CO 5	Develop and optimize network using various platforms and tools available for WSN	L6

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		3											3		
CO2		3				2							3		
CO3		3				2							3		
CO4		3				2								3	
CO5		3			3	2	1								

3: Strong, 2: Medium, 1: Weak **** H: Highly related S: Supportive**

Department: *Computer Science and Engineering*	***Course Type:****Programme Elective*
Course Title*: Soft Computing*	***Course Code:****17CSE754*
L-T-P *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces students with the basics of neural networks, fuzzy logic, genetics algorithms and machine learning concepts.

PREREQUISITES

- Algorithms concepts, set theory concepts.

COURSE OBJECTIVES

- Make students understand and learn the basics of neural networks, fuzzy logic, and machine learning.

COURSE CONTENTS

UNIT-I **10 Hours**

Neural NetworksSupervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Multilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – HebbianLearning.**Fuzzy Set Theory-**Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization

UNIT-II **10 Hours**

Fuzzy Set Theory-Cont Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

Genetic Algorithm: Difference between Traditional Algorithms and GA, The basic operators, Schema theorem, convergence analysis, stochastic models, applications in search and optimization. Encoding, Fitness Function, Reproduction, Cross Over, Mutation, Convergence Theory; Applications – Match Word Finding, Travelling Sales ManProblem.

UNIT-III **10 Hours**

Rough Set:Indiscernibility Relations, Reducts, Rough Approximation. Applications. Hybrid Systems: Neuro Fuzzy Systems, Fuzzy Logic Controlled GA, Fuzzy Membership Interpretation using Rough Set theoryetc. **Neuro Fuzzy Modeling**AdaptiveNeuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks

UNIT-IV **11 Hours**

Neuro Fuzzy Modeling-Contd…

Neuro Fuzzy Spectrum. Neuro-Fuzzy Systems for Pattern Recognition: Image-, Speech- and Language Processing , Application - Speech Recognition

Neuro-Genetic Information Processing For Optimization: Adaptation in Intelligent Systems, Evolving Connectionist and Fuzzy Connectionist Systems, Applications for Adaptive Systems, On-line Intelligent Systems, GA Based Weight Optimization.

UNIT-V **11 Hours**

Machine Learning

Learning form Examples - Inductive Concept Learning - Sequence Prediction - Effect of Noise in Input.Learning by Analogy- Concept formation - Derivational Analogy. Learning by Observation and Discovery - Search for Regularity- Conceptual Clustering, Computational LearningTheory.

Applications of Computational Intelligence: Shortest Path Algorithm, Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction, Stock Market Forecasting

TEXT BOOKS

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education2004.
2. Michalski, Carbonnel& Michel (Eds.): Machine Learning - An A. I. Approach, Vol-I.
3. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
4. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI,2003.
5. S Machine Learning by Tom. M Mitchell, McGrawHill International Edition, Computer ScienceSeries.

REFERENCE BOOKS

1. David E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y.,1989.
2. Neural network fuzzy logic genetic algorithm synthesis and application- S. Rjaesh Karan.
3. Neuro-Fuzzy Techniques for Intelligent Information Systems by Nikola Kasabov and Robert Kozma (eds), ISBN3-7908-1187-4.

TEACHING METHODS

- Black Board Teaching
- Lecture by Presentations (ppt)

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Programming Assignment	10
Seminar from IEEE/ACM papers	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

CO	Description	Blooms Level
CO 1	Understanding and analysing concepts of Neural Networks and Fuzzy set theory.	**L2,L4**
CO 2	Understanding and analysing the concepts of Fuzzy Set Theory and Genetic Algorithm	**L2,L4**
CO 3	Understanding and analysing the concepts of Rough Set and Neuro Fuzzy Modeling	**L2,L4**
CO 4	Understanding and analysing the concepts of Neuro Fuzzy Modelling and Neuro-Genetic Information Processing For Optimization	**L2,L4**
CO 5	Understanding and analysing the concepts of Machine Learning and Applications of Computational Intelligence	**L2,L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)															
Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**	**2**	**2**									3	
CO2		**3**	**3**	**3**										3	
CO3		**3**	**3**	**3**	**2**									3	
CO4		**3**	**2**	**2**										3	
CO5		**3**	**2**	**2**			**3**							3	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:****Programme Elective*
Course Title*: Quantum Computing*	***Course Code****: 17CSE755*
L-T-P:4-0-0	***Credits:*** *04*
Total Contact Hours: *48 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces students to the next revolution in computer science, the quantum computing. The students learn the nuts and bolts of quantum computers, from the basic gates to the proven quantum algorithms like Shor's algorithm. The students will also be exposed to the experimental quantum computers open sourced by IBM. By the end of the course, the students will have basic understanding of the quantum computers and should be able to appreciate the complexity of building one.

PREREQUISITES

1. Basic linear algebra, complex numbers
2. Idea of algorithms and their complexities
3. Idea of classical gates

COURSE OBJECTIVES

- To give the students a basic idea of quantum computing, concepts, complexity and its applications.
- Solve certain problems with vast number of combinations.
- Simulation of quantum processes.

COURSE CONTENTS

UNIT -I **08 Hours**

Introduction and Mathematical Foundations: What are quantum computers?, Why quantum computers?, Complex numbers, Linear Algebra, Probability

UNIT -II **08 Hours**

Quantum Physics Fundamentals: Quantum Superposition, Quantum Tunneling, Quantum Entanglement, Superconductivity

UNIT -III **12 Hours**

Qubit and Quantum Gates: Leap from Classical to Quantum, Qubits, Bits vs Qubits, Classical Gates, Quantum Gates

UNIT -IV **12 Hours**

Quantum Algorithms: Deutsch's Algorithm, Shor's Algorithm, Grover's Algorithm

UNIT -V **8 Hours**

Experimenting with available online quantum computers and Quantum Computer Applications: Experimenting with IBM-Q Quantum computers, Applications of Quantum computers to cryptography, Other applications

TEXT BOOKS

1. Phillip Kaye, Raymond Laflamme, Michele Mosca, "An Introduction To Quantum Computing", 1st edition, Oxford University Press, ISBN: 978-0198570004, 2007
2. Eleanor G. Rieffel, Wolfgang H. Polak, "Quantum Computing : A Gentle Introduction", 1st edition, The MIT Press, ISBN: 978-0262526678, 2014

REFERENCE BOOKS

1. Michael A. Nielsen & Isaac L. Chuang, "Quantum Computation and Quantum Information", 10th Anniversary Edition, Cambridge University Press, ISBN - 978-1107619197, 2011
2. Chris Bernhardt, "Quantum Computing For Everyone", 1st edition, The MIT Press, ISBN - 978-0262039253, 2019

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of Programming Assignments	10
Problem Solving Test	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

CO	Description	Blooms Level
CO 1	Understand what and why quantum computing	**L2**
CO 2	Apply and appreciate the complexity in involved in building a quantum computer.	**L3**
CO 3	Understand the theory behind the quantum computing.	**L2**
CO 4	Apply and understand the current quantum algorithms	**L3,L2**
CO 5	experiment with online quantum computing platforms	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)															
Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1	3						2						3		
CO2	3	3	3	3									3	3	
CO3	3	3				2							2		
CO4	3			3									3		
CO5	3						3		2				3	3	2

*3: Strong, 2: Medium, 1: Weak 3: Highly related 2: Supportive

Department: *Computer Science and Engineering*	***Course Type:****Programme Elective*
Course Title: *System Simulation and Modeling*	***Course Code:****17CSE756*
L-T-P:*3-0-2*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course serves to understand discrete event system simulation, the event scheduling/time advance algorithm, useful statistical models, various distributions, random number generators, random variate generators, input modeling and output analysis for single model.

PREREQUISITES

- Students should have Knowledge of Probability and statistics

COURSE OBJECTIVES

- Analysing the application areas of simulation and different types of models of simulation.
- Illustrate the concept of discrete event simulation and Analyse the statistical models in simulation.
- Analysing the properties of Random-Variate and generation of Random-Number.
- Identifying the distribution, Parameter estimation, Goodness of Fit Tests etc with respect to Input modeling.
- Analyse, verify and validate the simulation models.

COURSE CONTENTS

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UNIT – I **11 Hours**

Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet. Simulation of inventory systems.

UNIT – II **11 Hours**

General Principles, Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time advancAlgorithm, World Views,

Manual simulation Using Event Scheduling.

Statistical Models in Simulation: Review of terminology and concepts;Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical

distributions.

UNIT – III **10 Hours**

Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

.UNIT – IV **10 Hours**

Input Modeling : Data Collection; Identifying the distribution with data;Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

UNIT – V **10 Hours**

Output Analysis for single Model: Types of simulations with respect to output analysis; stochastic nature of output data; Absolute measures of performance and their estimation;
Verification and Validation of simulation Models: Model building,verification and validation; Verification of simulation models; Calibration and validation of models.

TEXT BOOKS

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.
   (Listed topics only from Chapters1 to 12)

REFERENCE BOOKS

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007.

TEACHING METHODS

- Blackboard teaching
- PowerPoint presentations
- Problem Solving
- Videos

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg of 2 Tests)	30
Simulation of Programming Assignments (usingC/C++/Java/C#/Python/Any Simulation Tool)	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	BLOOM'S LEVEL
CO 1	Analysing the application areas of simulation and different types of models of simulation.	**L4**
CO 2	Illustrate the concept of discrete event simulation and Analyse the statistical models in simulation.	**L4**
CO 3	Analysing the properties of Random-Variate and generation of Random-Number.	**L4**
CO 4	Identifying the distribution, Parameter estimation, Goodness of Fit Tests etc with respect to Input modeling.	**L3**
CO 5	Analyse, verify and validate the simulation models	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)

System simulation and modeling course maps majorly to 1,2,4,10 program outcomes															
POs **COs**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**		**2**						**3**			**3**		
CO2	**3**	**3**		**2**						**3**			**3**		
CO3	**3**	**3**		**2**						**3**				**3**	
CO4	**3**	**3**		**2**						**3**				**3**	
CO5	**3**	**3**		**2**						**3**				**3**	

***3: Strong, 2: Medium, 1: Weak**

***Department**: Computer Science and Engineering*	***Course Type**: Elective*
***Course Title:** Game Theory*	***Course Code**:17CSE757*
***L-T-P**:4-0-0*	***Credits**: 04*
***Total Contact Hours**: 52 Hours*	***Duration** of SEE: 3 Hours*
***SEE Marks**: 50*	***CIE Marks**: 50*

COURSE DESCRIPTION

The course will provide the basics: representing games and strategies, the extensive form (which computer scientists call game trees), Bayesian games (modeling things like auctions), repeated and stochastic games, and more. A variety of examples including classic games and a few applications will be included.

PREREQUISITES

- Mathematical thinking.
- Basic probability theory, Calculus

COURSE CONTENTS

UNIT - I **10 Hours**

Introduction: Introduction, overview, uses of game theory, some applications and examples, and formal definitions of: the normal form, payoffs, strategies, pure strategy Nash equilibrium, dominant strategies.

UNIT – II **11 Hours**

Mixed-Strategy Nash Equilibrium: Pure and mixed strategy Nash equilibria. **Alternate Solution Concepts:** Iterative removal of strictly dominated strategies, minimax strategies and the minimax theorem for zero-sum game, correlated equilibria

UNIT-III **10 Hours**

Extensive-Form Games: Perfect information games: trees, players assigned to nodes, payoffs, backward Induction, subgame perfect equilibrium, introduction to imperfect-information games, mixed versus behavioral strategies.

UNIT – IV **10 Hours**

Repeated Games

Repeated prisoners dilemma, finite and infinite repeated games, limited-average versus future-discounted reward, folk theorems, stochastic games and learning.

UNIT – V **11 Hours**

Bayesian Games General definitions, ex ante/interim Bayesian Nash equilibrium. **Coalitional Games:** Transferable utility cooperative games, Shapley value, Core, applications.

TEXT BOOKS

- Essentials of Game Theory, by Kevin Leyton-Brown and YoavShoham; Morgan and Claypool Publishers, 2008.
- A Brief Introduction to the Basics of Game Theory, by Matthew O. Jackson.

REFERENCE BOOKS

1. Osborne, M.J.An Introduction to Game Theory, Oxford University Press, 2004
2. Mas-Colell,A., M.D. Whinston and J.R. Green Microeconomic Theory, Oxford University Press, 1995
3. Gibbons, R.A Primer in Game Theory,Pearson Education, 1992

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best)	30
Seminar	10
Case Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

CO	Description	Blooms Level
CO 1	Understand the Gaming basics and its various applications.	L2
CO 2	Solve problems on game theory for pure and mixed strategy under competitive environment.	L3
CO 3	Understand and Apply Perfect Information Game strategies for real world games.	L2
CO 4	Recognize and evaluate the classic "Prisoners' Dilemma" to a variety of real-world problems	L5
CO 5	Apply Bayesian Nash equilibrium strategy for a specific problem.	L3

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
Pos Cos	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3		2									3		2
CO2	3	3		2									3		2
CO3	3	3		2									3		2
CO4	3	2		2									3		2
CO5	3	2		2									3		2

Department: *Computer Science and Engineering*	***Course Type*** *Program Elective*
Course Title*: Software Testing*	***Course Code:*** *17CSE758*
L-T-P:4*-0-0*	***Credits:*** *04*
Total Contact Hours:*52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an understanding of Software testing. The course also provides the knowledge of White box and Black box testing, Functional and Non-functional testing in real time applications.

PREREQUISITES

Students should have basic knowledge of software engineering.

COURSE OBJECTIVES

- To understand the fundamentals of Software testing.
- To enable students to write Test cases ,Test plan
- To help students, demonstrate the ability to use validation activities(UNIT testing, Integration testing, system testing.

COURSE CONTENTS

UNIT – I **10 Hours**

Basics Of Software Testing – 1: Human Errors and Testing; Software Quality; Requirements, Behavior and Correctness; Correctness versus Reliability; Testing and Debugging; Test Metrics.

UNIT – II **10 Hours**

Basics of Software Testing – 2: Software and Hardware Testing; Testing and Verification; Defect Management; Test generation Strategies, Static Testing. Types of Testing; the Saturation Effect.

UNIT – III **10 Hours**

Test Generation from Requirements: Introduction; the Test-Selection Problem; Equivalence Partitioning; Boundary Value Analysis; Category-Partition Method.

UNIT – IV **11 Hours**

Verification Testing: Basic verification methods, getting leverage on verification, verifying documents at different phases, three critical success factors for implementing verification.

Validation Testing: Validation methods, validation activities.

Controlling Validation Costs: Minimizing the cost performing tests, minimizing the cost of maintaining the tests, minimizing validation test ware development costs. Testing Tasks, Deliverables and Chronology: Master test planning, verification testing tasks and deliverables, validation testing tasks and deliverables.

UNIT – V **11 Hours**

Software Testing Tools: Categorizing testing tools, tool acquisition,

Organizational approach to Testing: structural design elements, approaches to organizing the test functions.

Current practices, Trends, Challenges: GUI's. What is new here, usage testing, tester to develop ratios.

TEXT BOOKS

1. Foundations of Software Testing - Aditya P Mathur, Pearson Education, 2008.
2. Ed Kit: Software Testing in the real world, Addison-Wesley, 1995.
3. SrinivasanDesikan, Gopalaswamy Ramesh: Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Auerbach Publications, 2008.
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
3. https://nptel.ac.in/course.php

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of case study implementation using testing tools	10
Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Blooms Level
CO 1	Apply terms associated with software testing	L3
CO 2	Design various test generation strategies.	L4
CO 3	Implement different types of software testing in application development.	L3
CO 4	Summarize aspects of functional and nonfunctional testing.	L1
CO 5	Apply the usage of test Management and automation in software testing.	L3

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
PO/CO	1												PSO1	PSO2	PSO3
CO 1	2													2	3
CO 2														3	3
CO 3														3	3
CO 4														3	3
CO 5														3	2

*3: Strong, 2: Medium, 1: Weak **3: Highly related 2: Supportive

Department : *Computer Science and Engineering*	***Course Type :*** *Progamme Core*
Course Title: *User Interface Design*	***Course Code:*** *17CSE759*
L-T-P: 4*-0-0*	***Credits:*** 04
Total Contact Hours: 52 *Hours*	***Duration of SEE :*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

The course covers human capabilities, design principles, prototyping techniques, evaluation techniques, and the implementation of graphical user interfaces.

COURSE CONTENT

UNIT-I **11 Hours**

Essentials of designing interactive systems, PACT: a framework for designing interactive systems, People Activities, Contexts and Technologies, Accessibility , Usability , Acceptability, Design principles.

UNIT-II **10 Hours**

Techniques for designing interactive systems: Understanding, Envision, Design, Evaluation, Task analysis, Visual interface design, Multimodal interface design

UNIT-III **11 Hours**

Visual design, Unity and variety , Focal point , Economy of elements , Balance and proportion , Interaction ,Association and affordance , Economy of motion , Responsive design , Psychology , The effects of good UXD design ,Flow and Interaction , Guiding principles

UNIT-IV **10 Hours**

Text for web pages - effective feedback-guidance & assistance- Internationalization-accessibility -Icons-Image-Multimedia-coloring.

UNIT-V **10 Hours**

Windows layout-test :prototypes - kinds of tests - retest - Information search - visualization - Hypermedia - www - Software tools.

TEXT BOOKS

4. David Benyon, "Designing Interactive Systems- A comprehensive guide to HCI, UX and interaction design" Pearson, 2014, ISBN- 9781447920113

OTHER REFERENCES

- F.E. Ritter, G.D. Baxter, and E.F. Churchill. " Foundations for Designing User–Centred Systems: What System Designers need to know about People", Springer, 2014 ISBN-978-1447151333
- M.B. Rosson and J Carroll, Usability Engineering: Scenario–Based Development of Human–Computer Interaction, Morgan Kaufmann, 2002 1558607129 978-1558607125
- J. Sauro and J.R. Lewis, Quantifying the User Experience; Practical Statistics for User Research, Morgan Kaufman 2012 978-0123849687

COURSE DELIVERY METHODS

- Lecture (PPT)
- Programming Assignments
- Course Project

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COS)

At the completion of this course, the student will be able to:

COs	Description	Blooms Level
CO 1	Understand the principles of UI/UX Design in order to design with intention.	**L2**
CO 2	Discover the industry-standard tools and specific project deliverables in UI/UX.	**L2**
CO 3	Describe a variety of approaches to user interface design	**L1**
CO 4	apply a variety of methods for evaluating the design of user interfaces	**L3**
CO 5	Create the user interfaces that are appropriate for the user.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)

Pos Cos	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3	3		3								3		
CO4	2	2	2	2									3		
CO5	2	2	3	3	2			1	2	1		1		2	

Course Content for Open Elective – I VII - Semester

Department: *Computer Science and Engineering*	***Course Type: Open Elective***
Course Title*: Introduction to Cyber Security*	***Course Code:****17CSO761*
L-T-P:4*-0-0*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSEDESCRIPTION

Cyber Security course covers system vulnerabilities, and introduces few network defense and web applications tools. The course also gives a brief introduction about cyber crime and investigation.

PREREQUISITES

Required Knowledge of any Operating System, Networking and Digital Security Issues.

COURSE OBJECTIVES

- Able to identify security risks and take preventive steps
- Investigate cybercrime and collect evidences
- Able to use knowledge of forensic tools and software

COURSE CONTENTS

UNIT – I **11 Hours**

Systems Vulnerability: Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, Network Reconnaissance – Nmap, Network Sniffers and Injection tools – Tcpdump and Wireshark, Hping Kismet.

UNIT – II **10 Hours**

Network Defense tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall.

UNIT – III **10 Hours**

Web Application Tools: Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra.

UNIT – IV **10 Hours**

Cyber Crime: Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional

Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world. .

UNIT – V **11 Hours**

Cyber Investigation: Introduction to Cyber Crime Investigation Firewalls and Packet Filters, password Cracking, Key loggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.

TEXT BOOKS

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelpure, Publication Wiley

REFERENCE BOOKS

1. Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
2. Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cybersecurity - CRC Press
3. Bill Nelson, Amelia Phillips, Christopher Steuart - Guide to Computer Forensics and Investigations -engage Learning.

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Case study	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COs)

CO	Description	Blooms Level
CO 1	Define and illustrate cyber security concepts and applications	**L1**
CO 2	Analyze the working of cyber security principles to system design	**L4**
CO 3	Illustrate appropriate techniques to solve cyber security threats	**L2**
CO 4	Evaluate and implement cyber security through network security	**L4**
CO 5	Understand the concepts of Cyber Crime Investigation Firewalls	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		3		3									3	2	
CO2			3	3										3	
CO3			3	3										3	
CO4			3	3									3		
CO5			3	3									2	2	

Strong -3, Medium – 2, Weak -1 3 – Supportive, 2 – Highly Related

Department : *Computer Science and Engineering*	***Course Type :*** *Open Elective*
Course Title: *Introduction to Software Testing*	***Course Code:*** *17CSO762*
L-T-P: 4*-0-0*	***Credits:****04*
Total Contact Hours: 52 *Hours*	***Duration of SEE :*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an understanding of Software testing. The course also provides the knowledge of White box and Black box testing, Functional and Non-functional testing in real time applications.

PREREQUISITES

- Basic Knowledge of Computer Programming.

COURSE OBJECTIVES

- To understand the fundamentalsof Software testing.
- To automate Web applications using Selenium.

COURSE CONTENTS

UNIT – I **11 Hours**

Basics Of Software Testing: Human Errors and Testing; Software Quality; Requirements, Behavior and Correctness; Correctness versus Reliability; Testing and Debugging; Test Metrics, Software and Hardware Testing; Testing and Verification. Defect Management; Execution History; Test generation Strategies, Static Testing. Model-Based Testing and Model Checking ; Control-Flow Graph.

UNIT – II **10 Hours**

Test Generation From Requirements: Introduction, The Test-Selection Problem, Equivalence Partitioning, Boundary Value Analysis, Category-Partition Method, Cause-Effect Graphing.

UNIT – III **10 Hours**

Types Of Testing – 1: White Box Testing, Introduction, Static Testing, Structural Testing, Challenges in Whit box testing, Black Box Testing: Introduction, Testing methods. Integration Testing: Introduction, Integration testing as a Type of Testing, Integration testing as a Phase of Testing, Scenario Testing, Defect Bash.

UNIT – IV **10 Hours**

Types of Testing - 2:System and Acceptance Testing, Overview, Functional System Testing, Non-functional Testing, Acceptance Testing; Summary of Testing Phases, Regression Testing: **Test Management and automation**: Introduction, Test planning, Test management, Test process, Test reporting, Test planning checklists, Test plan template.

UNIT – V **11 Hours**

What is Test automation? Terms used in Automation, Skills needed for Automation, what to automate, scope of automation, design and architecture for automation. GUI Testing, Web Application Testing: Introduction to Selenium, Getting Started With the Tools, Selenium IDE Basics, Essential Firefox Add-on's, Testing HTML Forms, Using javascript with Selenium, Introduction to Agile testing.

TEXT BOOKS

1. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. SrinivasanDesikan, Gopalaswamy Ramesh: Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach
2. Auerbach Publications, 2008.
3. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class
4. Case Study using Selenium tool.

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of case study implementation using Selenium	10
Two Surprise test	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COS	Description	Blooms Level
CO 1	Use terms associated with software testing	L2
CO 2	Illustrate various test generation strategies.	L3
CO 3	Implement different types of software testing in application development.	L2
CO 4	Summarize aspects of functional and nonfunctional testing.	L2
CO 5	Apply the usage of test Management and automation in software testing.	L4

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
PO/CO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	2	3										3		
CO2		3	3										2	3	
CO3		3	3										3		
CO4		3	3										2	3	
CO5		3	2		3				3	3			3		3

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

***Department**: Computer Science and Engineering*	***Course Type**: Open Elective*
***Course Title**: Introduction to Business Intelligence and Its Applications*	***Course Code**: 17CSO763*
***L-T-P**: 4-0-0*	***Credits**: 4*
***Total Contact Hours**: 52 Hours*	***Duration of SEE**: 3 Hours*
***SEE Marks**:50*	***CIE Marks**: 50*

PREREQUISITES

- Student should have prior knowledge of DBMS
- Student should have queried some database using SQL

COURSE OBJECTIVES

- To get basic knowledge of business intelligence (BI), BI technology, and related concepts.
- To get knowhow on data integration methods, architecture and technology.
- To design multi-dimensional data modelling.
- To gain knowledge of enterprise reporting techniques and to design such reports.

COURSE CONTENTS

UNIT – I **10 Hours**

Introduction to Business Intelligence: Types of digital data; Introduction to OLTP, OLAP and Data Mining; BI Definitions & Concepts; Business Applications of BI; BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities.

UNIT – II **10 Hours**

Basics of Data Integration: Basics of Data Integration (Extraction Transformation Loading); Concepts of data integration; Need and advantages of using data integration; Introduction to common data integration approaches; Introduction to data quality, data profiling concepts and applications.

UNIT – III **11 Hours**

Introduction to Data Integration: Introduction to SSIS Architecture, Introduction to ETL using SSIS; Integration Services objects; Data flow components – Sources, Transformations and Destinations; Working with transformations, containers, tasks, precedence constraints and event handlers.

UNIT – IV **11 Hours**

Introduction to Multi-Dimensional Data: Modeling Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. Multi-dimensional modeling; Concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema; Introduction to business metrics and KPIs; Creating cubes using SSAS.

UNIT – V **10 Hours**

Basics of Enterprise Reporting: Introduction to enterprise reporting; Concepts of dashboards, balanced scorecards; Project: Data warehouse creation and designing reports; Introduction to SSRS Architecture, Enterprise reporting using SSRS; Use of Business Intelligence Development Studio (BIDS).

TEXT BOOK

1. R N Prasad and Seema Acharya, Business Analytics & its Applications, Wiley India, 2013.

REFERENCE BOOKS

1. David Loshin, Business Intelligence, 2nd edition , Morgan Kaufmann, 2012.
2. Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional, 2003.
3. Larissa Terpeluk Moss and ShakuAtre, Business Intelligence Roadmap, Addison Wesley, 2003.
4.Cindi Howson, Successful Business Intelligence: Secrets to making BI a Killer Applications, Tata McGraw-Hill Edu.Pvt.ltd, 2007.

TEACHING METHODS

- Black board and chalk
- Power Point Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project/assignment	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to :

COs	Description	Blooms Level
CO 1	Explain BI concepts, methodologies & BI framework.	**L1**
CO 2	Build Data Warehouse by understanding complete ETL process.	**L3**
CO 3	Illustrate SQL Server Integration Services (SSIS) & SSRS Architectures.	**L2**
CO 4	Describe various Data modelling & Dimensional modelling techniques and design with these.	**L2**
CO 5	Demonstrate Enterprise reporting, Concepts of dashboards & Balanced scorecards.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs)															
Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	1		3	3							1	3	3		
CO2	1		3	3	2	3					1	3	3		3
CO3	2	3	3	2	3	3		2				3	3		
CO4	2	2	3	3								3	3		
CO5	3	3	3		3			2	3	3		3	2	3	2

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:****Programme Elective*
Course Title *Introduction to Mobile Computing*	***Course Code:****17CSO764*
L-T-P *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course will give an understanding of mobile computer systems particularly in the context of wireless network systems such as 2G/3G/4G mobile telephony, data networks, and other wireless networks and infrastructure.

PREREQUISITES

- Students should have prior knowledge of Computer Networks, basics of programming

COURSE OBJECTIVES

- To understand and learn the basics of mobile devices
- To understand and learn the different types of wireless medium access control
- To understand and learn different broadcast techniques
- To understand and learn how to manage transaction

COURSE CONTENTS

UNIT – I **12 Hours**

Mobile Devices And Systems, Architectures: Mobile phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices, Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems. GSM – Services and System Architectures, Radio Interfaces, Protocols, Localization, Calling, Handover, General Packet Radio Service.

UNIT – II **10 Hours**

Wireless Medium Access Control AndCdma – Based Communication: Medium Access Control, Introduction to CDMA – based Systems, OFDM, Mobile Ip Network Layer, Mobile Transport Layer: IP and Mobile IP Network Layers Packet Delivery and Handover Management.

UNIT – III **10 Hours**

Location Management, Registration, Tunneling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol. Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP – layer Transmission for Mobile Networks. Databases: Database Hoarding Techniques, Data Caching, Client –Server Computing and Adaptation.

UNIT – IV **10 Hours**

Transactional Models, Query Processing, Data Recovery Process, Issues relating to Quality of Service. Data Dissemination And Broadcasting Systems: Communication Asymmetry, Classification of Data – Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Techniques.

UNIT – V **10 Hours**

Digital Audio Broadcasting, Digital video Broadcasting. Data Synchronization In Mobile Computing Systems: Synchronization, Synchronization Protocols, SyncML – Synchronization Language for Mobile Computing, Synchronized Multimedia Markup Language (SMIL).

TEXT BOOK

1. Mobile Computing – Raj Kamal, Oxford University Press, 2007.

REFERENCE BOOKS

1. Mobile Computing: Technology, Applications and Service Creation, Asoke K. Talkukder, Roopa R Yavaga, Tata McGraw Hill, 2005.
2. Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Reza B'Far, 5th Edition, Cambridge University press, 2006.
3. Principles of Mobile Computing – UweHansmann, LothatMerk, Martin S Nicklous and Thomas Stober, 2nd Edition, Springer International Edition, 2003.
4. Mobile Communication – Schiller, Pearson Education, 2004.

TEACHING METHODS

- Lecture using presentations (PPT)
- Black board teaching

ASSESSMENTMETHODS

Parameter	Marks
Midterm Test (2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

CO	Description	Blooms Level
CO 1	Learn the principles of mobile computing technologies	L1
CO 2	List different applications that mobile computing offers to people, employees, and businesses	L2
CO 3	Describe the possible future of mobile computing technologies and applications	L2
CO 4	Learn about traditional and modern network technologies and mobile computing protocols.	L2
CO 5	Learn broadcast technologies, Synchronized Multimedia Markup Language	L2

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1		3		3									3		
CO2		3				2				2				3	
CO3				3		2									3
CO4		3								3				3	
CO5															3

*3: Strong, 2: Medium, 1: Weak **3: Highly related 2: Supportive

Course Content for VIII - Semester of 2017 Scheme

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Green Computing*	***Course Code:*** *17CS81*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

PREREQUISITES

- Technical background

COURSE DESCRIPTION

Our societal energy usage is rising at an alarming rate and thus it is critical to manage its consumption more efficiently for long term sustainability. This course introduces students to the exciting area of "Green Computing" aiming to help students acquire the knowledge and skills needed to do research in this space.

COURSE CONTENTS

UNIT -I **8 Hours**

Green IT Fundamentals: Business, IT and the Environment, Green computing: carbon foot print, scoop on power, Green IT Strategies: Drivers, Dimensions and Goals, Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT -II **8 Hours**

Green Assets: Buildings, Data Centers, Networks, and Devices, Green Business Process Management: Modeling, Optimization, and Collaboration, Green Enterprise Architecture, Environmental Intelligence, Green Supply Chains, Green Information Systems: Design and Development Models.

UNIT- III **8 Hours**

Virtualizing of IT systems, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Materials recycling, Best ways for Green PC, Green Data center, Green Grid framework.

UNIT- IV **8 Hours**

Socio-cultural aspects of Green IT, Green Enterprise Transformation Roadmap, Green Compliance: Protocols, Standards, and Audits, Emergent Carbon Issues: Technologies and Future.

UNIT- V **7 Hours**

IT Enabled Smart Buildings : Sensing within Buildings (Occupancy), Sensing within Buildings (Energy and Water), Managing the Data Deluge and "App Platforms" for Smart Buildings , Energy Management in Smart Homes , Modeling, Prediction and Control for Smart Buildings , Security and Privacy.

TEXT BOOKS

1. BhuvanUnhelkar, "Green IT Strategies and Applications: Using Environmental Intelligence", CRC Press, June 2011, ISBN-13: 978-1439837801
2. Woody Leonhard and Katherrine Murray, "Green Home computing for dummies", August 2009, ISBN: 978-0-470-46745-9.

REFERENCE BOOKS

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journe", Shoff/IBM Rebook, 2011.
2. John Lamb, "**The Greening of IT: How Companies Can Make a Difference for the Environment",** Pearson Education, 2009

TEACHING METHODS

- PPTs

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best)	30
Rubrics evaluation for the Course Project	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COs):

At the end of the course student will be able to:

CO	Description	Blooms Level
CO 1	Describe awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement	**L2**
CO 2	Understand the Green Assets in green Computing for eco-friendly.	**L1**
CO 3	Illustrate the Socio-cultural aspects of Green IT.	**L2**
CO 4	Use Green IT Strategies and metrics for ICT development.	**L1**
CO 5	Illustrate various green IT services and its roles.	**L2**

Mapping of Course Outcome to Programme Outcome* & PSO**															
Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
Pos/ Cos	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	**2**	**3**		**2**	**2**								3	2	
CO2	**2**	**3**		**2**	**2**	**2**							2	3	
CO3	**2**	**2**	**3**	**3**	**3**	**2**							2	3	
CO4	**2**	**3**	**3**	**3**	**2**	**2**							2	3	
CO5	**2**	**3**	**3**	**3**	**2**	**3**						**2**	2	2	2

***Department**: Computer Science and Engineering*	***Course Type**: Humanities*
***Course Title**: Cyber Laws & Ethics*	***Course Code**: 17CS82*
***L-T-P**:4-0-0*	***Credits**: 04*
***Total Contact Hours**: 52 Hours*	***Duration** of SEE: 3 Hours*
***SEE Marks**: 50*	***CIE Marks**: 50*

COURSE DESCRIPTION

This course covers basic laws and ethical behavior associated with network security. Topics include discussions about current common practices used to secure networks as well as test them, and the potential these methods can have in creating a secure network environment.

PREREQUISITES

- Network Security
- Information Security

COURSE OBJECTIVES

- To give an understanding of how ethical issues affect individuals, communities and societies and be able to analyze the consequences of various professional ethical dilemmas.
- To create awareness and understanding of what is morally/ethically at stake in various situations.
- To Apply moral principles and standards of behavior in a workplace setting.
- To Identify concepts such as ethics, morals, character, ethical principles and ethical relativism.
- Identify organizations, laws and regulations related to computer ethics, law, and policy.

COURSE CONTENTS

UNIT- I **12 Hours**

Intellectual property rights, computer software copyrights, copyright in databases and electronic publishing, law of confidence, patent laws, trademarks, designs.

UNIT -II **10 Hours**

Computer contracts, liability for defective hardware and software, contracts for writing software, hardware contracts.

UNIT -III **12 Hours**

Computer crime, computer fraud, hacking, unauthorized modification of information, piracy,computer pornography and harassment.

UNIT- IV **10 Hours**

Understanding Computer, Internet and Cyber laws,IT ACT 2000,Protection ofIPR in Cyber Space

UNIT- V **08 Hours**

Some important offences under the cyber space law and the internet in India International efforts related to cyber space laws.

TEXT BOOKS

1. D. Bainbridge, Introduction to Computer Law, 5/e, Pearson Education, 2004.
2. Harish Chander, Cyber Laws and IT Protection, PHI Learning Private Limited, 2012.

REFERENCES

1. P. Duggal, Cyber law: the Indian Perspective, Saakshar Law Publications, Delhi, 2005.
2. C. P. Fleeger and S. L. Fleeger, Security in Computing, 3/e, Pearson Education, 2003.

TEACHING METHODS

- Black board teaching
- PPTs if needed
- Assignments

ASSESSMENT METHODS

Parameter	Marks
Midterm Test(Aveg of 2 Tests)	30
Case study	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Blooms Level
CO 1	Recall the importance of Cyber laws and ethics in the field of IPR and IT Act	**L1**
CO 2	Demonstrate the IT Act 2000 and Offences for cyber-crimes.	**L2**
CO 3	Apply the knowledge of laws and ethics to develop the Hardware and Software Contracts	**L3**
CO 4	Analyze the Ethical issues, cyber-crimes and cyber laws in various types of cyber-crimes in Indian and international cyber laws	**L4**
CO 5	Justify the Cyber laws for Effective protection and utilization of IPR in cyber space in India	**L3**

Mapping of Course outcomes(Cos) to Program outcomes(Pos)															
Course Outcomes mapping to Program Outcomes													Program Specific Outcomes(PSOs)		
Pos/COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1						3	3	3		2			1	1	3
CO2						3	3	3		2			1	1	3
CO3						3	3	3		2			1	1	3
CO4						3	3	3		2			1	1	3
CO5						3	3	3		2			1	1	3

***3:Strong 2:Medium 1:Weak** ****3:Highly related 2:Supportive**

Department: *Computer Science And Engineering*	***Course Type:*** *Programme Core*
Course Title*: Project Work-II*	***Course Code:****17CSP84*
L-T-P:0-0-24	***Credits:****12*
Total Contact Hours:52 Hours	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE OBJECTIVES

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under Phase-1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.

COURSE CONTENTS:

Based on the survey, identify the project requirements and do feasibility study.

- Identify and draw a system level architecture by showing subsystems and their input/output need.
- Implement the programs using step by step for each module.
- Integrate and examine the implementation and test the project scope and the requirements.
- Prepare Project document and the demonstrating their work.
- The evaluation is based on presentation and report.
- The evaluation will be done by the internal guide and panel of examiners twice during the semester.
- Students must do a group presentation and produce documents of system requirements, and system design (during 6th week)
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department;
- **Final Evaluation**: At the End of the semester students must do a group presentation, demonstrate the project work and submit the complete report. (during 13th week)

COURSE OUTCOMES

At the end of the course, the students should be able to:

- Review the current state of Art and trends in their area of interest and identify a suitable problem in their chosen subject domain with justification. (PO-1,2,6, 7, 9, 10, 11, PSO-2,3)
- Survey the available research literature/documents for the tools and techniques to be used. (PO-1, 2, 5, 8, 9, 10, 11, 12, PSO-2,3)
- Examine the functional, non-functional, and performance requirements of their chosen problem definition. (PO-1,2,4, 9, 10, 11, 12, PSO-2,3)

- Design system architecture and different components and develop all the system components using appropriate tools and techniques. (PO-1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, PSO-2,3)
- Work effectively in a team and use good project management practices and defend the project work as a team(PO-5, 8, 9, 10, 11, 12, PSO-2,3)

Rubrics for Project Evaluation: The rubrics for project evaluation is provided in separate project work book maintained for each project team.

Review No.	Agenda	Assessment	Weightage
Phase- 1	Project Synopsis / Proposal Evaluation	Rubric 1	25%
Phase-2	Mid-Term Project Evaluation (Design Phase)	Rubric 2	25%
Phase-3	Demonstration, Result discussion, Project Dissertation	Rubric 3	50%

Rubric 1: Project Synopsis/Proposal Evaluation

Level of Achievement					
	Excellent	**Good**	**Average**	**Poor**	**Score**
Identification of Problem Domain and Detailed analysis of Feasibility, Objectives and Methodology of Project Proposal	Detailed and extensive explanation of the purpose and need of the project, Specifications, Limitations of Existing Systems All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified	Good explanation of the purpose and need of the project , study on existing systems Good justification to the objectives; Methodology to be followed is specified but detailing is not done	Average explanation of the purpose and need of the project; Moderate study of the existing systems; Incomplete justification to the objectives proposed; Steps are mentioned but unclear;	Moderate explanation of the purpose and need of the project the limitations of the existing systems not very satisfactory; Only Some objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are not specified properly	

Rubric 2: Mid-term Project Evaluation (Design phase)

Level of Achievement					
	Excellent	**Good**	**Average**	**Poor**	**Score**
Design Methodology	Division of problem into modules and good selection of computing framework ; Appropriate design methodology and properly justification	Division of problem into modules and good selection of computing framework ; design methodology not properly specified	Division of problem into modules but inappropriate selection of computing framework ; Design methodology not defined properly	Partial division of problem into modules and inappropriate selection of computing framework Design methodology not defined properly	
Demonstration and Presentation	Contents of presentations are appropriate and well arranged ; Proper eye contact with audience and clear voice with good spoken language	Contents of presentations are appropriate but not well arranged; Satisfactory demonstration	Contents of presentations are appropriate but not well arranged; Eye contact with few people and unclear voice	Contents of presentations are not appropriate; Demonstration not satisfactory	

Rubric #R3: End Semester Internal Project Evaluation

Level of Achievement					
	Excellent	**Good**	**Average**	**Poor**	**Score**
Project Demonstration And Presentation	All defined objectives are achieved All modules of project are well integrated and system working is accurate Contents of presentations are appropriate and well delivered	All defined objectives are achieved Integration of all modules not done and system working is not very satisfactory Contents of presentations are appropriate and well delivered	All defined objectives are achieved Modules of project are not properly integrated Contents of presentations are appropriate but not well delivered	Only some of the defined objectives are achieved Contents of presentations are not appropriate and not well delivered	
Description of Concepts and Technical Details in Project Report	Project report is according to the specified format ; References and citations are appropriate and well mentioned ; Complete explanation of the key concepts	Project report is according to the specified format ; References and citations are appropriate but not mentioned well	Project report is according to the specified format but some mistakes ; In-sufficient references and citations; Incomplete explanation of the key concepts	Project report not prepared according to the specified format ; References and citations are not appropriate ; Inappropriate explanation of the key concepts	

Course Content for VIII - Semester Program Elective - D

Department : *Computer Science and Engineering*	***Course Type :*** *Programme Elective*
Course Title: *Advanced Artificial Intelligence*	***Course Code:*** *17SE831*
L-T-P: 4-0-0	***Credits:04***
Total Contact Hours: *52 Hours*	***Duration of SEE :*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of Classical Planning, Planning and Acting in the Real World, Knowledge Representation. Uncertain Knowledge and Reasoning, Quantifying Uncertainty, Probabilistic Reasoning over time, Learning from examples, Learning probabilistic models, Reinforcement Learning, Natural language processing, Natural language for communication.

COURSE OBJECTIVES

- To understand and analyze the classical planning, planning and acting in the real world.
- To understand and analyze Knowledge Representation, Quantifying Uncertainty.
- To understand and analyze Probabilistic Reasoning over time, Learning.
- To understand and analyze learning probabilistic models, Reinforcement Learning.
- To understand and analyze Natural language processing, Natural language for communication.

PREREQUISITES

- Students should have knowledge of Design and Analysis of Algorithms
- Students should have knowledge of Probability Theory.

COURSE CONTENTS

UNIT - I **10 Hours**

Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches.

Planning and Acting in the Real World: Time, Schedules and Resources, Hierarchical Planning, Planning and Acting in Non-Deterministic Domains, Multiagent Planning.

UNIT – II **11 Hours**

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning systems for categories, reasoning with default Information, The Internet shopping world.

Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under uncertainty, basic probability notation, inference using full joint distributions, independence, Baye's rule and its use. Probabilistic reasoning: Representing knowledge in an uncertain domain. The semantics of Bayesain networks, efficient representation of conditional distributions, exact inference in Bayesian networks.

UNIT-III **11 Hours**

Probabilistic Reasoning over time: Time and Uncertainty, Inference in temporal models, Hidden Markov Models, Kalman Filters, Dynamic Bayesian networks.

Learning: Learning from examples: Forms of Learning, Supervised learning, Learning decision trees, Evaluating and choosing the best Hypothesis, The theory of learning, Regression and Classification with linear models, artificial neural networks, support vector machines, ensemble learning, practical machine learning.

UNIT – IV **10Hours**

Learning probabilistic models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

Reinforcement Learning: Introduction, passive Reinforcement learning, active reinforcement learning, generalization of reinforcement learning, policy search, application of reinforcement learning.

UNIT – V **10Hours**

Natural language processing: Language models, text classification, information retrieved, information extraction

Natural language for communication: phrase structure grammars, syntactic analysis (parsing), augmented grammars and semantic interpretation, machine translation, speech recognition.

TEXT BOOK

1. Artificial Intelligence-A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 3rd Edition, eleventh impression 2018.

REFERENCE BOOKS

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata MCGraw Hill 3rd edition. 2013
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

TEACHING METHODS

1. Lecture using Black board and chalk
2. Presentations
3. Programming Assignments
4. Seminar on AI topics

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Programming Assignments	10
Seminar on AI topics	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of Course, Student will be able to

CO	Description	Blooms Level
CO 1	Understand and analyze the classical planning, planning and acting in the real world.	**L2,L4**
CO 2	Understand and analyze Knowledge Representation, Quantifying Uncertainty	**L2,L4**
CO 3	Understand, and analyze Probabilistic Reasoning over time, Learning	**L2,L4**
CO 4	Understand, and analyze Learning probabilistic models, Reinforcement Learning.	**L2,L4**
CO 5	Understand and analyze Natural language processing, Natural language for communication.	**L2,L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)													Program Specific Outcomes(PSOs)		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1		3	3	3										3	3
CO2		3	3	3										3	3
CO3		3	3	3										3	3
CO4		3	3	3										3	3
CO5		3	3	3										3	3

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Agile Software Development*	***Course Code:*** *17CSE832*
L-T-P 4-0-0	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course is rapidly becoming the choice for software development where requirements are unpredictable or is expected to change over time. This course will help you gain knowledge on what is agile? Why agile is better suited for these situations? We will also cover some of the most common agile frameworks like scrum and XP in depth.

PREREQUISITES

- Awareness of basics of software engineering concepts and waterfall methodology
- Exposure to any object oriented programming language such as Java, C#.

COURSE OBJECTIVES

1) To learn and demonstrate the ability to participate effectively in agile practices/process for software development.
2) To explain the purpose behind common agile practices.
3) To gain ability to apply agile principles and values to a given situation.
4) To gain ability to identify and address most common problems encountered in adopting Agile methods.

COURSE CONTENTS

UNIT-1 **10 Hours**

Fundamentals of Agile: The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools.

UNIT-I1 **12 Hours**

Agile Scrum Framework: Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management

UNIT-I1I **10 Hours**

Agile Testing: The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUNIT framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

UNIT-IV **10 Hours**

Agile Software Design and Development: Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control

UNIT-V **09 Hours**

Industry Trends: Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies

TEXT BOOKS

1.James shore, , The Art of Agile Development (Pragmatic guide to agile software development, O'Reilly Media, Shroff Publishers & Distributors, 2007

REFERENCE BOOKS

1. Robert C. Martin, Agile Software Development, Principles, Patterns, and Practices, , Prentice Hall; 1st edition, 2002.
2. Craig Larman, "Agile and Iterative Development A Manger's Guide", Pearson Education, First Edition, India, 2004.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Programming Assignments

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Model Based Learning	10
Case study Presentation	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of this elective, student will be able to:

CO	Description	Blooms Level
CO 1	Describe the background and driving forces for taking an Agile approach to software development	**L2**
CO 2	Illustrate the business value of adopting Agile approaches, and the Agile development practices	**L3**
CO 3	Drive development with UNIT tests using Test Driven Development	**L3**
CO 4	Apply design principles and refactoring to achieve Agility	**L3**
CO 5	Deploy automated build tools, version control and continuous integration	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													**Program Specific Outcomes (PSOs)**		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3								3	3			3	
CO2		3	3			3								3	
CO3	3	3	3	3		2								3	
CO4		3		3		3				3	3			3	
CO5		3		3			2	2	2	2			3		

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Introduction to Natural Language Processing*	***Course Code:****17CSE833*
L-T-P *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course is about a variety of ways to represent human languages as computational systems, and use the representations to write programs for processing text and speech data, like translation, summarization, extracting information, question answering, natural interfaces to databases, and conversational agents.
This course will include some ideas about discrete classification, probability models and about Linguistics like morphology, syntax, semantics.
The course also covers computational treatments of words, sounds, sentences, meanings, and conversations.

PREREQUISITES

- Data structures and algorithms
- Programming principles and practices

COURSE OBJECTIVES

- Comprehend the techniques in natural language processing.
- Be familiar with the natural language generation and Text Mining.
- Understand the information retrieval techniques and linguistic phenomena.
- Design, analyze and implement NLP algorithms.

COURSE CONTENTS

UNIT – I **09 Hours**

Overview and language modelling

Overview: Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval. Language Modeling: Various Grammar-based Language Models, Statistical Language Model.

UNIT – II **10 Hours**

Word level and syntactic analysis:

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing, Probabilistic Parsing.

UNIT – III **11 Hours**

Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles:
Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.

A Case Study in Natural Language Based Web Search:
InFact System Overview, The GlobalSecurity.org Experience.

UNIT – IV **12 Hours**

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems. Textual Signatures: Identifying Text, Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, CohMetrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.

Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining.

UNIT – V **10 Hours**

INFORMATION RETRIEVAL AND LEXICAL RESOURCES:
Information Retrieval: Design features of Information Retrieval Systems, Classical, Non classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net, Frame Net, Stemmers, POS Tagger.

TEXT BOOK

1. TanveerSiddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet , "Natural LanguageProcessing and Text Mining", Springer-Verlag London Limited 2007.

REFERENCE BOOKS

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.

3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

TEACHING METHODS

- Board teaching
- Lecture (PPT)
- Programming practices, assignment & quiz

ASSESSMENTMETHODS

- Internal Assessment
- Assignments

COURSE OUTCOMES

The students should be able to:

CO	Description	Blooms Level
CO 1	Describe the natural language text.	**L1**
CO 2	Carry out word level analysis and syntactic analysis.	**L3**
CO 3	Illustrate the concepts of Text mining and develop applications.	**L2**
CO 4	Perform the document processing and solve related problems.	**L3**
CO 5	Apply information retrieval techniques.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)															
Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		3	3	2								2		3	
CO2		3	3	3								2		3	
CO3		3	3	3	3							3		3	
CO4		3	3	3	3							3		3	
CO5		3	3	3	3							3		3	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

***Department**: Computer Science and Engineering*	***Course Type**: Programme Elective*
***Course Title** Virtual Reality*	***Course Code**: 17CSE834*
***L-T-P**:4-0-0*	***Credits**: 04*
***Total Contact Hours**: 52 Hours*	***Duration** of SEE: 3 Hours*
***SEE Marks**: 50*	***CIE Marks**: 50*

COURSE DESCRIPTION

Virtual Reality (VR) Systems Design covers the architecture and design of current generation systems for creating 3D VR environments. Topics included are application/hardware architecture, pipeline development, geometric transformations in a 3D coordinate system, geometry and pixel shading, lighting systems, texturing and VR development. Students will be exposed to current VR technologies and next generation algorithms.

PREREQUISITES

- Students should have knowledge of C or C++, visual Basic or Java language
- Students should have knowledge of mathematics Geometry, Graphs and Matrix
- Students should have knowledge Computer Graphics

COURSE OBJECTIVES

- To learn the basics of VR and all components of VR System
- To understand the modeling of VR Systems
- To introduce students with unity development tool

COURSE CONTENTS

UNIT-I **12 Hours**

Introduction of Virtual Reality: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three- dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. (1.1, 1.3, 1.5, 2.1, 2.2 and 2.3 of Text Book (1)).

UNIT-II **10 Hours**

Output Devices and Modeling in Virtual Reality**: Output Devices: Graphics displays, sound displays & haptic feedback, modeling: Geometric modeling, kinematics modeling, physical modeling, (3.1, 3.2, 3.3, 5.1,and 5.3 of Text Book(1)).**

UNIT-III **10 Hours**

Modeling in Virtual Reality and Implementation of VR :behavior modeling, model management, How VR works, Stereoscopic displays, Binocular vision, VR Head mounted displays

UNIT-IV **10 Hours**

Getting started with Unity development: Unity Interface**,** Game objects, Importing assets to Unity, Textures and Materials, Unity Scripting Input and UI Unity, UI Components, Beginner Game play Scripting.

UNIT-V **10 Hours**

Getting started with VR development for Google cardboard using unity: Enabling unity's native VR Integration, Creating a VR scene in unity, Integrating Google VR SDK, Deploying the VR application to Android platform**,** Additional Read on unity VR Development

TEXT BOOKS

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons, Inc.,

REFERENCE BOOKS

1. Understanding Virtual Reality, interface, Application and Design, William R. Sherman, Alan Craig, Elsevier(Morgan Kaufmann).
2. 3D Modeling and surfacing, Bill Fleming, Elsevier(Morgan Kauffman).
3. 3D Game Engine Design, David H.Eberly,Elsevier.
4. Virtual Reality Systems, John Vince, Pearson Education.

TEACHING METHODS

- Black boardteaching
- PPTs ifneeded
- Assignments

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg of2Tests)	30
MiniProject	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Blooms Level
CO 1	Understand the basis concept and framework of Virtual reality	L1
CO 2	Understand the technologies for multimodel User interaction and perception in VR, In Particular the Visual, audio and haptic interface and behaviour	L2
CO 3	Explain the VR system framework and development tools	L2
CO 4	Develop application in a given VR environment	L3
CO 5	Develop animated images using GUI design principles, Virtual reality	L3

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3				3								2		
CO2	3				3								2		
CO3	3				2								2		
CO4	3				3								2		
CO5	3				3								2		

***3: Strong 2:Medium 1:Weak **3:Highly related2:Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme elective*
Course Title*: Pattern Recognition*	***Course Code:****17CSE835*
L-T-P:*4-0-0*	***Credits:****04*
Total Contact Hours: *52 Hours*	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

This course deals with providing the basic concepts of Pattern Recognition, Clustering and theories such as Bayes classifier, linear discriminate analysis

PREREQUISITES

- Basic knowledge of Programming, Data Structures and Algorithms.
- Knowledge on Data mining Techniques.

COURSE OBJECTIVES

1. Understand basic concepts in pattern recognition
2. Gain knowledge about state-of-the-art algorithms used in pattern recognition research
3. Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
4. Apply pattern recognition techniques in practical problems.

COURSE CONTENTS

UNIT – I **7 Hours**

Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

UNIT – II **13 Hours**

Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT – III **11 Hours**

Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; k n – Nearest-Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

UNIT – IV **11 Hours**

Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

Non-Metric Methods: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.

UNIT – V **10 Hours**

Unsupervised Learning and Clustering: Introduction; Mixture DensitiesandIdentifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

TEXT BOOKS

1. Richard O. Duda, Peter E. Hart, and David G.Stork: Pattern Classification, 2 nd Edition, Wiley-Interscience, 2001.

REFERENCE BOOKS

1. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.

TEACHING METHODS

- Black board teaching
- Tutorials

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of course project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Blooms level
CO 1	Describe classifiers for pattern recognition	L1
CO 2	Explain the feature selection and dimensionality reduction techniques	L2
CO 3	Classify the data objects and develop template matching module to recognize the patterns.	L3
CO 4	Apply unsupervised learning algorithms to data objects.	L3
CO 5	Analyze clustering algorithms.	L4

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	2	2	1		3	1						3		
CO2		3				2							3		
CO3		3				2							3		
CO4		3				2								3	
CO5		3			3	2	1								3
CO 6	2	1	2	1	3	2		1							3

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Cyber Physical Systems*	***Course Code:*** 17CSE836
L-T-P *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Cyber-physical systems, which consist of physical systems tightly integrated and/or controlled by software, are ubiquitous in many safety critical domains, including automotive, avionics, railways, healthcare, atomic energy, power, and industrial automation

PREREQUISITES

- Students should have knowledge of programming. Knowledge of Real-time Embedded Systems will help.

COURSE OBJECTIVES

- Develop an exposition of the challenges in implementing a cyber-physical system from a computational perspective
- To expose the student to real world problems in this domain and provide a walk through the design and validation problems for such systems.

COURSE CONTENTS

UNIT – I **10 Hours**

Introduction: Motivation & Intro to Cyber Physical Systems (CPS): Key issues in CPS design: timing predictability, verification and certification; integration and composability,modeling and abstraction,COTS components and time-to-market.Introduction to Real-Time Systems: Task model.Quality of service.Interplay between timing properties and digital control. Basic schedulabilityresults.The worst-case execution problem.The end-to-end delay problem.

UNIT – II **10 Hours**

Applications of Cyber-Physical Systems: Overview of CPS applications. IMA (Integrated Modular Avionics) design.Issues in ARINC 653.AUTOSAR (Automotive Open System Architecture).Further examples of Medical systems, Power grid control, monitoring applications.

UNIT – III **10 Hours**

Predictable Computer Architectures: Impact of architectural features on predictability. Controllablepipelines.Cachepartitioning strategies.Scratchpadmemories.Busscheduling.Network-on-chips and Real-time Predictable memory controllers.

UNIT – IV **11 Hours**

Predictable OS Abstractions: Overview of Real-Time OS and Hypervisors. Interrupt scheduling. Hierarchical and component-based OS.Predicable task execution.Parallel execution models.Introduction to Timing and Performance Analysis.

UNIT – V **11 Hours**

Timing and Performance Analysis: Overview of static analysis methodologies. Measurement-based techniques.Cache, Bus and memory analyses. Introduction to Models of Computation and Verification for CPS: Tools and architectural description languages.

TEXT BOOKS

1. E. Lee and S. Seshia. Introduction to Embedded Systems - A Cyber-Physical Systems Approach, LeeSeshia.org, 2011
2. G. Buttazzo. Hard Real-Time Computing Systems, Springer, 2011
3. H. Kopetz. Real-Time Systems: Design Principles for Distributed Embedded Applications, Springer, 2011.

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Research Literature Survey	10
Project / Modelling Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSEOUTCOMES

CO	Description	Blooms level
CO 1	Understand the principles of Cyber Physical Systems and Real Time System design. Address key factors that contribute to design of "Safe CPS"	**L1**
CO 2	Enable formulation of Functional, Safety and Testability specifications for CPS.	**L2**
CO 3	Understand and Analyze Hardware architectural components and establish criteria for predictable behavior of CPS	**L1,L3**
CO 4	Understand the OS abstractions as applicable to CPS and establish the criteria for ensuring predictable behavior of CPS	**L1**
CO 5	Create high fidelity models of CPS to analyze the real-time behavior and performance of the systems.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)

INTRODUCTION TO CYBER PHYSICAL SYSTEMS													PSO		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1											3		
CO2	3	3	1			2	2							3	
CO3	3	3	2		2									3	
CO4	3	3	2	3	2									3	
CO5	3	3	3		3	2									3

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Operations Research*	***Course Code:****17CSE837*
L-T-P *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces students to the fundamentals of Operations Research Models including linear programming and applications. Students will learn how to construct models appropriate to particular applications, develop optimal solutions, understand the theory behind solutions and translate solutions into directives for action

PREREQUISITES

- Students should have knowledge of basic mathematics
- Students should have some knowledge of probability and queuing theory

COURSE OBJECTIVES

1. Define and formulate linear programming problems and appreciate their limitations.
2. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3. Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship.
4. Develop mathematical skills to analyse and solve integer programming and network models arising from a wide range of applications.
5. Effectively communicate ideas, explain procedures and interpret results and solutions in written and electronic forms to different audiences. .

COURSE CONTENTS

UNIT – I **10 Hours**

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

UNIT – II **10 Hours**

The simplex method: Introduction, Definitions, Artificial Variable Technique, Two phase method. Big-M-method (Charne's penalty method).Degeneracy-Methods to resolve degeneracy. Special cases- Alternative, unbounded & non-existing solution, Concept of duality, primal & dual correspondence, Dual simplex method.

UNIT – III **12 Hours**

Transportation Problem:Mathematical Formulation, Matrix form, Definitions, Initial basic feasible solution using different methods. Optimality methods.Minimization problem, unbalanced transportation problem, degeneracy in transportation problems.Assignment Problem: Mathematical Formulation, Hungarian method, Minimal, Maximal & unbalanced assignment problem, traveling salesman (Routing) problem.

UNIT – IV **10 Hours**

Sequencing:Terminology& notations, Johnson's algorithm, processing of: n-jobs to 2 machines, n jobs 3 machines, n jobs m machines without passing sequence. 2 jobs n machines with passing. Graphical solution.Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

UNIT – V **10 Hours**

PERT-CPM Techniques: Definitions, difference between CPM & PERT. Applications.Network construction, labelling using Fulkerson's '1-J' Rule. Time Estimates and Critical path – Forward & Backward pass computation. Determination of Floats, Slack times & critical path. PERT-critical path, scheduling by project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks- Optimum duration & Minimum duration cost.Queuing Theory: Queuing system and their characteristics. The M/M/1 queuing system, steady state performance and analysis of M/M/1 & M/M/C queuing model.

TEXT BOOKS

1. Operation Research, S. D. Sharma –KedarnathRamnath and Co ,2002.
2. Problems in Operations Research – P.K. Gupta, Manmohan, Sultan Chand Publications,2005

REFERENCE BOOKS

1. Operations Research – Kantiswaroop, P.K. Gupta, Manmohan, Sultan Chand Publications, 2005.
2. Operations Research – An Introduction, Taha H.A. –Low price Edition, 7th Edn,2006
3. Introduction to Operation Research, Hiller and Liberman, McGraw Hill. 5th edition 2001.
4. Operations Research: principles and practice: Ravindran, Philips and Solberg, Wiley India its 2nd edition 2007.
5. Operation Research, Prem Kumar Gupta, D S Hira,S Chand pub, New Delhi, 2007.

TEACHING METHODS

- Black board teaching
- PPT

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project	10
Tutorial test	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

CO	Description	Blooms Level
CO 1	Describe the evolution and applications of operations in various fields, mathematically formulate linear programming problems and solve them using different techniques	**L2**
CO 2	Apply optimization methods to optimize the solutions to minimize cost or maximize profit	**L3**
CO 3	Construct lpp , a project network and apply program evaluation review technique and critical path method to find date of completion of project and other project related metrics	**L3**
CO 4	Analyse problems of sequencing of production runs , use Game theory to identify the optimal strategies for players and solve problems on queuing theory	**L4**
CO 5	Formulate a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													**Program Specific Outcomes (PSOs)**		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**		**2**	**2**								3		
CO2	**3**	**2**		**2**	**2**									3	
CO3	**3**	**3**		**2**	**2**										3
CO4	**3**	**3**		**2**	**2**									3	
CO5	**3**	**3**		**2**	**2**				**3**						3

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Mobile Computing*	***Course Code:****17CSE838*
L-T-P *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course will give an understanding of mobile computer systems particularly in the context of wireless network systems such as 2G/3G/4G mobile telephony, data networks, and other wireless networks and infrastructure.

PREREQUISITES

- Students should have prior knowledge of Computer Networks, basics of programming

COURSE OBJECTIVES

- To understand and learn the basics of mobile devices
- To understand and learn the different types of wireless medium access control
- To understand and learn different broadcast techniques
- To understand and learn how to manage transaction

COURSE CONTENTS

UNIT – I **12 Hours**

Mobile Devices And Systems, Architectures: Mobile phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices, Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems. GSM – Services and System Architectures, Radio Interfaces, Protocols, Localization, Calling, Handover, General Packet Radio Service.

UNIT – II **10 Hours**

Wireless Medium Access Control AndCdma – Based Communication: Medium Access Control, Introduction to CDMA – based Systems, OFDM, Mobile Ip Network Layer, Mobile Transport Layer: IP and Mobile IP Network Layers Packet Delivery and Handover Management.

UNIT – III **10 Hours**

Location Management, Registration, Tunneling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol. Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP – layer Transmission for Mobile Networks. Databases: Database Hoarding Techniques, Data Caching, Client –Server Computing and Adaptation.

UNIT – IV **10 Hours**

Transactional Models, Query Processing, Data Recovery Process, Issues relating to Quality of Service. Data Dissemination And Broadcasting Systems: Communication Asymmetry, Classification of Data – Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Techniques.

UNIT – V **10 Hours**

Digital Audio Broadcasting, Digital video Broadcasting. Data Synchronization In Mobile Computing Systems: Synchronization, Synchronization Protocols, SyncML – Synchronization Language for Mobile Computing, Synchronized Multimedia Markup Language (SMIL).

TEXT BOOK

1. Mobile Computing – Raj Kamal, Oxford University Press, 2007.

REFERENCE BOOKS

1. Mobile Computing: Technology, Applications and Service Creation, Asoke K. Talkukder, Roopa R Yavaga, Tata McGraw Hill, 2005.
2. Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Reza B'Far, 5th Edition, Cambridge University press, 2006.
3. Principles of Mobile Computing – UweHansmann, LothatMerk, Martin S Nicklous and Thomas Stober, 2nd Edition, Springer International Edition, 2003.
4. Mobile Communication – Schiller, Pearson Education, 2004.

TEACHING METHODS

- Lecture (PPT)
- Black board teaching

ASSESSMENTMETHODS

Parameter	Marks
Midterm Test (2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

CO	Description	Blooms Level
CO 1	Learn the principles of mobile computing technologies	L1
CO 2	List different applications that mobile computing offers to people, employees, and businesses	L1
CO 3	Describe the possible future of mobile computing technologies and applications	L2
CO 4	Learn about traditional and modern network technologies and mobile computing protocols.	L1
CO 5	Illustrate the synchronization in wireless communication.	L2

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		3		3									3		
CO2		3				2				2				3	
CO3				3		2									3
CO4		3								3				3	
CO5															3

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**