Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

CURRICULUM & SYLLABUS

BACHELOR OF TECHNOLOGY
COMPUTER SCIENCE AND ENGINEERING
(Part Time)

REGULATION 2022

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

Department of CSE

Vision:

To become a Premier Institution of Excellence in Computer Science and Engineering that would develop self sustaining and globallycompetent Computer Science and Information Technology Professionals.

Mission:

M1: Enable studentswith the best of Technologies and Knowledge emerging in the domain of Computer Science and Engineering.

M2: Equip the department laboratories with the power of in-demand Technologies and Software for the On-Demand Industry.

M3: Share and Collaborate knowledge across the IT Industries for holistic development of skilled and talented students.

M4: Impart the students with Ethical values, Critical thinking and Broad based computational skills.

M5: Motivate the students to comprehend problems across Inter Disciplinary Domains and offer innovative solution using ICT.

B. Tech-CSE Program Educational Objectives (PEO)

The Graduate will be able to

PEO1: Establish a career in Computer Science and Engineering in Industry, Government, Academia and work collaboratively with Peers

PEO2: Successfully pursue Higher Studies in the field of Engineering, Science, Technology and Management and/or take up Research

PEO3: Promote Design, Research and implementation of Products and Services in the field of Computer Science & Engineering through strong Communication, Leadership and Entrepreneurial Skills

PEO4: Engage himself in a Professional, Ethical and Responsible manner to the Profession, Industry, Nation and the Society

PEO5: Undertake the development of Innovative Systems and Solutions using Hardware and Software integration

PEO6: Contribute to the Nation's ICT Mission through software development and ICT related activities of the government

B. Tech-CSE Program Specific Outcomes (PSO)

PSO's describe what students are expected to know or be able to do by the time of graduation from the program.

PSO1: To apply the knowledge and professional skill of theoretical Computer science to provide ethical solutions for real world problems

PSO2: To comprehend highly complex engineering problems with the knowledge of basic science and engineering.

PSO3: To design economic, innovative hardware and software system for various domains.

PSO4: To create platforms for secured information sharing and management for engineering or social applications.

B. Tech-CSE Program Outcomes (PO)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping of Mission with PEO

Mission/ PEO	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
M1	3	3	3	2	3	**2**
M2	3	3	3	1	2	2
M3	3	2	3	3	2	1
M4	2	2	3	3	3	1
M5	2	2	3	2	3	3

Mapping of PEO with PO

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	2	2	3	1	2	3	2	1	3
PEO2	3	3	3	2	2	3	2	2	1	3	1	3
PEO3	3	3	3	3	2	2	2	2	3	3	3	2
PEO4	3	3	3	1	2	3	3	3	3	2	1	1
PEO5	3	3	3	3	3	2	2	2	3	2	3	3
PEO6	3	2	2	1	2	3	3	3	3	3	3	2

Mapping of PEO with PSO

PEO/PSO	PSO1	PSO2	PSO3	PSO4
PEO1	3	3	2	1
PEO2	2	2	1	2
PEO3	2	3	3	3
PEO4	3	1	2	2
PEO5	1	2	3	2
PEO6	2	2	2	2

Strength of Correlation 3-High 2-Medium 1-L

I SEMESTER								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBMA22006	Discrete Mathematics	Ty	3	1/0	0/0	4	BS
2	EBCS22003	Data Base Management System	Ty	3	0/0	0/0	3	PC
3	EBEC22ID1	Digital Principles and System Design	Ty	3	0/0	0/0	3	ID
4	EBCS22002	Data Structures	Ty	3	1/0	0/0	4	PC
PRACTICALS*								
1	EBCS22L01	Data Structures Lab	Lb	0	0/0	3/0	1	PC
2	EBCS22ET3	Object Oriented Programming With C++	ETL	1	0/1	3/0	3	PC
Credits Sub Total							18	

II SEMESTER								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBMA22011	Statistics for Computer Engineers	Ty	3	1/0	0/0	4	BS
2	EBCS22004	Design and analysis of Algorithms	Ty	3	0/0	0/0	3	PC
3	EBCS22005	Operating Systems	Ty	3	0/0	0/0	3	PC
4	EBEC22ID2	Microprocessor and Microcontrollers	Ty	3	0/0	0/0	3	ID
PRACTICALS*								
1	EBCS22L04	Operating Systems Lab	Lb	0	0/0	3/0	1	PC
2	EBCS22ET4	Java Programming	ETL	1	0/1	3/0	3	PC
Credits Sub Total							17	

III SEMESTER								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22006	Computer Organization and Architecture	Ty	3	1/0	0/0	4	PC
2	EBCS22007	Computer Networks	Ty	3	0/0	0/0	3	PC
3	EBCS22EXX	Program Elective I	Ty	3	0/0	0/0	3	PE
PRACTICALS*								
1	EBCS22L05	Network Programming Lab	Lb	0	0/0	3/0	1	PC
2	EBCS22ET5	User Experience design	ETL	1	0/1	3/0	3	PC
Credits Sub Total							14	

IV SEMESTER							
SUBJECT CODE	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
EBCS22009	Object Oriented Software Engineering	Ty	3	0/0	0/0	3	PC
EBCS22008	Principles of Compiler Design	Ty	3	0/0	0/0	3	PC
EBCS22011	Artificial Intelligence	Ty	3	0/0	0/0	3	PC
EBCS22EXX	Program Elective II	Ty	3	0/0	0/0	3	PE
PRACTICALS*							
EBCS22L07	Object Oriented Software Engineering Lab	Lb	0	0/0	3/0	1	PC
					Credits Sub Total		13

VSEMESTER								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22012	Big Data Analytics	Ty	3	1/0	0/0	4	PC
2	EBCS22010	Web Design Using PHP& MySQL	Ty	3	0/0	0/0	3	PC
3	EBCS22014	Cloud Computing	Ty	3	1/0	0/0	4	PC
4	EBCS22EXX	Program Elective III	Ty	3	0/0	0/0	3	PE
PRACTICALS*								
1	EBCS22L08	Web Design Using PHP& MySQL Lab	Lb	0	0/0	3/0	1	PC
						Credits Sub Total		15

VI SEMESTER								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22015	Machine Learning	Ty	3	0/0	0/0	3	PC
2	EBCC22ID2	Principles Of Management and Behavioral Science	Ty	3	0/0	0/0	3	HS
3	EBCS22EXX	Program Elective IV	Ty	3	0/0	0/0	3	PE
PRACTICALS*								
1	EBCS22L09	Data Analytics Lab using Machine Learning Algorithms	Lb	0	0/0	3/0	1	PC
2	EBCS22I05	Project Phase – 1	Lb	0	0/0	3/3	2	PC
						Credits Sub Total		12

VII SEMESTER								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22EXX	Program Elective V	Ty	3	0/0	0/0	3	PE
PRACTICALS*								
1	EBCS22L11	Project Phase – II	Lb	0	0/0	12/12	8	PC
Credits Sub Total							11	

Credit Summary

Semester 1: 18
Semester 2: 17
Semester 3: 14
Semester 4: 13
Semester 5: 15
Semester 6: 12
Semester 7: 11

Total Credits :100

ELECTIVE -I								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22E01	Image Processing	Ty	3	0/0	0/0	3	PE
2	EBCS22E02	Geographical Information Systems	Ty	3	0/0	0/0	3	PE
3	EBCS22E03	Database Tuning	Ty	3	0/0	0/0	3	PE
4	EBCS22E04	Component Based Technology	Ty	3	0/0	0/0	3	PE
5	EBCS22E05	E-Commerce	Ty	3	0/0	0/0	3	PE
6	EBCS22E06	Computer Graphics and Multimedia	Ty	3	0/0	0/0	3	PE
7	EBCS22E07	Wireless and Mobile Networking	Ty	3	0/0	0/0	3	PE

ELECTIVE -II								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22E08	5 G Networks	Ty	3	0/0	0/0	3	PE
2	EBCS22E09	Information Storage Management	Ty	3	0/0	0/0	3	PE
3	EBCS22E10	Risk Management	Ty	3	0/0	0/0	3	PE
4	EBCS22E11	Cryptography and Network Security	Ty	3	0/0	0/0	3	PE
5	EBCS22E12	Mobile Adhoc Networks	Ty	3	0/0	0/0	3	PE
6	EBCS22E13	Network Infrastructure Management	Ty	3	0/0	0/0	3	PE
7	EBCS22E14	Cyber Forensics and Internet Security	Ty	3	0/0	0/0	3	PE
8	EBCS22E15	Database Security	Ty	3	0/0	0/0	3	PE
9	EBCS22E16	Management Information Systems	Ty	3	0/0	0/0	3	PE

ELECTIVE –III								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22E17	Mobile Application Development	Ty	3	0/0	0/0	3	PE
2	EBCS22E18	Data Science	Ty	3	0/0	0/0	3	PE

3	EBCS22E19	Embedded Systems Architectures	Ty	3	0/0	0/0	3	PE
4	EBCS22E20	Agile Software Development	Ty	3	0/0	0/0	3	PE
5	EBCS22E21	Automation	Ty	3	0/0	0/0	3	PE
6	EBCS22E22	Social Computing	Ty	3	0/0	0/0	3	PE
7	EBCS22E23	Enterprise Architecture	Ty	3	0/0	0/0	3	PE
8	EBCS22E24	Network Forensics	Ty	3	0/0	0/0	3	PE
9	EBCS22E25	Distributed Computing	Ty	3	0/0	0/0	3	PE

ELECTIVE –IV								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCS22E26	Edge Computing	Ty	3	0/0	0/0	3	PE
2	EBCS22E27	Cyber Physical Systems	Ty	3	0/0	0/0	3	PE
3	EBCS22E28	Foundations of Parallel Programming	Ty	3	0/0	0/0	3	PE
4	EBCS22E29	Virtualization	Ty	3	0/0	0/0	3	PE
5	EBCS22E30	Data Modernization Analysis	Ty	3	0/0	0/0	3	PE
6	EBCS22E31	Robotics	Ty	3	0/0	0/0	3	PE
7	EBCS22E32	Deep Learning Techniques	Ty	3	0/0	0/0	3	PE
8	EBCS22E33	Enterprise Resource Planning	Ty	3	0/0	0/0	3	PE
9	EBCS22E34	Quantum Computing	Ty	3	0/0	0/0	3	PE
10	EBCS22E35	Social Network Analysis	Ty	3	0/0	0/0	3	PE
11	EBCS22E36	Neuro Fuzzy Computing	Ty	3	0/0	0/0	3	PE
12	EBCS22E37	Augmented And Virtual Reality	Ty	3	0/0	0/0	3	PE
13	EBCS22E38	Blockchain	Ty	3	0/0	0/0	3	PE
14	EBCS22E39	M-Commerce	Ty	3	0/0	0/0	3	PE
15	EBCS22E40	Real Time Systems	Ty	3	0/0	0/0	3	PE
16	EBCS22E41	Optimization Techniques	Ty	3	0/0	0/0	3	PE
17	EBCS22E42	Natural Language Processing	Ty	3	0/0	0/0	3	PE

SEMESTER 1 :

COURSE CODE **EBMA22006**	COURSE NAME **: Discrete Mathematics**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: First year Engineering Mathematics	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :
The students should be made to
To understand the Basic concepts in Truth Table, Mathematical Logic and Inference Theory
To understand the Basic concepts in Mathematical Induction and Recurrence relations
To understand the Basic concepts in Group theory, Rings and Fields
To understand the Basic concepts in Finite Automata, Finite state machine.
To understand the Basic concepts in Graph theory

COURSE OUTCOMES (COs) : Students will be able to

CO1	To understand the Basic concepts in Logic and Predicate calculus
CO2	To understand the Basic concepts in Combinatorics
CO3	To understand the Basic concepts in Group theory
CO4	To understand the Basic concepts in Automata
CO5	To understand the Basic concepts in Graph theory

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**1**	**3**
CO2	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**3**
CO3	**2**	**3**	**1**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**3**
CO4	**3**	**3**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**1**	**2**
CO5	**2**	**3**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**1**	**3**	**1**
CO2	**2**	**1**	**3**	**1**
CO3	**2**	**1**	**3**	**1**
CO4	**2**	**1**	**3**	**1**
CO5	**2**	**1**	**3**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill	Practical /Project			
	√											

COURSE CODE: **EBMA22006**	COURSE NAME :	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	DISCRETE MATHEMATICS	Ty	3	1/0	0/0	4

UNIT I LOGIC **12 hrs**

Statements – Truth Table – Connectives – Normal Forms – Predicate Calculus – Inference Theory.

UNIT II COMBINATORICS **12hrs**

Mathematical Induction – Pigeon Hole Principle – Principle of Inclusion and Exclusion – Recurrence Relations – Generating Functions.

UNIT III GROUPS **12 hrs**

Basic Concepts – Groups – Subgroups – Homomorphism – Kernel – Cosets – Lagrange's theorem - Group Homomorphisms – Rings and Fields (Definitions and simple theorems and problems).

UNIT IV AUTOMATA **12 hrs**

Finite Automata – Regular grammar – Introduction – Context free grammar – Introduction to Turing machine – Finite state machine – Introduction – Language Recognition

UNIT V GRAPHS **12 hrs**

Introduction to Graphs – Terminology – Matrix representation of Graphs: Incidence matrix, Adjacency matrix – Graph Isomorphism – Connectivity – Euler and Hamiltonian Paths (simple theorems and problems).

Total Hours: 60

Reference Books:

1) Veerarajan T., *Discrete Mathematics*, Tata McGraw Hill Publishing Co., (2008).
2) Tremblay J.P., Manohar R., *Discrete Mathematical structures with applications to Computer science*, Tata McGraw Hill Publishing Co., (2008).
3) Kolman, Busby, Ross, *Discrete Mathematical Structures*, Pearson, (2014).
4) Kenneth Rosen, *Discrete Mathematics and its applications (SIE)*, Tata McGraw Hill Publishing Co., (2007).

COURSE CODE:	COURSE NAME: DATABASE MANAGEMENT SYSTEMS	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22003	**Prerequisite**: DATA STRUCTURES	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL /IE: Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

Thestudents should be made to

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To develop an understanding of essential DBMS concepts such as: database security, integrity, and concurrency.

COURSE OUTCOMES (COs): Students will be able to	
CO1	Understand the fundamental concepts and techniques of DBMS[L2]
CO2	Apply indexing and hashing in database implementation[L3]
CO3	Analyze routine requisite for maintaining and querying databases and need for sorting and join operations in databases[L4]
CO4	Understand the importance of transaction management, concurrency control and recovery system in databases[L2]
CO5	Apply advanced representations of databases suited for real-time applications[L3]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1				2	2	2		2
CO2	3	2	3	1	1			2	2	2	1	3
CO3	2	3	3	1				1	3	3	1	3
CO4	2	3	3	1	1	1		2	3	3	1	3
CO5	3	3	3	1	1	1		3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1		1
CO2	2	1		1
CO3	1	1		1
CO4	2	1	2	1
CO5	2	1	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22003	DATABASE MANAGEMENT SYSTEMS	Ty	3	0/0	0/0	3

UNIT I FUNDAMENTALS OF DATABASE **9 Hrs**

Introduction - Purpose of database systems – Data Abstraction -Data models – Instances and schemas – Data Independence – DDL – DML – Database user – ER model – Entity sets- keys – ER diagram – relational model – structure – relational algebra- relational calculus- views

UNIT II SQL, INDEXING & HASHING **9 Hrs**

SQL - normalization – normalization using functional – Multivalued join dependence - file transaction – data dictionary – indexing and hashing basic concepts and B+ tree Indices - static and dynamic hash functions

UNIT III QUERY PROCESSING AND TRANSACTIONS **9 Hrs**

Overview - Measures of Query Cost - Selection Operation – Sorting - Join Operation- Transaction Concept - A Simple Transaction Model - Storage Structure – Serializability

UNIT IV CONCURRENCY CONTROL AND RECOVERY SYSTEM **9 Hrs**

Lock-Based Protocols - Deadlock Handling - Timestamp-Based Protocols - Validation-Based Protocols - Failures Classification – Storage - Recovery and Atomicity - Recovery Algorithm - Buffer Management

UNIT V ADVANCED TOPICS IN DATABASES **9 Hrs**

Database-System Architectures - Parallel Databases - Distributed Databases - Database Tuning - Introduction to Special Topics - Spatial & Temporal Databases – Data Mining and Warehousing.

Total Hours: 45

TEXT BOOKS:

1. Abraham, Silberschatz. Henry, F. K..Sudharshan, S. (2013) Database System Concepts (6thed.) Tata McGraw Hill, New Delhi

REFERENCE BOOKS:

1. *Ramez, E. Shamkant, B. Navathe (2008) Fundamentals of database systems (5th ed.), Pearson Education*
2. *Date, C. J, (2012) An Introduction to Database Systems (8th ed.), Pearson Education*

COURSE CODE: EBEC22ID1	DIGITAL PRINCIPLES AND SYSTEM DESIGN	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- To introduce number systems and codes and its conversions
- To introduce Boolean algebra and its applications in digital systems
- To introduce the design of various combinational digital circuits using logic gates
- To bring out the analysis for synchronous and asynchronous Sequential circuits

COURSE OUTCOMES (COs) : Students will be able to	
CO1	Acquired knowledge about number systems and its conversions
CO2	Acquired knowledge about boolean algebra
CO3	Ability to identify, analyze & design combinational circuits
CO4	Ability to identify & analyze synchronous & asynchronous circuits

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1	1	1	1	1	2	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	1
CO3	2	2	3	1	1	2	1	1	2	2	1	1
CO4	2	2	3	1	1	2	1	1	2	2	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	3	1	1
CO3	3	2	1	1
CO4	3	2	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✔					

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBEC22ID1	**DIGITAL PRINCIPLES AND SYSTEM DESIGN**	Ty	3	0/0	0/0	3

UNIT I NUMBER SYSTEMS **9 Hrs**

Review of Decimal, Binary, Octal And Hexadecimal Number Systems-Binary Addition Subtraction, Multiplication& Division—Number Conversions – Signed Magnitude form – 1's and 2's Complement - Binary weighted codes- Binary arithmetic – codes – BCD code, Gray code, Excess-3 Code.

UNIT II BOOLEAN ALGEBRA **9 Hrs**

Binary logic Functions- Boolean laws –Boolean Algebra – Reduction of Boolean Expressions De Morgan's Theorems, Sum Of Products –Product Of Sums –karnaugh map- Quine McCluskey Method.

UNIT III COMBINATIONAL LOGIC **9 Hrs**

Logic gates – AND, OR, NOT, NOR, NAND and EX-OR Gates– Half adder –Full adder- Half subtractor– Full subtractor - Multiplexer – Demultiplexer- Encoder – Decoder.

UNIT IV SYNCHRONOUS/ASYNCHRONOUS SEQUENTIAL LOGIC **9 Hrs**

Latches-R-S- Flip Flop, S-R Flip Flop, D Flip Flop, JK Flip Flop, T Flip-Flop - Master slave Flip-Flop - Counters –Up Down counters- Binary Counters-Ring counter- Shift Registers.Asynchronous counters – Decade counters - State diagram - State Table – State Reduction – State Assignment- Excitation Table- Analysis of Asynchronous sequential circuits - Design of ASynchronous Sequential Circuits.

UNIT V MEMORY DEVICES **9Hrs**

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) -Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL.

Total Hours: 45

TEXT BOOKS:

1. Charles H. Roth & Larry L.Kinney, "Fundamentals of Logic Design", Cengage Learning, 7th Edition.
2. M. Morris Mano & Michael D.Ciletti (2008) Digital Design. Pearson Education
3. Thomas.L.Floyd (2013) "Digital Fundamentals", 10th Edition Pearson Education
4. A.Anand Kumar ―Fundamentals of Digital Circuits‖, 4th Edition, PHI Learning Private Limited, 2016.
5. Soumitra Kumar Mandal ― Digital Electronics‖, McGraw Hill Education Private Limited,2016.

REFERENCE BOOKS:

1. *Ronald J. Neal S. Gregory L (2009), "Digital Systems", 10th Edition, Pearson Prentice Hall.*
2. *R P Jain, (2010), "Modern Digital Electronics", 4th Edition, Tata Mcgraw Hill Ed. Pvt. Ltd*

COURSE CODE: EBCS22002	COURSE NAME: DATA STRUCTURES	Ty/ Lb/ ETL/IE	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

L : Lecture T:Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory andLab/Internal Evaluation

OBJECTIVES:

Thestudents should be made to

- Master the implementation of linked data structures such as linked lists and binarytrees
  Be familiar with advanced data structures such astrees and hashtables.
- Be familiar with several sub-quadratic sorting algorithms including quicksort, merge sortandheapsort
- Be familiar some graph algorithms such as shortest path and minimum spanning tree
- Master the standard data structure library of a major programming language(java)

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand space and time complexity of various algorithms and implement various operations on arrays and linked list[L2]
CO2	Apply major algorithms and data structures to solve problems[L3]
CO3	Design and apply tree data structure in data compression algorithms[L3]
CO4	Analyze and apply appropriate searching and/or sorting techniques in the application development[L4]
CO5	Analyze graph data structure and apply it to real world problems in finding shortest Path[L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1			2	2	1	2		2
CO2	3	3	3	1			3	2	3	2	1	2
CO3	3	2	3	1		1	2	2	3	1	1	2
CO4	3	3	3	1	1	1	2	2	3	2	1	2
CO5	3	3	3	1	1	1	2	3	2	1	1	1

COs / PSOs	PSO1	PSO 2	PSO 3	PSO4
CO1	3	3	2	1
CO2	3	3	1	2
CO3	3	2	3	1
CO4	3	3	1	2
CO5	3	3	2	1

3/2/1 indicates StrengthofCorrelation 3- High, 2- Medium,1-Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE: **EBCS22002**	COURSE NAME:	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	DATA STRUCTURES	Ty	3	1/0	0/0	4

UNIT – I LINEAR DATA STRUCTURES – LIST **12Hrs**

Introduction: Abstract Data Types (ADT) **Arrays**: Definition, Single and Multidimensional Arrays, **Linked lists**: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.

UNIT – II LINEAR DATA STRUCTURES – STACK AND QUEUES **12Hrs**

Stacks: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, **Queues**: Queue ADT, Operations on Queue: ENQUE, DEQUE, Full and Empty, Circular queues, Array and linked implementation of queues, Dequeue and Priority Queue.

UNIT – III NON LINEAR DATA STRUCTURES - TREES **12Hrs**

Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Threaded Binary trees, Binary Search Trees, AVL Trees, B-Trees, Heaps.

UNIT – IV NON LINEAR DATA STRUCTURES –GRAPHS **12Hrs**

Graphs: Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Shortest Path algorithm: Dijikstra Algorithm

UNIT – V SEARCHING, SORTING AND HASHING **12Hrs**

Searching: Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Hashing: Hash Function, Collision Resolution Strategies **Total Hours:60**

TEXTBOOK

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition, Oxford University Press, 2011

REFERENCES

1. Aaron M. Tenenbaum,YedidyahLangsam and Moshe J. Augenstein “Data Structures Using C and C++”, PHI Learning Private Limited, Delhi India
2. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publications Pvt Ltd Delhi India.

A.K. Sharma ,Data Structure Using C, Pearson Education IN

COURSE CODE: **EBCS22L01**	COURSE NAME: **DATA STRUCTURES LAB**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/ R**	**C**
	Prerequisite: C PROGRAMMING AND MS OFFICE TOOLS	Lb	0	0/0	3/0	1

L : Lecture T:Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory andLab/Internal Evaluation

OBJECTIVES : The students should be made to

- To strengthen their problem-solving ability by applying the characteristics of an object-oriented approach.
- To introduce object oriented concepts inJava.

COURSE OUTCOMES (COs) : Students will be able to

CO1	Understand the basic operations on arrays, lists, stacks and queue data structures
CO2	Apply non linear data structure in real world application
CO3	Apply various data structures in simple applications
CO4	Analyze algorithms for operations on Binary Search Trees
CO5	Analyze the complexity of given algorithms

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**1**				**2**	**2**	**2**		**2**
CO2	**3**	**2**	**3**	**1**	**1**			**2**	**2**	**2**	**1**	**3**
CO3	**2**	**3**	**3**	**1**				**1**	**3**	**3**	**1**	**3**
CO4	**2**	**3**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**1**	**3**
CO5	**3**	**3**	**3**	**1**	**1**	**1**		**3**	**3**	**2**	**1**	**3**
	3	**2**	**2**	**1**				**2**	**2**	**2**		**2**

COs / PSOs	**PSO 1**	**PSO 2**	**PSO3**	**PS O4**
CO1	**2**	**1**		**1**
CO2	**2**	**1**		**1**
CO3	**1**	**1**		**1**
CO4	**2**	**1**	**2**	**1**
CO5	**2**	**1**	**2**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Compone	Practical /Project			
				✔					✔			

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22L01	DATA STRUCTURES LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. Write a program to implement list ADT using arrays and linked list.
2. Write a Program to implement the following using an array a) Stack ADT b) Queue ADT.
3. Write a Program to implement the following using a singly linked list a) Stack ADT b) Queue ADT.
4. Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression.
5. Write a Program to traverse binary tree in preorder, postorder and inorder.
6. Write a program to perform the following operations a) Insert an element into a binary search tree.b)Delete an element from a binary search tree.c)Search for a key element in a binary search tree.
7. Write a Program for the implementation of Binary Heaps
8. Write a Program for the implementation of Breadth First Search and Depth First Search.
9. Write a Program for the implementation of Linear Search and Binary Search
10. Write a Program for sorting. (bubble sort, insertion sort, shell sort, heap sort)
11. Write a Program for the implementation of Collision Resolution using Open Addressing

Software requirement: C/C++

Total Hours:45

COURSE CODE **EBCS22ET3**	COURSE NAME: **OBJECT ORIENTED PROGRAMMING WITH C++**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: C PROGRAMMING AND MS OFFICE TOOLS	ETL	2	0/0	2/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand the basic concepts and techniques which form the object oriented programming paradigm.
- Remember the operator concepts
- Design the applications using File concepts

COURSE OUTCOMES (COs): Students will be able to

CO1	Understanding the Basic Concepts of object oriented programming. [L2]
CO2	Getting Knowledge about Classes and Objects[L2]
CO3	Imparting skills on various kinds of overloading and inheritance concepts[L3]
CO4	Design generic classes with C++ templates[L6]
CO5	Develop an Application with C++ Techniques[L6]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**
CO2	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**1**
CO3	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**2**
CO4	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**1**	**2**
CO5	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**3**	**1**	**1**
CO2	**1**	**3**	**1**	**1**
CO3	**2**	**3**	**2**	**1**
CO4	**2**	**3**	**1**	**2**
CO5	**1**	**3**	**1**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22ET3	OBJECT ORIENTED PROGRAMMING WITH C++	ETL	2	0/0	2/0	3

UNIT I **12Hrs**

BASIC CONCEPTS OF OOPS: Programming methodologies - Object Oriented Concepts –Features & Applications of OOPS-Benefits of OOPS–Structure of C++ - C++ Tokens-Operators in C++ - Data types-Control statements – Arrays

UNIT II **12Hrs**

Class & Objects: Classes and Objects-Abstraction-Encapsulation-Definition - Data members - Function members - Access Modifiers– Constructors – Types of Constructors– Destructors - Static members - Inline functions- Arrays of Object

UNIT III **12Hrs**

INHERITANCE AND POLYMORPHISM: Overloading Operators - Rules for Operator overloading, – Function Overloading- Overloading Unary & Binary Operators – Friend Function - Virtual functions - Abstract Classes -Inheritance –Definition –Single Inheritance-Multiple Inheritance-Hierarchical Inheritance-Single Inheritance-Hybrid Inheritance.

UNIT IV **12Hrs**

TEMPLATES & EXCEPTION HANDLING: Class Templates - Function Templates - Overloading Template Functions-Basics of Exception handling –Try-Catch-Throw – Rethrowing an Exception, Exception specifications, Processing Unexpected Exceptions-Error handling during File operations, Formatted I/O.

UNIT V **12Hrs**

Files and Streams: Creating a Sequential Access File- Reading Data from A Sequential Access File, Updating Sequential Access Files-Random Access Files-Creating A Random Access File- Writing Data Randomly To a Random Access File- Reading Data Sequentially from a Random Access File. Stream Input/Output Classes and Objects, Stream Output, Stream Input, Unformatted I/O (with read and write), Stream Manipulators, Stream Format States, Stream Error States.

Total Hours: 60

TEXT BOOKS:

1. Stanley, B. Lippman (2012) The C++ Primer, (5th ed.), Addison Wesley

2.C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall

REFERENCES:

1. Stroustrup, B (2004) The C++ Programming Language, (3 rd ed.), Pearson Education

2. Balagurusamy, E (2008) Object Oriented Programming with C++, (4th ed.), Tata Mcgraw Hill

II SEMESTER :

COURSE CODE EBMA22011	COURSE NAME : **Statistics for Computer Engineers**	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: First year Engineering Mathematics	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :

The students should be made to

- To understand the Basic concepts in Frequency distribution, Measures of Central Tendency and Relative Measures of Dispersion.
- To understand the Basic concepts in Random Events, Random variable and Probability.
- To understand the Basic concepts in Bi-variate data, Coefficient of Correlation and Regression.
- To understand the Basic concepts in Probability distributions
- To understand the Basic concepts in Null hypothesis, Alternative hypothesis and Critical points

COURSE OUTCOMES (COs): Students will be able to

CO1	To understand the Basic concepts in Statistics
CO2	To understand the Basic concepts in Probability
CO3	To understand the Basic concepts in Correlation
CO4	To understand the Basic concepts in Probability distributions
CO5	To understand the Basic concepts in Sampling theory

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	1	2	1	2	2	1	1	2
CO2	3	3	1	2	2	2	2	2	1	1	2	2
CO3	2	2	1	3	1	2	1	1	2	2	2	3
CO4	3	2	1	3	1	1	2	2	1	1	1	3
CO5	3	3	2	2	1	2	2	1	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	1
CO2	2	1	3	1
CO3	2	1	3	1
CO4	2	1	3	1
CO5	2	1	3	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
	√											

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBMA22011	STATISTICS FOR COMPUTER ENGINEERS	Ty	3	1/0	0/0	4

UNIT I BASICS OF STATISTICS 12 hrs

Variables – Uni-variate Data – Frequency Distribution – Measures of Central Tendency – Mean –Median – Mode – Quartiles – Measures of Dispersion – The Range – Mean deviation -Quartile Deviation –Standard Deviation – Relative Measures of Dispersion – Coefficient of Variation – Quartile Coefficient of Variation – Skewness and Kurtosis (Definition and Simple problems).

UNIT II PROBABILITY AND RANDOM VARIABLE 12 hrs

Axioms ofProbability - Independent Events – Mutually exculsive Events– Conditional probability – Total probability – Baye's Theorem – Random variable – Probability mass function – Probability density function – Properties(Definition and simple problems).

UNIT III CORRELATION &REGRESSION 12 hrs

Bi-variate data – Applications of Correlation: Karl Pearson's Coefficient of Correlation – Rank Correlation: Spearman's Rank Correlation – Linear Regression.

UNIT IV STANDARD DISTRIBUTIONS 12 hrs

Binomial – Poisson – Geometric –Uniform – Exponential –Normal distributions.

UNIT V TESTING OF HYPOTHESIS 12 hrs

Tests of Significance – Null hypothesis – Alternative hypothesis – Critical points - Large Sample Tests – Mean proportions – Small Sample Tests – t, F, Chi-square Tests: Independence of Attributes, Goodness of Fit.

Total Hours: 60

Reference Books:

1) Veerarajan T., *Probability, Statistics and, Random Processes*, Tata McGraw Hill Publishing Co., (2008).
2) Singaravelu, *Probability and Random Processes*, Meenakshi Agency, (2017).
3) Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S.Chand& Co., (2007).
4) Richard Johnson A., *Miller & Freund's Probability and statistics for Engineers (9th ed),* Prentice Hall of India, (2016).

COURSE CODE: EBCS22004	COURSE NAME: DESIGN AND ANALYSIS OF ALGORITHMS	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: DATA STRUCTURES	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

Thestudents should be made to:

- To Learn the algorithm analysis techniques.
- To understand the different algorithm design techniques.
- To Understand Iterative algorithms
- To Understand the limitations of Algorithm power

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the fundamentals of algorithms[L2]
CO2	Analyze time complexity of various algorithms[L4]
CO3	Apply the different problem solving techniques to solve basic mathematical problems[L3]
CO4	Analysing the structure of tree and graphs to identify the limitations in solving the problem[L4]
CO5	Evaluate the algorithms for solving real world applications[L5]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2					2	2		2
CO2	3	3	3	1					3	2		2
CO3	3	2	2	2					3	2		2
CO4	2	3	3	1			1		2	2	1	2
CO5	2	3	3	1	1		1		2	2	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	3	1	1
CO3	3	2	2	2
CO4	3	3	3	2
CO5	3	3	3	3

3/2/1indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	InterDisciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22004	DESIGN AND ANALYSIS OF ALGORITHMS	Ty	3	0/0	0/0	3

UNIT I BASIC CONCEPTS AND INTRODUCTION TO ALGORITHMS 9 Hrs

Introduction-Historical Background-Time Complexity-Space Complexity— Fundamentals of Algorithmic Problem Solving — Important Problem Types ——Asymptotic Notations and their properties. Analysis Framework — Empirical analysis — Mathematical analysis for Recursive and Non-recursive algorithms — Visualization

UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER 9 Hrs

Brute Force – Closest-Pair and Convex Hull Problems-Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem. Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication-Closest-Pair and Convex Hull Problems.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9 Hrs

Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm-Huffman Trees.

UNIT IV ITERATIVE IMPROVEMENT 9 Hrs

The Simplex Method-The Maximum-Flow Problem – Maximm Matching in Bipartite Graphs- The Stable marriage Problem.

UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9 Hrs

Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems–Coping with the Limitations – Backtracking – n-Queens problem – The 3-Coloring Problem-Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem-Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem – Knapsack problem.

Total Hours: 45

TEXT BOOK:

1. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. M. H. Alsuwaiye, "Voronoi Diagrams", Third Edition, World Scientific.

REFERENCE BOOKS*:*

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

3.Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

4. http://nptel.ac.in/

COURSE CODE	COURSE NAME: OPERATING SYSTEM	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22005	Prerequisite: Computer Organization and Architecture	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- understand the concepts of Operating System and process.
- Illustrate the Scheduling of a processor for a given problem instance, identify the dead lock situation and provide appropriate solution, analyze memory management techniques and implement page replacement Algorithm, understand the implementation of file systems and directories.
- appreciate emerging trends in operating systems.

COURSE OUTCOMES (COs): Students will be able to

CO1	Remember and Understand functions, structures and history of operating systems[L1]
CO2	Analyze various functions of CPU processing algorithms[L4]
CO3	Understand the concept of hazard and analyze with prevention process[L2]
CO4	Analyze various memory management schemes[L4]
CO5	Apply the functionality of file systems[L3]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	1	1		1		2	1
CO2	3	3	2	1	1	1				1	2	2
CO3	3	3	3	1	2	1			1		1	
CO4	3	3	3	1	1	2	1			1		
CO5	3	3	3	2	2	2			1	1		

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	1	2
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	InterDisciplinary	Skill Component	Practical /Project			
				✓								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22005	OPERATING SYSTEM	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

CONCEPTS & PROCESSES

Introduction -Computer system architecture-operating system structure-operations-management of process, memory, storage-protection and security-Operating System Services-System Calls-types-System Programs-System Structure-Virtual Machines-System Design and Implementation- Process Concept-Process Scheduling-Operation on Process-Cooperating Processes- Inter Process Communication

UNIT II **9 Hrs**

PROCESS MANAGEMENT, SYNCHRONIZATION AND DEADLOCKS

Threads-Multithreading Models. CPU Scheduling Concepts-Scheduling Criteria-Scheduling Algorithms-Threads and Multiple-Processor Scheduling-Real Time Scheduling- - Process Synchronization-The Critical Section Problem-Synchronization-Peterson solution, mutex-Hardware-Semaphores Monitor-Deadlocks-Deadlock Characterization-Methods of Handling Deadlocks-Deadlock Prevention-Deadlock Avoidance-Deadlock Detection-Recovery form Deadlock

UNIT III **9 Hrs**

MEMORY MANAGEMENT

Main Memory-Swapping-Contiguous Memory Allocation - Address Translation - Paging - Segmentation – Virtual Memory-Demand paging-page replacement-thrashing-allocating Kernel memory.

UNIT IV **9 Hrs**

STORAGE MANAGEMENT

Files And Secondary Storage Management: File Concepts - Access Methods - Directory Structure - File System Mounting - File Sharing - Protection - File System Structure - Implementation - Recovery - Disk Structure - Disk Scheduling - Disk Management- I/O Systems

UNIT V **9 Hrs**

CASE STUDY

Linux System — Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Network Structure, Security. Windows 10 - Design Principles, System Components, Terminal Services and fast user switching, File System, Networking, Programmer Interface.

Total Hours: 45

TEXT BOOKS:

1.Abraham Silberschatz, Peter B. Galvin, Greg Gagne(2018) Operating System Concepts (10th ed.), ISBN: 978-1-119-32091-3

REFERENCE BOOKS:

1. *D.M.Dhamdhere. D. M. (2012) Operating Systems, (3 rd ed.), Tata McGraw Hill*
2. *Tanenbaum (2015) Modern Operating Systems,Pearson Publication.*

William Stallings (2015) Operating Systems (8 th ed.) Prentice Hall of India

COURSE CODE: EBEC22ID2	COURSE NAME: MICROPROCESSORS AND MICROCONTROLLERS	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: DIGITAL PRINCIPLES AND SYSTEM DESIGN	TY	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

Thestudents should be made to

- To study the basic architectures and operational features of the processors and controllers.
- To learn the assembly language and programming of 8086.
- To design and understand the multiprocessor configuration.
- To understand the interfacing concepts of the peripheral devices with processors.

COURSE OUTCOMES (Cos): Students will be able to

CO1	Describe the working of 8086 Microprocessor
CO2	Demonstrate the programming in microprocessor
CO3	Analyze the interfacing of different peripheral devices with the microprocessors
CO4	Explain the operation of 8051 microcontroller in real time process
CO5	Illustrate the applications of 8051

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	1	1	2	1	2	2	2
CO2	3	3	3	3	2	1	2	2	2	2	2	2
CO3	2	3	3	3	3	2	2	2	1	3	2	2
CO4	3	3	3	3	3	1	2	2	2	2	2	3
CO5	3	3	3	3	3	1	2	2	1	1	3	3

Cos /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1
CO2	2	3	3	1
CO3	3	3	3	2
CO4	3	3	3	1
CO5	2	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✔					

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBEC22ID2	MICROPROCESSORS AND MICROCONTROLLERS	Ty	3	0/0	0/0	3

UNIT I: THE 8086 MICROPROCESSORS **9 Hrs**

Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming

UNIT II : 8086 SYSTEM BUS STRUCTURE **9 Hrs**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, closely coupled and loosely Coupled configurations

UNIT III I/O INTERFACING **9 Hrs**

Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller

UNIT IV: MICROCONTROLLER **9 Hrs**

Architecture of 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes.

UNIT V: INTERFACING MICROCONTROLLER **9 Hrs**

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.

Total Hours: 45

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family –

Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007.

2. Mohamed Ali Mazidi, Janice GillispieMazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition, Pearson education, 2011.

REFERENCES:

1. DoughlasV.Hall, ―Microprocessors and Interfacing, Programming and Hardware‖,TMH,2012

2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012

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COURSE CODE **EBCS22L04**	COURSE NAME: **OPERATING SYSTEM LAB**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: DBMS LAB	**Lb**	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- To learn to Create processes and implement IPC
- To learn to use system calls through C programs
- To learn to use the file system related system calls
- To gain knowledge to Analyze the performance of the various Page Replacement Algorithms
- To learn to Implement File Organization and File Allocation Strategies

COURSE OUTCOMES (Cos): Students will be able to

CO1	Understand processes concept and implement IPC[L2]
CO2	Understand and apply Deadlock avoidance and Detection Algorithms[L3]
CO3	Analyze the performance of various CPU Scheduling Algorithms[L4]
CO4	Analyze the performance of the various Page Replacement Algorithms[L4]
CO5	Apply File Organization and File Allocation Strategies[L3]

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**1**				**2**	**2**	**2**		**2**
CO2	**3**	**2**	**3**	**1**	**1**			**2**	**2**	**2**	**1**	**3**
CO3	**2**	**3**	**3**	**1**				**1**	**3**	**3**	**1**	**3**
CO4	**2**	**3**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**1**	**3**
CO5	**3**	**3**	**3**	**1**	**1**	**1**		**3**	**3**	**2**	**1**	**3**

Cos / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**3**	**2**
CO2	**3**	**3**	**2**	**3**
CO3	**3**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**1**
CO5	**3**	**1**	**2**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✓					✓			

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22L04	OPERATING SYSTEM LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. Basic UNIX commands – learning and usage.

2. Shell Programming.

3. File system related system calls. (Learn to create, open, read, write, seek into, close files & open, read, write, search, close directories).

4. Process management – Fork, Exec (Learn to create a new process and to overlay an executable binary image on an existing process).

5. Process synchronization using semaphores (Solutions to synchronization problems like producer consumer problem, dining philosopher's problem etc...).

6. Inter-process communication among unrelated processes using shared memory.

7. CPU Scheduling algorithms.

8. Implementation of Deadlock Detection Algorithm

9. Contiguous memory allocation strategies – best fit, first fit and worst fit strategies.

10. Page replacement algorithms

Total Hours:45

COURSE CODE **EBCS22ET4**	COURSE NAME: **JAVA PROGRAMMING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: OOPS	ETL	2	0/0	2/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to
- Understand the basic concepts and techniques which form the object-oriented programming concepts.
- Create a secured programming language

COURSE OUTCOMES (COs): Students will be able to

CO1	Understanding about Object Oriented Programming concepts and basic characteristics of Java[L2]
CO2	Imparting the principles of packages, inheritance and interfaces[L3]
CO3	To define exceptions and use I/O streams[L4]
CO4	Developing a java application with threads and generics classes[L6]
CO5	Designing and building simple Graphical User Interfaces[L6]

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**
CO2	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**2**
CO4	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**1**	**2**
CO5	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**2**	**3**	**2**	**2**
CO5	**1**	**3**	**1**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and Social Science	Program Core	Program Elective	Open Elective	Inter Disciplinary	Skill Component	Practical / Project			
				✔					✔			

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22ET4	JAVA PROGRAMMING	ETL	2	0/0	2/0	3

UNIT I **12Hrs**

INTRODUCTION TO OOP AND JAVA FUNDAMENTALS: Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java – Features of Java – The Java Environment – Java Source File -Structure – Compilation-Fundamental Programming Structures in Java – Defining Classes and Objects in Java – Constructors- Methods -Access specifiers – static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays.

UNIT II **12Hrs**

INHERITANCE AND POLYMORPHISM: Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – Defining an interface-Implementing interface- Differences between classes and interfaces and extending interfaces – Object cloning -Inner Classes-Array Lists – Strings and its Functions

UNIT III **12Hrs**

EXCEPTION HANDLING & STREAMS: Exceptions – Exception hierarchy – Throwing and catching Exceptions – Built-in exceptions- Creating own exceptions, Stack Trace Elements-Input / Output Basics –Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV **12Hrs**

MULTITHREADING AND GENERIC PROGRAMMING: Multithreading Definition-Differences between Multi-threading and Multitasking-Thread- Thread life cycle- Creating threads-Synchronizing threads-Inter-thread communication, Daemon threads- Thread groups-Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT V **12Hrs**

EVENT DRIVEN PROGRAMMING: Graphics programming – Frame – Components – working with 2D Shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes -actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices Scrollbars – Windows –Menus – Dialog Boxes.

Total Hours: 60

TEXT BOOKS:

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

REFERENCES:

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2. Programming with Java E. BalagurusamyTataMc-Graw Hill, 5th Edition New Delhi.
3. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
4. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

III SEMESTER:

COURSE CODE: **EBCS22006**	COURSE NAME: **COMPUTER ORGANIZATION AND ARCHITECTURE**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Microprocessor and Microcontrollers	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

Thestudents should be made to

- Conceptualize the major components of a computer including CPU, memory, I/O and storage, understand the uses for cache memory,
- understand a wide variety of memory technologies both internal and external,
- understand the role of the operating system in interfacing with the computer hardware

COURSE OUTCOMES (Cos): Students will be able to	
CO1	Understand the theoretical basics of central processing unit[L2]
CO2	Understand the basic operations of CPU[L2]
CO3	apply the knowledge gained and Designa central processing unit[L3]
CO4	apply the concepts of memory organization and I/O processing unit[L2]
CO5	Analyze the execution of simple instruction[L4]

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**						**1**		**1**	**1**
CO2	**3**	**3**	**3**						**1**		**1**	**1**
CO3	**3**	**2**	**2**								**1**	**1**
CO4	**3**	**3**	**3**	**1**				**1**			**1**	**1**
CO5	**3**	**2**	**3**	**1**				**1**	**1**		**1**	**1**

Cos / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**		**1**
CO2	**3**	**2**	**1**	
CO3	**-**	**3**	**1**	
CO4	**2**	**2**		**1**
CO5	**2**	**2**		**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22006	COMPUTER ORGANIZATION AND ARCHITECTURE	Ty	3	1/0	0/0	4

UNIT I BASIC STRUCTURE OF COMPUTERS 12 Hrs

Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

UNIT II ARITHMETIC AND LOGIC UNIT 12 Hrs

Data representation: signed number representation, fixed and floatingpoint representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division – non-restoring and restoring techniques, floating point arithmetic.

UNIT III PROCESSOR UNIT 12 Hrs

Data path implementation-Control unit-hardwired control – micro programmed control, nano programming - Concepts of pipelining – Pipeline hazards

UNIT IV MEMORY SYSTEM 12 Hrs

Memory hierarchy-Internal organization of RAM – ROM – Interleaved Memory-Cache and associative memories -Virtual memory – Memory organization and cache coherence issues

UNIT V INPUT/OUTPUT AND PERIPHERALS 12 Hrs

Input-output subsystems, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions.

Total Hours: 60

TEXT BOOKS:

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier Publishers, Fouth Edition, 2012.
2. John Hayes (2012) ,(2007)digitized Computer Architecture and Organization, Tata McGraw Hill
3. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCE BOOKS:

1.Morris Mano (2009) Computer System Architecture,(3rd ed.),Pearson Education

Subject Code:	COURSE NAME: COMPUTER NETWORKS	Ty/Lb/ ETL/IE	L	T/S. Lr	P/R	C
EBCS22007	Prerequisite: OPERATING SYSTEMS	Ty	3	0/0	0/0	3

L:LectureT:Tutorial S.Lr:Supervised Learning P:Project R:ResearchC:Credits

T/L/ETL/IE:Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

The students should be made to

- Remember how the networks functions takes place
- Understand how communication takes place in various mediums
- Learn about the protocols for data communication in the net work layers
- Study about the various network algorithms or smooth data communication

COURSEOUTCOMES(COs: Students will be able to

CO1	Students will understand and remember how network works. [L2]
CO2	Students will have knowledge on Ip address and analyze the protocols. [L1]
CO3	Apply knowledge about protocols to avoid congestion. [L3]
CO4	Acquaintance to apply algorithms in networks. [L4]
CO5	Will understand how layers of networks work. [L2]

MappingofCourseOutcomeswithProgramOutcomes (Pos)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	1	3	3	3	3	2
CO2	3	2	1	2	2	3	3	1	3	3	3	2
CO3	3	2	1	3	3	3	2	2	3	3	3	2
CO4	3	3	2	3	1	3	1	3	2	3	3	2
CO5	3	2	2	2	1	3	3	3	3	3	3	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	2	3	2
CO3	3	2	3	2
CO4	3	1	3	2
CO5	3	3	3	2

3/2/1IndicatesStrengthOfCorrelation,3–High,2-Medium,1- Low

Category	Basic Science	Engineering Science	Humanities and Social	Program Core	Program Elective	Open Elective	Inter Disciplinary	Skill Component	Practical / Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S .Lr	P/R	C
EBCS22007	COMPUTER NETWORKS	Ty	3	0/0	0/0	3

UNITI INTRODUCTION 9Hrs

Introduction to computer networks and uses – Network: devices, topology, types – Reference model – The physical layer – The theoretical basis for data communication – Transmission media: Guided and unguided- Public Switched Telephone Network. Mobile telephone system.

UNITII DATALINKLAYER 9Hrs

Data link layer design issues – Error detection and correction – Sliding window protocols- example data link protocols HDLC –Channel access on links: SDMA – TDMA – FDMA – CDMA – ETHERNET – 802.11, 802.16 – Bridges and Switches-Bluetooth

UNITIII NETWORKLAYER 9Hrs

Network layer design issues – Circuit switching – Packet switching – Virtual circuit switching- Routing algorithms – Congestion control algorithms – Internetworking- Network layer in Internet – IPV4 and Basics – IPV6 Addressing – IPV6 Protocol.

UNITIV TRANSPORTLAYER 9Hrs

Transport layer design issues – Transport protocols – Simple transport protocol – Internet transport protocols UDP, TCP – Flow Control – Congestion control – Congestion avoidance

UNITV APPLICATION LAYER 9Hrs

Domainnamesystem-Electronicmail–IntroductiontoWorldWideWeb: HTTP, APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, RTP.

TotalHours:45

TEXTBOOKS:

1. PetersonDavie(2012)ComputerNetworks-AsystemApproach (2nd ed.),MorganKauffmanHarcourt Publishers.
2. JamesF.Kurose,KeithW.RossComputerNetworking:Atop-DownApproach/Edition6, Pearson publication,2012.

REFERENCEBOOKS:

1. *AndrewS. Tanenbaum. DavidJ. Wetherall,"ComputerNetworks"5thEditionPHI,2011*
2. *WilliamStallings," Dataandcomputer communications", PHI,2001*
3. *DouglasE.comer,"Internetworkingwith TCP/IP-Volume-I",PHI,5thedition2006*
4. *Godbole, "Data communicationandnetworking",TMH,2004.*
5. *ForouzanB.A., "DataCommunicationsandnetworking", TMH, 2003.*

COURSE CODE: EBCS22L05	COURSE NAME: NETWORKPROGRAMMINGLAB	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: OPERATING SYSTEMS LAB	Lb	0	0/0	3/0	1

L:LectureT:Tutorial S.Lr:SupervisedLearning P:Project R:ResearchC:Credits
Ty/Lb/ETL/IE:Theory/Lab/EmbeddedTheoryandLab/Internal Evaluation

OBJECTIVES:

The students should be made to

- HandsonExperiencetodesignanapplicationusingTCP andUDPsockets.
- HandsonExperiencetodesignaninterfacetotransferafilebetweentwoendsusingFTP
- HandsonExperiencetodevelopa RMIapplicationforspecificoperation
- TohaveacknowledgetoworkwithNetworkSimulators

COURSEOUTCOMES (COs): Students will be able to

CO1	AbilitytoapplytheknowledgeinSocketProgrammingusingTCP andUDP[L3]
CO2	Design a Client/ServerApplicationProgrambyrememberingthestandardsofprotocol[L6]
CO3	AbilitytocreateaServerbasedapplicationusingRMIandRPCconcepts[L6]
CO4	Understandhownetwork stimulatorworks[L2]
CO5	Analyzethestateofnetwork[L4]

MappingofCourseOutcomeswithProgramOutcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	1	3	3	3	3	2
CO2	3	2	1	2	2	3	3	1	3	3	3	2
CO3	3	2	1	3	3	3	2	2	3	3	3	2
CO4	3	3	2	3	1	3	1	3	2	3	3	2
CO5	3	2	2	2	1	3	3	3	3	3	3	3

COs/PSOs	PSO1	PSO2	PSO3	PSO 4
CO1	3	3	3	3
CO2	3	2	3	3
CO3	3	3	3	3
CO4	3	2	2	2
CO5	3	2	3	2

3/2/1IndicatesStrengthOfCorrelation,3–High,2-Medium,1- Low

Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project	
			✔					✔	

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22L05	NETWORKPROGRAMMING LAB	Lb	0	0/0	3/0	1

LISTOF EXPERMENTS:

1.Networking Commands with options. (Case Study).

2. Socket program to extent communication between two deferent ends using TCP.

3. Socket program to extent communication between two deferent ends using UDP

4. Create a Socket (TCP) between two computers and enable file transfer between them.

5. Design a TCP concurrent server to echo given set of sentences using poll functions

6. Implement Concurrent Time Server application using UDP to execute the program at remote server. Client sends a time request to the server; server sends its system time back to the client. Client displays the result.

7. Implementation of RPC in server-client model

8. Implementation of ARP/RARP.

9. HTTP Socket program to download a web page.

10. File transfer in Client-Server architecture using following methods
    a) Using RS232C b) Using TCP/IP
11. To implement RMI (Remote Method Invocation)

12. Write a network program to broadcast/ multicast a message to a group in the same network.

13. Demonstration of Network Simulators.

Total Hours:45

COURSE CODE EBCS22ET5	**COURSE NAME:** **USER EXPERIENCE DESIGN**	**Ty/Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	ETL	2	0/0	2/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits

Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Gain knowledge on the desirable features of good user interfaces and the design process
- Ability to design effective screens, web interfaces, system menus and navigational schemes and to identify suitable interaction devices.
- Ability to identify the Internationalization aspects of User Interface Design and apply them in practice.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the many considerations involved in interface and screen design (L1)
CO2	Learn the rationale and apply the rules for an effective design methodology (L3)
CO3	Design and organize screens and Web pages that encourage efficient, accurate comprehension and execution (L5)
CO4	Identify the components of graphical and Web interfaces and screens — windows, menus, and controls (L2)
CO5	Perform the user interface design process, including interface development and testing (L5)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**		**1**	**1**	**1**	
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**			**1**	**1**	**1**
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**1**			**1**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**				
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**1**					

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22ET5	**USER EXPERIENCE DESIGN**	ETL	2	0/0	2/0	3

UNIT-I INTRODUCTION TO USER INTERFACES **12Hrs**

Importance of User Interface: Definition-Importance of good design-Benefits of good design Characteristics of Graphical and Web Interfaces: Interaction styles-The Graphical User Interfaces Popularity of graphics - The concept of direct manipulation - Advantages/Disadvantages of Graphical systems-Characteristics of GUI- The Web User Interface-Popularity and characteristics of Web Interface- Principles of User Interface Design.

UNIT-II USER INTERFACE DESIGN PROCESS **12Hrs**

Designing for people-Seven Commandments-Common usability problems-measures of usability. Know your user (or) Client: Important Human Characteristics in design- Human Considerations in the design - Human Interaction Speeds-Performance versus preference. Understand the business function: Business definition and requirements analysis-determining basic business functions-Design Standards (or) Style Guides-Training and documentation needs.

UNIT-III INTERFACE AND SCREEN DESIGN **12Hrs**

Interface Design Goals - Screen & Web page Meaning and purpose- Organizing Elements – consistency Starting point-Ordering Data and Content - Navigation and Flow - Visually Pleasing Composition - Distinctiveness- Focus and Emphasis - Technological considerations in Interface Design.

UNIT IV DEVELOP SYSTEM MENUS AND NAVIGATION SCHEMES **12Hrs**

Structure of Menus: Single-Sequential Linear- Simultaneous-Hierarchical-Connected-Event Trapping Menus. Functions of Menus: Navigation-Execution-displaying information-parameter input. Contents of Menus: Menu context-Menu Title-Choice Descriptions-Completion

Instructions. Formatting of Menus: Consistency-Display-Presentation-Organization-Complexity-Item arrangement- Ordering-Grouping- Selection support Menus. Phrasing the menus: Menu Titles -Menu Choice description-Menu Instruction-Intent Indicators-Keyboard short cuts. Web site Navigation Kinds of Graphical menus.

UNIT V WINDOWS AND INTERACTION DEVICES **12Hrs**

Window Characteristics- Components of a Window-Window Presentation Styles-Types of Windows Organizing Window functions-The Web and the Browser. Input Devices-Characteristics-Selection of proper input device. Output Devices-Screens-Speakers International Considerations:-Localization-Cultural considerations-Words and Texts-Images and symbols- Colors, Sequence and functionality-Requirements determination and testing. Accessibility: Types of Disabilities-Accessibility Design.

Total Hours: 60

TEXT BOOKS:

1.The Essential Guide to User Interface Design: An Introduction To GUI Design Principles and Techniques 3rd Edition, **By** Wilbert O**.** Galitz

2. User Interface Design and Evaluation **1st Edition - March 22, 2005** Debbie Stone, Caroline Jarrett, Mark Woodroffe, ShaileyMinocha

REFERENCE BOOKS:

1. Wilbert O Galitz, "The Essential Guide to User Interface Design", Wiley India Pvt., Ltd., Third Edition,

2. Ben Shneidermann, "Designing the User Interface", Pearson Education Asia, Fifth Edition, 2013

3. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education

SEMESTER IV:

COURSE CODE **EBCS22009**	COURSE NAME: **OBJECT ORIENTED SOFTWARE ENGINEERING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: OBJECT ORIENTED PROGRAMMING WITH C++	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand different software life cycle concepts
- Study and design SRS Documents for software projects.
- Use UML Diagrams to express design of a software system
- Understand various testing and maintenance measures

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the key activities in managing Software Development[L2]
CO2	Apply Object-Oriented Design Principles to develop software [L3]
CO3	Apply different Modeling Techniques to model software projects[L3]
CO4	Apply Systematic Procedure for Software Design and Deployment[L3]
CO5	Analyze various testing and maintenance techniques[L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**2**	**1**	**3**
CO2	**2**	**3**	**2**	**1**	**3**	**3**	**1**	**3**	**2**	**2**	**1**	**3**
CO3	**3**	**2**	**2**	**1**	**3**	**2**	**1**	**3**	**2**	**3**	**1**	**2**
CO4	**3**	**3**	**2**	**1**	**3**	**2**		**3**	**2**	**2**	**1**	**3**
CO5	**3**	**2**	**2**	**1**	**2**	**2**		**3**	**3**	**2**	**1**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**3**	**2**
CO2	**3**	**3**	**3**	**3**
CO3	**2**	**3**	**2**	**2**
CO4	**2**	**2**	**3**	**3**
CO5	**2**	**1**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engine	Humanities and social	Program	Program	Open Elective	Inter Discipli	Skill Compon	Practical /Project			
				✓								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22009	OBJECT ORIENTED SOFTWARE ENGINEERING	Ty	3	0/0	0/0	3

UNIT I SOFTWARE DEVELOPMENT LIFE CYCLE AND MODELS 9Hrs

Introduction – **Software Development Life Cycle:** Requirement Analysis – Designing – Coding – Testing – Deployment – Maintenance – **Software Process Models:** Waterfall Model – Incremental Development – Reuse-oriented Software Engineering – **OOSD Life Cycle:** Object-Oriented Analysis – Object-Oriented Design – Object-Oriented Implementation – **Software Process Activities:** Software Specification – Software design and implementation – Software Validation – Software Evolution – **Object Modeling Techniques –** Rumbaugh Methodology – Booch Methodology – Jacobson Methodology – Agile Methodology – Boehm's Spiral Model.

UNIT II OBJECT ORIENTED SOFTWARE REQUIREMENT ANALYSIS 9 Hrs

Introduction – Software Requirements Specification (SRS) Document – System Functions: Functional and Non-Functional Requirements – **Unified Modeling Language (UML):** Introduction – Classification of UML Diagrams: **Structural UML:** Class Diagram – Object Diagram – Component Diagram – **Behavior UML:** State Diagram – Activity Diagram – Use Case Diagram – Sequence Diagram – **System Modeling:** Context Models – Interaction Models – Structural Models – Behavioral Models.

UNIT III OBJECT ORIENTED SOFTWARE DESIGN 9 Hrs

System Design: System Architectural Design Decisions – Architectural Views – Architectural Patterns **-- Object-Oriented Design:** OO Concepts – OO Design Axioms and Corollaries – Design Patterns – Designing Classes – Designing protocols and class visibility – OO Design using UML – Designing Methods – **Access Layer:** OODBMS – Table Class Mapping – Designing Access Layer Classes – **View Layer:** Designing Interface Objects.

UNIT IV SOFTWARE TESTING 9 Hrs

Introduction –Testing Strategies – Test Cases – Test Plan – **Types of Testing:** Unit Testing – Integration Testing – Development Testing – Object Oriented Testing – User Acceptance Testing – Quality Assurance Testing – Myer's Debugging Principles.

UNIT V SOFTWARE QUALITY MANAGEMENT 9 Hrs

Software Quality – **Software Quality Management:** Quality Assurance – Quality Planning – Quality Control – Benefits Of Software Quality – Best Practices of Software Quality **-Project Management:** Risk Management – Configuration Management – Change Management – Version Management – Release Management.

Total Hours: 45

TEXT BOOK:

1. Yogesh Singh, Ruchika Malhotra (2012), Object-Oriented Software Engineering, PHI Learning Private Limited.

REFERENCES:

1. *Ian Sommerville (2008) Software Engineering (9th ed.) Pearson Education Asia*
2. *Ali Bahrami (2008) Object Oriented System Development McGraw Hill international*
3. *Roger S. Pressman (2010) Software Engineering: A Practitioner Approach (8th ed.) McGraw hill Publications*
4. *Grady Booch (2009) Object oriented Analysis &design ,Pearson Education India*

COURSE CODE: EBCS22008	COURSE NAME: PRINCIPLES OF COMPILER DESIGN	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
	Prerequisite Computer Organization and Architecture	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

Thestudents should be made to

- To understand, design and implement a lexical analyzer.
- To understand, design and implement a parser.
- To understand, design intermediate code generation schemes.
- To understand runtime environment and machine independent optimization.

COURSE OUTCOMES (COs): Students will be able to

CO1	To realize basics of compiler design and apply for real time applications. (L1)
CO2	To Introduce different translation languages (L4)
CO3	Ability to understand the importance of code generation and code optimization. (L2)
CO4	To know about compiler generation tools and techniques (L2)
CO5	Design a simple compiler using the construction tools. (L5)

Mapping of Course Outcomes with Program Outcomes (Pos)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	1	1	2	2	2	2		
CO2	2	2	2	1	2	1	2	2	2	1	1	1
CO3	3	2	3	2	2	2	1	1	1		1	1
CO4	3	3	3	2	3	3	1					
CO5	3	3	3	2	3	2	1					

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	2	3	2	2
CO3	2	2	1	1
CO4	2	1	1	-
CO5	2	1	1	-

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
				✔					

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22008	PRINCIPLES OF COMPILER DESIGN	Ty	3	0/0	0/0	3

UNIT I- Introduction: **9 Hrs**

The structure of a compiler, The science of building a compiler, Programming language basics

Lexical Analysis:

The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of a Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers.

UNIT II – Syntax Analysis **9 Hrs**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar, Top-Down Parsing – General Strategies Recursive Descent Parser –FIRST and FOLLOW- -LL(1) grammars- Non Recursive Predictive Parser-Bottom Up Parsing – Shift Reduce Parser-LR Parser-LR (0) Item Construction of SLR Parsing Table - Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT III – Syntax-Directed Translation: **9 Hrs**

Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.

Intermediate-Code Generation:

Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Switch Statements.

UNIT IV- Run-Time Environments: **9 Hrs**

Storage Organization- Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection.

Code Generation:

Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.

UNIT V – Machine-Independent Optimization: **9 Hrs**

The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs.

Total Hours: 45

TEXT BOOKS: 1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (2007), Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India.

REFERENCE BOOKS:

1. Alfred V. Aho, Jeffrey D. Ullman (2001), Principles of compiler design, Indian student edition, Pearson Education, New Delhi, India.
2. Kenneth C. Louden (1997), Compiler Construction– Principles and Practice, 1st edition, PWS Publishing.
3. K. L. P Mishra, N. Chandrashekaran (2003), Theory of computer science- Automata Languages and computation, 2nd edition, Prentice Hall of India, New Delhi, India.

COURSE CODE **EBCS22011**	**COURSE NAME: ARTIFICIAL INTELLIGENCE**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- To gain a historical perspective of AI and its foundations.
- To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- The students will be able to solve problems using AI techniques.
- To develop new games using AI techniques.
- To guide the process of deducing information in a computational manner.

COURSE OUTCOMES (COs): Students will be able to

CO1	Illustrate different types of AI agents and searching strategies.
CO2	Discover to inference the knowledge and plan effectively.
CO3	Discuss the techniques used for game playing using various search algorithms.
CO4	Analyze various types of planning to create effective AI applications.
CO5	Classify various learning techniques.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
CO2	**3**	**3**	**1**	**1**	**3**	**3**	**2**	**1**	**3**	**2**	**1**	**3**
CO3	**2**	**3**	**2**	**2**	**3**	**3**	**1**	**1**	**3**	**3**	**1**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**
CO5	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**2**	**1**	**1**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**1**	**1**
CO2	**3**	**3**	**3**	**2**
CO3	**3**	**2**	**2**	**3**
CO4	**2**	**3**	**3**	**3**
CO5	**3**	**2**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22011	ARTIFICIAL INTELLIGENCE	Ty	3	0/0	0/0	3

UNIT I Introduction and Agents 9 Hrs

Introduction– History of AI-Intelligent agent –Structure of Agents– Problem solving agents - Uninformed search strategies-Searching with partial information.

UNIT IIIInformed Search Methods and Game Playing 9 Hrs

Informed search Strategies – A* Heuristic function – Hill Climbing search – Constraint Satisfaction problem - Optimal decisions in games – Pruning –Alpha-Beta pruning.

UNIT IIIKnowledge and Logic 9 Hrs

Knowledge based agent – The Wumpus world environment –Propositional Logic- First-order logic –Syntax and Semantics of FOL-Knowledge engineering process –Inference in FOL – Forward and backward chaining algorithm.

UNIT IVPlanning 9 Hrs

Planning Problem-Language of planning problems-Planning with state space search-Partial order planning-Planning graphs-Planning with propositional logic-Analysis of planning approaches.

UNIT VForms of Learning 9 Hrs

Inductive learning-Learning Decision trees-Ensemble Learning-Logical formulation of learning-Explanation based learning-Learning using relevance information.

Total Hours: 45

TEXT BOOKS:

1. Stuart R. Peter N. (2010) Artificial Intelligence A modern Approach, Prentice Hall
2. Elaine R. Kevin K. (2008) Artificial Intelligence Tata McGraw Hill

REFERENCE BOOKS:

1. *Tim Jones M. (2008) Artificial Intelligence, A System Approach(Computer Science)*
2. *Ben Coppin (2004) Artificial intelligence illuminated, Jones and Bartlett Learning*

COURSE CODE **EBCS22L07**	COURSE NAME: **OBJECT ORIENTED SOFTWARE ENGINEERING LAB**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: OBJECT ORIENTED PROGRAMMING WITH C++	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Design and implement complex software solutions using software engineering techniques
- Understand working knowledge of Unified Modeling Language (UML) Sources Control
- Identify Use Cases and develop Use Case Model
- Identify Conceptual Classes and develop a domain model with UML Class Diagram
- Understand the interaction between objects and represent them using UML Interaction Diagrams.

COURSE OUTCOMES (COs): Students will be able to

CO1	Analyze and design solutions for complex projects[L4]
CO2	Apply the appropriate notation to construct various UML Models[L3]
CO3	Understand the importance of Systems Analysis and Design in solving complex problems[L2]
CO4	Evaluate the difference between Object-Oriented Approach and Traditional Approach[L5]
CO5	Apply the role and function of each UML Model in developing object-oriented software[L3]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**3**	**1**	**2**	**1**	**1**	**2**	**3**	**2**	**2**	**3**
CO2	**2**	**3**	**1**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**1**	**3**
CO3	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**
CO4	**3**	**3**	**1**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**1**	**3**
CO5	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**3**	**2**
CO2	**3**	**3**	**3**	**3**
CO3	**2**	**3**	**2**	**2**
CO4	**1**	**2**	**1**	**3**
CO5	**2**	**1**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✓								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22L07	OBJECT ORIENTED SOFTWARE ENGINEERINGLAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Study of Case tools such as Rational Rose or Equivalent Tools
2. Student Result Management System
3. Inventory Control System
4. Railway Reservation System
5. Hotel Management System
6. Automating Banking Process
7. Library Management System
8. Passport Automation System
9. E-Ticketing

SOFTWARE REQUIRED:

Languages: C/C++/JDK 1.3, JSDK, WEB BROWSER & UML

Any Front End Tools (Like VB, VC++, Developer 2000)

Any Back End Tools (Like Oracle, MS-Access, SQL, DB2)

Modelling and Design: Rational Rose

Total Hours:45

SEMESTER V:

COURSE CODE **EBCS22012**	COURSE NAME: **BIG DATA ANALYTICS**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Data Base Management System	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to

- Identify Big Data and its Business Implications
- To understand and implement Haoop Distributed file system
- To introduce MongoDB for Distributed database applications
- To understand, use MapReduce and its usage in real time applications

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the Big Data Platform and its Use cases (L1)
CO2	Able to implement Apache Hadoop (L4)
CO3	Apply HDFS Concepts and Interfacing with HDFS (L3)
CO4	Understand Map Reduce Jobs (L2)
CO5	Understand Data Analytics with Cassandra& R. (L2)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	
CO2	**3**	**3**	**1**	**3**	**2**	**2**	**1**	**1**	**1**		**1**	
CO3	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**1**		**1**		
CO4	**2**	**3**	**3**	**2**	**2**	**1**						
CO5	**3**	**2**	**2**	**2**	**2**	**1**	**1**				**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**2**	**3**	**1**
CO2	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**3**	**1**
CO4	**2**	**2**	**2**	**2**
CO5	**3**	**2**	**3**	**2**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22012	BIG DATA ANALYTICS	Ty	3	1/0	0/0	4

UNIT I Introduction to Big Data and Hadoop 12 Hrs

Big Data overview – Types of Digital Data –Data preparation phase- Apache Hadoop – History of Hadoop – Analyzing Data with Hadoop - Hadoop Streaming – Analytical Architecture – Big data ecosystem - IBM Big Data strategy – Infosphere BigInsights and Big Sheets

UNIT II HDFS (Hadoop Distributed File System) 12 Hrs

HDFS Concepts – HDFS Architecture- HDFS Files – HDFS high availability- Analysing data with Hadoop – Hadoop Streaming – Hadoop echo System- Data flow – Types of NoSQL Databases comparison of SQL and NoSQL Data ingestion with Flume and Scoop- Hadoop archives- Hadoop I/O: Compression – Serialization – Avro – File based Data Structure

UNIT III Introduction to MongoDB and MapReduce Programming 12Hrs

MongoDB: Features – JSON – Generating a unique key – Data types –Terms used in RDBMS and MongoDB – MongoDB Query Language – Insert method – Arrays – Indexes – Mango Import – Mongo Export – **MapReduce:** Mapper – Reducer – combiner – Partitioner – Searching – Sorting - compression

UNIT IV Introduction to Hive and Pig 12 Hrs

Hive: Introduction – Hive Architecture – Data types – File Formats – Hive Query Language Statements- Partitions – Bucketing – Views - Sub Query – joins - Aggregations – Group by Having – Hive user defined function – Serialization and Deserialization **Pig:** Primitive Data Types – Running Pig – Execution Modes of Pig – HDFS commands – Relational Operators – Eval Function - Complex Data Types – Piggy Bank – User defined functions – Parameter Substitution

UNIT V Introduction to Cassandra 12 Hrs

Apache Cassandra – Introduction – Features of Cassandra – Peer to Peer Networks – Gossip and failure detection – Partitioner - Replication Factor – Anti-Entropy and Read Repair – writes in Cassandra.
Analytics with R – Big Data Analytics with BigR

Total Hours: 60

TEXT BOOKS:

1. Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley Publication, 2015
2. Tom White " Hadoop: The DefintiveGudie 4th Edition, O'Reilly, 2015

REFERENCE BOOKS:

1. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
2. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013
3. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012

COURSE CODE: **EBCS22010**	COURSE NAME: **WEB DESIGNING USING PHP / MYSQL**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: JAVA PROGRAMMING	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Remember about HTML, CSS3, PHP and XML concepts
- Understand the installation process and work with MySQL database.
- Design the basic and advanced applications using PHP and MySQL.
- Study about the concept of Web services.

COURSE OUTCOMES (COs) : Students will be able to

CO1	Remember the fundamentals of HTML, CSS and PHP[L1]
CO2	Learn the database concepts and MySQL[L1]
CO3	Understand the skills that will enable to design and build high level web enabled applications[L2]
CO4	Apply the concept of the serverside programming to develop the application on web pages[L3]
CO5	Acquaint the latest programming language for the concepts of web services [L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	2	2	3	2	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	2	3
CO3	3	3	3	1	3	2	1	3	3	3	3	3
CO4	3	3	3	2	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	1	3	2	3	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	2	3	3
CO4	3	2	3	3
CO5	3	2	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✓								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22010	WEB DESIGNING USING PHP / MYSQL	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO HTML AND PHP 9 Hrs

Introduction to Web server and Web browser - HTML – forms – frames – tables – web page design – Dynamic HTML – introduction – cascading style sheets – object model and collections –event model – filters and transition – data binding – data control - Introduction to PHP-- Lexical structure -Variable function, - Manipulating and searching strings-Arrays

UNIT II XML 9 Hrs

Role of XML - XML and the Web - XML Language Basics - Revolutions of XML - Service Oriented Architecture (SOA). XML - Name Spaces - Structuring with Schemas and DTD - Presentation Techniques - Transformation - XML Infrastructure- Overview of SOAP- Introduction to SGML - COM – DCOM – CORBA

UNIT III SERVER SIDE PROGRAMMING 9 Hrs

Introduction to Servlets and Java Server Page (JSP), Servlets lifecycle, Servlet Classes and Sessions.JSP Application Design, JSP objects, sharing data between JSP pages, Sharing Session and Application Data, Database Programming using JDBC, development of java beans in JSP.

UNIT IV DATABASES AND GRAPHICS USING PHP 9 Hrs

Using PHP to access Database – Relational Databases and SQL – MySQLi Object interface – SQLite-Direct file level manipulation – mongoDB.Embedding an image in a page – Basic Graphic concepts – Creating and drawing images.

UNIT V WEB SERVICES 9 Hrs

Overview - Architecture - Technologies - UDDI - WSDL - ebXML -. File Handling in PHP-file uploads – file access

Total Hours: 45

TEXT BOOKS:

1. Richard Clark, Oli Studholme, Christopher Murphy and DivyaManian," Beginning HTML5 and CSS 3" @ Apress , 2012.
2. Frank. P. Coyle, "XML, Web Services and The Data Revolution", Pearson Education, 2002.
3. Kevin Tatroe, Peter MacIntyre, etal"Programming PHP" O REILLY 3rd Edition – 2013
4. Luke Welling, Laura Thomson "PHP and MySQL Web Development" Person Education 5th Edition – 2016.

REFERENCE BOOKS:

1. Robin Nixon "Learning PHP, MySQL & JavaScript" O REILLY – 5th Edition - 2015.
2. Laura Lemay, Rafe Coburn, Jennifer Kyrnin, "Mastering HTML, CSS & JavaScript Web Publishing", Pearson Education.2015 Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.

COURSE CODE **EBCS22014**	COURSE NAME: **CLOUD COMPUTING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Computer Networks	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Identify the technical foundations of cloud systems architectures.
- Analyze the problems and solutions to cloud application problems.
- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance.

COURSE OUTCOMES (COs) : Students will be able to

CO1	Understand the fundamental principles of cloud computing. [L2]
CO2	Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing. [L2]
CO3	Analyze the performance of Cloud Computing. [L4]
CO4	Learn the Concept of Cloud Infrastructure Model. [L1]
CO5	Understand the concept of Cloud Security. [L2]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**3**
CO3	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO5	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22014	CLOUD COMPUTING	Ty	3	1/0	0/0	4

UNIT I-FOUNDATION **12 Hrs**

Introduction to Cloud Computing, Migrating into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, The Enterprise Cloud Computing Paradigm

UNIT II-INFRASTRUCTURE AS A SERVICE (IAAS) **12 Hrs**

Virtual Machines Provisioning and Migration Services, On the Management of Virtual Machines for Cloud Infrastructures, Enhancing Cloud Computing Environments Using a Cluster as a Service, Secure Distributed Data Storage in Cloud Computing

UNIT III-PLATFORM AND SOFTWARE AS A SERVICE (PAAS/IAAS) **12 Hrs**

Aneka—Integration of Private and Public Clouds, CometCloud: An Autonomic Cloud Engine, T-Systems' Cloud-Based Solutions for Business Applications, Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments, TheMapReduce Programming Model and Implementations

UNIT IV-MONITORING AND MANAGEMENT **12 Hrs**

An Architecture for Federated Cloud Computing, SLA Management in Cloud Computing: A Service Provider's Perspective, Performance Prediction for HPC on Clouds

UNIT V-APPLICATIONS **12 Hrs**

Best Practices in Architecting Cloud Applications in the AWS Cloud, Massively Multiplayer Online Game Hosting on Cloud Resources, Building Content Delivery Networks Using Clouds, Resource Cloud Mashups

Total Hours: 60

TEXT BOOKS:

1.Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, eds. *Cloud computing: Principles and paradigms*. John Wiley & Sons, 2010.

REFERENCE BOOKS:

1.Voorsluys, William, James Broberg, and RajkumarBuyya. "Introduction to cloud computing." *Cloud computing: Principles and paradigms* (2011): 1-44.

2.Shawish, Ahmed, and Maria Salama. "Cloud computing: paradigms and technologies." *Inter-cooperative collective intelligence: Techniques and applications*. Springer, Berlin, Heidelberg, 2014. 39-67.

3.Birje, Mahantesh N., et al. "Cloud computing review: concepts, technology, challenges and security." *International Journal of Cloud Computing* 6.1 (2017): 32-57

COURSE CODE: EBCS22L08	**WEB DESIGN USING PHP& MYSQL LAB**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite:C PROGRAMMING AND MS OFFICE TOOLS	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

The students should be made to

- Develop an own web site.
- Understand the knowledge to design webpage using CSS.
- Gain knowledge to design a dynamic web site
- Develop a form based communication with Databases.

COURSE OUTCOMES (COs): Students will be able to

CO1	Design a webpage using various html tags[L6]
CO2	Remember the functions in PHP[L1]
CO3	Understanding the concept of CSS to develop interactive web pages[L2]
CO4	Able to learn and develop to design form handling[L6]
CO5	Create applications using different types of web services and frameworks[L6]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**2**
CO3	**2**	**3**	**3**	**3**
CO4	**2**	**1**	**2**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔					✔			

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22L08	**WEB DESIGNUSING PHP &MYSQL LAB**	**Lb**	**0**	**0/0**	**3/0**	**1**

LISTOF EXPERMENTS:

1. Create a web page which includes the following using HTML
   a) Import an Image,
   b) Include Check box, Radio Button,
   c) Use href tag
2. Create a web page which includes the following using HTML
   a) Create a table,
   b) Include the types of List
   c) Use hover tag
3. Generate the Fibonacci series using PHP user-defined function.
4. Apply any two PHP sort functions each on an indexed array and an associative array.
5. Create a web page with the following using HTML
   i) To embed an image map in a web page
   ii) To fix the hot spots
   iii) Show all the related information when the hot spots are clicked.
6. Create a web page with all types of Cascading style sheets.
7. Client Side Scripts for Validating Web Form Controls using DHTML
8. Form Handling in PHP- Create a recruitment website where a job seeker can upload his/her details (ex naukri)
9. Create an Employee database with two fields Employer's Name, Employee's Name with MySql and insert two records into those fields using PHP code.
10. Develop a webpage using scripting languages with the help of CSS

Total Hours:45

SEMESTER VI:

COURSE CODE **EBCS22015**	COURSE NAME: **MACHINE LEARNING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Artificial Intelligence	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- understand the need for machine learning for various problem solving
- Known the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- understand the latest trends in machine learning
- design appropriate machine learning algorithms for problem solving

COURSE OUTCOMES (COs): Students will be able to	
CO1	Understand various machine learning algorithms and terminologies and perform data pre-processing[L2]
CO2	Apply appropriate supervised learning algorithms to design predictive models to solve any given problem[L3]
CO3	Apply appropriate unsupervised learning algorithms and develop applications for performing clustering and dimensionality reduction[L3]
CO4	Evaluate the solutions for complex problems using artificial neural networks and kernel machines[L5]
CO5	Understand and apply probabilistic graphical models for suitable applications[L2]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**1**	**3**	**2**	**1**	**1**			**1**	**1**
CO2	**3**	**3**	**3**	**3**	**3**	**1**	**1**				**1**	**1**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**1**			**1**	**1**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**1**				**1**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**	**1**				**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**1**	**1**	**3**
CO2	**3**	**2**	**2**	**2**
CO3	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				√								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22015	**MACHINE LEARNING**	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION TO MACHINE Learning **9 Hrs**

Machine Learning Fundamentals –Types of Machine Learning - Supervised, Unsupervised,Reinforcement- The Machine Learning process. Terminologies in ML- Testing ML algorithms: Overfitting, Training, Testing and Validation Sets-Confusion matrix -Accuracy metrics- ROC Curve- Basic Statistics: Averages, Variance and Covariance, The Gaussian- The Bias-Variance trade off- Applications of Machine Learning.

UNIT II: SUPERVISED LEARNING **9 Hrs**

Regression: Linear Regression – Multivariate Regression- Classification: Linear Discriminant Analysis, Logistic Regression- K-Nearest Neighbor classifier. Decision Tree based methods for classification and Regression- Ensemble methods.

UNIT III: UNSUPERVISED LEARNING **9 Hrs**

Clustering- K-Means clustering, Hierarchical clustering - The Curse of Dimensionality –Dimensionality Reduction - Principal Component Analysis - Probabilistic PCA- Independent Components analysis

UNIT IV: ARTIFICIAL NEURAL NETWORKS AND KERNEL MACHINES **9 Hrs**

Perceptron- Multilayer perceptron- Back Propagation – Initialization, Training and Validation Support Vector Machines (SVM) as a linear and non-linear classifier - Limitations of SVM

UNIT V: PROBABILISTIC GRAPHICAL MODELS **9 Hrs**

Bayesian Networks - Learning Naive Bayes classifiers-Markov Models – Hidden Markov Models Sampling – Basic sampling methods – Monte Carlo -Reinforcement Learning

Total Hours: 45

TEXT BOOKS

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009.
3. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, Pearson Education, 2018.
4. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2011.

REFERENCE BOOKS

1. Andreas C. Muller, “Introduction to Machine Learning with Python: A Guide for Data Scientists”, O'Reilly,2016.
2. Sebastian Raschka, “Python Machine Learning”, Packt Publishing, 2015.

COURSE CODE: EBCC22ID2	COURSE NAME: PRINCIPLES OF MANAGEMENT AND BEHAVIORAL SCIENCE	Ty/Lb/ ETL/IE	L	T/S Lr	P/R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L:LectureT:Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits

T/L/ETL/IE:Theory/Lab./EmbeddedTheoryandLab./Internal Evaluation

OBJECTIVE: The students should be made to

- About the evolution, functions and principles of Management Studies
- The applications of the principles in an organization
- The system and process of effective controlling in the organization.

COURSEOUTCOMES(COs): Students will be able to

CO1	Clear understanding in planning, and have knowledge in aspect of Management Studies (Level 2)
CO2	Understanding the planning process in the organization. (Level 2)
CO3	Understanding the concept of organization. (Level 2)
CO4	Demonstrate the ability to directing and coordinating. (Level 3)
CO5	Analyze and formulate the best control methods. (Level 4)

MappingofCourseOutcomes(COs)withProgramOutcomes(POs)&ProgramSpecificOutcomes(PSOs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3		2		3	3	2	3	2
CO2	3	2	2	3		2		3	2	3		2
CO3	3			2			3	2		2	2	2
CO4	3	3	3	3		2		2	2	2	2	2
CO5	2	3	3		3	3	3	2	3	2	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1		2	3	3
CO2		2	3	3
CO3		2	3	3
CO4		2	3	3
CO5		2	3	3

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓					

COURSE CODE:	COURSE NAME: PRINCIPLES OF MANAGEMENT AND BEHAVIORAL SCIENCE	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22ID2	Prerequisite: Nil	Ty	3	0/0	0/0	3

UNIT- I INTRODUCTION **9 hours**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and responsibilities – Evolution of Management –need and Importance of Organizational Behavior, Leadership styles – Theories – Leaders Vs Managers.

UNIT –II PLANNING & ORGANISING **9 hours**

Nature and purpose of planning – planning process – types of planning – Planning premises objectives –hierarchy of objectives, Management By Objectives (MBO)— Decision making process. Nature and purpose of Formal and informal organization structure– types – Line and staff authority– delegation of authority – centralization and decentralization.

UNIT-III STAFFING AND COORDINATING **9 hours**

Human Resource Planning, Job Analysis, Recruitment, Selection, Training and Development, Performance Management, Career planning. Coordination –Nature and purpose - Coordination at various levels: Top management, Middle management, Supervisory management and workers. Techniques for effective coordination

UNIT- IV DIRECTING AND CONTROLING **9 hours**

Direction: Principles of direction – Need and Importance for directing, process of controlling – budgetary and non-budgetary control techniques – use of technology. Recent Trends in Management controlling.

UNIT-V GROUP BEHAVIOUR AND MOTIVATION **9 hours**

Group Dynamics - How Groups Work, Stages of Group Development, Team building, Motivation – Theories of motivation Organizational Conflict – Causes – Types of Conflicts, Managing conflicts.

Total Hours: 45

Reference Books:

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, “Fundamentals of Management” 7th Edition, Pearson Education,2011.
2. Robert Kreitner& Mamata Mohapatra, “Management”, Biztantra,2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata Mc Graw Hill,1998.
4. S.S. Khanka - Organizational Behaviour - S. Chand Ltd. – 2006.
5. L.M.Prasad - Organizational Behaviour. S. Chand Company – 3rd edition – 2004.

COURSE CODE **EBCS22L09**	COURSE NAME: **Data Analytics Lab using Machine Learning Algorithms**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Artificial Intelligence	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to
- Implement Big Data Analytics Problems

COURSE OUTCOMES (COs): Students will be able to

CO1	Explore the Big Data Platform Hadoop and its Use cases (L4)
CO2	Implement and demonstrate various algorithms using Hadoop (L5)
CO3	Exposure on Big data Analytics problems. (L3)
CO4	Explore and implement Map Reduce Jobs (L4)
CO5	Exposure to Decision Tree based ID3 problems (L3)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**1**	**1**	**1**		**1**
CO2	**1**	**3**	**1**	**2**	**3**	**2**	**2**	**1**	**1**	**1**		
CO3	**3**	**2**	**3**	**3**	**3**	**2**	**1**		**1**		**1**	
CO4	**3**	**2**	**3**	**2**	**2**	**2**	**1**					
CO5	**2**	**3**	**2**	**2**	**2**	**2**	**1**					

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**3**	**2**
CO2	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**2**	**1**
CO4	**2**	**1**	**1**	**2**
CO5	**3**	**2**	**2**	**1**

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔					✔			

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22L09	**Data Analytics Lab using Machine Learning Algorithms**	Lb	0	0/0	3/0	1

List of Experiments

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Start-up scripts, Configuration files.

2. Hadoop Implementation of file management tasks, such as Adding files and directories, Retrieving files and Deleting files

3. Implement of Matrix Multiplication with Hadoop Map Reduce

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

5. Implementation of K-means clustering using Map Reduce

6. Implement and demonstrate theFIND-S Algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a CSV file.

7. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

8. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

9. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

10. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Total Hours:45

COURSE CODE: **EBCS22I05**	COURSE NAME: **PROJECT PHASE - I**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: NIL	IE	0	0/0	3/3	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL /IE: Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:
The students should be made to

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : Students will be able to

CO1	Apply the knowledge and skills acquired in the course of study, addressing a specific problem or issue.
CO2	Design the software system effectively
CO3	Encourage students to think critically and creatively about societal issues and develop user friendly solution.
CO4	Support the field experience and get linked with the professional network.
CO5	Equip the students with industry knowledge and understanding of various possible technologies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
CO5	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**1**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**2**	**2**	**2**	**2**
CO5	**3**	**2**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
									✔			

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22I05	PROJECT PHASE – I	IE	0	0/0	3/3	2

OBJECTIVE:

B. Tech CSE Project carries 12 credits of which, Phase I carries 2 credit.

In Phase I, Students are expected to

i. Identify a Problem.

ii. Have the feasibility explored.

iii. Freeze the Requirement specification (both user and system).

iv. Construct the architectural model (as many as required).

v. Design the solution.

vi. If possible, publish the Feasibilty study as a survey paper

DESCRIPTION:

Students are expected to do the Project in a group of 3 to 4 students. They should identify the area/topic of the Project and should collect the literatures related to the project. Students intending to do Industrial projects will approach the industries with the support of the university, identify the industrial problem and finalize the project. In case of Industrial projects apart from Industry guide, a guide has to be appointed by the department. At the end of the Semester the students should submit their Project Phase - I report to the Department and Viva -Voce examination will be conducted by the examiners duly appointed by the Head of the department.

Total Hours:45

SEMESTER VII :

COURSE CODE: EBCS22L11	**COURSE NAME : PROJECT PHASE – II**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite:Project Phase I	**Lb**	**0**	**0/0**	**12/12**	**8**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL /IE: Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:
The students should be made to

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs): Students will be able to

CO1	To explain the functionality of the system
CO2	To express proficiency in handling the technologies
CO3	To support the societal problems
CO4	To summarize the innovative ideas with good documentation
CO5	To validate the implementation of the software/Hardware system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
CO5	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**1**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**2**	**2**	**2**	**2**
CO5	**3**	**2**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
									✔			

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22L11	**PROJECT PHASE – II**	**Lb**	**0**	**0/0**	**12/12**	**8**

OBJECTIVE:

Students are expected to carry out the following:

(i) Implement the Design using suitable technologies.

(ii) Generate the test cases.

(iii) Demonstrate the solution with suitable user interface.

(iv) Prepare a project report consolidating the phase-I and II activities.

DESCRIPTION:

To make the students to make use of the knowledge and skill developed during their four years of study and to apply them for making an innovative product/process for the development of society and industries.Students are expected to do a Project work either in an Industry or at the University in the field of relevant Engineering /inter-disciplinary /multi-disciplinary area in a group of 3 or 4 students. The work to be carried out in Phase II should be continuation of Phase I. Each group will be allotted a guide based on the area of Project work. In case of industrial Project external guide has to be allotted from Industry. Inter disciplinary/multi-disciplinary project can be done with students of different disciplines as a group. Monthly reviews will be conducted during the semester to monitor the progress of the project by the project review committee. Students have to submit the Project thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by the examiners duly appointed by the Controller of Examination. In case of industrial project certificate in proof has to be included in the report along with the bonofide certificate.

Total Hours:45

ELECTIVE-I

COURSE CODE: **EBCS22E01**	COURSE NAME: **IMAGE PROCESSING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite:Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- To Lean the image fundamentals and mathematical transforms necessary for image processing.
- To Learn the image enhancement and frequency domain of various transform
- To Learn image restoration procedures.
- To Learn the image segmentation and representation techniques
- To Learn the image compression procedures

COURSE OUTCOMES (COs) : Students will be able to

CO1	To understand properties of digital image and its fundamentals (L1)
CO2	Apply image enhancement and Analyze images in the frequency domain (L3)
CO3	Apply image restoration techniques (L3)
CO4	Apply segmentation method and detect boundary region of an image (L3)
CO5	Able to improve the quality of an image (L4)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	
CO2	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**				**1**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**2**		**1**			
CO4	**2**	**2**	**2**	**1**	**2**	**2**	**2**		**1**			
CO5	**3**	**3**	**2**	**2**	**2**	**1**	**2**		**1**		**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**1**	**3**
CO3	**2**	**3**	**2**	**3**
CO4	**2**	**3**	**1**	**2**
CO5	**3**	**3**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSENAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E01	IMAGEPROCESSING	Ty	3	0/0	0/0	3

UNIT I Digital Image Fundamentals 9 Hrs

Digital image representation-Fundamental steps in image processing -Elements of digital image processing systems, Digital Image Fundamentals - Elements of visual perception-A simple image model -Sampling and quantization - Some basic relationship between pixels-Imaging geometry -2D Transformations-DFT, DCT, KLT and SVD.

UNIT II IMAGE ENHANCEMENT 9 Hrs

Background -Enhancement by point Processing -Enhancement in the frequency domains - Spatial Domain: Gray level transformations: Histogram Processing, Spatial filtering, Image Smoothing, Image Sharpening. - Color image processing. Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION 9 Hrs

Image Restoration: -Algebraic approach to restoration- degradation model, Properties,Noise models –Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener - Interactive Restoration.

UNIT IV IMAGE SEGMENTATION 9 Hrs

Images Segmentation: Detection of discontinuous, Edge linking and boundary detection - Thresholding - Region - Oriented segmentation – The use of motion in segmentation. Morphological image processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphologic algorithms.

UNIT V Image Compression & Object Recognition 9 Hrs

Fundamentals -image Compression models -Elements of information Theory - Error-free Compression - Lossy Compression - Image Compression standards. Object Recognition: Patterns and patterns classes, recognition based on decision–theoretic methods, matching, optimum statistical classifiers, neural networks, structural methods – matching shape numbers, string matching

Total Hours: 45

TEXT BOOKS:

Digital Image Processing, RafealC.Gonzalez, Richard E.Woods, Second Edition, Pearson Education/PHI.

REFERENCE BOOKS:

1. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning.

2.Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology

3. Computer Vision and Image Processing, Adrian Low, Second Edition, B.S.Publications

4. Digital Image Processing using Matlab, RafealC.Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education.

COURSE CODE: EBCS22E02	COURSE NAME: Geographical Information Systems	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL /IE: Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

The students should be made to:

- The students will be able to design, explore, interpolate and analyze GIS models
- To create a new geo coding technique and apply the learnt GIS modeling for a real time case study.

COURSE OUTCOMES (COs) : Students will be able to	
CO1	Able to apprehend GIS concepts (L2)
CO2	Understand the various GIS models (L1)
CO3	Apply the learnt GIS models in real time application (L3)
CO4	To analyze the various GIS techniques (L4)
CO5	To apply the new geo coding technique for real time case study(L3)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	3	3		2	2		
CO2	2	2	2	2	2	2	2		2	1		
CO3	3	2	3	3	2	3	2	2	1	2		1
CO4	3	1	2	3	3	2	2		2	1	1	1
CO5	3	3	3	2	2	2	1	2	2	1	1	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2
CO2	2	2	1	1
CO3	2	1	1	2
CO4	2	1	2	1
CO5	2	2	2	2

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E02	GEOGRAPHICAL INFORMATION SYTEMS	Ty	3	0/0	0/0	3

OBJECTIVES:

- The students will be able to design, explore, interpolate and analyze GIS models
- To create a new geo coding technique and apply the learnt GIS modeling for a real time case study.

UNIT I BASIC CONCEPTS 9 Hrs

Introduction - History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – Coordinate Systems - Vector Data Model - Raster Data Model.

UNIT II DATA ACQUISTION & MANIPULATION 9 Hrs

GIS Data Acquisition - Geometric Transformation - Spatial Data Editing - Attribute Data Input and Management - Data Display and Cartography.

UNIT III DATA ANALYSIS 9 Hrs

Data Exploration - Vector Data Analysis tools- Raster Data Analysis tools - Terrain Mapping and Analysis - Viewsheds and Watersheds.

UNIT IV INTERPOLATION &MODELLING 9 Hrs

Spatial Interpolation - Geocoding and Dynamic Segmentation - Path Analysis and Network Applications - GIS Model and Modelling

UNIT V APPLICATIONS 9 Hrs

GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies.

Total Hours: 45

TEXT BOOK:

1. Kang-tsung Chang (2015), *Introduction to Geographic Information Systems*, (8th ed.), Mcgrawhill ISBN 0078095131, 9780078095139

REFERENCE BOOKS:

1. Prithvish Nag And Smita Sengupta, Introduction To Geographical Information Systems, Concept Publishing Company, 2007, ISBN 8180694399, 9788180694394
2. Paul Longley, Geographical information systems, 2/e, Wiley, 1999,Digitised 2007, ISBN - 0471321826, 9780471321828

COURSE CODE:	COURSE NAME: **DATABASE TUNING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
EBCS22E03	Prerequisite: DBMS	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- The students will be able to tune the databases for different data base applications
- To develop case studies in data bases, and able to troubleshoot the data bases
- Identify the critical performance tuning steps

COURSE OUTCOMES (COs): Students will be able to	
CO1	Remember the concepts of DBMS[L1]
CO2	Understand the fundamentals of Tuning. [L2]
CO3	Analyze the databases for different Applications[L4]
CO4	Apply the Troubleshoot ideas in the data bases [L3]
CO5	Develop Applications and Case Studies in data bases. [L6]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**3**	**2**
CO2	**1**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**3**
CO4	**2**	**2**	**2**	**1**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E03	DATABASE TUNING	Ty	3	0/0	0/0	3

UNIT I Fundamentals of Tuning 9 Hrs

Review of Relational Databases – Relational Algebra - Locking and Concurrency Control – Correctness Consideration – Lock Tuning – Logging and the Recovery Subsystem – Principles of Recovery – Tuning the Recovery Subsystem – Operating Systems Considerations – Hardware Tuning

UNIT II Indexing and Hashing 9 Hrs

Types of Queries – Data Structures – B tree – B+ Tree - Hash Structures – Bit Map Indexes – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Hot Tables – Comparison of Indexing and Hashing Techniques

UNIT III Query Optimization 9 Hrs

Techniques - Tuning Relational Systems – Normalization – Tuning De-normalization – Clustering Two Tables – Aggregate Maintenance – Record Layout – Query Tuning – Triggers – Client Server Mechanisms – Objects, Application Tools and Performance – Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases

UNIT IV Troubleshooting 9 Hrs

Query Plan Explainers – Performance Monitors – Event Monitors – Finding ―Suspicious‖ Queries – Analyzing a Query ‘s Access Plan – Profiling a Query Execution – DBMS Subsystems

UNIT V Interface and Connectivity Tuning 9Hrs

Objects, Application Tools and Performance –Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases – ODBC – JDBC Tuning ― Case Studies: Tuning E Commerce Application– Data Warehouse Tuning – Transaction Chopping

TOTAL HOURS: 45

TEXT BOOKS:

1. Dennis Shasha and Philippe Bonnet (2005) Database Tuning, Principles, Experiments, and Troubleshooting Techniques, Elsevier
2. Thomas Connoly and CarlolynBegg (2009) Database Systems, A Practical Approach to Design, Implementation and Management, (4th ed.) Pearson Education

REFERENCES:

1. Peter Gulutzan and Trudy Pelzer, ―SQL Performance Tuning, Addison-Wesley, First Edition, 2002.

COURSE CODE **EBCS22E04**	COURSE NAME: **COMPONENT BASED TECHNOLOGY**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Internet Programming	Ty	3	0	0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

1. Study in depth JAVA, CORBA and .Net Components
2. Implement Fundamental properties of components, technology and architecture and middleware.
3. Understand Component Frameworks and Development.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the fundamentals of software components and their architecture (L1)
CO2	Develop a Java Thread and Create a bean for an application (L5)
CO3	Develop and Implement CORBA Based Technology Component (L5)
CO4	Apply .NET Based Technology Component for s/w development (L3)
CO5	Analyze Component Based connectors, development and testing Tools (L4)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**1**
CO2	**3**	**2**	**3**	**1**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	
CO3	**3**	**2**	**3**	**2**	**3**	**1**	**1**	**2**	**2**	**3**	**3**	
CO4	**3**	**2**	**1**	**2**	**3**	**1**		**2**	**2**	**3**	**2**	
CO5	**2**	**3**	**1**	**2**	**3**	**1**		**2**	**1**	**2**	**2**	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**2**	**1**	**1**
CO2	**3**	**3**	**1**	**2**
CO3	**3**	**3**	**2**	**3**
CO4	**2**	**3**	**2**	**3**
CO5	**1**	**3**	**2**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E04	COMPONENT BASED TECHNOLOGY	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION 9Hrs

Software Components – objects – fundamental properties of Component technology – modules – interfaces – callbacks – directory services – component architecture – components and middleware

UNIT II JAVA BASED COMPONENT TECHNOLOGIES 9Hrs

Threads – Java Beans – Events and connections – properties – introspection – JAR files – reflection – object serialization – Enterprise Java Beans – Distributed Object models – RMI and RMI-IIOP

UNIT III CORBA COMPONENT TECHNOLOGIES 9Hrs

Java and CORBA – Interface Definition language – Object Request Broker – system object model – portable object adapter – CORBA services – CORBA component model – containers – application server – model driven architecture

UNIT IV NET BASED COMPONENT TECHNOLOGIES 9Hrs

COM – Distributed COM – object reuse – interfaces and versioning – dispatch interfaces – connectable objects – OLE containers and servers – Active X controls – .NET components – assemblies – appdomains – contexts – reflection – remoting

UNIT V COMPONENT FRAMEWORKS AND DEVELOPMENT 9Hrs

Connectors – contexts – EJB containers – CLR contexts and channels – Black Box {PAGE } component framework – directory objects – cross-development environment – component-oriented programming – Component design and implementation tools – testing tools – assembly tools.

Total Hours:45

TEXT BOOK

1. Clemens‖Szyperski,‖,Component‖Software: Beyond Object-Oriented Programming‘,‖Pearson‖Education‖publishers,‖2013

REFERENCES

1. Ed‖Roman,‖,Mastering‖Enterprise‖Java‖Beans‘,‖John‖Wiley‖&‖Sons‖Inc.,‖2012.
2. Mowbray,‖,Inside‖CORBA‘,‖Pearson‖Education,‖2013.
3. Freeze,‖,Visual‖Basic‖Development‖Guide‖for‖COM‖&‖COM+‘,‖BPB‖Publication,‖ 2011. 4. Hortsamann,‖Cornell,‖,CORE‖JAVA Vol-II‘‖,‖Sun‖Press,‖2012.

COURSE CODE: EBCS22E05	COURSE NAME: **E-COMMERCE**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand the nature of e-Commerce
- Recognize the business impact and potential of e-Commerce
- To Learn the E-Commerce Platform and its concepts
- To Understand the Technology, infrastructure and Business in E-Commerce
- To Understand the Security and Challenges in E-Commerce
- To Build an Own E-Commerce using Open Source Frameworks

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the concepts of E-commerce business models and strategy (L2)
CO2	Able to implement infrastructure for E-commerce and various services (L5)
CO3	Design and apply various protocols for wireless devices for M-commerce (L5)
CO4	Able to classify the technologies of Mobile commerce (L4)
CO5	Design and develop an E-Commerce model for enterprise (L5)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**1**				**1**
CO2	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**1**	**1**		**1**	
CO3	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	
CO4	**3**	**3**	**2**	**3**	**2**	**2**	**2**		**1**			
CO5	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**1**	**1**

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**1**	**1**	**1**
CO2	**2**	**2**	**2**	**2**
CO3	**2**	**1**	**1**	**1**
CO4	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S. Lr	P/R	C
EBCS22E05	**E-COMMERCE**	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT I Introduction 9 Hrs

History of E-Commerce -E-Commerce Vs E-Business-Emergence of the Internet- Advantages-Disadvantages- Business model- E –Business Models based on the relationship of Transaction Parties- E –Business Models based on the relationship of Transaction Types- Technologies of World Wide Web- Internet Client Server Applications- Networks and Internets-Software Agents-Internet Standards and Specification-Internet Service Provider-Markup Language and the web-JavaScript-XML-Intranets and Extranets.

UNIT II E-Marketing 9 Hrs

Identifying Web Presence Goals- The Browsing Behaviour Model-Online Marketing-E-Advertising-Internet Marketing Trends-Targets Markets-E-Branding-Marketing Strategies E-Security: Security on the Internet-E- Business Risk Management Issues-E-Payment Systems: Digital Token based e-payment System-Classification of New Payment System- Electronic Cash-Risk and E-Payment System-Designing E-paymentSystem- Digital Signature.

UNIT III E-Customer Relationship Management 9 Hrs

CRM-ECRM Solutions- ECRM Toolkit-Typical Business Touch point. E-Supply Chain Management-Supply Chain Management- Supply chain Management for Various Industries- E-Strategy and Knowledge management.

UNIT IV Mobile Commerce 9 Hrs

Information System for Mobile Commerce-Mobile Payments-Cellular Networks-Different Generations in wireless Communication- Technologies for mobile Commerce-WAP Programming Model. Portals for E-Business: Portals- Requirements of Intelligent Websites, Ethical, Social,Political issues in E-Commerce.

UNIT V Applications 9 Hrs

Plan your Business and create a web Site with wordpress.B2B ,B2C models of E-commerce.

Business model of any E-commerce website Mini project develop E-Commerce projects

Total Hours: 45

TEXT BOOK:

1. P.T. Joseph, S.J. (2015),E-Commerce Indian Perspective Fifth Edition, PHI Learning

2. Kenneth C.Laudon,Carol Guercio Traver-E-Commerce,Pearson,10th Edition,2016

REFERENCE BOOKS:

1. *Zheng Qin(2009), Introduction to E-Commerce,Springer.*
2. *MamtaBhusry,E-Commerce, Laxmi Publications PVT Ltd.*

COURSE CODE EBCS22E06	COURSE NAME: COMPUTER GRAPHICS AND MULTIMEDIA	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand the output primitives, two dimensional graphics and their transformations.
- Understand the three dimensional graphics and their transformations.
- Understand illumination and color models
- Learn to create animations
- To become familiar with Blender Graphics

COURSE OUTCOMES (COs) : Students will be able to

CO1	Understand the various output primitives, transform geometrical structures and different shading, colour models[L2]
CO2	Understand and apply 2D transformations, viewing and clipping techniques [L2]
CO3	Apply the 3D objects concepts and projections and solving numerical problems on 3D transformation and polygon rendering methods[L3]
CO4	Understand the architecture, compression, decompression and different file formats involved in multimedia[L2]
CO5	Design and analyze basic shapes using Blender [L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO10	PO11	PO12
CO1	3	3	1	1	2	1	1	1	1	1		
CO2	3	3	2	3	2	1	1	1	1	1		
CO3	3	3	2	3	2	1	1	1	1	1		
CO4	2	2	3	2	2	1	1	1	1	1		
CO5	2	2	3	2	2	1	1	1	1	1		

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1
CO2	2	2	1	1
CO3	2	1	1	1
CO4	3	1	1	1
CO5	3	2	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and	Program	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E06	COMPUTER GRAPHICS AND MULTIMEDIA	Ty	3	0/0	0/0	3

UNIT I BASICS OFCOMPUTER GRAPHICS AND COLOUR MODELS 9Hrs

Output primitives-Line drawing algorithms-Loading the frame buffer-Line function-Circle generation algorithms –Ellipse generation algorithms- Attributes of output primitives-Basic illumination models — halftone patterns and dithering techniques; Properties of light — Standard primaries and chromaticity diagram; Intuitive color concepts — RGB colour model — YIQ colour model — CMY colour model - colour selection

UNIT II TWO DIMENSIONAL GRAPHICS 9 Hr

Two dimensional transformations- Matrix representations and homogeneous coordinates - Composite transformations – two dimensional viewing -Window to view port transformation - Clipping operations - Point clipping - Line clipping (Cohen - Sutherland line Clipping) - Polygon clipping(Sutherland - Hodgeman algorithm) –Numerical problem solving and programming on two dimensional transformation ,viewing and clipping

UNIT III THREE DIMENSIONAL GRAPHICS 9 Hrs

Three dimensional concepts - Three dimensional object representation -Three Dimensional Transformations - Visible surface detection methods (Back Face Detection - Depth Buffer Method - Scan Line Method) - Numerical problem solving and programming on three dimensional transformations

UNIT IV MULTIMEDIABASISANDTOOLS 9 Hrs

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

UNIT V HYPERMEDIA 9 Hrs

Multimedia authoring and user interface — Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems. CASE STUDY: BLENDER GRAPHICS Blender Fundamentals — Drawing Basic Shapes — Modeling — Shading & Textures

Total Hours: 45

TEXT BOOKS:

1. **1.** Donald, D. Hearn. Pauline, Baker, M. Warren, Carithers. (2010) Computer graphics with Open GL, (4th ed.)
2. **2.** Computer Graphics (Special Indian Edition) (Schaum's Outline Series) 2nd Edition, 2006 (English, Paperback, Xiang, Plastock, Avadhani), McGraw Hill Education (India) Private Limited

3. K.R. Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Prentice Hall, 2014, ISBN-978- 81203-2145-8 2

REFERENCE BOOKS:

1. *Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin*

Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.

2. *John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", 3rd Edition, Addison- Wesley Professional,2013*

COURSE CODE EBCS22E07	COURSE NAME: WIRELESS AND MOBILE NETWORKING	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to
- Understand the Communication Systems
- Analyze the mobile network issues

COURSE OUTCOMES (COs): Students will be able to

CO1	To understand about wireless communication[L2]
CO2	To know about the different architecture of cellular system[L4]
CO3	To understand various standards of wireless system[L2]
CO4	To analyze about the Mobile network issues[L4]
CO5	To know about Mobile network applications[L2]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	2	3	2	2	1	2	2	2
CO2	2	1	1	2	2	2	2	1	3	1	2	2
CO3	2	2	2	3	1	1	2	1	2	2	2	1
CO4	1	2	2	1	2	3	1	1	2	2	2	2
CO5	2	2	1	1	2	2	3	1	1	1	2	2
	2	2	2	1	1	2	2	2	1	3	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2
CO2	3	2	2	2
CO3	2	2	2	1
CO4	3	2	2	2
CO5	2	1	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					□							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E07	WIRELESS AND MOBILE NETWORKING	Ty	3	0/0	0/0	3

UNIT ICOMMUNICATION FUNDAMENTALS 9 Hrs

Introduction - Wireless Transmission - Frequencies for Radio Transmission - Signals - Signal propagation - Multiplexing, Modulation - Bandwidth-Spread spectrum - Cellular systems.

UNIT II MAC AND COMMUNICATION SYSTEMS 9 Hrs

Functions of MAC - Interference -FDMA-TDMA-CDMA and OFDM. Telecommunication systems -GSM-UMTS and IMT-2000, Satellite systems - Broadcast systems - Data Digital Audio Broadcasting - Digital Video Broadcasting.

UNIT III WIRELESS STANDARDS 9 Hrs

Wireless LAN - Infrared vs. Radio Transmission - Infra structure and ad hoc Networks, 802.11, 802.15, MANET - HIPERLAN - Piconet. Wireless ATM - Services - Radio Access Layer - 3GPP,3G, 4G and 5G standards.

UNIT IV MOBILE NETWORK ISSUES 9 Hrs

Mobile network layer - Mobile IP - DHCP - Mobile transport layer - Traditional TCP - Indirect TCP - Snooping TCP, Mobile TCP - Selective Retransmission - Transaction Oriented TCP, Routing Algorithm and protocols

UNIT V MOBILE APPLICATIONS 9 Hrs

Support for Mobility - File systems - Consistency - World wide web - Hyper Text Transfer Protocol - Hypertext markup language –Next generation- Wireless Application Protocol. Over view of smart phones

Total Hours 45

TEXT BOOKS:

1. Jochen Schiller, (2008) Mobile Communications (2nd ed.), Pearson Education

2. Blake (2002) Wireless Communication Technology,Thomson Learning

REFERENCES:

1. Theodore S.Rappaport (2010) Wireless Communication: Principles and practice, Prentice Hall.

ELECTIVE-II

COURSE CODE **EBCS22E08**	COURSE NAME **:** **5G NETWORKS**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite:Nil	**Ty**	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to

- Understand that the networks will deliver higher data speeds
- Analyzing how to strengthening the communications infrastructure

COURSE OUTCOMES (COs): Students will be able to

CO1	To understand about 5G Architecture[L2]
CO2	To know about the machine type communication[L1]
CO3	To understand communication takes place in 5G[L2]
CO4	To analyze the features of 5G[L4]
CO5	To evaluate the mobility and dynamic configuration[L5]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**
CO3	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**1**	**1**
CO4	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**3**	**2**	**2**
CO5	**3**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**1**
CO4	**2**	**2**	**2**	**3**
CO5	**2**	**2**	**1**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S. Lr	P/R	C
EBCS22E08	5G Networks	Ty	3	0/0	0/0	3

Unit I: **9 Hrs**

5G Architecture, Modelingrequirementsandscenarios, Channelmodelrequirements,Propagation scenarios, NFV and SDN, Basics about RAN architecture , High-level requirements for the 5G architecture , Functional architecture and 5G flexibility , Enhanced Multi-RAT coordination features , 5G deployment.

Unit II: **9 Hrs**

Machine-type communications- MTC requirements, Fundamental techniques for MTC , Data and control for short packets , Non-orthogonal access protocols , Massive MTC , Design principles , Technology components , Ultra-reliable low-latency MTC , Design principles , Technology components.

Unit III: **9 Hrs**

Device-to-device (D2D) communications- D2D standardization: 4G LTE D2D , D2D in 5G: research challenges , Radio resource management for mobile broadband D2D , RRM techniques and concepts for mobile broadband D2D , RRM and system design for D2D , Multi-hop D2D communications for proximity and emergency services , Multi-operator D2D communication.

Unit IV: **9 Hrs**

Millimeter wave communications- Channel propagation, Hardware technologies for mmW systems, Architecture and mobility, Beam forming, Physical layer techniques. 5G radio-access technologies - Access design principles for multi-user communications, Multi-carrier with filtering: a new waveform, Non-orthogonal schemes for efficient multiple access, Radio access for dense deployments, Radio access for V2X communication, Radio access for massive machine-type communication.

Unit V: **9 Hrs**

Massive multiple-input multiple-output (MIMO) systems - Coordinated multi-point transmission in 5G - Relaying and wireless network coding - Interference management, mobility management, and dynamic reconfiguration.

Total Hours45

Text Books:- 1. 5G Mobile and Wireless Communications Technology ,AfifOsseiran ,Ericsson , Josef. Monserrt ,UniversitatPolitècnica de València , Patrick Marsch , Nokia , Second Edition 2011.

2. 5GNR: " TheNextGenerationWirelessAccessTechnology" , ErikDahlman,StefanParkvall,JohanSköld , Elsevier , FirstEdition ,2016.

References:-

1. Fundamentalsof5GMobileNetworks ,JonathanRodriguez , Wiley , First edition 201

COURSE CODE **EBCS22E09**	COURSE NAME: **INFORMATION STORAGE MANAGEMENT**	**Ty/Lb/ ETL/IE**	**L**	**T/S. Lr**	**P/R**	**C**
	Prerequisite:Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

The students should be made to

- Understand the basic components of Storage System Environment.
- Understand the Storage Area Network Characteristics and Components.
- Examine emerging technologies including IP-SAN.
- Learn the architectures, features, and benefits of intelligent storage systems.
- Understand the various storage infrastructure components in data center environments.

COURSE OUTCOMES (COs): Students will be able to

CO1	Determine storage requirements for a data center. [L1]
CO2	Evaluate the performance of storage subsystems. [L5]
CO3	Design storage solutions based on application needs. [L6]
CO4	Define backup, recovery, disaster recovery, business continuity, and replication. [L1]
CO5	Understand logical and physical components of a storage infrastructure[L2]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO 6**	**PO 7**	**PO8**	**PO 9**	**PO10**	**PO1 1**	**PO1 2**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**3**	**1**	**1**	**2**	**1**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**
CO5	**3**	**2**	**3**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	**2**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**2**	**3**
CO5	**3**	**2**	**2**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E09	INFORMATION STORAGE MANAGEMENT	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO STORAGE SYSTEMS 9 Hrs

Information Storage - Evolution of Storage Technology and Architecture – Data Centre – Infrastructure – ILM – Storage System Environment -Components of Host RAID: Implementation, RAID Array Components-RAID levels & comparison –RAID Impact On Disk Performance- ISS-Components, Intelligent Storage Array.

UNIT II STORAGE NETWORKING TECHNOLOGIES 9 Hrs

Direct-Attached Storage- Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces-Introduction to Parallel SCSI, SCSI Command Model-Storage Area Networks- Fiber Channel, SAN Evolution, SAN Components, Fiber Channel Connectivity, Fiber Channel Ports, Fiber Channel Architecture, Zoning, Fiber Channel Login Types, Fiber Channel Topologies-NAS-Benefits, NAS File me /Components and Operations, Implementations, File Sharing Protocols.

UNIT III VIRTUALIZATION AND ADVANCED STORAGE NETWORKING 9 Hrs

IP SAN: iSCSI, FCIP. Content-Addressed Storage: Fixed Content and Archives, Types of Archives, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples. Storage Virtualization: Forms of Virtualization, NIA Storage Virtualization Taxonomy, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization.

UNIT IV BUSINESS CONTINUITY AND STORAGE SECURITY 9 Hrs

Information availability – BC Planning Life Cycle, failure analysis, Business Impact Analysis – Backup & Recovery –Purpose and Considerations-Restoration operations-Backup Topologies and Technologies.

UNIT V LOCAL AND REMOTE REPLICATION 9 Hrs

Local Replication: Source and Target, Uses, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface.
Remote Replication: Modes of Remote Replication and its Technologies, Network Infrastructure.

Total Hours: 45

TEXT BOOKS:

1. EMC Corporation, Information Storage and Management, Wiley India, 2nd edition 2012
2. G.Somasundaram, A.Shrivastava, "Information Storage and Management: Storing, Managing and Protecting Digital Information in Classic, Virtualized and Cloud Environment", 2nd Edition, Wiley publication, 2012.

REFERENCE BOOKS:

1. Robert Spalding, ―Storage Networks: The Complete Reference ―, Tata McGraw Hill, Osborne, 2003.
2. Meeta Gupta, Storage Area Networks Fundamentals, Pearson Education Limited, 2002.
3. Marc Farley, ―Building Storage Networks‖, Tata McGraw Hill, Osborne, 2001.

COURSE CODE: EBCS22E10	COURSE NAME: RISK MANAGEMENT	Ty/Lb/ ETL/IE	L	T/ S. Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to:

- Identify and categories the various risks face by an organization
- Explain the various risk control measures available
- Design a risk management program for a business organization.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the various risks face by an organization (L1)
CO2	Able to applying various risk control measure to the suitable risk organization (L3)
CO3	Demonstrating the knowledge of financial and financial related risks facing Organizations (L3)
CO4	Able to analyzing a risk management program for an organization (L4)
CO5	Design a risk management program for a business organization. (L5)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	2	2	1	1	
CO2	2	2	2	1	3	3	2	1	2	1	1	1
CO3	3	2	2	1	1	1	1	1	1	2		
CO4	2	3	2	1	2	2	3	1	1			1
CO5	3	3	3	2	3	2	1	1	1		1	1

COs / PSOs	PSO1	PSO2	PO3	PSO4
CO1	3	2	3	2
CO2	3	2	3	3
CO3	3	1	3	3
CO4	3	3	1	1
CO5	3	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S .Lr	P/ R	C
EBCS22E10	RISK MANAGEMENT	Ty	3	0/0	0/0	3

UNIT I: The Risk Management Process 9 Hrs

Introduction to software risk management, why do we need to manage risk in software development, Use, Objectives, Risk Management Paradigm, Risk management and litigation. Models for Risk Management.

UNIT II: Discovering Risk In Software Development 9 Hrs

Risk attributes and Identification, Identifying software risk, Common software project risks, Risk Taxonomy, Risk Mapping, statements, reviews., Risk ownership and stakeholder management.

UNIT III: Risk Assessment 9 Hrs

Objectives and goals. Approach to assessment, Risk assessment tools and techniques, presenting the risk findings.

UNIT IV: Planning Risk Mitigation Strategies 9 Hrs

Risk Planning, Best practices in the risk planning, Risk management tools, Risk mitigation strategies, Formulating and Implementing risk management plans.

UNIT V: Monitoring Risk in Software Projects 9 Hrs

Developing a process for monitoring risk, formulating a project risk database, Managing and tracking risk, Risk support tools. Software Risk Metrics, organization, estimation, development methodology.

Total Hours: 45

TEXT BOOKS:

1. Yacov Y. Haimes, (2011) Risk Modeling, Assessment, and Management, Wiley
2. John Mcmanus,(2004) Risk Management in software development projects, Elsevier Butterworth- Heinemann

REFERENCE BOOKS:

1. *Martin Loosemore, John Raftery, (2006) Risk management in projects,Taylor& Francis Ltd*
2. *Ravindranath P. C, (2007) Applied Software Risk Management, Auerbach,*
3. *Dale Walter Karolak,,(1995) Software engineering risk management, Wiley-Ieee Computer Society*

COURSE CODE: EBCS22E11	COURSE NAME: CRYPTOGRAPHY AND NETWORK SECURITY	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: COMPUTER NETWORKS	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The student will be able

- Understand OSI security architecture and classical of modern cryptography.
- To gain knowledge onPublic Key Cryptography.
- Understand various block cipher modes.
- Understands the principles of public key cryptosystems, and different message authentication and integrity techniques

COURSE OUTCOMES (COs) : Students will be able to

CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities [L2]
CO2	Apply the different cryptographic operations of symmetric and Asymmetric cryptographic algorithms[L3]
CO3	To design, analyze and implement different network security protocols [L4]
CO4	Apply the various Authentication schemes to simulate different applications[L3]
CO5	Understand various Security practices and System security standards[L2]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	1	2	2	1	1	1
CO2	3	2	3	2	3	1	2	1	2	1	1	1
CO3	3	3	3	2	2	1	2	1	2	1	1	1
CO4	3	2	3	2	3	2	2	2	2	1	1	2
CO5	3	3	3	2	3	2	2	2	2	1	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	1	1	3
CO3	3	1	2	3
CO4	3	2	2	3
CO5	3	2	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E11	CRYPTOGRAPHY AND NETWORK SECURITY	Ty	3	0/0	0/0	3

UNIT I Introduction to modern cryptography **9 Hrs**

OSI security architecture - Security attacks, Services and Mechanisms - -Network security model-Classical encryption techniques: substitution techniques, transposition techniques, steganography-Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

NUMBER THEORY: Modular arithmetic-Euclid's algorithm- Fermat's and Euler's theorem- The Chinese remainder theorem- Discrete logarithms.

UNIT II SYMMETRIC KEY CIPHERS **9 Hrs**

SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 –Key distribution.

UNIT III **9 Hrs**

Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange--Elliptic curve cryptography.

UNIT IV

Cryptographic Data Integrity Algorithms **9 Hrs**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols-DSS.

UNIT VNetwork Security and System Security

9 Hrs

Authentication Applications –Pretty Good Privacy – S/MIME – IP Security – Web Security.Intruders – Intrusion Detection– Malicious Software – Viruses and Related Threats -Viruses Countermeasures – Distributed Denial of Service Attacks - Firewalls – Firewall Design Principles – Trusted Systems.

Total Hours: 45

TEXT BOOK:

1. William Stallings (2011) *Cryptography And Network Security – Principles and Practices*, (5th ed.) Pearson Education.

REFERENCE BOOKS:

1. *Atul Kahate (2008) Cryptography and Network Security Tata McGraw Hill*
2. *Bruce Schneier (2007) Applied Cryptography, John Wiley & Sons Inc.*
3. *Charles B. Pfleeger, Shari Lawrence Pfleeger (2007) Security in Computing (4th ed.), Pearson Education*

COURSE CODE **EBCS22E12**	**MOBILE ADHOC NETWORKS**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to

- Understands the most recent research and development in the rapidly growing area of ad hoc networks.
- Analyze and understands the ad hoc networking trends, possible architectures, and the advantages/limits for future commercial, social, and educational applications.
- Develop many products that fully utilize the ad hoc technology that are being widely deployed throughout the world.

COURSE OUTCOMES (COs): Students will be able to

CO1	Create instant wireless networks for conventions, conferences, emergency situations, educational or military uses, and more [L6]
CO2	Build wireless community networks where little or no infrastructure exists [L6]
CO3	To Integrate wireless multihop relaying technologies with existing wireless LAN technologies[L4]
CO4	To Deliver QoS for multimedia and other functions in untethered nets [L3]
CO5	Translate the IETF MANET standards into practical terms [L3]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**
CO3	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO5	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**
CO3	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E12	MOBILE ADHOC NETWORKS	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

Introduction- Adhoc networks. Mobile Ad-Hoc networking with a View of 4G Wireless, Off-the-Shelf Enables of Ad Hoc, IEEE 802.11 in Ad Hoc Networks:

UNIT II **9 Hrs**

Protocols, Performance and Open Issues, Scatter net Formation in Bluetooth Networks , Antenna Beam forming and Power Control for Ad Hoc Networks, Topology Control in Wireless Ad Hoc Networks, Broadcasting and Activity Scheduling in Ad Hoc Networks.

UNIT III **9 Hrs**

Location Discovery, Routing Approaches in Mobile Ad Hoc Networks, Energy-Efficient Communication in Ad Hoc Wireless, Ad Hoc Networks Security, Self-Organized and Cooperative Ad Hoc Networking.

UNIT IV **9 Hrs**

Simulation and Modeling of Wireless, Mobile, and Ad Hoc Networks, Modeling Cross-Layering Interaction Using Inverse Optimization Algorithmic Challenges in Ad Hoc Networks

UNIT V **9 Hrs**

Sensor Networks Introduction to sensor network, Unique constraints and challenges, Localization and Tracking, Networking Sensors, Infrastructure establishment, Sensor Tasking and Control, Sensor network databases, Sensor Network Platforms and tools, Industrial Applications and Research directions.

Total Hours: 45

TEXT BOOKS:

1. Mobile Adhoc Networks – Aggelou , George (McGraw-Hill).

2. Mobile Adhoc Networking – Stefano Basagni (Editor), Marco Conti (Editor), Silvia Giordano (Editor), Ivan Stojmenovi&Cacute (Editor) (Wiley-IEEE Press).

REFERENCE BOOKS:

1.Mobile Ad Hoc Networks 2009 George AggelouMcGraw Hill Education
2. Mobile Ad Hoc Networking: Cutting Edge Directions (IEEE Series on Digital & Mobile Communication) Hardcover – Import, 26 March 2013 Stefano Basagn

COURSE CODE: EBCS22E13	COURSE NAME: NETWORK INFRASTRUCTURE MANAGEMENT	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Computer Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL /IE: Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:
The students should be made to

- To learn Network Layers functionality, to acquire knowledge about VLANs, and to test Network security and wireless security.

COURSE OUTCOMES (COs) : Students will be able to

CO1	Recall the concepts of computer networks
CO2	Outline the use of network infrastructure
CO3	RecognizetheimportanceandrelevanceofVLANs and EIGRP
CO4	Analyze and solve the problems in the network infrastructure
CO5	Compare and contrast various network infrastructures

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	3	1	3	3	3	3	2
CO2	3	2	1	2	2	3	2	1	3	3	3	2
CO3	3	2	2	3	2	3	2	2	3	2	3	2
CO4	3	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	2	3	2	3	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	2	3	2
CO3	3	2	3	2
CO4	3	3	3	3
CO5	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E13	NETWORK INFRASTRUCTURE MANAGEMENT	Ty	3	0/0	0/0	3

UNIT I Internetworking & Ip Addressing 9Hrs

Internetworking Models – Layered Approach – OSI Reference Models – Ethernet Networking – Cabling – Data Encapsulation – Three Layer Hierarchical model – core layer – distribution layer – Access layer – TCP/IP and DoD Model – IP Addressing – Hierarchical IP Addressing scheme - Broadcast Address.

UNIT II Subnetting, VLSM And Ios 9Hrs

Subnetting basics – CIDR – VLSM Design – Summarization – Troubleshooting IP Addressing – IOS user interface – CLI – Router and switch Administrative Configuration – Router Interfaces – viewing, saving, and erasing configuration

UNIT III Managing Internetwork and Ip Routing 9Hrs

Internal component of a Router – routing boot sequence – configuration register – backing up and restoring configuration – CDP – resolving hostnames – Checking network connectivity – IP routing basics – Static routing – default routing – dynamic routing – RIP – IGRP

UNIT IV Eigrp, OSPF, STP and VLANS 9Hrs

EIGRP features – RTP – DUAL – EIGRP to support large Networks –Configuring EIGRP - Load balancing – OSPF terminology – Configuring and verifying OSPF – DR and BDR elections – Loopback interfaces – troubleshooting – STP spanning tree terms and operations – VLANs Basics – memberships – VTP – Configuring VLAN – Inter VLAN routing.

UNIT V ACLS, NAT and Wireless Technologies 9Hrs

Access Lists, VTY access, advanced Access List, Named ACLs, monitoring Access List, configuring access list – NAT names – PAT configuration – NAT using SDM – Wireless technologies – Unified wireless solutions – split MAC architecture – MESH and LWAPP - wireless security

Total Hours: 45

TEXT BOOKS:

1. Todd Lammle, 2011 “CCNA Cisco Certified Network Associate study guide – Wiley India.
2. Brian Hill, 2013 “The complete Reference - Cisco ” Tata McGraw-Hill.

REFERENCE BOOKS:

1. *Richard Deal, 2013 “CCNA Cisco Certified Network Associate study guide” Tata McGraw-Hill.*
2. *Steven Latre et al 2015 “Intelligent Mechanism for Network Component and Security” Springer.*

COURSE CODE EBCS22E14	COURSE NAME: CYBER FORENSICS AND INTERNET SECURITY	Ty/Lb/ ETL/I E	L	T/S.Lr	P/R	C
	Prerequisite: OS, Data Structure, Networking, Web Technology	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- To learn the computer forensic fundamentals
- To understand various types of cyber crime activities involved in the digital world
- To study various network security technologies to prevent the data from hacker or intruder

COURSE OUTCOMES (COs): Students will be able to

CO1	Understanding how to protect the data/secure their personal and official data in computer.
CO2	Analyze the cybercrimesusingdigital forensics
CO3	Enable data security in the network using network security technologies.
CO4	Apply the knowledge to find the frauds with help of case study
CO5	Analyze various internet security techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	2	2	1	1	1	1
CO2	3	3	3	3	2	2	2		2	1	1	1
CO3	3	3	2	2	3	2	2	1	1			
CO4	3	3	3	3	3	3	1	1				
CO5	3	3	3	3	3	3	1	1		1	1	

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E14	CYBER FORENSICS AND INTERNET SECURITY	Ty	3	0/0	0/0	3

UNITI–CyberForensics **9Hrs**

Introduction to Cyber Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules.

UNITII–Cyber Forensics ystems **9Hrs**

Understanding Computer components- input and output devices, CPU, Digital Media, System software - Operating System Architecture, Application Software, File Systems, Memory organization concept, Data Storage concepts. Network: Topology, Devices, Protocols and Port, Communication media. IP Address: Types and classes.

UNIT III – Cyber Attacks **9Hrs**

Ethical hacking, Attack Vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems associated with Computer Crimes, Realms of Cyber world, brief history of the internet, contaminants and destruction of data, unauthorized access, computer intrusions, white-collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and obscenity in internet, Cyber psychology, Social Engineering.

UNITIV–Digita lForensic **9Hrs**

Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling, analysis and advanced tools, forensic technology and practices, Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis.

UNITV – Internet Security **9Hrs**

E-mail Security, Pretty Good Privacy (PGPs) / MIME, IP Security, Access and System Security, Intruders, Intrusion Detection and Prevention, Firewall, Hardware Firewall, Software Firewall, Application Firewall, Packet Filtering. , Packet Analysis, Proxy Servers, Firewall setting in Proxy, ACL in Proxy.

Total Hours:45

TEXT BOOKS: 1. John R. Vacca, (2005) Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media. 2. Man Young Rhee, (2003) “Internet Security Cryptographic Principles, Algorithms and Protocols”, WILEY.

REFERENCE BOOKS:

1. William Stallings, “Cryptography and Network Security: Principles and Standards”, Prentice Hall India, 3rd Edition, 2003

2. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010

3. Christof Paar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners, 2nd Edition, Springers, 2010**.**

COURSE CODE: **EBCS22E15**	COURSE NAME: **DATABASE SECURITY**	**Ty/Lb/ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite:Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

Thestudents should be made to

- To provide a foundation in database security
- Understand the various database vulnerabilities
- Learn to audit the databases.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the fundamentals of security process[L2]
CO2	Analyze the different database perspective and vulnerabilities in operating system[L4]
CO3	Apply the security policies and techniques[L3]
CO4	Understand and applyvarious Database Application in Security Models[L2]
CO5	Able to develop the database project in real time process[L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**2**	**1**	**1**	**1**				**1**	**1**
CO2	**3**	**2**	**3**	**2**	**1**	**1**	**2**				**1**	**1**
CO3	**3**	**2**	**2**	**2**	**1**	**1**	**2**				**1**	**1**
CO4	**3**	**3**	**3**	**2**	**2**	**2**	**1**				**2**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**1**	**2**				**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**3**	**3**
CO2	**2**	**3**	**3**	**3**
CO3	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E15	DATABASE SECURITY	Ty	3	0/0	0/0	3

UNIT I Security Architecture & Operating System Security Fundamentals 9Hrs

Security Architecture: Introduction-Information Systems- Database Management Systems-Information Security Architecture- Database Security–Asset Types and value-Security Methods Operating System Security Fundamentals: Introduction-Operating System Overview-Security Environment – Components- Authentication Methods-User Administration-Password Policies-Vulnerabilities-E-mail Security.

UNIT II Administration of Users, Profiles, Password Policies, Privileges and Roles9 Hrs

Administration of Users: Introduction-Authentication-Creating Users, SQL Server User-Removing, Modifying Users-Default, Remote Users-Database Links-Linked Servers-Remote Servers-Practices for Administrators and Managers-Best Practices Profiles, Password Policies, Privileges and Roles: Introduction-Defining and Using Profiles-Designing and Implementing Password Policies-Granting and Revoking User Privileges-Creating, Assigning and Revoking User Roles-Best Practices.

UNIT III Database Application Security Models 9 Hrs

Introduction-Types of Users-Security Models: Access Matrix model, Access mode model- DBMS Design Security Packages-Statistical Database Protection & Intrusion Detection Systems-Application Types: Client/Server Applications, Web Applications, Data ware house applications- Application Security Models-Data Encryption.

UNIT IV Virtual Private Databases 9 Hrs

Virtual Private Databases: Introduction-Overview of VPD-Implementation of VPD using Views, Application Context in Oracle-Implementing Oracle VPD-Viewing VPD Policies and Application contexts using Data Dictionary, Policy Manager Implementing Row and Column level Security with SQL Server.

UNIT V Auditing Database Activities and Project Cases 9 Hrs

Using Oracle Database Activities-Creating DLL Triggers with Oracle - Auditing Database Activities with Oracle-Auditing Server Activity with SQL Server 2000-Security and Auditing Project Case Study - Case Studies : Developing an online database, payroll management, tracking database changes, developing a secured authorization repository.

Total Hours: 45

TEXT BOOK:

1. Hassan A. Afyouni, 2009 “Database Security and Auditing”, Third Edition, Cengage Learning.

REFERENCE BOOKS:

1. *Charu C. Aggarwal, Philip S Yu, 2008, “Privacy Preserving Data Mining”: Models and Algorithms, Kluwer Academic Publishers.*
2. *Ron Ben Natan, 2005, ”Implementing Database Security and Auditing”, Elsevier Digital Press.*

COURSE CODE **EBCS22E16**	COURSE NAME: **MANAGEMENT INFORMATION SYSTEMS**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Evaluate the role of the major types of information systems in a business environment and their relationship to each other;
- Assess the impact of the Internet and Internet technology on business electronic commerce and electronic business;
- Identify the major management challenges to building and using information systems and learn how to find appropriate solutions to those challenges

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the basic concepts and technologies used in the field of management information systems (L1)
CO2	Apply the role of the ethical, social, and security issues of information systems. (L3)
CO3	To Understand about the Business Model (L1)
CO4	Apply the understanding of how various Consumer Oriented Applications are like DBMS work together to accomplish E-Commerce. (L3)
CO5	Implement EDI (Electronic Data Interchange) (L5)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	
CO2	**2**	**3**	**3**	**2**	**3**	**1**	**2**	**2**	**1**		**1**	
CO3	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**3**	**2**	**1**	**1**	
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**1**				**1**
CO5	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**				

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**1**	**2**
CO2	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**2**	**3**
CO5	**3**	**2**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E16	MANAGEMENT INFORMATION SYSTEMS	Ty	3	0/0	0/0	3

UNIT I : FUNDAMENTALS OF INFORMATION SYSTEMS 9 Hrs

Information systems in business- Fundamentals of information systems-Solving business problems with information systems-Business Information systems- Transaction processing systems-Management Information Systems and Decision Support Systems-Artificial intelligence technologies in business-Information system for strategic applications and Issues in Information Technology.

UNIT II: ISSUES IN MANAGING INFORMATION TECHNOLOGY 9 Hrs

Managing Information Resources and Technologies-Global Information Technology, Management, Planning and Implementing Change- Integrating Business change with IT-Security and Ethical challenges in managing IT-Social challenges of InformationTechnology.

UNIT III: INTRODUCTION TO E-BUSINESS 9 Hrs

E-commerce frame work, Media convergence, Consumer applications, Organization applications-BUSINESS MODEL: Architectural frame work for E-commerce, Application services and transaction Models – B2C Transactions, B2B Transactions- Intra-Organizational Transactions- WWW Architecture: Client server structure of the web- E-Commerce Architecture-Technology behind the web.

UNIT IV: CONSUMER-ORIENTED E-COMMERCE 9 Hr

Consumer oriented Application: Finance and Home Banking- Home shopping-HomeEntertainment, -Mercantile Process Models-Consumers perspective- Merchantsperspective.

UNIT V: ELECTRONICS DATA INTERCHANGE (EDI)9 Hrs

EDI Concepts, Applications in business – components of international trade, CustomsFinancial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures andEDI.

Total Hours: 45

TEXT BOOKS:

1. Management Information Systems- Managing Information Technology in the internet worked Enterprise- James. A O'Brien - Tata McGraw Hill publishing company limited, 2002.
2. Management Information Systems - Laaudon& Laudon PHI ISBN 81-203-1282-1.1998.

REFERENCES:

1. Management Information systems- S. Sadogopan.PHI 1998Edn. ISBN 81-20311809
2. Information systems for modern management - G.R. Murdi

ELECTIVE-III

COURSE CODE	COURSE NAME: MOBILE APPLICATION DEVELOPMENT	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E17	Prerequisite: Operating System, Computer Graphics, Computer Networks and Web Design	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Describe the limitations and challenges of working in a mobile and wireless environment
- Describe and apply the different types of application models/architectures used to develop mobile software applications.
- Describe the components and structure of a mobile development frameworks

COURSE OUTCOMES (COs) :): Students will be able to

CO1	Able to remember the various Mobile Platforms and analyze its architectures
CO2	Understand and develop various Mobile Applications for Android and Apple
CO3	Apprehend the design and develop own mobile application
CO4	Apply the different types of application models and architectures
CO5	Analyze the concepts of various mobile services

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	1	1	2	3	2	1	1		
CO2	2	2	3	1	1	2	3	2	1			1
CO3	3	3	3	2	3	3	3	2	2			
CO4	3	2	3	3	2	2	3	1	2	1	1	
CO5	2	2	2	1	3	3	2	1	2	1		1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	2	2	3
CO3	3	3	2	2
CO4	2	2	3	3
CO5	2	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships /	Soft Skills			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E17	**Mobile Application Development**	Ty	3	0/0	0/0	3

UNIT I Introduction **9 Hrs**

Introduction to Mobile Platforms – Exploring Android Platform – Android Studio, Java, XML – Exploring Apple IPhone Platform – XCode, Objective C, Swift – Options for development, Mobile Software Engineering

UNIT II User Interface Development **9 Hrs**

UI Elements – Frameworks and Tools - Generic UI Development – VUIs and Mobile Apps - Designing the Right UI - Multichannel and Multimodial UIs - Layouts – Android Intents and Services - Gesture based interfaces –Styles & Themes.

UNIT III Google Andriod Platform **9 Hrs**

Characteristics of Mobile Applications - Google Application Architecture – Basic Building Blocks - The Android Emulator – Event based programming – SQLite Database Access – ADB – Mobility and Location Based Services

UNIT IV Apple Iphone Platform **9 Hrs**

UI Kit for Interfaces - Understanding basics of Swift - Application development using Swift - Understanding basics of Objective – C - App development using Objective – C– SQLite Database Access – Application Debugging – Location Handling

UNIT V Implementing Software as a Service **9 Hrs**

Service Oriented Computing Examples – Google Maps – Enabling Map based services in Application – Amazon Web Services – Exploring AWS S3 & AWS IoT APIs. Case studies on Mobile Application

Total Hours: 45

TEXT BOOKS:

1. Ed Burnette (2015) Hello, Android: Introducing Google's Mobile Development Platform, 4th edition, Pragmatic Bookshelf.
2. Marko Gargenta (2011) Learning Android, O'Reilly Media.

REFERENCE BOOKS:

1. Richard Rodger (2012) Beginning Mobile application development in the cloud, Wrox Publication.
2. Jonathan A. Zdziarski (2008), iPhone Open Application Development, 2nd edition, O'Reilly Media Publication.

COURSE CODE **EBCS22E18**	COURSE NAME: **DATA SCIENCE**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- know the fundamental concepts of data science and analytics
- learn various techniques for mining data streams
- learn Event Modeling for different applications.
- know about Hadoop and Map Reduce procedure

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the application and process of data science[L2]
CO2	Analyzing the different models with examples[L4]
CO3	Applying various techniques for data mining[L3]
CO4	Write and evaluate efficient algorithms for mining the data from large volumes[L5]
CO5	Understand and apply different Frameworks and Visualization techniques for Real world problems[L3]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1				1	1
CO2	3	3	3	2	1	1	2				1	1
CO3	3	3	2	2	1	1	2				1	1
CO4	3	3	2	2	2	2	1				2	2
CO5	3	3	2	2	2	1	2				1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	2	2
CO3	3	3	3	3
CO4	3	3	2	2
CO5	3	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E18	DATA SCIENCE	Ty	3	0/0	0/0	3

UNIT I Introduction To Data Science And Big Data 9 HRS

Introduction to Data Science – Applications - Data Science Process – Exploratory Data analysis – Collection of data – Graphical presentation of data – Classification of data – Storage and retrieval of data – Big data – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

UNIT II Data Analysis 9 HRS

Correlation – Regression – Probability – Conditional Probability – Random Variables – Analysis using Mean, Median, Mode, Standard Deviation, Skewness, Kurtosis- Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics.

UNIT III Data Mining Techniques 9 HRS

Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods- Neuro-Fuzzy Modelling – Association rule mining – Clustering – Outlier Analysis – Sequential Pattern Mining – Temporal mining – Spatial mining – Web mining.

UNIT IV Mining Data Streams 9 HRS

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V Frameworks and Visualization 9 HRS

Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications.

Total Hours: 45

REFERENCES

1.Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2.Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
3.Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
4.Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.
5. Rachel Schutt, Cathy O'Neil, “Doing Data Science”, O'Reilly Publishers, 2013.
6. Foster Provost, Tom Fawcet, “Data Science for Business”, O'Reilly Publishers, 2013.
7. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications“, Wiley Publishers, 2014.
8. S. N. Sivanandam, S. N Deepa, “Introduction to Neural Networks UsingMatlab 6.0”, Tata McGraw- Hill Education, 2006.

COURSE CODE	COURSE NAME: **EMBEDDED SYSTEM ARCHITECTURES**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
EBCS22E19	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand the basics of an embedded system.
- Understand the typical components of an embedded system.
- To understand different communication interfaces.
- To learn the design process of embedded system applications.
- To understands the RTOS and inter-process communication

COURSE OUTCOMES (COs): Students will be able to

CO1	To understand the basics of Embedded System (L1)
CO2	Able to design processor and memory for Embedded systems (L5)
CO3	To develop an Embedded Firmware (L5)
CO4	To identify best operating system for embedded system (L4)
CO5	To apply the basic task Communication (L3)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**1**				**1**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**1**			
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**1**	**1**		**1**	
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**			**1**		
CO5	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**		**2**		

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCS22E19	EMBEDDED SYSTEM ARCHITECTURES	Ty	3	0/0	0/0	3

UNIT –I **9 Hrs**

Introduction to Embedded Systems: Definition of Embedded System, Embedded SystemsVs General Computing Systems, History of Embedded Systems, Classification, MajorApplication Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:

9Hrs

Typical Embedded System: Core of the Embedded System: General Purpose and DomainSpecific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface:Onboard and External Communication Interfaces.

UNIT -III:

9Hrs

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, RealTime Clock, Watchdog Timer, Embedded Firmware Design Approaches and DevelopmentLanguages.

UNIT-IV:

9Hrs

RTOS Based Embedded System Design: Operating System Basics, Types of OperatingSystems, Tasks, Process and Threads, Multi processing and Multitasking, Task Scheduling.

UNIT -V:

9Hrs

TASK COMMUNICATION: Shared Memory, Message Passing, Remote Procedure Calland Sockets, Task Synchronization: Task Communication/Synchronization Issues, TaskSynchronization Techniques, Device Drivers, How to Choose an RTOS.

Total Hours:45

TEXT BOOKS:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

REFERENCE BOOKS:

1.Embedded Systems - Raj Kamal, TMH.
2.Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3.Embedded Systems – Lyla, Pearson, 2013.
4.An Embedded Software Primer - David E. Simon, Pearson Education.

COURSE CODE **EBCS22E20**	COURSE NAME: **AGILE SOFTWARE DEVELOPMENT**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand the theoretical as well as practical aspects of agile software development practices and how small teams can apply them to create high-quality software.
- Understanding of software design and a set of software technologies and APIs.
- do a detailed examination and demonstration of Agile development and testing techniques.
- Understand the benefits and pitfalls of working in an Agile team.
- Understand Agile development and testing.

COURSE OUTCOMES (COs): Students will be able to

CO1	Analyze existing problems with the team, development process and wider organization[L4]
CO2	Apply a thorough understanding of Agile principles and specific practices[L3]
CO3	Understand and apply the most appropriate way to improve results for a specific circumstance or need[L2]
CO4	Analyze and apply appropriate adaptations to existing practices or processes depending upon analysis of typical problems[L4]
CO5	Evaluate likely successes and formulate plans to manage likely risks or problems[L5]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**2**	**1**	**1**	**1**		**1**		**1**	**1**
CO2	**3**	**3**	**3**	**2**	**1**	**1**	**2**		**1**		**1**	**1**
CO3	**3**	**2**	**3**	**2**	**1**	**1**	**2**		**1**		**1**	**1**
CO4	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**		**2**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**1**	**2**	1	**1**		**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**
CO5	**3**	**2**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	2022 Regulation COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E20	AGILE SOFTWARE DEVELOPMENT	Ty	3	0/0	0/0	3

UNIT I -Agile Development **9 Hrs**

Agile Practices, Overview of Extreme Programming, Planning, Testing, Refactoring, A Programming Episode.

UNIT II-Agile Design **9 Hrs**

What is Agile Design? SRP: The Single-Responsibility Principle, OCP: The Open-Closed Principle, LSP: The Liskov Substitution Principle, DIP: The Dependency-Inversion Principle, ISP: The Interface-Segregation Principle.

UNIT III-The Payroll Case Study **9 Hrs**

Command and Active Object, Template Method & Strategy: Inheritance vs Delegation, Facade and Mediator, Singleton and Monostate, Null Object, The payroll Case Study: Iteration One Begins, The Payroll Case Study: Implementation.

UNIT IV-Packaging the Payroll System **9 Hrs**

Principles of Package Design, Factory, The Payroll Case Study (part 2)

UNIT V-The Weather Station Case Study **9 Hrs**

Composite, Observer-Backing into a Pattern, Abstract Server, Adapter, and Bridge, Proxy and Stairway To Heaven: Managing Third Party APIs, Case Study: Weather Station.

Total Hours: 45

TEXT BOOKS:

1. “Agile Software Developement principles, Patterns and Practices” by Robert C. Martin, 1st edition 2003.

REFERENCE BOOKS:

1."Agile Software Developement" by Thomas Uwe Hansmann, Springer-Verlag Berlin Heidelberg 2010.

2. "The Art of Agile Developement" by James Shore & Shane Warden 2006.

COURSE CODE **EBCS22E21**	COURSE NAME **:** **AUTOMATION**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	**Ty**	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand the concepts of automation
- Apply the software automation concepts in real world
- Design usecases for any software programs
- Analyze the software testing models

COURSE OUTCOMES (COs) : Students will be able to

CO1	Remember the concepts of Automation[L1]
CO2	Understand the fundamentals of Usecases. [L2]
CO3	Analyze thesoftware testing modelsL4]
CO4	Apply the no code ideas in the testing[L3]
CO5	Apply the concepts in real time entities and case studies in automation [L6]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**3**	**2**
CO2	**1**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**2**
CO4	**2**	**2**	**2**	**1**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E21	AUTOMATION	Ty	3	0/0	0/0	3

UNIT I **9Hrs**

Overview- Types of automation -Overview of IT automation -Automation use cases - Automation trends -AI and machine learning in automation

UNIT II **9Hrs**

Role of Automation in Computer-based Systems- Machine Readable Specification&Design- Automatic Code Verification-Automatic Load Testing- Automatic Problem Discovery- Intelligent Operator Training

UNIT III **9Hrs**

Machine learning and workflow- Hyperautomation- Intelligent automation- Intelligent industrial robots- Low-code or no-code workflow

UNIT IV **9Hrs**

Terminologies used in Testing- How to write testcases- Principles of testing- Test process steps- Levels of independence in testing- Levels of testing- Software testing models- Introduction to Jira tool-Bugzilla Tool

UNIT V **9Hrs**

Invoicing without the use of paper- Applications for jobs - Automated notifications and warnings- Documents in the cloud- Automated software testing- Online sales and marketing- New career paths- Enhancing the need of cybersecurity- Automated data imports and exports

Total Hours:45

TEXT BOOKS:

1. Suresh Chandra Satapathy, Ajay Kumar Jena, Jagannath Singh, Saurabh Bilgaiyan," Automated Software Engineering: A Deep Learning-Based Approach (Learning and Analytics in Intelligent Systems) 1st ed. 2020 Edition"
2. Design, Build, Ship: Faster, Safer Software Delivery 1st Edition, by Sam Newman (Author), ISBN-13: 978-1491984871

REFERENCE BOOKS:

1.Raoul-Gabriel Urma, Richard Warburton, " Real-World Software Development: A Project-Driven Guide to Fundamentals" 1st Edition

COURSE CODE	COURSE NAME:	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E22	**SOCIAL COMPUTING**					
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Understand the concepts and various types of design patterns in social computing techniques
- Analyze the techniques and applications of social computing.
- Design various applications to solve the social computing models

COURSE OUTCOMES (COs): Students will be able to

CO1	Remember the basic concept of data Collection and Tools[L1]
CO2	Apply, evaluate the Data Process Methodology in social computing approaches[L3]
CO3	Recognize the feasibility of applying a social computing methodology for a particular Learning model. [L3]
CO4	Design the methodology to solve optimization problems using Artificial algorithms[L6]
CO5	Design social network analysis to revise the principles of social computing in various applications[L6]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	2	2	3	2	3	3
CO2	3	3	3	2	3	2	2	2	3	2	3	3
CO3	3	2	3	2	3	2	2	3	2	3	2	2
CO4	3	2	2	2	3	2	2	2	3	2	3	2
CO5	3	3	2	2	3	2	2	2	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	2	3
CO3	3	3	3	2
CO4	3	2	3	2
CO5	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					□							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E22	SOCIAL COMPUTING	Ty	3	0/0	0/0	3

UNIT I -DATA COLLECTION **9 Hrs**

Data Collection-Data types and sources, Data Collection and Tools- Data Acquisition, Common Data Processing Toolkit.

UNIT II-DATA PROCESSING METHODOLGY **9 Hrs**

Data Processing Principles-Behavior Tracking, Data Processing Methods.

UNIT III-SUPERVISED AND UNSUPERVISED LEARNING MODELS **9 Hrs**

Supervised Learning Models-Generalized Linear Algorithms, Decision Trees, Bayesian Method, Bayesian Regression, Gaussian Processes. Unsupervised learning model-Dimensionality Reduction Algorithm, Clustering algorithm.

UNIT IV-STATE-OF-THE-ART ARTIFICAL INTELLIGENCE ALGORITHMS 9Hrs

Deep Learning, Reinforcement Learning, Brother Learning, Epiphany Learning.

UNIT V-SOCIAL NETWORK DATA MINING AND KNOWLEDGE DISCOVERY 9Hrs

Online Social Networks Text Processing Method-Information Extraction, Keyword Mining, Topics Detection and Tracking, online Social Networks Image Recognition methods-Image Retrieval, Image object Detection and Classification.

Total Hours: 45

TEXT BOOKS:

1. “Social Computing with Artificial Intelligence” ,byXung Liang, Springer 2020.

REFERENCE BOOKS:

1.Huan Liu John J. Salerno Michael J.young,” *Social Computing, Behavioral Modeling and Prediction*”, Springer, 2008.

2.Ajith Abraham,” *Computational social Network Analysis”*: Springer

COURSE CODE: EBCS22E23	COURSE NAME: ENTERPRISE ARCHITECTURE	Ty/Lb/ ETL/IE	L	T/S. Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

The students should be made to

- To understand, manage and develop business strategy in a complex IT landscape.
- To create a map or blueprint of the structure and operations of an organization.
- To handling the relationship and interdependencies of these elements and aligning them.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the basic concepts of Enterprise Architecture.
CO2	Analyze various EA Framework
CO3	Apply the knowledge to Evaluate the EA Framework Implementation.
CO4	Analyze the EA Framework with Broad view in process management.
CO5	Understand the Overall evaluation and perspectives.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	2	2	1	1		1
CO2	3	3	3	2	3	2	2	1	2	1	1	1
CO3	3	2	3	2	3	2	2		1		1	
CO4	3	2	2	2	3	2	2	1	1			
CO5	2	3	2	2	3	2	1	1				

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	2	3
CO3	3	3	3	2
CO4	3	2	3	2
CO5	3	2	3	2

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S. Lr	P/ R	C
EBCS22E23	ENTERPRISE ARCHITECTURE	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9 Hrs**

An overview of Digital Transformation and Enterprise Architecture, The purpose and Scope of this Research, The Primary Related Research.

UNIT II DIRECTION OF DIGITAL IT AND ENTERPRISE ARCHITECTURE 9 Hrs

Introduction, Directions of Cloud/Mobile IT, EA Frameworks-TOGAF, FEAF, Adaptive EA, EA Framework Analysis, Agile Enterprise Architecture and Scaling Agile Frameworks.

UNIT III EVALUATION FOR EA FRAMEWORK IMPLEMENTATION METHOD 9 Hrs

Case of EA Framework Building in a Global Pharmaceutical Company, Evaluation and Analysis of Case Study.

UNIT IV EVALUATION OF ARCHITECTURE BOARD REVIEW PROCESS WITH KNOWLEDGE MANAGEMENT 9 Hrs

Case of "Architecture Board Reviwe" in Global HealthCare Company, Evaluation and Analysis of Case Study of Architecture Board view, Global Communication Case Study, Verification and summary.

UNIT V OVERALL EVALUATION AND PERSPECTIVES 9 Hrs

Overall Evaluation-valuation of AIDAF for agility-Related Elements, Perspectives on AIDAF-Benefits of EA Implementation-AIDAF, Challenges Encountered in EA Implementation of AIDAF, Global Communication Structure in Architecture Board.

Total Hours: 45

TEXT BOOK:

1. Yoshimasa Masuda MurlikrishnaViswanthan, 2019, Enterprise Architecture for Global Companies in a Digital IT Era, Springer.

REFERENCE BOOKS:

1. *Thierry PerroudRetoInversini , 2013 "Enterprise Architecture Patterns", Springer.*
2. *Danny Greefhorst Erik Proper , 2011 "Architecture principles of Enterprise Architecture" Springer*

CourseCode: **EBCS22E24**	Course Name : **NETWORK FORENSICS**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Computer Networks	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to
- Provide a comprehensive understanding of network forensic analysis principles
- Understand the relationship between network forensic analysis and network security technologies.

COURSE OUTCOMES (COs) : Students will be able to	
CO1	Learn to identify network security incidents and potential sources of digital evidence.
CO2	Demonstrate the ability to perform basic network data acquisition and analysis using computer based applications and utilities
CO3	Identify potential applications for the integration of network forensic technologies
CO4	Apply tools for network forensic investigation
CO5	Recognize the network details and routing path

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**3**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**1**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**2**	**3**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**3**	**3**
CO2	**3**	**2**	**3**	**3**
CO3	**3**	**2**	**3**	**3**
CO4	**3**	**2**	**3**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EBCS22E24	NETWORK FORENSICS	Ty	3	0/0	0/0	3

UNIT I Technical Fundamentals 9 Hrs

Concepts in digital evidence- challenges- investigative methodology- sources of network based evidence- principles of internetworking-Internet Protocol suite- Evidence acquisition

UNIT II Packet and Statistical Flow Analysis 9 Hrs

Packet analysis - protocol analysis - flow analysis- higher layer traffic analysis – Statistical Flow analysis:- sensors-flow record export protocols- collection and aggregation- analysis tools and techniques – Case study and Tools Analysis: Wire Shark

UNIT III Network Intrusion Detection and Analysis 9 Hrs

NIDS/NIPS functionality- modes of detection-types-NIDS/NIPS evidence acquisition -NIPS/NIDS interfaces –packet logging – Case study and Tools Analysis : Snort

UNIT IV Network Devices and Servers 9 Hrs

Sources of Logs-Network log architecture- collecting and analyzing evidence- Switches- routers – firewalls-interfaces-logging - Case study and Tools Analysis: Angry IP Scanner

UNIT V Network Tunnelling and Case Studies 9 Hrs

Tunneling for functionality, confidentiality- covert tunneling- trends in malware evolution-network behavior of malware – future of malware and network forensics - Case study and Tools Analysis : Cuckoo Sandbox

Total Hours: 45

TEXT BOOK:

1. Network Forensics : Tracking Hackers Through CyberSpace Sherri Davidoff,Jonathan Ham Pearson Education 2012

REFERENCE BOOKS:

1. ***Introduction to Security and Network ForensicsWilliam J. Buchanan Auerbach Publications 2012***
2. *Handbook of Digital Forensics and Investigations, 1st Edition Eoghan Casey ed., Elsevier Academic Press, ISBN 13: 978-0-12-374267-4,.*

COURSE CODE: **EBCS22E25**	COURSE NAME: **DISTRIBUTED COMPUTING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Operating Systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:
The students should be made to

- understand the design of distributed systems
- understand communication concepts of distributed systems
- apply the memory management design of distributed systems to design a new memory

COURSE OUTCOMES (COs): Students will be able to	
CO1	Understand and analyze the relation among model designs of distributed computing systems [L2]
CO2	Apply the inter-process communication concepts of distributed systems[L3]
CO3	Understand a new memory with effective synchronization[L2]
CO4	Apply appropriate scheduling between resource and process[L3]
CO5	Analyze the security, consistency and replication of the distributed file system [L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**2**	**1**	**1**	**1**				**1**	**1**
CO2	**2**	**3**	**2**	**2**	**1**	**1**	**2**				**1**	**1**
CO3	**3**	**3**	**3**	**2**	**1**	**1**	**2**				**1**	**1**
CO4	**3**	**3**	**3**	**2**	**2**	**2**	**1**				**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**1**	**2**				**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**3**	**2**
CO2	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**
CO5	**2**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E25	DISTRIBUTED COMPUTING	Ty	3	0/0	0/0	3

UNIT IFundamentals and Remote Procedure Call 9 Hrs

Introduction to distributed computing system, Different models, Message passing-Introduction, Desirable features of a good message passing system, Issues in IPC, Synchronization, Buffering, Multidatagram, Process addressing, Failure handling, Group communication - Introduction, RPC model, transparency of RPC, Implementing RPC mechanism, Stub generation, RPC messages, Marshalling arguments and results, Sever management, parameter-passing semantics, Call semantics, Communication protocols for RPCs- Lightweight RPC.

UNIT II Distributed Shared Memory and Synchronization 9 Hrs

Introduction, General architecture of DSM systems, Design and implementation issues of DSM,Granularity, Structure of shared memory space, Consistency model, Replacement strategy, Thrashing, Different approaches to DSM, Advantages of DSM, Clock synchronization, Event ordering, Mutual exclusion, Deadlock, Election algorithm.

UNIT III Resource and Process Management 9 Hrs

Introduction, Desirable features of a good global scheduling algorithm, Task assignment approach, Load balancing approach, Load sharing approach, Process migration, Threads.

UNIT IV DFS/DCE Security 9 Hrs

Desirable features of good DFS, File models, File accessing, models, File sharing semantics, File cachingschemes, File replication, Fault tolerance, Atomic Transaction, Design principles, Authentication, Access control, Digital signatures, DCE security service.

UNIT V CONSISTENCY AND REPLICATION 9 Hrs

Introduction - Data-Centric Consistency Models- Client-Centric Consistency Models- Replica Management - Consistency Protocols

Total Hours: 45

TEXT BOOK:

1. Pradeep K. Sinha (2012 Reprint) ,*Distributed Operating System Concepts and Design* PHI
2. *Ajay D. Kshemkalyani ,MukeshSinghal (2008), Distributed computing : principles, algorithms and systems – Cambridge University Press*

REFERENCE BOOKS:

1. *Andrew S. Tenenbaum (2012), Modern Operating System (3rd ed.) PHI*
2. *Andrew S. Tenenbaum&MaatrenVansteen (2012) Distributed systems: Principles & Paradigms (2nd ed.),PHI*
3. *HagitAttiya And Jennifer Welch (2004) Distributed computing fundamentals, simulations and Advanced Topics (Digitized in 2007) (2nd ed.), Wiley*
4. *Jean Dollimore, Tim Kindberg, And George Coulouris (2005) Distributed Systems: Concepts and Design (4th ed.) Pearson Education*

ELECTIVE -IV& V

COURSE CODE: **EBCS22E26**	COURSE NAME: **EDGE COMPUTING**	**Ty/Lb/ ETL/IE**	**L**	**T/S. Lr**	**P/R**	**C**
	Prerequisite: Distributed Systems and Algorithms	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T / L/ ETL/IE: Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:
The students should be made to

- Understand the basics of Edge Computingtechnology
- Analyze the evolution of computing industry, cloud computing basics and edge computing.

COURSE OUTCOMES (COs): Students will be able to

CO1	Remember the research, frameworks, and applications in Edge Computing[L1]
CO2	Understand the review of current IoT Applications[L2]
CO3	Analyze the frameworks for computing using RaspberryPi[L4]
CO4	Evaluate the Interfacing edge with cloud applications[L5]
CO5	Analyze edge computing with others[L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**3**	**1**
CO2	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**3**	**1**
CO3	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**3**	**1**
CO4	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**1**	**2**
CO3	**3**	**2**	**3**	**1**
CO4	**3**	**1**	**1**	**2**
CO5	**3**	**3**	**2**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and	Program Core	Program	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E26	EDGE COMPUTING	Ty	3	0/0	0/0	3

UNIT I EDGE COMPUTING DEFINITION AND USE CASES

9Hrs

Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M

UNIT II IOT ARCHITECTURE AND CORE IOT MODULES

9Hrs

A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

UNIT III RASPBERRYPI

9Hrs

Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

UNIT IV IMPLEMENTATION

9Hrs

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example

UNIT V EDGE COMPUTING

9Hrs

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Total

Hours: 45

TEXT BOOK:

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

REFERENCE BOOK:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
2. David Jensen, “Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE

COURSE CODE **EBCS22E27**	COURSE NAME: **CYBER PHYSICAL SYSTEM**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Address challenges in implementing a cyber-physical system from a computational perspective.
- Integrate real valued and dense time real time systems with software based discrete automated control.
- Design and validate problems for Cyber Physical Systems using formal methods, safety assurance and security aspects.

COURSE OUTCOMES (COs): Students will be able to

CO1	Analyze the challenges in implementing a cyber-physical system from a computational perspective[L4]
CO2	Apply real-valued and dense time real-time systems with software-based discrete automated control[L3]
CO3	Evaluate the formalmethodsindesigningcyber-physical systems [L5]
CO4	Understand and apply cyber-physical system problems for safety assurance and security aspects[L2]
CO5	CreateHybrid Automata Modeling[L6]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**
CO3	**2**	**3**	**2**	**2**
CO4	**3**	**3**	**3**	**3**
CO5	**3**	**2**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E27	CYBER PHYSICAL SYSTEM	Ty	3	0/0	0/0	3

UNIT-I CPS HARDWARE PLATFORMS 9Hrs

Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS Processors, Sensors, Actuators, CPS Network, CPS SW stack RTOS, Scheduling Real Time control tasks. Principles of Automated Control Design, Dynamical Systems and Stability, Controller Design Techniques.

UNIT-II STABILITY ANALYSIS 9Hrs

CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise, From features to software components, Mapping software components to ECUs, CPS Performance Analysis: effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion

UNIT-III FORMAL METHODS FOR SAFETY ASSURANCE OF CYBER-PHYSICAL SYSTEMS 9Hrs

Advanced Automata based modelling and analysis: Basic introduction and examples, Timed and Hybrid Automata, Definition of trajectories, zenoness, Formal Analysis: Flow pipe construction, reachability analysis, Analysis of CPS Software, Weakest Pre-conditions, Bounded Model checking

UNIT-IV HYBRID AUTOMATA MODELLING 9Hrs

Flowpipe construction using Flowstar, SpaceX and Phaver tools, CPS SW Verification: Frama-C, CBMC, Secure Deployment of CPS: Attack models, Secure Task mapping and Partitioning, State estimation for attack detection, Automotive

UNIT-V CASE STUDY 9Hrs

Case study: Vehicle ABS hacking, Power Distribution

Case study: Attacks on Smart grid. **Total Hours: 45**

TEXT BOOKS:

1.E. A. Lee and S. A. Seshia, “Introduction to Embedded Systems: A Cyber-Physical Systems Approach”, 2011.

2.R. Alur, “Principles of Cyber-Physical Systems,” MIT Press, 2015.

3.T. D. Lewis “Network Science: Theory and Applications”, Wiley, 2009.

REFERENCES BOOKS:

1. P. Tabuada, “Verification and control of hybrid systems: a symbolic approach”, Springer-Verlag 2009.

2. C. Cassandras, S. Lafortune, “Introduction to Discrete Event Systems”, Springer 2007.

3. Constance Heitmeyer and Dino Mandrioli, “Formal methods for real-time computing”, Wiley publisher, 19

COURSE CODE **EBCS22E28**	COURSE NAME: **FOUNDATIONS OF PARALLEL PROGRAMMING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- To familiarize the issues in parallel computing.
- To describe distributed memory programming using MPI.
- To understand shared memory paradigm with Pthreads and with OpenMP.
- To learn the GPU based parallel programming using OpenCL.

COURSE OUTCOMES (COs): Students will be able to

CO1	Identify issues in parallel programming (L2)
CO2	Develop distributed memory programs using MPI framework (L5)
CO3	Design and develop shared memory parallel programs using Pthreads and using OpenMP (L5)
CO4	Implement Graphical Processing OpenCL programs. (L4)
CO5	Understand the practical parallel programming scenarios and possibilities (L2)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**		**1**
CO2	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**1**	**1**		**1**	
CO3	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**
CO4	**3**	**2**	**3**	**3**	**3**	**2**	**3**					
CO5	**2**	**2**	**2**	**2**	**3**	**2**	**2**					

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**2**
CO5	**3**	**2**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E28	FOUNDATIONS OF PARALLEL PROGRAMMING	Ty	3	0/0	0/0	3

UNIT I Foundations Of Parallel Programming **9Hrs**

Motivation for parallel programming – Need-Concurrency in computing – Basics of processes, multitasking and threads – cache – cache mappings – caches and programs – virtual memory – Instruction level parallelism – hardware multi-threading – Parallel Hardware-SIMD – MIMD – Interconnection networks – cache coherence – Issues in shared memory model and distributed memory model –Parallel Software- Caveats- coordinating processes/ threads- hybrid model – shared memory model and distributed memory model - I/O – performance of parallel programs-– parallel program design.

UNIT II Distributed Memory Programming WithMpi **9Hrs**

Basic MPI programming – MPI_Init and MPI_Finalize – MPI communicators – SPMD- programs– MPI_Send and MPI_Recv – message matching – MPI- I/O – parallel I/O – collective communication – Tree-structured communication -MPI_Reduce – MPI_Allreduce, broadcast, scatter, gather, allgather – MPI derived types – dynamic process management – performance evaluation of MPI programs- A Parallel Sorting Algorithm

UNIT III Shared Memory Paradigm WithPthreads **9Hrs**

Basics of threads, Pthreads – thread synchronization – critical sections – busy waiting – mutex – semaphores – barriers and condition variables – read write locks with examples - Caches, cache coherence and false sharing – Thread safety-Pthreads case study.

UNIT IV Shared Memory Paradigm: Openmp **9Hrs**

Basics OpenMP – Trapezoidal Rule-scope of variables – reduction clause – parallel for directive – loops in OpenMP – scheduling loops –Producer Consumer problem – cache issues – threads safety in OpenMP – Two-body solvers- Tree Search

UNIT V Parallel Programming **9Hrs**

Speed and Efficiency, Overhead and Challenges – **Scientific Computing**: Grid Computations, Particle Computations, Matrix Computations – Case Study of Parallel Programming Libraries in Pthread, MPI and OpenMP – Parallelizing Compilers – Other Parallel Programming Models – Parallel Programming Tools

Total Hours: 45

REFERENCES:

1. A. Munshi, B. Gaster, T. G. Mattson, J. Fung, and D. Ginsburg,―OpenCL programming guide‖, Addison Wesley, 2011

2. M. J. Quinn, ―Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill, 2003.

3. Peter S. Pacheco, ―An introduction to parallel programming‖, Morgan Kaufmann, 2011.

4. Rob Farber, ―CUDA application design and development‖, Morgan Haufmann, 2011.

5. W. Gropp, E. Lusk, and A. Skjellum, ―Using MPI: Portable parallel programming with the message passing interface‖, Second Edition, MIT Press, 1999

6. Greg Andrews ,*2000, Foundations of Multithreaded, Parallel, and Distributed Programming*. Addison-Wesley, Digitized in 16 Nov 2007, ISBN 0201357526, 9780201357523

7. *Zbigniew J. Czech, 2016, Introduction to Parallel Computing, Cambridge University Press, ISBN 1316802787, 9781316802786*

COURSE CODE	COURSE NAME: VIRTUALIZATION	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E29	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- To know the general concepts of virtualization
- To learn the design of scalable networks
- To understand the virtualizing storage methods
- To know the terminology of virtualization

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the architecture of virtual machines[L2]
CO2	Analyze the server consolidation[L4]
CO3	Applying virtual machine installation and administration[L3]
CO4	Analyze the virtual storage concepts[L4]
CO5	Understand the various virtualization techniques[L2]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**
CO5	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

SUBJECT CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E29	VIRTUALIZATION	Ty	3	0/0	0/0	3

Unit I Introduction to Virtualization **9hrs**

System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines – Taxonomy of Virtual Machines – Emulation: Basic Interpretation – Threaded Interpretation – Pre-Coded and Direct Interpretation – Binary Translation – Full and Para Virtualization – Types of Hypervisors – Types of Virtualizations.

UNIT II Server Consolidation **9 Hrs**

Hardware Virtualization – Virtual Hardware Overview - Sever Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform

UNIT III Network Virtualization **9Hrs**

Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design - WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization - Data-Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation - IPsec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF - Aware Routing Multi-Topology Routing.

UNIT IV Virtualizing Storage **9Hrs**

SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.

Unit V Applying Virtualization **9 hrs**

Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level – Shared Kernel – Enterprise Solutions: Vmware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box – Server Virtualization: Configuring Server with Server Virtualization, Adjusting and Tuning Virtual Servers, VM Backup and Migration – Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions,Localized Virtualized Desktop – Network and Storage Virtualization: VPN, VLAN, SAN and VSAN, NAS.

Total Hours: 45

Text Books:

1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress, 2005.
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

References:

1. William von Hagen, “Professional Xen Virtualization”, Wrox Publications, January, 2008.
2. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
3. Amy Newman, Kenneth Hess, “Practical Virtualization Solutions: Virtualization from the Trenches”, Prentice Hall, October 2009

COURSE CODE: **EBCS22E30**	COURSE NAME: **DATA MODERNIZATION ANALYSIS**	**Ty/Lb/ ETL/IE**	**L**	**T/S. Lr**	**P/ R**	**C**
	Prerequisite: NIL	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to

- Be exposed with the basic rudiments of business intelligence system
- Understand the modeling aspects behind Business Intelligence
- understand of the business intelligence life cycle and the techniques used in it
  Be exposed with different data analysis tools and techniques

COURSE OUTCOMES (COs) : Students will be able to

CO1	Remember the fundamentals of business intelligence.[L1]
CO2	Link data mining with business intelligence[L4]
CO3	Apply various modeling techniques.[L3]
CO4	Explain the data analysis and knowledge delivery stages.[L2]
CO5	Explain the emerging technology and visualization[L2]

Mapping of Course Outcomes with Program Outcomes (POs)

COs /POs	**PO1**	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**2**	**3**	**3**	**1**	**2**	**3**	**2**	**3**	**1**
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**3**	**2**	**3**	**2**
CO5	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**2**

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**3**	**3**
CO2	**2**	**3**	**3**	**3**
CO3	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Science	Engineering	Humanities and	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
					✔				

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E30	DATA MODERNIZATION ANALYSIS	Ty	3	0/0	0/0	3

UNIT I BUSINESS INTELLIGENCE 9 Hrs

Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

UNIT II KNOWLEDGE DELIVERY 9 Hrs

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

UNIT III EFFICIENCY 9 Hrs

Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis

UNIT IV BUSINESS INTELLIGENCE APPLICATIONS 9 Hrs

Marketing models – Logistic and Production models – Case studies.

UNIT V FUTURE OF BUSINESS INTELLIGENCE 9 Hrs

Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

Total Hours: 45

TEXT BOOK:

1. Efraim Turban, Ramesh Sharda, DursunDelen, "Decision Support and Business Intelligence
Systems", 9 th Edition, Pearson 2013.
2. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making",
Wiley Publications, 2009.
4. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012.
5. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw- Hill, 2007.
6. Ralph Kimball ,Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse LifecycleToolkit", Wiley Publication Inc.,2007

COURSE CODE EBCS22E31	COURSE NAME: ROBOTICS	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Expose students to the history and current developments in the field of robotics;
- Strengthen students' grasp of the mathematics and physics involved in the design, construction and control of robots, with a focus on linear algebra and geometry.
- Introduce students to fundamental concepts of electrical and mechanical engineering that will help them better understand the design and development challenges in the field of robotics;
- Help students develop and deepen their grasp of programming concepts and their programming skills.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the fundamentals of robotics and its components (L1)
CO2	Understand the Kinematics and Dynamics of robotics (L1)
CO3	Design related Instrumentation & control in robotics (L5)
CO4	Implement the movement of robotic joints with computers/microcontrollers. (L4)
CO5	understand the use of sensors and instrumentation in robotics (L1)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	2	1	2	1	1	1
CO2	3	3	3	3	3	2	1	1	1		1	1
CO3	3	3	3	3	3	1	1	2	1			
CO4	3	3	3	3	3	1	1	1				
CO5	3	3	3	3	3	1				1		

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	3	3
CO2	1	2	3	1
CO3	1	2	3	2
CO4	1	2	2	2
CO5	1	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill	Practical /Project			
					□							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E31	ROBOTICS	Ty	3	0/0	0/0	3

Unit-1 Introduction **9 hrs**

Introduction: Robots, Jobs and Ethics, Representing Position and Orientation: Working in Two Dimensions, Working in Three Dimensions (3D). Advanced Topics, Using the Toolbox, Wrapping Up, Time and Motion: Time-Varying Pose, Accelerating Bodies and Reference Frames, Accelerating Bodies and Reference Frames, Application: Inertial Navigation, Wrapping Up.

Unit-II Mobile Robots **9 hrs**

Mobile Robot Vehicles: Wheeled Mobile Robots, Flying Robots, Advanced Topics, Wrapping Up, Navigation: Reactive Navigation, Map-Based Planning, Localization: Dead Reckoning, Localizing with a Map, Creating a Map, Localization and Mapping, Rao-Blackwellized SLAM, Pose Graph SLAM, Sequential Monte-Carlo Localization, Application: Scanning Laser Rangefinder, Wrapping Up.

Unit-III Arm-Type Robots **9 hrs**

Robot Arm Kinematics: Forward Kinematics, Inverse Kinematics, Trajectories, Advanced Topics, Applications, Manipulator Velocity: Manipulator Jacobian, Jacobian Condition and Manipulability, Resolved-Rate Motion Control, Under- and Over-Actuated Manipulators, Force Relationships, Inverse Kinematics: a General Numerical Approach, Advanced Topics. Dynamics and Control: Independent Joint Control, Rigid-Body Equations of Motion, Forward Dynamics, Rigid-Body Dynamics Compensation, Applications.

Unit-IV Computer Vision **9 hrs**

Light and Color: Spectral Representation of Light, Color, Advanced Topics, Application: Color Image, Image Formation: Perspective Camera, Camera Calibration, Wide Field-of-View Imaging, Unifi ed Imaging, Novel Cameras, Advanced Topics, Images and Image Processing, Image Histograms, Monadic Operations, Diadic Operations, Spatial Operations, Mathematical Morphology, Shape Changing,Image Feature Extraction:RegionFeatures,LineFeatures,Point Features, Using Multiple Images:FeatureCorrespondence,Geometry of Multiple Views, Stereo Vision, Bundle Adjustment,Point Clouds, Structured Light, Applications.

Unit-V Robotics, Vision and Control **9 hrs**

Vision-Based Control:Position-Based Visual Servoing, Image-Based Visual Servoing, Using Other Image Features, Advanced Visual Servoing: XY/Z-Partitioned IBVS, IBVS Using Polar Coordinates, IBVS for a Spherical Camera, Applications.

Total Hours:45

Text Book:

1. Robotics, Vision and Control,Fundamental Algorithms in MATLAB,"Second, completely revised, extended and updated edition With 492 Images", Peter Corke.

Reference Book:

1. Ghosal, A. (2006). *Robotics: fundamental concepts and analysis*. Oxford university press.
2. Corke, P. I., & Khatib, O. (2011). *Robotics, vision and control: fundamental algorithms in MATLAB* (Vol. 73, p. 2). Berlin: Springer

COURSE CODE: **EBCS22E32**	COURSE NAME: **DEEP LEARNING TECHNIQUES**	**Ty/Lb /ETL/ IE**	**L**	**T/ S. Lr**	**P/R**	**C**
	Prerequisite: Machine Learning	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

Thestudents should be made to

- understand the theoretical foundations, algorithms and methodologies of Neural Network
- design and develop an application using specific deep learning models
- provide the practical knowledge in handling and analyzing real world applications.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the characteristics of deep learning models that are useful to solve real-world problems[L2]
CO2	Understand different methodologies to create application using deepnets. [L2]
CO3	Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems. [L3]
CO4	Apply different deep learning algorithms[L3]
CO5	create the test procedures to evaluate the efficacy of the developed model[L5]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	2	3	2	2	3	3	3	3
CO2	3	3	3	3	2	3	2	2	3	3	3	3
CO3	3	3	3	3	1	3	2	2	3	2	3	3
CO4	3	3	3	3	2	3	2	2	3	2	3	3
CO5	3	3	3	3	2	3	2	2	3	2	3	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	2	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
EBCS22E32	DEEP LEARNING TECHNIQUES	Ty	3	0/0	0/0	3

UNIT I THE FUNDAMENTALS OF DEEP LEARNING and MACHINE LEARNING 9 Hrs

Introduction to Deep Learning – Difference between Deep Learning and machine learning - Evolution of AI and ML: Historical Epochs - Learning algorithms - Maximum likelihood estimation - Building machine learning algorithm - Neural Networks Multilayer Perceptron - Back-propagation algorithm and its variants.

UNIT II NEURAL NETWORKS AND DEPTHS OF DEEP LEARNING 9 Hrs

Representation Learning - Width and Depth of Neural Networks - Activation Functions: RELU, LRELU, ERELU - Unsupervised Training of Neural Networks - Restricted Boltzmann Machines - Auto Encoders - Deep Learning Applications.

UNIT III CONVOLUTIONAL NEURAL NETWORKS 9 Hrs

Architectural Overview - Motivation, Layers, Filters - Parameter sharing – Regularization - Popular CNN Architectures: ResNet, AlexNet – Applications.

UNIT IV SEQUENCE MODELLING –RECURRENT AND RECURSIVE NETS 9 Hrs

Recurrent Neural Networks - Bidirectional RNNs - Encoder-decoder sequence to sequence architectures - BPTT for training RNN - Long Short-Term Memory Networks.

UNIT V GENERATIVE DEEP LEARNING 9 Hrs

LSTMs to synthesize text - Neural Style transfer and applications - Image synthesis with variational auto encoders - Generative Adversarial Networks: What does a GAN look like? – Generator - Discriminator, Generator vs Discriminator - Training GANs.

Total hours:45

TEXT BOOKS

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

REFERENCE BOOKS

1. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
2. EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
3. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
4. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
5. Francois Chollet "Deep Learning with Python", Manning Publications, 2017.

COURSE CODE	COURSE NAME : **ENTERPRISE RESOURCE PLANNING**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
EBCS22E33	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :
The students should be made to

- Know basic business functional areas and explains how they are related.
- Illustrate how unintegrated information systems fail to support business decision and how integrated information systems can help a company prosper by providing business managers with accurate, consistent, and current data
- Understand how Enterprise Resource Planning software is used to optimize business processes Acquire experience in using ERP software that can be applied in further coursework

COURSE OUTCOMES (COs) : Students will be able to

CO1	Understand the basic structure and models of ERP (L2)
CO2	Design model for E-commerce architecture for any application (L5)
CO3	Develop an ERP system for the management of information across the functional areas of a business: (L5)
CO4	Apply working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process. (L3)
CO5	Evaluate organizational opportunities and challenges in the design system within a business scenario (L6)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**3**	**1**	**2**	**3**	**2**	**3**		**1**	
CO2	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**2**	**3**			**2**
CO3	3	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**1**	
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**			**2**
CO5	**2**	**2**	**2**	**3**		**2**	**2**	**2**	**1**			

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	**3**	**3**	**2**
CO2	2	3	**2**	3
CO3	**2**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**2**
CO5	**2**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E33	ENTERPRISE RESOURCE PLANNING	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP

UNIT II **9 Hrs**

Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Man-agement (PLM), LAP, Supply chain Management

UNIT III **9 Hrs**

ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Func-tional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications

UNIT IV **9 Hrs**

ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.

UNIT V **9 Hrs**

ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study

Total Hours: 45

TEXT BOOKS:

1. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning Concepts and Practice”, PHI.
2. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”, Thompson Course Technology

REFERENCE BOOKS:

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill
2. Rahul V. Altekar “Enterprise Resource Planning”, Tata McGraw Hill,
3. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – A Concepts and Practice”, PHI
4. Mary Summer, “Enterprise Resource Planning”- Pearson Education

COURSE CODE	COURSE NAME: QUANTUM COMPUTING	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E34	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:
The students should be made to
- Understand the fundamentals of Quantum Computing
- Remember the Quantum computers and its principles
- Analyze the formations and its operations

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the fundamentals of Quantum computing and its Applications. [L2]
CO2	Understand the efficient quantum algorithms for several basic promise problems[L2]
CO3	To gain knowledge about quantum computers and their principles[L4]
CO4	To understand the principles, quantum information and limitation of quantum operations formalizing[L2]
CO5	To gain knowledge about different quantum error and its correction techniques. [L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1		1			1			3
CO2	3	3	2	2	1				1	1		3
CO3	3	3	3	2	1	2			2	1	1	
CO4	1	2	1	2	2	1	2			3	1	1
CO5	2	2	2	2	2	1	1	2	1			3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	3	1	1	2
CO3	2	2	2	3
CO4	1	2	2	2
CO5	2	2	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E34	QUANTUM COMPUTING	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

FUNDAMENTALS OF QUANTUM COMPUTING: Fundamental Concepts: Introduction and Overview – Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information. Problems on Qubits.

UNIT II **9 Hrs**

QUANTUM COMPUTATION: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database. Problems on Boolean functions and Quantum gates

UNIT III **9 Hrs**

QUANTUM COMPUTERS: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.

UNIT IV **9 Hrs**

QUANTUM INFORMATIONS: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. Problems on Measurement

UNIT V **9 Hrs**

QUANTUM ERROR CORRECTION AND CRYPTOGRAPHY: Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation. Quantum Cryptography-Private Key Cryptography, Privacy Amplification and Information Reconciliation, Quantum Key Distribution, Privacy and Coherent Information, The Security of Quantum Key Distribution. Problems on Quantum error correction and cryptography

Total Hours: 45

TEXT BOOKS:

1.Chris Bernhardt ,"Quantum Computing for Everyone", (The MIT Press) Hardcover – Illustrate ,September 2020.
2. Willi-Hans Steeb; "Problems and Solutions in Quantum Computing and Quantum Information", Yorick Hardy Academic Consulting and Editorial Services (ACES) Private Limited, January 2020
3. M.A. Nielsen and I.Chuang,"Quantum Computation and Quantum Information", Cambridge University Press 2010

REFERENCE BOOKS:

1. Parag K. Lala ,Quantum Computing: A Beginner's Introduction Paperback" , McGraw Hill November 2020.
2. V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing company,2007.
3. Nayak, Chetan; Simon, Steven; Stern, Ady; Das Sarma, Sankar, "NonabelianAnyons and Quantum Computation", 2008.

COURSE CODE: EBCS22E35	COURSE NAME: SOCIAL NETWORK ANALYSIS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
	Prerequisite:Nil	Ty	3	0/0	0/0	3

L:LectureT:Tutorial S.Lr:SupervisedLearning P:Project R:ResearchC:Credits
T/L/ETL/IE:Theory/Lab/EmbeddedTheoryandLab Internal Evaluation

OBJECTIVE:

The students should be made to

- Understand the concept of Ontology using Knowledge Representation.
- Learn the prediction of Human Behavior in Social Communities.
- Understand the concept of developing Social-Semantic Applications.
- Understand the visualization of Social Networks with Matrix-Based Representations.

COURSEOUTCOMES(COs): Students will be able to

CO1	Students will have the knowledge to develop social-semantic applications. [L6]
CO2	Students will predict human behavior in social, web and other related communities[L4]
CO3	Students will apply the concept of ontology using knowledge representation[L3]
CO4	Students will visualize social networks with the help of matrix-based representations. [L5]
CO5	Understand the fundamental concepts in analyzing the large-scale data that are derivedfrom social networks[L2]

MappingofCourseOutcomeswithProgramOutcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	1	3	3	3	3	2
CO2	3	2	1	2	2	3	3	1	3	3	3	2
CO3	3	2	1	3	3	3	2	2	3	3	3	2
CO4	3	3	2	3	1	3	1	3	2	3	3	2
CO5	3	2	2	2	1	3	3	3	3	3	3	3

COs/PSO	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	2	3	2
CO3	3	2	3	2
CO4	3	1	3	2
CO5	3	3	3	2

3/2/1IndicatesStrengthOfCorrelation,3–High,2-Medium,1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME:	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E35	SOCIAL NETWORK ANALYSIS	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION 9 Hrs

Semantic Web: Limitations - Development – Web 2.0 + Semantic Web - Social Network analysis: Development - Key concepts and measures - Electronic sources for network analysis: Electronic discussion networks - Blogs and online communities - Web-based networks.

UNIT II KNOWLEDGE REPRESENTATION, MODELLING AND AGGREGATING 9 Hr

Ontology Representation: Knowledge Representation – Ontology languages for the Semantic Web: RDF and RDF Schema - OWL - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data : Representing identity – Reasoning with instance equality.

UNIT III DEVELOPING SOCIAL-SEMANTIC APPLICATIONS-EXTRACTION 9 Hrs

Building Semantic Web applications with social network features: Architecture of Semantic Web applications – Sesame - Elmo – GraphUtil - Flink: Features – System design - Openacademia: Features - System design

UNIT IV PREDICTING HUMAN BEHAVIOR FOR SOCIAL COMMUNITIES 9 Hrs

User data management - Inference and Distribution - Enabling new human experiences - The Social Enabler - Applications - Managing Trust in Online Social Networks: Online Social Networks - Trust in Online Environment - Trust Models Based on Subjective Logic - Trust Network Analysis - Trust Transitivity Analysis

UNIT V Visualizing Social Networks with Matrix-Based Representations 9 Hrs

Social Network Analysis: Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Novel Visualizations and Interactions for Social Networks Exploration: Node-Link Diagrams - Social Network Analysis – Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

TotalHours:45

TEXTBOOKS:

1. Peter Mika, ―Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, ―Handbook of Social Network Technologies and Applications, 1st Edition, Springer,
2010.

REFERENCEBOOKS:

1. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web, Springer, 2009.
2. GuandongXu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
3.ForouzanB.A., "DataCommunicationsandnetworking", TMH, 2003.

COURSE CODE	COURSE NAME:	Ty/Lb /ETL/IE	L	T/S.Lr	P/R	C
EBCS22E36	**NEURO FUZZY COMPUTING**					
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab Internal Evaluation

OBJECTIVES:

Thestudents should be made to

- To introduce the various learning rules of Neural Networks both supervised and unsupervised.
- To explain the working of error back propagation training algorithm and its use as a mathematical tool for solving problems.
- To provide knowledge on associative memories and their applications.
- To introduce Fuzzy Logic, Fuzzy relations and Fuzzy mathematics
- To introduce the various learning rules of Neural Networks both supervised and unsupervised.

COURSE OUTCOMES (COs) : Students will be able to

CO1	To Understand the fundamentals of Fuzzy set theory (L1)
CO2	T o learn the different Fuzzy Inference System (L1)
CO3	To Understand the basics of Neural Network and supervised learning networks (L2)
CO4	To design Various Associative Memory Networks and Unsupervised Learning Networks (L5)
CO5	To apply Adaptive Neuro-Fuzzy Inference Systems and Applications (L3)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**		**1**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**		**1**	**1**		
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**					
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**				

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	EAngineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCS22E36	NEURO FUZZY COMPUTING	Ty	3	0	0	3

UNIT I Fuzzy Sets

9Hrs

Introduction – Basic definitions and terminology – Set-theoretic Operations – MF Formulation and Parameterization – MFs of one Dimension - MFs of two Dimension – Derivatives of Parameterized MFs – Fuzzy Complement – Fuzzy Intersection and Union- Parameterized T-norm and T-conorm.

UNIT II Fuzzy Inference System

9Hrs

Extension Principle – Fuzzy Relations – Linguistic variables – Fuzzy If-Then Rules – Composite rule of inference – Fuzzy Reasoning – Mamdani Fuzzy Models – Other variants – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models.

UNIT III Neural Network

9Hrs

Fundamental Concepts – Models of a Neuron – Learning – Supervised Learning – Unsupervised Learning – Reinforcement Learning - Types of activation function – Network Architectures – Adaptive Networks – Backpropagation for Feed forward Networks – Supervised Learning Neural Networks –Perceptrons – Adaline – Backpropagation Multilayer perceptron – Radial Basis Function Networks

UNIT IV Other Neural Networks

9Hrs

Associative Memory Network – Autoassociative Memory Network – Heteroassociative Memory Network – Bidirectional Associative Memory – Hopfield Network - Unsupervised Learning Neural Networks – Competitive learning networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Adaptive Resonance Theory – Fundamental Architecture.

UNIT V Adaptive Neuro-Fuzzy Inference Systems and Applications

9Hrs

Adaptive Neuro-Fuzzy Inference Systems – ANFIS Architecture – Applications - Non-linear systemIdentification – Channel Equalization – Adaptive Noise cancellation.

Total Hours:45

Text Books

1. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.
2. Simon Haykin, “Neural Network, A Comprehensive Foundation”, 2nd Edition Pearson Prentice Hall, 2005.
3. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

Reference Books

1. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
2. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edn., 2003.
3.Satish Kumar, “Neural Network, A **Classroom Approach”, Tata McGraw – Hill, 2007.**

COURSE CODE: EBCS22E37	COURSE NAME: AUGMENTED AND VIRTUAL REALITY	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab Internal Evaluation

OBJECTIVES:

The students should be made to

- Establish and cultivate a broad and comprehensive understanding of this rapidly evolving and commercially viable field of Computer Science
- Understand virtual reality, augmented reality and using them in engineering applications
- Analyze the user engagement, Boost in Brand Loyalty, Mobility, Better Advertising of products and many more

COURSE OUTCOMES (COs) : Students will be able to

CO1	To understand fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR[L2]
CO2	To understand geometric modeling and Virtual environment[L2]
CO3	To relate and differentiate VR/AR technology[L4]
CO4	To use various types of Hardware and software in virtual Reality systems[L3]
CO5	To implement Virtual/Augmented Reality applications[L3]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	2	2	3	2	3	3
CO2	3	3	3	2	3	2	2	2	3	2	3	3
CO3	3	2	3	2	3	2	2	3	2	3	2	2
CO4	3	2	2	2	3	2	2	2	3	2	3	2
CO5	3	3	2	2	3	2	2	2	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	2	3
CO3	3	3	3	2
CO4	3	2	3	2
CO5	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E37	AUGMENTED AND VIRTUAL REALITY	Ty	3	0/0	0/0	3

UNIT I -INTRODUCTION TO AR-VR TECHNOLOGIES **9 Hrs**

History of VR-The five Classic Components of a VR System-Early Commercial VR Technology-VR Becomes an Industry-Reality, Virtuality and Immersion-VR, AR, MR, xR: similarities and differences between AR and VR -Current trends

UNIT II-COMPUTER GRAPHICS AND GEOMETRIC MODELING **9 Hrs**

Introduction, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, simple 3D boundary representation& modeling, 3D clipping, Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Modeling transformations, Instances, Picking, Flying, Scaling the VE

UNIT III-VIRTUAL ENVIRONMENT **9 Hrs**

Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output: Visual /Auditory / Haptic Devices. Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems-cyber sickness -side effects of exposures to virtual reality environment

UNIT IV- VR ON THE WEB & MOBILE **9 Hrs**

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics

UNIT V-DEVELOPMENT TOOLS AND FRAMEWORKS **9 Hrs**

Human factors: Introduction, the eye, the ear, the somatic senses. Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML-AR / VR Applications

Total Hours: 45

TEXT BOOKS

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016.

2. C. Burdea& Philippe Coiffet, “Virtual Reality Technology”, Second Edition, Gregory, John Wiley & Sons, Inc.,2008.

3. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

REFERENCE BOOKS:

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

2. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

3. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.

COURSE CODE: **EBCS22E38**	COURSE NAME: **BLOCKCHAIN TECHNOLOGY**	**Ty/Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab Internal Evaluation

OBJECTIVES:

The students should be made to:

- understand the history, types and applications of Blockchain
- acquire knowledge about cryptography and consensus algorithms
- Familiar with future currencies and to create own crypto token

COURSE OUTCOMES (COs) : Students will be able to

CO1	Understand the functional/operational aspects of Block chain[L2]
CO2	Apply the different Consensus Mechanisms[L3]
CO3	Apply the different cryptocurrency for different types of domains[L3]
CO4	Understand emerging abstract models for Blockchain Technology[L2]
CO5	Design and analyze the applications based on Blockchain Technology[L4]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**1**	**1**	**2**	**1**	**1**			**1**	**1**
CO2	**3**	**3**	**2**	**3**	**3**	**1**	**1**	**2**			1	**1**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**			1	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**1**			1	**1**
CO5	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**			1	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**1**	**1**	**3**
CO2	**3**	**2**	**2**	**2**
CO3	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social	Program	Program elective	Open Elective	Inter Disciplina	Skill Compone	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E38	BLOCK CHAIN TECHNOLOGY	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

Introduction: Defining Blockchain and Distributed Ledger, Blockchain Properties Decentralized, Transparent, Immutable and secure. Blockchain Applications. Types of Blockchain: Public, private, and consortium based blockchain, When to use, and when not to use Blockchain, History of Blockchain.Peer to Peer Network,P2P network for blockchain

UNIT II **9 Hrs**

Blockchain Data Structure, Characteristics and Consensus Mechanisms -Cryptographic Hash Functions, Digital Signatures, Public Keys as Identities, Hash Pointers and Hash chain and Merkel tree, Consensus mechanisms--Decentralized Identity management, Transactions, incentivising and mining. Distributed Consensus (PoW),.-Proof of storage, proof of stake**,** proof of deposit, proof of burn, proof of activity. algorithms for adjusting difficulty and retargeting.

UNIT III **9 Hrs**

Bit Coin: Cryptocurrency as the first blockchain application. Mechanics of Bitcoin, Bitcoin Scripts, Storing and Using Bitcoins, Mining in Bitcoinhardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin Limitations of Bitcoin, alternative cryptocurrencies.

UNIT IV **9 Hrs**

Smart Contracts and Ethereum History, Purpose and types of smart contracts, Introduction to Ethereum, bitcoin vs Ethereum stack. P2P network in Ethereum, consensus in Ethereum, scripts in Ethereum, Smart contracts (Ethereum Virtual Machine). Developing and executing smart contracts in Ethereum. State and data structure in Ethereum.

UNIT V **9 Hrs**

Private and Consortium based Blockchain: Hyperledger-Need for the consortium. Hyperledger stack, Multichainblockchain. Innovation in Hyperledger, smart contracts, and distributed applications in hyperledger

Case studies/ Enabling Technologies and applications-Application of blockchain in privacy and security, IoT and smart cities, Business and Industry, Data management, e-Governance

Total Hours: 45

Text Books:

1. Andreas M. Antonopoulos and Dr. Gavin Wood "Mastering Ethereum Building Smart Contracts and DApps " O"Reilly, Copyright 2019
2. Melanie Swan ,"Blockchain: Blueprint for a New Economy " Copyright 2015 Melanie Swan
3. Imran Bashir," Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks "
4. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and SmartContracts Explained", Packt Publishing, first edition – 2012

ReferenceBooks:

1. Ritesh Modi, "Solidity Programming Essentials: A Beginner"s Guide to Build Smart Contracts forEthereum and Block Chain", PacktPublishi

COURSE CODE: **EBCS22E39**	COURSE NAME: **MOBILE COMMERCE**	**Ty/Lb/ ETL/I E**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	Ty	3	0	0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

Thestudents should be made to

- Help businesses target customers according to their location, service provider, the type of device they use and various other criteria. This can be a good marketing tool.
- Understand the basic concepts and technologies used in the field of management information systems Have the knowledge of the different types of management information systems
- Understand the processes of developing and implementing information systems
- Case Study to implement m commerce.

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand the importance of E-commerce[L2]
CO2	Analyze the importance of M-commerce[L4]
CO3	Understand the technologies used in M-Commerce[L2]
CO4	Implementing theory and applications of M-Commerce[L3]
CO5	Creative implementingonBusiness models[L6]

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**2**	**1**
CO2	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**2**	**1**
CO3	**1**	**2**	**1**	**3**	**2**	**3**	**3**	**1**	**2**	**1**	**3**	**2**
CO4	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**3**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**2**	**2**
CO2	**3**	**1**	**1**	**2**
CO3	**2**	**2**	**2**	**3**
CO4	**1**	**2**	**2**	**2**
CO5	**2**	**2**	**2**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E39	**MOBILE COMMERCE**	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION OF E- COMMERCE 9Hrs

Traditional commerce and E-commerce – Internet and WWW – Role of WWW – Value Chains – Strategic Business And Industry Value Chains – Role of E-commerce. Packet Switched Networks – TCP/IP Protocol Script – Internet Utility Programmers – SGML, HTML And XML – Web Client and Servers – Web Client/Server Architecture – Intranet And Extranets – Web Based Tools For E-commerce – Security.

UNIT II STRUCTURE OF M-COMMERCE 9Hrs

Introduction – Infrastructure of M–Commerce – Types of Mobile Commerce Services – Technologies Of Wireless Business – Benefits And Limitations, Support, Mobile Marketing & Advertisement, Non– Internet Applications In M–Commerce – Wireless/Wired Commerce Comparisons.

UNIT III TECHNOLOGY TO DEVELOP MOBILE COMMERCE 9Hrs

A Framework for The Study of Mobile Commerce – Wireless Devices For Mobile Commerce – Towards A Classification Framework For Mobile Location Based Services – Wireless Personal And Local Area Networks –The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

UNIT IV MOBILE COMMERCE: THEORY AND APPLICATIONS 9Hrs

The Ecology of Mobile Commerce – The Wireless Application Protocol – Mobile Business Services – Mobile Portal – Factors Influencing The Adoption of Mobile Gaming Services – Mobile Data Technologies And Small Business Adoption And Diffusion – E–commerce in The Automotive Industry. Case Studies in implementing mobile commerce: finance, retail, telecommunication, healthcare, information technology, sales and services.

UNIT V BUSINESS– TO– BUSINESS E & M COMMERCE 9Hrs

Enterprise Enablement – Email and Messaging – Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare) – Field Sales Support (Content Access, Inventory) – Asset Tracking and Maintenance/Management – Remote IT Support – Customer Retention (B2C Services, Financial, Special Deals) – Warehouse Automation – Security

TotalHours: 45

TEXT BOOKS:

1. E.BrianMennecke, J.Troy Strader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.
2. Ravi Kalakota, B.AndrewWhinston, "Frontiers of Electronic Commerce", Pearson Education, 2003

REFERENCE BOOKS:

1. P. J. Louis, "M-Commerce Crash Course", McGraw- Hill Companies February 2001.
2. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies Of Wireless Business" Cambridge University Press March 2001.

COURSE CODE: EBCS22E40	COURSE NAME: REAL TIME SYSTEMS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/ Internal Evaluation

OBJECTIVE:

Thestudents should be made to

- Real-time scheduling and schedulability analysis
- Formal specification and verification of timing constraints and properties
- Design methods for real-time systems

COURSE OUTCOMES (COs) :Students will be able to

CO1	Understand the basic concepts of operating system (L1)
CO2	Implement various task assignment and scheduling algorithms (L4)
CO3	Apply the knowledge of programming languages and tools for real time systems (L3)
CO4	Analyze the problems in computing (L4)
CO5	Identify the solution to the computing problems (L6)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	1	1	1	1		1	
CO2	3	3	2	3	1	1	2	1	1	1		1
CO3	3	3	2	3	3	1	2	1		1	1	
CO4	2	3	2	3	2	1	2	1				
CO5	2	2	3	2	3	1	2		1			

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	2	2
CO3	3	3	3	2
CO4	3	3	3	2
CO5	3	3	3	2

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/ R	C
EBCS22E40	REAL TIME SYSTEMS	Ty	3	0/0	0/0	3

UNIT I Introduction, Task Assignment and Scheduling 9 Hrs

Architecture of real time systems/embedded systems-operating systems issues-performance measures-estimating program run times- Uniprocessor scheduling-IRIS tasks-task assignment algorithms- mode changes –fault tolerance scheduling.

UNIT II Programming Languages and Tools 9 Hrs

Desired characteristics based on ADA-data typing-control structures-packages-exception handling-overloading-multitasking-timing specification-task scheduling-just in time compilation-run time support.

UNIT III INTERTASK COMMUNICATION AND MEMORY MANAGEMENT 9 Hrs

Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.

UNIT IV Real Time Databases, Fault Tolerance, Reliability and Synchornization 9 Hrs

Basic definitions-main memory databases -transaction processing-concurrency control-disk scheduling algorithms-serialization and consistency-real time communication-

UNIT V Fault Tolerance, Reliability and Synchornization 9 Hrs

Fault types-fault detection and containment-redundancy-data diversity-reversal checks-obtaining parameter values-reliability models for hardware redundancy-software error models-clocks-fault tolerance synchronization-synchronization and software.

Total Hours: 45

TEXT BOOK:

1. C.M.Krishna, Kang.G.Shin, 2010, Realtime Systems, McGraw Hill.

REFERENCE BOOKS:

1. *Rajib Mall, 2007 "Real-time systems: theory and practice", Pearson Education.*
2. *Phillip A.Laplante 2011 Real Time System Design and Analysis,4 thedition,Wiley.*
3. *Alan burns and andy wellings,2009 "Real time systems and prog. Languages", 4 thedition,pearson.*

COURSE CODE	COURSE NAME: OPTIMIZATION TECHNIQUES	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E41	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL/IE : Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

The students should be made to

- Operation research models using optimization techniques based upon the fundamentals ofEngineering mathematics (minimization and Maximization of objective function).
- The problem formulation by using linear, dynamic programming, game theory and queuing models.
- The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.
- Formulation of mathematical models for quantitative analysis of managerial problems in industry

COURSE OUTCOMES (COs): Students will be able to

CO1	Understand Linear algebra and matrices, Elements of probability theory-Elementary multivariable calculus
CO2	Apply the theoretical foundations of various issues related to linear programming modeling to formulate real-world problems as a L P model
CO3	Understand Unconstrained optimization
CO4	Understand constrained optimization
CO5	Analyze Non-linear constrained optimization models

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	2	3	2	2
CO2	3	3	3	3	3	3	2	2	2	3	2	2
CO3	3	2	2	2	3	1	2	3	2	3	2	2
CO4	3	3	2	2	3	2	2	2	3	2	2	2
CO5	3	2	3	2	2	2	2	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	2	3	2
CO3	3	2	2	3
CO4	3	3	3	2
CO5	3	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
					✔							

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCS22E41	OPTIMIZATIONTECHNIQUES	Ty	3	0/0	0/0	3

UNIT- I

9Hrs

Mathematical preliminaries

Linear algebra and matrices-Vector space, eigen analysis-Elements of probability theory-Elementary multivariable calculus

UNIT-II
9Hrs

Linear Programming

Introduction to linear programming model - Simplex Method-Duality-Karmarkar's method

UNIT-III

9Hrs

Unconstrained optimization

One-dimensional search methods - Gradient-based methods -Conjugate direction and quasi-Newton methods

UNIT-IV **9Hrs**

Constrained Optimization

Lagrange theorem-FONC, SONC, and SOSC conditions

UNIT-V

9Hrs

Non-linear problems

Non-linear constrained optimization models- KKT conditions -Projection methods
Total Hours:45

Reference Books:

1. An introduction to Optimization by Edwin P K Chong, Stainslaw Zak

2. Nonlinear Programming by Dimitri Bertsekas

COURSE CODE: EBCS22E42	COURSE NAME: NATURAL LANGUAGE PROCESSING	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	TY	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL/IE : Theory/Lab/Embedded Theory and Lab/ Internal Evaluation

OBJECTIVES:

Thestudents should be made to

- To introduce the fundamental concepts and theory of Natural Language Processing
- To learn the challenges of natural language processing
- To understand the use of CFG rules in NLP
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques in practical applications
-

COURSE OUTCOMES (COs) : Students will be able to

CO1	Recognize the concepts and techniques of Natural Language Processing (L2)
CO2	Design and develop NLP Models (L5)
CO3	Implement a rule based system to tackle morphology/syntax of a language (L4)
CO4	Design a tag set to be used for statistical processing for real-time applications (L5)
CO5	Formulate natural language algorithms for processing Linguistic Information. (L3)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	2	2	1	1		2	2	1	
CO2	3	3	1	1	3	1	1		2	3		
CO3	2	3	3	2	2	1	1	1	2	1		1
CO4	2	3	3	3	3	2	2	2		1		
CO5	3	2	3	3	2	1	1	1			1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	3	1
CO3	2	3	2	2
CO4	3	2	3	2
CO5	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✔								

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBCS22E42	NATURAL LANGUAGE PROCESSING	Ty	3	0/0	0/0	3

UNIT I – Introduction **9 Hrs**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Text Normalization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II – Word Level Analysis **9 Hrs**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Kneser –Ney Smoothing, Huge Language model and Back off – Word Classes, Part-of-Speech Tagging, Rule-based, Named Entities and Named Entity Tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models, Evaluation of Name Entity Recognition.

UNIT III – Syntactic Analysis **9 Hrs**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Lexicalized Grammars, Dependency Grammar – Syntactic Parsing, Ambiguity, CKY Dynamic Programming parsing – Span Based Neural Constituency Parsing, Evaluating Parsing – Dependency Relations, Dependency Formalisms, Transaction based Dependency Relations, Graph Based Dependency Relations

UNIT IV-Semantics and Pragmatics **9 Hrs**

Requirements for representation, First-Order Logic, Description Logics – Word Senses, Relations between Senses, Word Sense Disambiguation, The WSD Algorithm and Tasks, Word Sense Induction. Semantic Roles, Problem with Thematic Roles, Semantic Role Labeling, Selectional Restrictions.

UNIT V -DISCOURSE ANALYSIS AND LEXICAL RESOURCES **9 Hrs**

Coherence Relations, Discourse Structure Parsing, Centering and Entity based Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm

Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Total Hours:45

EXT BOOKS:

1. Daniel Jurafsky and James H Martin,"Speech and Language Processing", 3e, Pearson Education, 2020..

2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python‖, First Edition, O_Reilly Media, 2009.

REFERENCES

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.

2. Richard M Reese, ―Natural Language Processing with Java‖, O_Reilly Media, 2015.

3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008